PR24

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A3-13 STORM OVERFLOWS

NES27

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1. INTRODUCTION

Many of our sewers carry a combination of wastewater from homes and businesses, and rainwater. At times of heavy rainfall, this can mean that the pipes can reach full capacity. This risks a combination of rainwater, wastewater and other items flushed into the network being forced back into customers' homes. Therefore, storm overflows act as a relief valve, releasing this heavily diluted mix from pipes – typically mostly rainwater – to rivers or the sea, thereby protecting homes from sewer flooding. However, a growing population, an increase in impermeable surfaces and more frequent and heavier storms due to climate change have increased pressure on our sewer network to safely move wastewater for treatment and disposal. At the end of 2021, we had 1,567[1] storm overflow assets, the majority of which spill to inland watercourses and 84 to bathing waters.

Our Long-Term Strategy describes our approach to meeting the statutory requirements in the Environment Act 2021, and as described in the Government's Storm Overflows Discharge Reduction Plan (SODRP), which requires us to:

- protect our designated bathing waters and 75% of our most sensitive and protected habitats from storm overflow sewage discharges by 2035;
- eliminate all adverse ecological impacts from storm overflows by 2050; and
- make sure that storm overflows discharge in fewer than an average of ten rainfall events per year by 2050.

Therefore, our AMP8 business case outlines our proposed investment for:

- investigations to understand whether storm overflows cause local ecological harm by April 2027;
- a reduction in spills to an average of 10 per annum for inland storm water overflows, including 38% to high priority sites and 14% of all storm overflows by 2030;
- a reduction of spills to an average of 2 per bathing water season where spills occur to bathing and shellfish waters; and
- the installation of screens to improve the aesthetics of the river and sea.

The monitoring requirements associated with storm overflows, or the receiving water body are included in our enhancement business case for monitoring.

Our investment proposal for AMP8 is set out in Table 1.

[1] Northumbrian Water, EDM Annual Return 2021 assessed as the reference year.

TABLE 1: OUR PLAN FOR AMP8

Elements of our storm overflows programme	Costs
Undertake the following Urban Pollution Management Investigations 3 level 3 investigations comprising 42 overflows 36 level 2 investigations comprising 132 overflows~300 level 1 investigations comprising 827 overflows	Capex = £38.66m
Install storage schemes to reduce spills by 2728	Capex = £134.153m Opex = £0.495m
Install sustainable drainage/attenuation in the network to reduce spills by 621	Capex = £117.903
Install source surface water separation to reduce spills by 1139	Capex = £592.729m
Install sewer flow management and control to reduce spills by 258	Capex = £28.221m
66 screens	Capex = £34.585m Opex = £0.414m
TOTAL	**£946.35m**

2. NEED FOR ENHANCEMENT INVESTMENT

2.1. ALIGNMENT WITH STATUTORY PLANNING FRAMEWORKS

All elements of this business case have been developed in accordance with two statutory planning frameworks, the PR24 Water Industry National Environment Programme (WINEP) Driver Guidance for Storm overflow reductions[2] and our **Drainage and Wastewater Management Plan** (DWMP). We have specified where we have done this throughout the case. This includes in Section 3.2, where we describe how we have met the requirements of the SODRP. In addition, Table 2 below provides a high-level overview of how we have incorporated the DWMP principles into this business case.

TABLE 2: MEETING DRAINAGE WASTEWATER MANAGEMENT PLAN PRINCIPLES

Expectation	How this has been met
Be comprehensive, evidence based and transparent in assessing, as far as possible, current capacity and actions needed in 5, 10 and minimum 25-year periods considering risks and issues such as climate change. Plans should also align, as far as possible, with other strategic and policy planning tools.	Our modelling of storm overflow impacts has been based on hydraulic models and event duration monitoring data, which record the number and duration of spills. Ninety-nine percent of our population is covered by modelling at Type II as defined by the CIWEM Urban Drainage Group's code of practice. We have assessed the impact of storm overflows and associated flooding as part of our DWMP for 5,10, 25 and 40-year planning horizons up to 2060. These consider the impact of population growth, urban creep, climate change and infiltration. Our DWMP is an integrated approach which fully encompasses the requirements of the Urban Wastewater Treatment Directive, the Water Framework Directive, the Environment Act, Continuous River Water Monitoring, 25 Year Environment Plan, Bathing Water investigations, Shellfish Investigations and Marine Conservation Zones.
Strive to deliver resilient systems that will address operational and other pressures and minimise system failures.	Before we consider changing our network or pumping stations to reduce spills from storm overflows, we firstly make sure that our network is working according to its design parameters. This means ensuring the network is 100% clean and that we carry out routine maintenance and remove blockages. These items are carried out from base allowances and so our plans already assume that base allowances are used to maintain networks to a high standard. These costs are not reflected in this case and customers will not be paying more for these costs. Further detail is contained in sections 2.2 and 2.4.1
Consider the impact of drainage systems on immediate and wider environmental outcomes including habitats and in developing options for mitigation to include consideration of environmental net gain and enhancement. Improve customer outcomes and awareness and that solutions and actions provide both value for money and consider societal benefits.	Our assessment of benefits considers a wide range of environmental and social outcomes such as amenity and biodiversity which form part of our value framework. We have selected options using customer valuations and external benchmarks of the benefits (including the impact on wider environmental outcomes, see section 3.5.1). Our research/h shows that although customers do support wider environmental and social benefits, they do not always want to pay for these in the context of other priorities (and "must do" investments). In some areas of our plan – such as storm overflows – there are some "near miss" options which include the opportunity for wider benefits at a relatively low marginal cost (but technically exceed best value by a small margin), and we have subsequently asked customers their views on these in the round too, as outlined in Section 2.5.

[2] Environment Agency, PR24 WINEP driver guidance – Storm overflow reductions V0.3.

Expectation	How this has been met
Be collaborative by recognising the importance of sectors working together to consider current and future risks and needs and to deliver effective solutions, setting out how they will do this, how they have engaged with and responded to stakeholders.	Our optioneering process considers a broad range of options including how we can collaborate with customers to reduce demand, how we can work with local authorities to understand the rate of new development and how we can collaborate with other stakeholders to deliver projects which deliver wider benefits to communities. Section 3.6 describes multiple case studies where we have worked with stakeholders to identify risks and deliver effective solutions. Further information on how we engaged with external stakeholders is contained in Section 10.1 of our DWMP technical summary.
Show leadership in considering the big picture for an organisation's operational capacity to develop and deliver the plan, and to be mindful of linkages with other strategic planning frameworks.	Our DWMP and this business case consider a multi-driver approach and therefore overlaps with: • the WINEP programme; • the opportunity for flooding benefits; and • the removal of infiltration from the sewerage system. We applied a geographical catchment-based approach to our planning. We have assessed the capacity of the supply chain to deliver and have appointed our strategic partner for AMP8 delivery. We intend to start the delivery of our Berwick storm overflow work as part of our early start programme in 2024.

2.2. OUR PROGRESS UP TO 2025

We are investing more than £80m towards reducing our reliance on and use of storm overflows between 2020 and 2025[3], and we are on track to achieve an average of 20 spills per overflow by the end of AMP7.

In 2022, we achieved reductions of around 20% in spills per overflow and 40% in the average duration of spills compared to 2021. We also observed improvements in the magnitude of overflow events, including a greater proportion of overflows that didn't spill or spilled fewer than 20 times, which may have come from having greater visibility of overflows through monitoring. While this is, in part, the result of the weather due to experiencing a year with fewer intense storms, it also reflects our investment and focus in this area.

During AMP7 we have three programmes of work to investigate and resolve storm overflows. These include:

- Our existing WINEP. We have completed 127 investigations at high frequency-spilling storm overflows identified by the Storm Overflows Assessment Framework (SOAF). This entails determining the main cause of the spills and the environmental impact for overflows that discharge more than 40 times a year (SOAF threshold). For 15 overflows, the main cause was found to be operational, and these issues have been resolved to reduce spills. The remaining 112 sites are due to hydraulic capacity, and we have progressed five sites for spill reduction schemes to meet the new ten spills standard by 2025.
- Our programme to increase our capacity to accommodate growth which involves increasing storm tank capacity and pumping, to hold flows within the network.

[3] Northumbria water and Essex & Suffolk water, 2023, A Vision for our coasts and river 2023

- Our pledges to reduce sewage spills to rivers and bathing waters as set out in our vision for our coasts and rivers[4] where we committed to:
  - Work with the Environment Agency, Natural England, The Rivers Trust, and Catchment Partnerships to identify and plan to eliminate all impediments to our rivers receiving good ecological status due to our operations.
  - Invest in monitoring to provide more 100% real time data on all storm overflows by 2023. At the end of 2022 we delivered 98.6% and are on track to deliver 100% in 2023.
  - Implement 27 water quality monitoring devices at 22 of our highest priority storm overflow locations by 2025; installation is planned to start in late 2023.
  - Reduce spills from storm overflows to an average of 20 per year by 2025. At the end of 2022, we reduced the average number of spills to 20.3 and are on track to deliver an average of 20 by 2025. Further information can be found in our update published in April 2023.

Reducing spills to an average of 20 per year equates to reducing spills in our region by 8,000 per annum. Our activities are focused on storm overflows in the sewerage network and at sewage pumping stations (SPSs) where most of the spills occur. The main actions are:

- Network: conduct CCTV inspections and complete targeted cleaning and fixing of issues such as tree roots and lining sewers downstream of high spilling overflows.
- Network Controls: inspect every flow control device at storm overflows to make sure they are correctly calibrated and improve controls through modifications and renewals.
- Storm harvester smart network management system: use advanced machine learning, together with hyperlocal rainfall forecasting, to predict performance of our assets, provide accurate notifications and alarms, and capture learnings on response performance following spill reduction activities.

There are also two activities which we are doing in advance of new WINEP monitoring requirements, in order to help us detect where we might have an increase in pollutions as a result of new monitoring requirements (see our pollutions enhancement case, NES37):

- Pumping Stations: assess the flow pass forward at high spilling overflows and make necessary changes to pumps, such as new impellers or pump sets. (AMP8 preparation)
- Enhanced Storm Overflow reporting: track all storm overflow and spill reductions, this includes company scorecard targets and forecast spill performance for every storm overflow. (AMP8 preparation)

We are tracking the delivery of our pollution action plan to understand the benefit of the activities and to set future maintenance programmes to maintain reduced spill levels. This will continue into AMP8 with our automated intelligence identifying when we need to cleanse networks.

[4] Northumbria water and Essex & Suffolk water, 2023, A vision for our coasts and rivers

In AMP7 we are investing £7.3m above our funded base allowances to reduce spills to 20 on average by 2025. We are not requesting funding within this enhancement business case for items that have been funded at previous price reviews or in base allowances.

As part of our early start programme for AMP8, we are intending to invest £30.05m on storm overflows in 2024 - 2025. This includes £1.85m on our most significant storm overflow project at Berwick (as agreed with Ofwat under accelerated funding), and an additional £15.1m of transition expenditure to make sure that our programme can be delivered by 2030. We are also looking at how we can start our investments in smart networks earlier, so that we can explore options for moving flows around the network.

2.3. NEED FOR INVESTMENT IN AMP8

2.3.1 Statutory need for investment

Reporting on the elimination of discharges from storm overflows is a new statutory requirement, set out in the Environment Act 2021 Section 84(3)[5]. This goes beyond our existing legal duties under the Urban Wastewater Treatment Regulations 1994 and under the Water Industry Act 1991, to effectively drain our area. The requirements and timing of investments are set out in the Defra Storm Overflow Reduction Plan[6] and the PR24 WINEP framework driver guidance[7] which are shown in Table 3.

Within AMP8 we are expected to:

- carry out investigations to understand whether storm overflows cause local ecological harm by April 2027;
- reduce the number of spills to ten per annum for inland storm water overflows for 38% of high priority and 14% of overall storm overflows by 2030 (the targets by 2030 are an indicative trajectory set out in the WINEP guidance to the 2035 targets which are statutory);
- reduce spills to two per bathing season for spills, for excellent bathing water quality; and
- install screens to improve aesthetics of the river and sea.

We have tested the scale and timing of investment with customers as described in our research in Section 2.5.

[5] Environment Act 2021 (legislation.gov.uk)
[6] Defra, August 2022, Storm overflows discharge reduction plan 26
[7] Environment Agency, PR24 WINEP driver guidance – Storm overflow reductions V0.3

TABLE 3: WINEP FRAMEWORK REQUIREMENT AND LINK TO PR24 DATA TABLES

Driver code	Description	Legal obligation	Obligation date	PR24 data tables enhanced category
EnvAct_INV4	Investigations to reduce storm overflow spills to protect the environment so that they have no local adverse ecological impact. These will inform the improvements which will be delivered under Env_Act_IMP2.	Statutory	Investigations into storm overflows that will have an EnvAct_IMP2 scheme in PR24 or PR29. Investigations to inform PR24 EnvAct_IMP2 schemes should be completed by 30 April 2027. Other investigations should conclude by 30 April 2027.	Investigations, other - multiple surveys, and/or monitoring locations, and/or complex modelling
EnvAct_IMP2	Improvements to reduce storm overflow spills to protect the environment so that they have no local adverse ecological harm. These will be informed by the investigations carried out in INV_4. Sites identified to date as also part of IMP3 and IMP4 which have more stringent targets.	Statutory	WaSCs should include this driver for PR24 as early contribution to building their programme to achieve the Defra consulted target dates to achieve no local adverse ecological impact of: • 75%+ storm overflows discharging in or close to high priority sites by 2035; • 100% overflows discharging in or close to high priority sites by 2045; and • All remaining storm overflow sites by 2050. For storm overflows impacting shellfish waters, the target is 2030.	
EnvAct_IMP3	Improvements to reduce storm overflows that spill to designated bathing waters to protect public health to at least two times per season using EDM data. Demand is identified from DWMP modelling assessments.	Statutory	WaSCs should profile this driver over PR24 and PR29 and include this driver for PR24 at their own discretion as early contribution to building their programme to achieve the Defra consulted target date of 2035. Newly designated, bathing waters at poor status and storm overflows previously improved but not meeting current design objectives should be prioritised for PR24 at WaSC discretion.	Storage schemes to reduce spill frequency at CSOs etc - grey solution. Storage schemes to reduce spill frequency at CSOs etc – green solution. Storm overflow - discharge relocation and increase in combined sewer / trunk sewer capacity.

Driver code	Description	Legal obligation	Obligation date	PR24 data tables enhanced category
Env_Act_IMP4[8]	Improvements to reduce storm overflows spills so that they do not discharge above an average of ten rainfall events per year by 2050.	Statutory	WaSCs should include this driver for PR24 to achieve the target of at least: • 38% of high priority storm overflows by 2030; and • 14% of the total stock of their storm overflows by 2030.	Storm overflow - sustainable drainage / attenuation in the network Storm overflow - source surface water separation - infiltration management, - sewer flow management and control.
Env_Act_IMP5	Improvements to reduce storm overflow aesthetic impacts by installation of screens.	Statutory	WaSCs should include this driver for PR24, where the storm overflow qualifies and has another improvement driver assigned for PR24.	Storm overflow - new/upgraded screens.

The investigations delivered under EnvAct_INV4 may inform a change to requirements to reduce storm overflow spills to protect the environment so that they have no local adverse ecological harm. There are no current requirements under EnvAct_IMP2 - Improvements to reduce storm overflow spills to protect the environment so that they have no local adverse ecological impact.

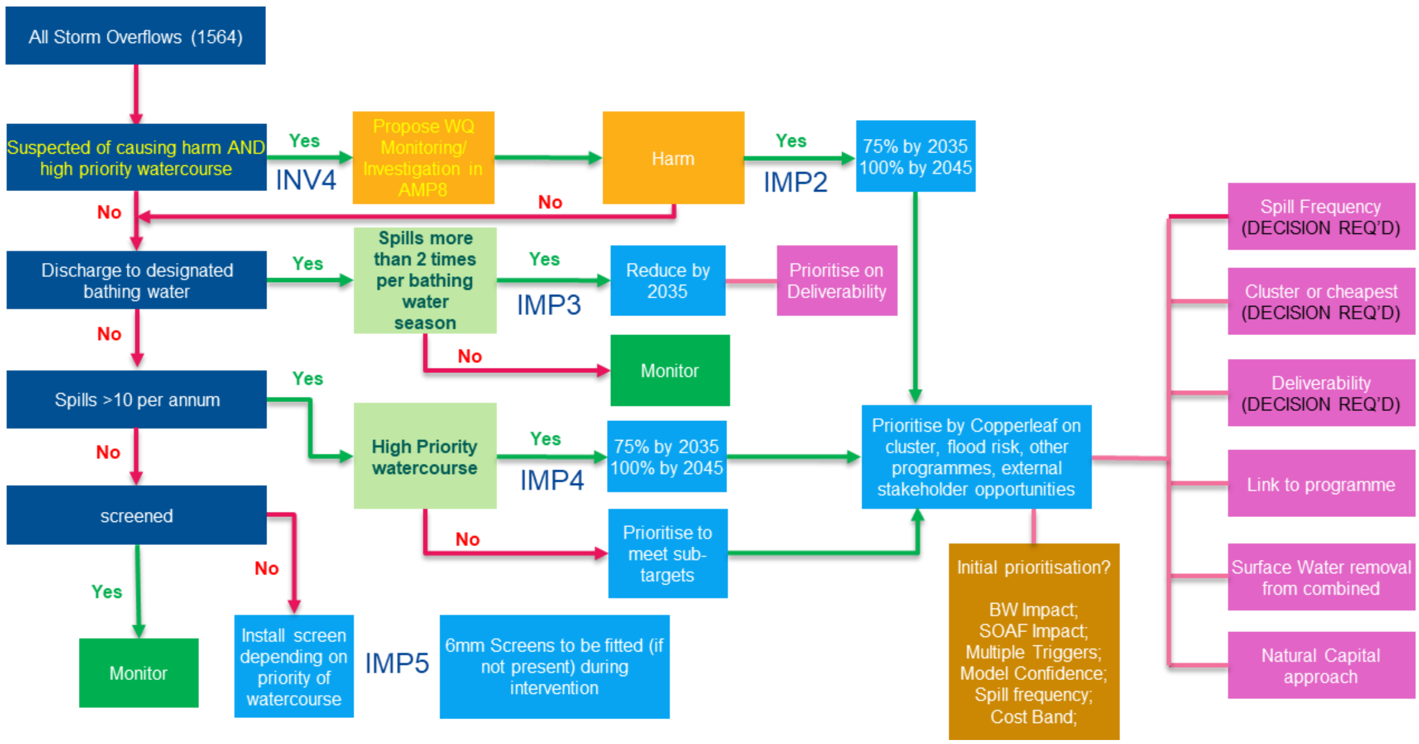
2.3.2 Methodology for the identification of overflows

Figure 1 shows the process that we applied to each of the 1,567 storm overflows to understand whether work was required under each of the statutory drivers:

- First, we identified the number of investigations (INV4) required (as described in Section 2.3.3).
- Secondly, we identified the number of discharges to bathing water which were spilling greater than two times per bathing season (IMP3) from event duration monitor data.
- Thirdly we identified the number of storm overflows spilling more than ten times and which were discharging into a high priority watercourse (as described in section 2.3.4).
- Finally, we identified the sites which did not have a 6mm screen installed (as described in section 2.3.6).

[8] Information Letter EA/07/23 Storm Overflows – Ecological impact investigations – EnvAct_INV4 6 March 2023

FIGURE 1: APPROACH TO CLASSIFYING DRIVERS FOR STORM OVERFLOWS



2.3.3 Approach for identifying needs related to investigations (EnvAct_INV4))

Our approach to identifying investigations has been informed by the PR24 WINEP Storm Overflow Reduction Driver Guidance[9] published in July 2022, the subsequent clarification issued in November 2022 and EA's PR24 Frequently Asked Questions.

We have used GIS (Geographic Information System) processes to identify the receiving water type for each storm overflow. We applied the Urban Pollution Management (UPM) methodology[10] for studies applies to inland waters and can be applied to some "riverine" estuarine discharges. We filtered out those discharges relating to the coast and near coast. We undertook the following steps to identify the required study level as defined in the Storm Overflow Assessment Framework (SOAF) guidance[11].

STEP 1 - ESTIMATE DILUTION RATIO

The SOAF guidance indicates a dilution ratio of less than 8 as the threshold for preventing significant water quality impact. However, delivery to date has indicated a potential sensitivity at higher dilutions and a ratio of 20 has been

[9] PR24 WONEP Storm Overflow Reduction Driver Guidance July 2022
[10] UK Water Industry, January 2019, Urban Pollution Manual Version 3.1 – 7
[11] Environment Agency, June 2018, Storm overflow assessment framework Version 1.6

used as a threshold. Draft dilution ratio calculations have been completed for many discharges where constituent parameters were available (River Q95 flow and CSO Dry Weather Flow). Where the ratio is less than 20, the INV4 investigation is proposed to confirm the dilution ratio calculation.

STEP 2 – INITIAL IDENTIFICATION OF SOAF STUDY LEVEL FOR REMAINING SITES

The UPM Manual lays out the factors influencing the selection of water quality study level. The most significant factors are the hydrological response type, the in-reach residence time/time of travel, and the role of in-river water quality process mechanisms (most significantly the extent of sediment deposition/resuspension and sediment oxygen demand).

The initial investigation type (study level) was identified as follows:

- The intermittent discharges were clustered by receiving watercourse reach - visual GIS review.
- SOAF level 1 was assigned to all members of a reach cluster where no significant wastewater final effluent enters the reach.
- SOAF level 2 was assigned to all members of a reach cluster where significant final effluent enters the reach. This is because a more detailed representation of catchment runoff hydraulics can help separate the intermittent discharge impact from the final effluent impact.
- The assignments excluded sites for which the appropriate investigation level was identified to be the Dilution Assessment in Step 1.

STEP 3 – REVIEW FOR UPM LEVEL 3 REQUIREMENT

The cluster reaches were reviewed for factors that merit a (more detailed) level 3 approach. These are:

- Current (2019) Water Framework Directive Dissolved Oxygen status lesser than Good. This indicates that the watercourse has a potential sensitivity to oxygen response that merits a more detailed assessment approach which allows for detailed representation of oxygen dynamics, including riverbed demand effects.
- Extended spatial distribution of intermittent discharges. This indicates that there is potential risk of extended impact durations in the watercourse as multiple discharges pass through that merits a more detailed representation of hydraulics and dispersion.

There are three cluster reaches (Seaton Burn 3 and 4, and Lustrum Beck) where these factors are present, and river dilution is considered to be modest. These require a Level 3 study which involves modelling validated by actual river flow and water quality data. Table 4 shows the list of investigations we identified from our methodology.

TABLE 4: LIST OF INVESTIGATIONS

Title	Site(s)	Description / Aims
UPM Level 3 Investigation	Lustrum Beck Seaton Burn 3 Seaton Burn 4	Carry out Level 3 UPM to confirm compliance with UPM standards and identify options as required. 3 studies comprising 42 overflows over 2 years 2025-2027.
UPM Level 2 Investigation	NWG Regionwide	Carry out Level 2 UPM to confirm compliance with UPM standards and identify options as required. 36 studies comprising 132 overflows over 2 years 2025-2027.
UPM Level 1 Investigation	NWG Regionwide	Carry out Level 1 UPM to confirm compliance with UPM standards and identify options as required. ~300 studies comprising 827 overflows over 2 years 2025-2027.
Dilution Assessment	NWG Regionwide	Carry out dilution assessment to confirm if watercourse dilution is sufficient to prevent ecological harm. Avoid or add detailed investigation for 381 overflows over 2 years 2025-2027.

2.3.4 Approach for identifying needs related to designated bathing and shellfish water discharges

We have followed the WINEP Storm Overflow driver guidance and completed the supplementary SO Reduction Prioritisation Matrix to identify the overflows that are linked to designated coastal bathing and shellfish waters. There are no designated inland bathing waters in our operating area. We have decided to plan for all overflows linked to bathing waters to achieve no more than two spills per bathing water season, on average. We compared the recorded spills against the spills from the hydraulic modelling and obtained the volumes of storage required for the relevant overflows to achieve the spill performance.

2.3.5 Approach for identifying needs related to inland, estuarine and coastal discharges

We have followed the WINEP Storm Overflow driver guidance and completed the supplementary SO Reduction Prioritisation Matrix to identify the priority overflows discharging to inland and estuarine watercourses. We used event duration monitor data to identify the number of spills per annum and to identify the sensitivity of the reviewing watercourse for the discharge of these assets. This includes Sites of Special Scientific Interest (SSSI), Special Protection Areas (SPA), Special Areas of Conservation (SAC), Ramsar and Eutrophic waters. We also assessed if previous Storm Overflow Assessment Framework (SOAF) studies have identified an environmental impact through water quality modelling or sampling. We compared the spill data against the spills from the hydraulic modelling and determined the volumes of storage required to achieve no more than ten spills per year, on average.

For the overflows that discharge to coastal locations but are not linked to designated bathing or shellfish waters, the approach followed for inland and estuarine overflows has been applied. Where an investment has been identified, a target of no more than ten spills per year, on average, has been defined. There is ongoing consultation[12] about coastal overflows, which closed on 24 July 2023. We will update our plan accordingly, if required.

2.3.6 Approach for identifying needs related to screens

For each of the storm overflows identified as requiring investment, we undertook an assessment to determine whether a screen was required. We used photos, asset records and operator feedback to confirm which overflows are unscreened or had a non-compliant screen. The number of screens required are shown in Table 6 in the following section.

2.3.7 The scale and timing of investment

Of the total 1,567 overflows identified in the 2021 reference year, 1,017 were identified as spilling greater than ten times per year and 333 were identified as high priority. Fifty-four spill more than two times a bathing season into bathing waters. Our decision on how many priority assets to profile in each AMP has been informed by the following criteria:

- The WINEP profiling guidance says that for AMP8, 38% of the high priority overflows or 14% of the total have to be addressed whichever number is the lowest. Table 5 shows that 38% of 333 priority ones (127) is lower than 14% of 1,017 (143).
- The SODRP targets are based on individual assets. However, to deliver on these targets most effectively, we have grouped them into geographical areas called drainage communities, as shown in Figure 2, to provide efficiency, maximise opportunities for benefit and reduce adverse impacts on customers. This is why we are intending to deliver 132 high priority sites rather than 127 sites in AMP8.
- Our feedback from customers which is described in section 2.5.

TABLE 5: CUMULATIVE NUMBER OF STORM OVERFLOWS

AMP (year)	8 (2030)	9 (2035)	10 (2040)	11 (2045	12 (2050)
Target based on guidance					
Target % high priority	38	75	87	100	100
Target number of high priority sites	127	250	290	333	333
Target % Total	14	28	52	76	100
Target number of overflows > 10 spills	143	286	530	775	1017
Proposed delivery profiles					
Proposed high priority sites	132	255	291	333	333
Proposed non-high priority sites			189	389	630
Proposed bathing waters	27	54	54	54	54
Proposed storm overflows improved	159	309	534	776	1017

[12]Defra, 2023, Storm Overflows Discharge Reduction Plan Consultation - Defra - Citizen Space

Since publishing our DWMP which contained 160 sites, we have removed one overflow (Burniston Drive PS) from AMP8 as it is being abandoned as part of an AMP7 delivery scheme. There are a further five overflows that we intend to deliver in AMP7 as part of our UIMP4 WINEP commitments. These overflows were included in the DWMP in AMP8 (three overflows) and AMP9 (two overflows). This work is described in Section 2.2.

FIGURE 2: GIS MAP SHOWING RELEVANT DRAINAGE AREAS

We selected the drainage catchments for AMP8 using the following criteria:

- The drainage catchments with the highest concentration of priority overflows have been profiled in earlier AMPs.
- The drainage catchments where we also have the highest confidence in the correlation between modelled spills and event duration monitor data are profiled in earlier AMPs. Where confidence is lower, we have profiled delivery into AMP9 to allow us sufficient time to carry out further investigation work to inform our identification of the correct intervention.
- The bathing water no deterioration drivers for Seaton Carew and Marske bathing waters.

Table 6 shows the list of storm overflows that we have identified as needs for AMP8 for the relevant drivers.

TABLE 6: LIST OF SITES

Drainage Area	Sewage Treatment Works (STW)	No. of Drainage Communities	No. of BW Assets (Env_Act_IMP3)	No. of Inland Water Assets (Env_Act_IMP4)	No. of Screens Required (Env_Act_IMP5)
Bedlington & Cambois	Cambois STW	4		7	
Benton	Howdon STW	1		1	
Berwick	Berwick STW	6	13	5	17
Birtley	Birtley STW	1		2	1
Bishop Auckland	Bishop Auckland (Vinovium) STW	4		6	2
Burn Valley	Seaton Carew STW	1	1	0	1
Carrville & Belmont & Shincliffe	Belmont STW	2		2	1
Chester le Street	Chester Le Street STW	6		10	2
Crook	Low Wadsworth STW	4		7	
Darlington South	Stressholme STW	1		2	2
Durham City & Newton Hall	Barkers Haugh STW	6		9	4
Eaglescliffe	Bran Sands ETW	3		6	5
Eastbourne	Bran Sands ETW	1		2	2
Ebchester	Consett STW	3		4	2
Felton	Felton STW	2		5	2
Guisborough	Marske STW	1		2	
Hartlepool South	Seaton Carew STW	3	2	1	1
Herrington	Sedgeletch STW	1		3	
Jarrow,Hedworth	Howdon STW	4		6	5
Lanchester & Burnhope	Lanchester STW	2		3	2
Leam Lane,Wardley,Bill Quay	Howdon STW	1		1	
Marske	Marske STW	4	6	0	
Nettlesworth	Plawsworth STW	1		2	2
Peterlee	Horden STW	2		2	
Redcar	Marske STW	2	5	0	
Rowlands Gill	Lockhaugh STW	5		6	2
Seaburn and Roker	Hendon STW	1		2	2
South Stanley & Craghead	Hustledown STW	4		9	1
Spennymoor	Tudhoe Mill STW	3		5	1

Drainage Area	Sewage Treatment Works (STW)	No. of Drainage Communities	No. of BW Assets (Env_Act_IMP3)	No. of Inland Water Assets (Env_Act_IMP4)	No. of Screens Required (Env_Act_IMP5)
Stockton East	Bran Sands ETW	2		2	
Thornaby North	Bran Sands ETW	1		1	
Washington North	Washington STW	2		3	1
West Rainton	Leamside (West Rainton) STW	1		5	2
Whitton & Thorpe Thewles	Carlton & Redmarshall STW	4		5	3
Willington & Hunwick	Willington STW	3		3	1
Wooler	Wooler STW	3		3	2
Total		**95**	**27**	**132**	**66**

2.4. NEED FOR ENHANCEMENT EXPENDITURE IN AMP8

2.4.1 Base vs Enhancement for AMP8

Table 7 lists our assumptions for what we have included within our base and enhancement cases. We have excluded all base expenditure from this investment case, so there is no overlap with enhanced expenditure.

TABLE 7: OUR ASSUMPTIONS AROUND BASE AND ENHANCEMENT

Base	Enhancement
• Meeting our obligations to drain our area – under current regulatory interpretation (that is, the assumptions in base models). • Cleaning of the network to make sure a network is effectively drained. • Removal of infiltration from the network where it is possible to do so. • Removal of internal flooded properties to upper quartile level. • Removal of external flooded properties to industry average • Activities to reduce spills to an average of less than 20 spills per annum (forecast to be achieved in AMP7.) • Refurbishment of screens. • Network Growth and urban creep.	• A new statutory obligation as defined by the WINEP Driver guidance. • New screens required to meet the requirements for screening under driver Env_Act_IMP5.

Our drainage and wastewater management plan identifies the preferred option to deal with the requirements of the Storm Overflow Discharge Reduction Plan (SODRP). It identifies the needs for today and into the future, 2045 and 2060. In accordance with DWMP guidance our modelling takes account of climate change, growth and increase in impermeable area (creep). As funding for growth and creep is base expenditure, we have removed this from our calculations before we consider the impact of flow on spills.

For example, if the Risk Based Catchment Screening stage of the DWMP identified growth as a driver in the catchment and the preferred intervention is storage, then we have compared the cost to meet the storage for storm overflows vs storm overflows + growth + creep. The difference has been allocated to base. There are some drainage communities where the storage requirement in 2045 is lower than that required today due to positive impacts from climate change. In these cases, we have not allocated expenditure to base. When identifying the changes to costs of solution, we have determined that it is only the storage cost that changes. The conveyancing of the flows to the storage remains the same. It is highly unlikely that small reductions in storage will impact on the length and size of sewers, the number of manholes, the location of a blue/green corridor, the requirement for service diversions, excavation depth, soil conditions or the scale of customer engagement – all of which make up the cost of a solution.

We have therefore reduced our grey storage investment in those catchments with growth by 4.8% and reallocated it to base expenditure.

2.4.2 Our historical base expenditure and comparative efficiency and service performance

In seeking to understand what can be achieved from base expenditure it is important to consider historical expenditure on base cost allowances for wastewater as well are our comparative efficiency and service performance. Where we have spent all our allowances in full there cannot be reasonable challenge that we should have invested more, or indeed that we have underinvested provided that we are managing our asset base effectively. At the same time where we are efficient, and our service performance is strong there is less scope to 'catch-up' to other companies.

We discuss what can be achieved from base investment in our **DWMP technical document**[13]. Historical analysis of our spend on base capital maintenance in wastewater confirms that we have spent everything we were allowed since 2000 and in fact overspent relative to allowances. This overspend gap increases on a forecast basis to 2025 (see our **asset health enhancement case**, NES35). The same case also presents wider evidence that questions the extent to which capital maintenance allowances are sufficient already to meet long-term sustainable levels of capital maintenance and also provides **independent assurance evidence** (NES67) that we are an effective manager of our assets, achieving a rating against Ofwat's AMMA framework of between 'competent' and 'optimising'. We have not underspent relative to our allowances and our AMMA performance gives some confidence that we are managing that expenditure effectively and efficiently.

We also rank first on Ofwat's PR24 wastewater efficiency models in aggregate and operate amongst the best performers in the sector for environmental and wastewater performance with a strong culture of innovation.

[13] See pp.25-28 'Driving improvement'

"*Some companies are doing better, and some metrics are improving. Credit to Severn Trent Water who retain a 4-star rating for the fourth year, and to United Utilities and Northumbrian Water who are not far behind.*" **EA, EPA report 2022**

Our relative performance on efficiency and service performance also suggests that there will be limited scope to reduce CSO spills from base cost allowances as we already operate at or close to the sector frontier.

2.4.3 Impact of silt on storm overflows

We have completed the Storm Overflow Assessment Framework WINEP investigations for 127 storm overflows during AMP7. Part of this process was to determine whether high spill frequencies at storm overflows were caused by hydraulic or operational (for example, build-up of sediment, asset operation, EDM installation) causes. Out of the 127 storm overflows investigated, less than 15 were concluded as having an operational influence on spill frequencies. A much lower number were concluded as being entirely driven by operational issues such as the build-up of silt in the sewer network. The vast majority of storm overflows were found to be spilling due to the hydraulic controls on the sewer network. Again this implies that there is limited opportunity to achieve more from base investment.

Our hydraulic modelling and solution development is based on a clean network. For each of the storm overflows that we plan to address in AMP8, we have modelled three scenarios to understand the impact of spill relating to 1) a clean network with no silt, 2) the network with 10% silt added to sewers with a gradient of less than or equal to 1 in 150, 3) the network with 20% silt added to sewers with a gradient of less than or equal to 1 in 150. We have then compared this to the actual number of spills measured by event duration monitors.

On average our event duration monitors spills are within 0.1% of our modelled clean network spills. On average, with 10% silt depth applied, spills increased by 3.8% overall and with 20% silt depth applied, spills increased by 10% overall. The largest increases in spill frequency were observed at a small number of storm overflows rather than at all storm overflows within an area. In most cases, spill frequencies were predicted to change insignificantly. In some cases, spill frequencies were predicted to reduce as flows were predicted to be held back in the upstream network as a result of reduced pass-forward flow capacity. The modelling showed that a non-clean system impacts on the number of predicted spills at only some storm overflows that are sensitive to silt build-up in the network. Our modelling of a clean network forecast, which is based on clean hydraulic models, shows the best achievable spill frequency and effectively already starts from a position that will require additional base maintenance to achieve- because out network is not 100% clean.

2.4.4 Link to long term strategy

Our long-term strategy is being developed alongside the long-term planning frameworks. We are focusing on an adaptive planning approach for four long-term areas where investment is needed to maintain and enhance the service we provide. Our DWMP process sits within the 'protecting and improving our local water environment' area.

The targets set out in Table 5 come from our Long-Term Strategy (NES_LTDS). This has decision and trigger points for storm overflows fixed to the DWMP regulatory five-year cycle, and the government review of storm overflow targets in 2027 as outlined in the Storm Overflows Discharges Reduction Plan. The resulting adaptive pathway for environmental protection is therefore centred around the five-yearly cycles.

The network of EDM enables the number of storm overflow discharges to be continually monitored. Following interventions, the impact can be assessed, and any future investment adjusted accordingly.

The need for storm overflows is statutory and therefore investment in storm overflow discharge reductions is included in our core pathway. But within this, there are still some options around phasing of the programme over multiple price control periods. Our long-term delivery strategy describes our need to make decisions about whether or not to accelerate or delay the storm overflows programme. We considered how quickly we should deliver these reductions, including the scope for accelerating this before the Government deadline in 2040. Alternatively, we considered delaying parts of the programme until 2030-2035 to prioritise affordability for the 2025-2030 period.

Our long-term strategy sets this decision in 2024, as accelerated investment would need to begin in 2026 and be funded through the PR24 price review process. This decision needs us to balance customer priorities between environmental outcomes and affordability, while meeting the statutory deadlines and ensuring the long-term programme is deliverable. Our PR24 business plan (including this enhancement case) sets out our current core pathway which would be needed to achieve this. We developed several alternative plans that could delay some of the work to 2030-2035. Through our engagement with customers and understanding their priority (shared with the Government) to tackle bathing waters early in the process, we have concluded that the plan set out in our DWMP is the right one.

This could change before the price review final determinations in 2024, in response to changing priorities or different views about how these priorities should be balanced. We have also included an uncertainty mechanism in A3 – costs (NES04) to reflect the potential for storm overflows requirements to change after 2025, in response to reviewing the SODRP.

The pathway beyond 2030 might also change, if for example our climate change, technology and demand scenarios turn out to be closer to the "benign" view in our long-term delivery strategy (for example, under our "sustainable future" scenario). In Section 3.3 of this enhancement case, we show the options we have considered. Options which either do not currently meet the need or are not technically feasible might become more feasible in future – for example, as technology develops, or customer views change, or as strategic partnerships emerge. We have noted where we can already see some of these options being developed as a strategic option (such as smart networks, behaviour change, or active management). These do not have known trigger points as these factors are yet unknown, but this could reduce future costs or create more opportunities.

To be able to take these opportunities in practice, we are exploring two projects to understand the scope for alternative pathways in future:

- As part of WINEP, we proposed discharge reduction trials to support customers in reducing the flow of storm water into sewers. This was rejected in WINEP, but we continue to explore how we might achieve this.
- The introduction of smart networks, where we are introducing more data and monitoring in order to control flows of storm water into and within our system.

These projects will help us understand if there are opportunities for alternative pathways in the future, including learning more about how these could work in practice. In addition, we expect the number of green solutions to increase over time as these become more feasible – and after discussing this with our customers, we have explicitly chosen more green solutions to support their preferences. This will provide further learning opportunities too, which we will share with the sector and supply chain to support further opportunities at future price controls.

Our long-term investment will be informed by the floating trigger points monitoring. We will monitor both the impact of storm overflow discharges and the number of discharges before and after interventions and adapt our investment accordingly.

2.5. CUSTOMER SUPPORT FOR THE NEED

Our customers expect us to deal with sewage and heavy rainfall effectively, and to take care to protect the environment in everything we do.

Although the storm overflows programme is a statutory requirement – and so the need for investment is set by the Government – we wanted to test this thoroughly with our customers. As we describe in Section 5.1 of **Appendix A1 – Customer Affordability** (NES02), we wanted to consider the balance between investment and affordability, which means considering the phasing of investment between AMP8 and AMP9.

Our customers tell us that the environment is important to them. However, the reduction of storm overflows is more mixed – our **common PCs insight summary** (NES42) scores this a “**medium**” priority. In Ofwat and CCW’s preferences research in 2022, participants ranked this as “lower importance/impact” and noted that they did not feel directly affected by storm overflows. In our own pre-acceptability research, our customers ranked "tackling storm overflows which release heavily diluted wastewater into rivers and seas" 6th out of the 14 areas presented.

We asked customers whether they preferred engineering solutions or nature-based solutions and provided some indicative costs. Customers told us that they preferred a hybrid approach, taking elements of each of the approaches and ultimately creating a lower-cost, nature-based solution (see our **common PCs insight summary**, NES42). In our DWMP research, customers said that concrete tanks were more affordable, but noted that they preferred nature-based options and wished these were more affordable.

We developed several options for each storm overflow (as detailed in our **storm overflows enhancement case**, NES27). These looked at grey storage as well as several green and hybrid options, and we estimated costs for each. In our pre-acceptability research, we discussed phasing storm overflows with our customers (at a potential cost of £31.48 on bills by 2030). Customers had mixed views, with some preferring to push back this investment beyond 2030, and some preferring to invest now. They asked us to look at alternative options for further discussions (see our **common PCs insight summary**, NES42).

In our **Affordability and Acceptability Testing qualitative research** (NES49), we asked customers about three possible phasing options, based on our previous discussions. Customers preferred our "middle" option (which is the option we put forward in this enhancement case), including the use of nature-based solutions in some cases where these were "best value" as they had additional environment and social benefits.

How did we make our decisions?

We wanted to find the right balance between providing an affordable wastewater service and delivering on environmental performance. Our early assessment of customer priorities and statutory requirements showed that there was limited flexibility in the speed and type of solutions, but there would be choices to make on:

1. **The phasing of investment**. The SODRP sets out the number of storm overflows we should tackle by 2030 (38% of high priority sites, and 14% of all overflows), but in our **draft DWMP** we said that we would be prepared to push back on this pathway if our customers supported a different approach. There were also choices about exactly which storm overflows to tackle in each five-year period, particularly when to improve storm overflows that could affect bathing waters (which can be many times more expensive to improve).
2. **The type of solutions**. Our customers told us they preferred a hybrid approach, taking elements of both engineering and nature-based solutions. We knew that there would be some choices about which solutions to apply where, with different costs and benefits attached to each.

We wanted to test this thoroughly with our customers to consider the right balance between investment and affordability.

We did the first part of this with our customer engagement on our draft DWMP, asking customers **their views about their priorities in shaping our plan in November 2020** and then **their feedback on our possible options in the draft DWMP** in November 2022. This showed that there were divergent views, with some customers preferring the cheapest options ("least cost" storm overflows and no ambitious flooding goal) and others preferring to include the Northumbrian Integrated Drainage Partnership (the partnership of Northumbrian Water, the North East's 14 Lead Local Flood Authorities and the Environment Agency) and "best value" storm overflows as this added better value, would be right for the environment, and would be the right choice for the future (one participant noted that storage tanks deferred the problem, but would be regarded in the future in the same way we consider combined sewer overflows now). Some customers preferred a more affordable option for now but would be open to revisiting options in the future.

This research showed that customers are divided on the right thing to do here – as citizens they support the outcomes of the more expensive options, but do not think everyone will be able to afford them. We left these options open and began to look at alternative approaches.

Customers told us they were concerned about potential bill increases, and so we provided evidence to the Government in our draft DWMP (and separate correspondence) about the potential bill impacts, and our concern that customer evidence should be considered when setting the Storm Overflow Discharge Reduction Plan (SODRP). We also asked Ofwat to support us in setting the right balance between investment and bill impacts, including taking a holistic approach across all the requirements for 2020-30. In the **final plan**, the Government decided that these targets – and the associated bill impacts – were appropriate.

We developed a plan to improve 38% of storm overflows, in line with the SODRP. We looked at a range of feasible options for tackling each storm overflow, including green and grey solutions (these options and their development are described in our **enhancement case for storm overflows**, NES27). We scored the benefits of each solution, using valuations from our framework which were derived directly from customer research (our "**Copperleaf valuation research**"). We identified the least cost and best value solutions for each storm overflow.

Our emerging costs for our draft DWMP were very high, and we looked at alternative options for tackling storm overflows. This included exploring innovative technology options for optimising our wastewater network, which we integrated into our options (this can be part of the improvements from a wider project, rather than tackling any storm overflows entirely on its own).

We then shared this plan with our customers again in our pre-acceptability research. Some of our customers wanted to push this investment back beyond 2030, where others preferred to invest now. Customers told us that although they supported doing more than the minimum, the "must do" plan (which included storm overflows) would already be difficult to afford. As a result of these findings, we looked at a range of alternative options where we might meet the statutory requirements by either reducing costs or delaying investments until 2030-35.

We modelled different scenarios for phasing investment between 2025-30 and 2030-35, looking at thirteen alternatives. Many of these alternatives did not comply with statutory requirements, particularly the requirement to invest at Marske-on-Sea and Seaton Carew before 2030 (to comply with “no deterioration” at these bathing waters). Our remaining flexibility was on other bathing water storm overflows, where our preferred plan would tackle half of these before 2030 – these are some of the more difficult and expensive schemes and could be delayed until the 2030-35 period if customers were comfortable with these bathing water overflows not being addressed before then. We considered alternative ways of targeting storm overflows, such as looking at those that spill the most first.

Given the expectations to meet our statutory requirements, we concluded that most of these options were not feasible. We put three phasing options forward for customers to discuss and consider more (bills here are the estimates we gave in our customer research; in our business plan we give updated lower bill impacts):

1. Delaying almost all bathing water schemes to 2030-35, except for Marske-on-Sea and Seaton Carew. This would reduce the impact on bills to £21 by 2030. This formed part of our “must do” plan for our Affordability and Acceptability Testing and represents a minimum statutory investment. This would replace bathing water overflows with inland overflows (which are much cheaper).
2. Our “preferred plan”, which improves half of our storm overflows that could affect bathing waters in each of 2025-30 and 2030-35. This would cost £33 on bills by 2030.
3. Accelerate our storm overflows plans to deliver the 2035 targets by 2030. This would cost £49-50 on bills by 2030.

Each of these options had a similar impact on bills by 2035, because they phase investment over this period rather than delivering different outputs. We explained that we preferred the plan for £33 on bills because these bathing water schemes were a priority for stakeholders (including statutory requirements under WISER). These bathing water schemes are not considered “high priority” under the SODRP.

Customers supported our preferred plan in our **Affordability and Acceptability Testing qualitative research** (NES49), with many preferring the higher phasing option to accelerate this further. Customers strongly thought this was an important investment.

We know this ambition needs to be balanced against affordability, with many customers in our qualitative research saying that even the “must do” plan is difficult to afford (around 29% of customers in the North East). There are also constraints on deliverability, with our analysis showing that a step-up in investment will already be challenging to deliver (with other investments and other companies also improving storm overflows). The Water Forum challenged us to increase the investment in storm overflows without increasing bills further for customers.

In response, we have put forward our preferred plan in our business plan – as this seems to provide the right balance of ambition against affordability and deliverability, while meeting the statutory SODRP requirements. However, we wanted to make sure that we could increase this investment if views about affordability or deliverability change in future – or, for example, if we find new and more efficient methods of tackling storm overflows. We have proposed an uncertainty mechanism which would protect customers if these costs are very different – and would allow the flexibility to increase the pace of the storm overflows programme before 2030 if the situation and customer views change. Customers said that they would prefer a more affordable option for now but would be open to revisiting options in the future. We expect that there could be more opportunities for partnership working during 2025-30, and our early engagement with local stakeholders (in March 2023) has shown that there are opportunities including through the Northumbria Integrated Drainage Partnership (NIDP).

In making this decision about phasing, we also looked forward through our long-term delivery strategy. With a larger investment in 2025-30 than in 2030-35, we would be able to increase the pace of the storm overflows programme in future investment periods if required – or meet other future environmental, climate change resilience, or net zero demands.

We also asked customers about nature-based and hybrid solutions for individual storm overflows. As customers had said they supported these where it was not much more expensive, we explored where this could be achieved. We identified where we could switch to better value green solutions for our plans across 2025-30 and 2030-35 – and developed a plan to reduce our storage by around 9,500m^3 in 2025-30 (for an additional £41m) and 5,700m^3 in 2030-35 (for an additional £31m). These green solutions are better value because they have lower embedded carbon, among other benefits (see our **storm overflows enhancement case for full details**, NES27). Customers agreed that this was acceptable in our pre-acceptability research, and in our Affordability and Acceptability Testing qualitative research.

We made our decisions about phasing and the different options in parallel with customer research, stakeholder engagement, and engineering options development – with many discussions at our Board and challenges from the Water Forum and others. This iterative approach helps us to be confident that this is the right approach.

In our **quantitative research** (NES50), 74% of customers supported our preferred plan, including this investment.

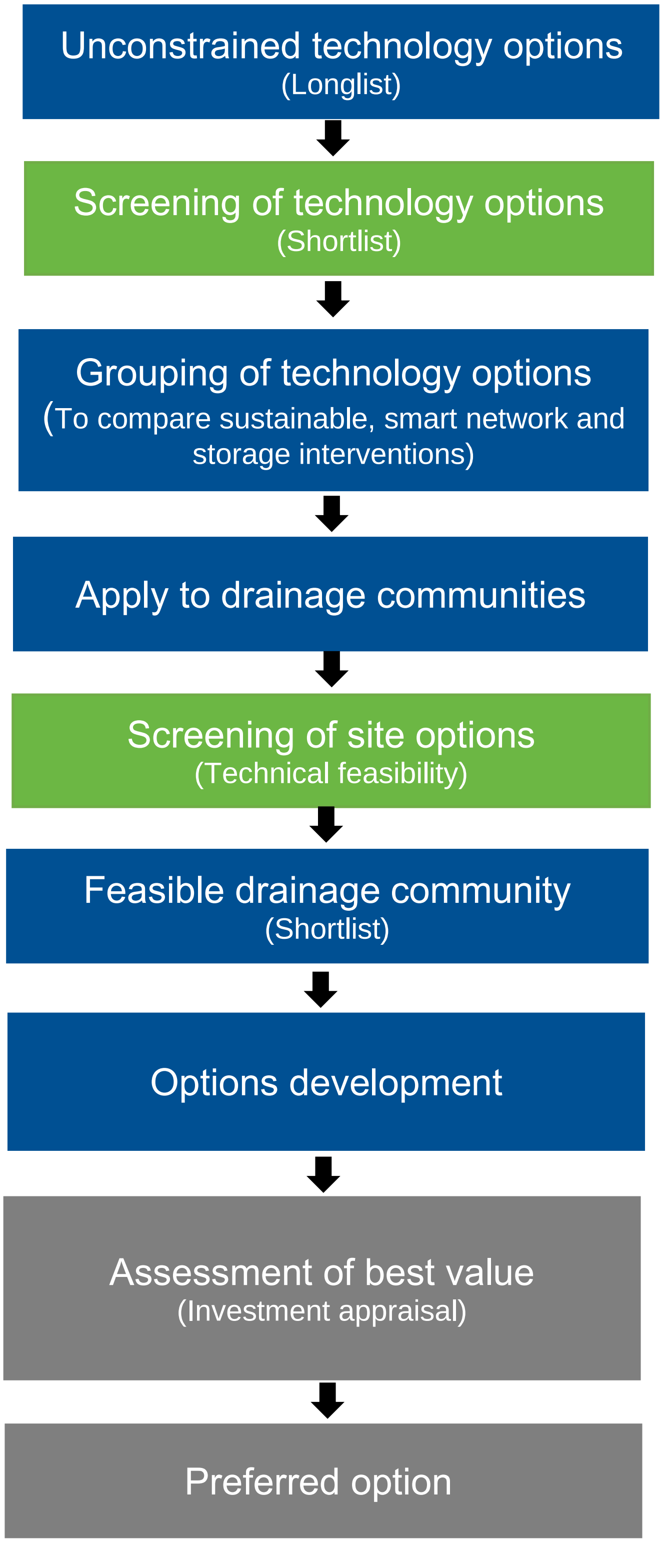
3. BEST OPTION FOR CUSTOMERS

3.1. PROCESS FOR IDENTIFYING THE BEST OPTION FOR CUSTOMERS

Figure 3 shows our process for identifying the best option for customers which is based on the principles of the HM Treasury's The Green Book: Central Government Guidance on Appraisal and Evaluation[14], with input from the WINEP Options Development Guidance and the Drainage and Wastewater Management Plan Framework. A full description of each step and the output from it is contained in the following sections.

[14] HM Treasury, 2022, The Green Book, Central Government Guidance on Appraisal and Evaluation

FIGURE 3: PROCESS FOR DEVELOPING AND FILTERING OPTIONS



Unconstrained list of technology options (Section 3.3.1)

We have developed a broad range of potential technology options in accordance with Section 7.2.1 of the WINEP Options development guidance. These either remove or hold back flows in the network, provide storage or treat storm overflows.

Constrained list of technology options (Section 3.3.2)

We have screened the unconstrained list of technology option against:

- expected to meet statutory obligation; and
- technically feasible in accordance with Section 7.2.2 of the WINEP Options Development Guidance.

Our initial constrained list contains a variety of options which will deliver part but not all spill reductions. We have therefore combined options as part of our DWMP process which allows us to assess differences between green, grey and technology options to make sure we maintain a long-term sustainable approach.

Application to drainage areas (Section 0)

The combined technology options allow us to apply a holistic approach to our drainage communities assessing different levels of cost, community, and environmental benefit for each area. We have applied blended options to each of our drainage communities and then screened this to make sure the technology is technically feasible to implement in that area. For example, we are unable to consider surface water removal of roof drainage if there are no commercial properties in the drainage community.

Options development (Section 3.3.4 and 3.4)

We have developed scope to level 2 which contains a mixture of modelled solutions. Where tanks proposed a desktop exercise has been carried out to make sure the proposed locations are suitable.

Assessment of best value (Section 3.5)

We have carried out an assessment of benefits and net present value for each of the options from the constrained list at each site using the guidance in Section 7.3 of the WINEP options development guidance. We have considered all the benefits that exist in the drainage community such as flooding, environmental and social benefits.

Preferred option (Section 3.5.2)

We have selected the preferred option and where we have not selected the least cost option we have explained why. For each option we have carried out a deliverability assessment. Further information is contained in Section 3.9.

3.2. DEFRA'S REQUIREMENTS FOR ASSESSMENT OF BEST VALUE

Table 8 outlines how we have met the expectations within Defra's Storm Overflows Discharge Reduction Plan.

TABLE 8: MEETING DEFRA'S STORM OVERFLOW DISCHARGE REDUCTION PLAN

Expectation	How this has been met
Maximise wider benefits and address multiple issues.	We have assessed each of the potential intervention options as part of our DWMP process and the WINEP guidance, where we consider all needs and interventions within a drainage area/community. Our wider benefits assessment includes pollution, internal and external flooding, carbon, biodiversity, amenity, health/wellbeing, trees and noise. We have used a combination of our value framework and the Construction Industry Research Best Value tool (B£ST). Further information is contained in section 3.5.1.
Deliver best value for people and the environment	We have identified a least cost and best value option for all drainage areas, which covers the extra benefits that will be delivered by as outlined above.
Progressively removing surface water from the sewer system year-on-year	Removal of surface water is core to our strategy and is considered prior to building of storage tanks and treating of flows. Our methodology for removal of surface water assumes that some surface water will be removed in AMP8 and some will be removed in AMP9 and in subsequent AMPs.
Consider biodiversity net-gain	We have used the CIRIA B£ST tool to calculate biodiversity net-gain for the options. Further information is contained in section 3.5.1.
Catchment level and nature-based solutions	We have considered nature-based solutions such as sustainable urban drainage, blue green corridors and reed beds for treatment as shown in Figure 4. We have engaged stakeholders on these wherever possible through stakeholder engagement. Our interventions consider the options for addressing other drivers as part of our DWMP.
Less carbon-intensive; sustainable and long-term effectiveness	Our optioneering hierarchy as shown in Figure 3 considers less carbon intensive and sustainable solutions. Section 3.5.1 describes how we have assessed each of our options against our value framework over a 30-year period, which considers the certainty that benefits will be delivered.
Provide co-benefits for the environment and society	Section 3.5.1 describes how we have assessed each of our options against our value framework which includes both environmental and social benefits from the wider environmental objectives. Section 3.11 includes three case studies which shows how we have assessed co-benefits for the environment and society.
Work in partnership to promote green infrastructure. New habitats and carbon sinks	We are actively working in partnership with the Environment Agency and the Lead Local Authorities as part of the Northumbria Integrated Drainage Partnership (NIDP) to promote collaborative working to reduce the risk from all sources of flooding. This work has continued in the DWMP, where we used our existing mature relationships to identify 700+ collaborative opportunities. The DWMP has identified an opportunity to expand the NIDP to a true drainage partnership by expanding it to include opportunities to implement green solutions for collaborative multiple outcome solutions including storm overflow reductions, water quality environment benefits, as well as all sources of flooding. The NIDP and DWMP both prioritise green infrastructure. For example, we have identified opportunities with Gateshead Council in Wrekenton East and with the Environment Agency in Hartlepool. The DWMP Option Development and Appraisal Hierarchy highlights this.

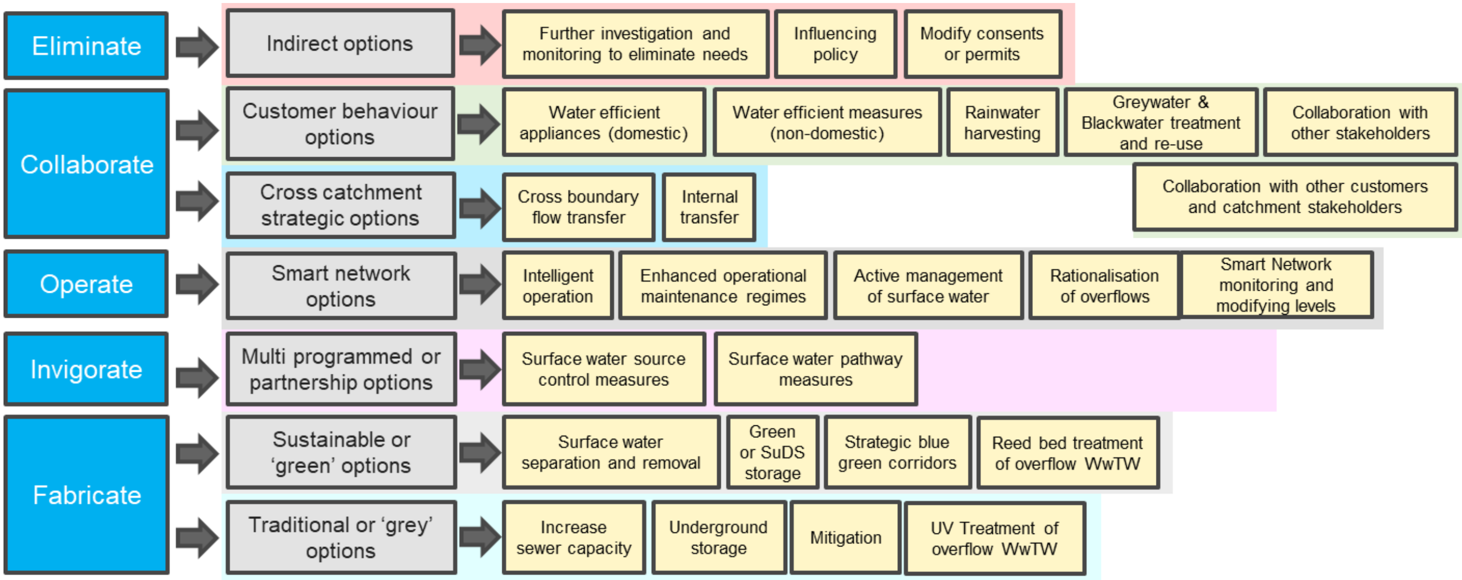
3.3. OPTIONS FOR REDUCING SPILLS

3.3.1 Broad range of options

Options for removing spills are primarily about removing surface water from the network or storing it or holding it back. As part of our drainage and wastewater management plan we have considered a broad range of options (our unconstrained list) with differing levels of costs and benefits, which are categorised as follows:

- **Eliminate** - identification of monitoring or changes to policy or permits which may remove the need for investment. Eliminate options are likely to have the lowest costs to deliver the benefit. They may be used in combination with other options.
- **Collaborate** - work with stakeholders to re-assign the issue or co-fund. Costs can be shared with third parties either to deliver the same or an extra level of social and environmental benefit. When considering the types of options to address spills, we have also worked in partnership with other teams to consider how this work overlaps with:
  - Flood Risk Management Plans;
  - National Infrastructure Commission – reducing the risk of surface water flooding;
  - Flood and Coastal Erosion Management; and
  - Flood and Coastal Innovation Programmes such as the Durham County Council Community sustainable urban drainage system innovation accelerator.
- **Operate** - improved operational management practices to enhance existing capacity. This includes the provision of Smart Networks, using RADAR rainfall data and hydraulic models to optimise operation of the network to reduce Storm Overflow Spills.
- **Invigorate** - invest in the existing infrastructure to improve performance. These options will provide an increased level of benefit but may be of a lower cost than fabricate options.
- **Fabricate** - new assets to augment or replace existing. These options are likely to have the highest costs. Green options will have lower carbon and potentially higher biodiversity and amenity benefits. Traditional grey options are likely to have highest certainty that service-related benefits will be realised. Innovative options have been considered such as smart networks and treatment of storm overflows via ultraviolet, reed beds and side streams and discussed with the Environment Agency on 26th June 2023. These have lower certainty that the benefits will be realised.

FIGURE 4: BROAD RANGE OF OPTIONS CONSIDERED[15]



It is a requirement of the SODRP to understand where properties with separate rainfall pipes are connected to the combined sewer network. In our region we have assumed that nearly all properties served by one pipe have their surface water connected to it. This is because we have very few soakaways or thatched roofs within the region. We are seeking to address this through surface water separation in the network and removal of surface water inflows. We are working with the Northumbria Integrated Drainage Partnership to use statistics to identify future opportunities for property level separation. Our plan to address these priorities will achieve year on year reductions in the amount of surface water that is connected to their sewer network – 166.3ha[16] by 2030.

3.3.2 Screening of technology options

As outlined in Figure 3, we screened each technology option in our constrained list (Figure 4) against the following two criteria to determine whether they meet the need:

- Expected to meet statutory obligation, and
- Technically feasible in accordance with Section 7.2.2 of the WINEP Options Development Guidance.

The outcome of this screening exercise is shown in Table 9.

[15] Note that the broad range of interventions applies to both base and enhanced allowances.
[16] Northumbrian Water, DWMP data tables

TABLE 9: SCREENING OF OPTIONS IN OUR UNCONSTRAINED LIST AGAINST NEED AND TECHNICAL FEASIBILITY

Option	Meet Statutory Obligations?	Technically Feasible?	Reason for discarding	PR24 data table line
Further investigation and monitoring to eliminate needs Understand root cause and risk.	Part (Bathing Water and River Water Quality only	Yes	**Carried forward for investigation** Investigations (ENVAct_INV4) to understand the monitoring requirements set out in our business case to understand the impact of storm overflows on receiving water bodies. These will inform our interventions but not remove the need for investing in reducing spills from storm overflows as this is a new statutory requirement.	Investigations, other - multiple surveys, and/or monitoring locations, and/or complex modelling
Influencing policy Growth, planning and urban creep.	No	Yes	**Discarded** This is a new statutory requirement so options for eliminating/reducing the need for investment are limited. Our normal new development process is to work with planners to make sure surface water is not connected to the combined sewerage system. The only growth should be dry weather flow, and this is very unlikely to impact on spill frequency. Opportunities for influencing policy around sustainable urban drainage exist and have been carried forward below.	Base
Modify consents or permits Review the permit with the Environment Agency and meet new permit conditions.	No	Yes	**Discarded** Reviewing permits and consents is not consistent with SO guidance which is intended to reduce spills. Any change in permit would not alter the number of spills and is unlikely to be accepted by the regulator.	Base
Water efficient appliances/water efficient measures (domestic and non-domestic) Supplying customers with household appliances which are designed to reduce water consumption. Reduced per capita consumption (PCC) can also benefit the wastewater system by reducing the dry weather flow to be conveyed through the sewer network and through the STWs.	No	Yes	**Discarded** Even though the option is technical feasibly, storm overflows are there to deal with rainwater entering the system and reducing dry weather flow will have very little to no impact.	

Option	Meet Statutory Obligations?	Technically Feasible?	Reason for discarding	PR24 data table line
Rainwater harvesting Removing surface water from the system and making it available to re-use by installing measures which collect and store the rainfall before it lands and is lost as runoff. Rainwater harvesting reduces the amount of flow that needs to be conveyed through the sewer network during a storm, thus reducing the likelihood of sewer flooding or spills to watercourse. Includes smart management of surface water before flow enters the system (for example, smart water butts). Assume 50% take up and 50% opportunities remaining are AMP8 and remainder are subsequent AMPs.	Part	Yes	**Carried forward**	Storm overflow - sewer flow management and control
Greywater/blackwater treatment and re-use Install systems to treat and re-use household greywater (excluding toilets) and blackwater (including toilets) for flushing toilets and gardening use. Either at property level or larger scale to reduce both flow and load to the system. The treatment levels considered vary from treatment for potable use to pre-treatment for discharge into the combined or foul sewer network.	Part	Yes	**Carried forward for discussion with NIDP** This option will progress if any Northumbria Integrated Drainage Partnership schemes are proposed within the Drainage area. Currently, there are schemes planned for Sedgefield, Whickham South and South Stanley. See section 3.6.	
Cross boundary flow transfer Utilise available capacity elsewhere by transferring flows to a neighbouring Water and Sewerage Companies i.e., Scottish Water, Yorkshire Water or United Utilities.	No	No	**Discarded** This option was considered for Berwick which is adjacent to Scottish Water's area but discarded because it wasn't technically feasible. There is no suitable network in the largely rural Scottish Water area which could accept flows from Berwick. This would require an extensive pumped transfer.	Storm overflow - discharge relocation
Internal transfer Divert flows from one drainage area into an adjacent area.	No	Yes	**Discarded** We have yet to identify any areas that can be transferred from one area to another in the drainage and wastewater management plan, however we will continue to review this as we undertake a greater level of design as part of the delivery process.	Storm overflow - discharge relocation

Option	Meet Statutory Obligations?	Technically Feasible?	Reason for discarding	PR24 data table line
Collaboration with other customers and catchment stakeholders Includes supporting schemes being progressed by some of our key stakeholders. For example, Local Authority or Environment Agency funded projects such as flood defence works, highway upgrade etc.	Part	Yes	**Carried forward for discussion with NIDP** see Section 3.6	Combined with another intervention
Smart Network and Intelligent operation Controlling flow movement in reaction to the current situation. Allows the system to be operated proactively, maximising the use of existing assets. These options cover a range of different approaches. For example, installing monitors modifying the start-stop levels at strategic pumping stations or the creation of new network control points which allow flows to be temporarily held back in the catchment.	Part	Yes	**Carried forward** Considered in conjunction with other options	Storm overflow - sewer flow management and control
Enhanced operation maintenance regimes Pro-active and targeted operation and maintenance rehabilitation programmes.	Part	Yes	**Carried forward in base programme** On its own, this would not be sufficient to address SO Needs but may be used as part of the solution to make sure that operational problems do not exacerbate spills which would not be addressed under routine maintenance regimes. It is not considered that there are any overflows in our plan which spill solely as a result of silt or operational issues. Our modelling is based on a clean network as described in section 2.4.3.	Base for normal levels of maintenance Enhanced for operation of new assets to meet higher standards
Active management of surface water Interventions are evidence based reactive to change. Real time data on rainfall, flows and spills are used to control interventions to maximise capacity in the network. For example, variable control strategies.	Part	Yes	**Carried forward** Same answer as Smart networks. This may be used as part of a wider strategic option.	Base

Option	Meet Statutory Obligations?	Technically Feasible?	Reason for discarding	PR24 data table line
Rationalisation Rationalisation of overflows within a single drainage area to improve management of spills without providing extra storage or increase capacity	Yes	Yes	**Carried forward for further investigation in delivery** We have not currently identified any opportunities for rationalisation of overflows in a drainage area. Rationalisation is likely to mean that by having less storm overflows, the remaining ones spill more frequently. As we progress through to detailed design, we will review this option as part of the process.	Storm overflow - discharge relocation,
Surface water source control measures Managing surface water and maximising its potential for re-use. Opportunities for large-scale source control installation such as retrofitting in highways and around buildings.	Yes	Yes	**Carried forward**	Storm overflow - source surface water separation
Surface water exceedance pathways The need to provide safe conveyance (as opposed to storage) for floodwater during an extreme rainfall event (when the capacity of the sewer network is exceeded). This could significantly mitigate the risk of considerable damage to public and private property and even loss of life that could result from an extreme rainfall event	No	No	**Discarded** This option is defined so that any exceedance is routed away from properties in severe events. This will not be an effective option for managing CSO spills.	Storm overflow - source surface water separation
Strategic blue green corridors Combine the management of blue and green spaces in urban environments with a focus on place making.	Part	Yes	**Carried forward**	Storm overflow - sustainable drainage / attenuation in the network
Surface water separation Separate surface water from combined systems by constructing new surface water networks.	Yes	Yes	**Carried forward**	Storm overflow - sustainable drainage / attenuation in the network
Surface Water Removal Preventing surface water from discharging into the combined system by diverting to watercourses or other surface water systems.	Part	Yes	**Carried forward**	Storm overflow - sustainable drainage / attenuation in the network

Option	Meet Statutory Obligations?	Technically Feasible?	Reason for discarding	PR24 data table line
Green or SuDS Storage SuDS Storage such as ponds. basins or swales.	Part	Yes	**Carried forward**	Storm overflow - sustainable drainage / attenuation in the network
Increase sewer capacity Increase sewer capacity downstream of the CSO and carry flow to the WwTW	Yes	Yes	**Carried forward to review as part of delivery** We have not found any of these options when we produced the drainage and wastewater management plan. We will consider it further as part of the delivery process, when detailed modelling of solutions would be required as part of the design to ensure the solution works.	Storm overflow - increase in combined sewer / trunk sewer capacity
New CSO Construction of a new CSO with overflow to river.	Part	Yes	**Carried forward to review as part of delivery** Considered that it is preferable to reduce spills at existing CSOs rather than to construct new assets However we may have to build new CSO's where is insufficient space to carry out work at some existing overflows. This will not be evidence until we are undertaking a greater level of design. Building a new overflow with a higher weir will reduce the number of discharges.	Storm overflow - increase in combined sewer / trunk sewer capacity
Underground storage Online upgrade of existing CSO/storage tanks to provide extra underground storage to reduce storm impact.	Yes	Yes	**Carried forward**	Storage schemes to reduce spill frequency at CSOs etc - grey solution
Mitigation Surface water receptor measures. Keep floodwater away from buildings and strategic infrastructure in the event of a storm. This would include property level protection (floodgates etc.).	No	No	**Discarded** Usually used to route storm water away from flooding properties but this is unlikely to be effective in sufficient time to stop the CSO spilling.	
Treatment of overflows Treatment of overflows using Ultra-violet, reed beds or side streams	No	Yes	**Not currently favoured by Environment Agency** Existing guidance states that treatment in lieu of spill reduction can only be considered in exceptional circumstances e.g., not feasible or viable to reduce spills.	

The results of our screening show there are:

- Two options which have been taken forward as part of our base investment programme.
- Three options which will be reviewed as part of the delivery process, as we require a further level of design to understand whether they are feasible.
- One option that is taken forward as an investigation.
- Seven options which represent our technology constrained list which are shown in Table 10.
- All potential collaborative options will be discussed with Northumbria Integrated Drainage Partnership.

3.3.3 Application of options to individual drainage communities

We held a series of internal workshops to review each drainage community individually. The workshops were attended by our sewer network modelers and engineers with a broad range of skills and experience. The scale of the needs within each drainage community was reviewed and the technical feasibility of providing each option in our constrained list was evaluated. Table 10 shows the data that was used to understand whether an option in our constrained list was feasible for each drainage community.

TABLE 10: PROCESS FOR DETERMINATION OF OPTION ELEMENT AVAILABILITY

Option	Availability Assessment
Rainwater harvesting **Residential source control** **Commercial source control**	GIS queries to determine the total area of impermeable roof surface currently contributing to surface water runoff to the combined sewer network within a drainage community. Available roof areas were quantified within a drainage community and characterised based on the building use (residential/commercial).
Smart Network and Intelligent operation	Assessment of sewer network pipe diameters and the presence of assets such as storm overflows, storage tanks and pumping stations to estimate the potential number of smart network opportunities within a drainage community.
Strategic blue green corridors	GIS analysis using topographical data (LiDAR) and land-use mapping information to determine suitable routes for strategic blue-green corridor infrastructure. This included above-ground assets such as conveyance swales as well as below-ground assets such as large diameter surface water sewers. Routes were plotted using GIS tools to determine feasible routes where blue-green corridors could discharge. The scope for a blue-green corridor was determined based on the characteristics of the drainage community and the land-use (for example, minor/major highways, green spaces).
Surface water separation	GIS analysis to determine where there are separately drained foul and surface water networks that are currently connected into the combined sewer network. An assessment was then made to determine the scope for a new sewer network that would be required to disconnect the surface water sewer from the combined sewer and discharge to a waterbody receptor.
Surface Water Removal	GIS analysis to determine where parts of the network are served by a combined sewer network. These areas were highlighted as potential locations for separation of the surface water runoff from highway surfaces (no allowance for separation of roof surfaces) through the provision of new surface water sewers. An assessment was made to determine the total area of surface water separation scope within the drainage community.

Option	Availability Assessment
Green or SuDS Storage	GIS analysis using topographical data (LiDAR) and land-use mapping information to determine suitable locations for above-ground SuDS storage assets. This was assessed in conjunction with the strategic blue-green corridor option. The scope of the SuDS storage was determined based on the area available.
Underground storage	Assessment of volume required to achieve 10 spills per year or 2 spills per bathing water season, depending on the characterisation of the storm overflow. This information was determined by hydraulic modelling.

If the option was applicable, we then assessed the quantity of surface water available to be removed or stored at the drainage community.

For the rainwater harvesting/residential and commercial source control options, the elements were prioritised so that the maximum area/scope was utilised before moving on to the next option For example, the maximum area of residential/commercial source control available within a drainage community may have been sufficient to achieve the required need for a storm overflow. In other drainage communities, the maximum area available may not have been sufficient, and therefore the next element would be considered. This process was followed until the need in the drainage community was satisfied by the option elements.

In circumstances where a drainage community required storm overflow spill frequency reduction schemes in multiple AMPs due to the prioritisation approach implemented, the available scope was pro-rated across the AMPs. For example, if the overall demand for a drainage community was higher in AMPs 10, 11 or 12, then the availability of the individual option elements was pro-rated so that not all was utilised in the earlier AMPs. This is demonstrated in the following example:

Drainage Community X

Total Rainwater Harvesting Available Area: 2 ha

- Storm Overflow 1 (AMP8): Rainwater Harvesting Need: 3 ha (37.5% of overall Need)
- Storm Overflow 2 (AMP11): Rainwater Harvesting Need: 5 ha (62.5% of overall Need)
- Availability of Rainwater Harvesting Area in AMP8: 0.75 ha (37.5% of overall availability)
- Availability of Rainwater Harvesting Area in AMP11: 1.25 ha (62.5% of overall availability)

For underground storage, the storage volume required to achieve the reduction in spill frequency for an individual storm overflow was reviewed to determine if there was physical space available to provide a storage tank. Furthermore, a high-level buildability evaluation was completed to determine whether the storage tank could be constructed and then operated safely; including whether there was existing access to the storage location and whether access could be maintained or created to ensure future maintenance of the asset.

An analysis was also completed, using engineering judgement and expertise, to evaluate whether the provision of an option locally would result in significant infrastructure upgrades elsewhere within the drainage area. For example, if the below-ground storage required in a drainage community could be emptied within a reasonable timeframe without requiring major upgrades to the receiving sewer network and/or STWs. Some storage solutions would result in detention periods of many days and in some cases over a week. This would result in the load to the receiving STWs being mostly rainwater and putting the overall treatment process at risk. When this instance occurred, storage was identified as not being a viable option. In all cases, green infrastructure is a viable option, either entirely or together with storage, to reduce spills to the required number.

3.3.4 Developing alternative options

In order to ensure we assessed a range of alternative options we created a number of options groups with different levels of green and grey benefits. These groupings also allow us some flexibility in the delivery process as some surface water removal options such as disconnection of roof drainage from the sewerage system for domestic properties are difficult to assess. We would need to do detailed studies of who is connected and whether customers are willing to have work done on their properties, which would incur too much cost unless delivery is confirmed.

The output of the grouping exercise is contained in Table 11. Column headings refer to the option groups which are described below, and the row headings refer to the options carried forward from Table 9. The numbers in the table refer to the priority of surface water removal of the option which prioritises the lowest carbon and most sustainable option first.

- Option group 1 – Green infrastructure. Our hierarchy maximises the provision of sustainable and low carbon infrastructure and minimises the provision of below-ground network storage. The numbers in Table 11 show the order of priority in which the intervention is considered.
- Option group 2 – Below-ground network storage only.
- Option group 3 – Green infrastructure and below ground storage. This option is as per option 1 but replaces higher expense separation areas with network storage. High expense separation would require a significant amount of new surface water infrastructure to convey flows from the separation area to a receiving waterbody (or existing surface water receptor).
- Option group 4 – Smart networks and storage. This option maximises the number of smart network installations and meets any remaining demand through the provision of below-ground network storage.
- Option group 5 – Surface water management and storage. This option maximises the surface water removal and separation within a drainage community and meets any remaining demand through below-ground network storage.
- Option group 6 – Surface water management and smart networks. This option maximises the number of smart network installations and meets any remaining demand through the provision of surface water removal and separation.

TABLE 11: GROUPING OF OPTIONS CARRIED FORWARD FROM TABLE 9

Option	Meets Need?	Option Group 1 Green infrastructure	Option Group 2 Below ground storage only	Option Group 3 Green Infrastructure and below ground storage	Option Group 4 Smart networks and storage	Option Group 5 Surface water management and storage	Option Group 6 Surface water management and smart networks
Rainwater harvesting Residential source control Commercial source control	Part	1 2	No	Yes	No	No	No
Greywater/blackwater treatment and re-use NIDP	Part	1 2	No	No	No	No	No
Collaboration with other customers and catchment stakeholders (not PO8)	Part	5	No	No	No	No	No
Smart Network and Intelligent operation (not PO8)	Part (All POs except PO8)	3	No	Yes	Yes	No	Yes
Enhanced operation maintenance regimes	Part	No	No	No	No	No	No
Active management of surface water	Part	No	No	No	Yes	No	Yes
Surface water source control measures	Yes	Yes	No	Yes	Yes	Yes	Yes
Strategic blue green corridors	Part	5 7	No	No	No	Yes	Yes
Surface water separation	Yes	5	No	Low cost	No	Yes	Yes
Surface Water Removal	Part	4	No	Low cost	No	Yes	Yes
Green or SuDS Storage	Part	Yes	No	Yes	No	Yes	Yes
Underground storage	Yes	No	Yes	Yes	Yes	Yes	No

Table 12 summarises the outcome of the screening of our drainage communities.

TABLE 12: PRIMARY SCREENING OF DRAINAGE COMMUNITIES AGAINST TECHNOLOGY OPTIONS

Drainage community	Option 1 Green infrastructure	Option 2 Below ground storage only	Option 3 Green Infrastructure and below ground storage	Option 4 Smart networks and storage	Option 5 Surface water management and storage	Option 6 Surface water management and smart networks
Bedlington & Cambois (Cambois STW) – 01	Yes	Yes	No	Yes	Yes	No
Bedlington & Cambois (Cambois STW) – 02	Yes	Yes	Yes	No	No	No
Bedlington & Cambois (Cambois STW) – 09	Yes	Yes	No	Yes	Yes	No
Bedlington & Cambois (Cambois STW) – 10	Yes	Yes	Yes	Yes	Yes	No
Berwick – 01	Yes	No	No	No	No	No
Berwick – 04	Yes	No	No	No	No	No
Berwick – 05	Yes	No	No	No	No	No
Berwick – 07	Yes	No	No	No	No	No
Berwick – 08	Yes	No	No	No	No	No
Berwick – 09	Yes	Yes	Yes	Yes	Yes	No
Birtley – 05	Yes	Yes	Yes	Yes	No	No
Bishop Auckland – 06	Yes	Yes	Yes	No	Yes	No
Bishop Auckland – 07	Yes	Yes	Yes	No	No	No
Bishop Auckland – 11	Yes	Yes	No	Yes	Yes	Yes
Bishop Auckland – 15	Yes	Yes	No	Yes	Yes	Yes
Burn Valley (Seaton Carew STW) – 11	Yes	*Yes*	No	*Yes*	*Yes*	*Yes*
Carrville & Belmont & Shincliffe – 01	Yes	Yes	Yes	No	No	No
Carrville & Belmont & Shincliffe – 05	Yes	Yes	Yes	No	Yes	No
Chester le Street – 05	Yes	Yes	No	Yes	Yes	Yes
Chester le Street – 08	Yes	Yes	Yes	No	No	No
Chester le Street – 10	Yes	Yes	No	Yes	Yes	No
Chester le Street – 11	Yes	Yes	No	Yes	Yes	Yes
Chester le Street – 14	Yes	No	No	No	No	No
Chester le Street – 15	Yes	Yes	Yes	No	No	No
Crook (Low Wadsworth STW) – 01	Yes	Yes	Yes	No	No	No
Crook (Low Wadsworth STW) – 05	Yes	Yes	No	Yes	Yes	Yes
Crook (Low Wadsworth STW) – 06	Yes	Yes	Yes	Yes	Yes	No
Crook (Low Wadsworth STW) – 07	Yes	Yes	Yes	No	No	No

Drainage community	Option 1 Green infrastructure	Option 2 Below ground storage only	Option 3 Green Infrastructure and below ground storage	Option 4 Smart networks and storage	Option 5 Surface water management and storage	Option 6 Surface water management and smart networks
Darlington South (Stressholme STW) - 06	Yes	No	No	No	No	No
Durham City & Newton Hall (Barkers Haugh STW) – 03	Yes	Yes	Yes	No	No	No
Durham City & Newton Hall (Barkers Haugh STW) – 05	Yes	Yes	No	Yes	Yes	No
Durham City & Newton Hall (Barkers Haugh STW) – 06	Yes	Yes	No	Yes	Yes	Yes
Durham City & Newton Hall (Barkers Haugh STW) – 08	Yes	Yes	No	Yes	Yes	Yes
Durham City & Newton Hall (Barkers Haugh STW) – 10	Yes	Yes	No	Yes	Yes	Yes
Durham City & Newton Hall (Barkers Haugh STW) – 12	Yes	Yes	Yes	No	No	No
Eaglescliffe (Bran Sands STW) – 12	Yes	No	No	No	No	No
Eaglescliffe (Bran Sands STW) – 25	Yes	Yes	No	No	Yes	No
Eaglescliffe (Bran Sands STW) – 28	Yes	Yes	No	No	Yes	No
Eastbourne (Bran Sands STW) – 11	Yes	No	No	No	No	No
Ebchester (Consett STW) – 03	Yes	Yes	Yes	No	Yes	No
Ebchester (Consett STW) – 05	Yes	Yes	No	Yes	Yes	No
Ebchester (Consett STW) – 06	Yes	Yes	Yes	Yes	Yes	No
Felton – 03	Yes	No	No	No	No	No
Felton – 05	Yes	No	No	No	No	No
Gosforth (Howden STW_C-Leg_DC) - 07	Yes	Yes	No	Yes	Yes	Yes
Guisborough (Marske) – 06	Yes	Yes	No	Yes	Yes	Yes
Hartlepool South (Seaton Carew STW) - 02	Yes	Yes	Yes	No	Yes	No
Hartlepool South (Seaton Carew STW) - 03	Yes	Yes	No	Yes	Yes	Yes
Hartlepool South (Graythorpe STW) - 01	Yes	Yes	Yes	No	No	No
Herrington (Sedgeletch STW) – 20	Yes	Yes	No	Yes	Yes	Yes
Jarrow,Hedworth (Howden STW_B D-Leg_DC) – 01	Yes	Yes	No	Yes	Yes	Yes
Jarrow,Hedworth (Howden STW_B D-Leg_DC) – 02	Yes	Yes	No	Yes	Yes	Yes
Jarrow,Hedworth (Howden STW_B D-Leg_DC) – 03	Yes	Yes	Yes	No	No	No
Jarrow,Hedworth (Howden STW) – 19	Yes	Yes	No	Yes	Yes	Yes
Lanchester & Burnhope – 04	Yes	Yes	No	Yes	Yes	Yes
Lanchester & Burnhope – 05	Yes	Yes	Yes	No	Yes	No
Leam Lane,Wardley,Bill Quay (Howden STW_B D-Leg_DC) – 15	Yes	Yes	No	No	Yes	No
Marske – 08	Yes	Yes	Yes	Yes	No	No
Marske – 09	Yes	Yes	Yes	Yes	Yes	No
Marske – 10	Yes	Yes	Yes	Yes	No	No

Drainage community	Option 1 Green infrastructure	Option 2 Below ground storage only	Option 3 Green Infrastructure and below ground storage	Option 4 Smart networks and storage	Option 5 Surface water management and storage	Option 6 Surface water management and smart networks
Marske – 16	Yes	No	No	No	No	No
Nettlesworth (Plawsworth STW) – 03	Yes	Yes	Yes	No	Yes	No
Peterlee (Horden STW) – 03	Yes	Yes	Yes	No	No	No
Peterlee (Horden STW) – 07	Yes	Yes	No	Yes	Yes	No
Redcar (Marske) – 02	Yes	Yes	Yes	No	No	No
Redcar (Marske) – 04	Yes	No	No	No	No	Yes
Rowlands Gill (Lockhaugh STW) – 01	Yes	Yes	Yes	Yes	Yes	No
Rowlands Gill (Lockhaugh STW) – 02	Yes	Yes	No	Yes	Yes	No
Rowlands Gill (Lockhaugh STW) – 03	Yes	Yes	No	Yes	Yes	Yes
Rowlands Gill (Lockhaugh STW) – 04	Yes	Yes	Yes	No	No	No
Rowlands Gill (Lockhaugh STW) – 06	Yes	Yes	Yes	No	No	No
Seaburn and Roker (Hendon STW_DC_19) – 05	Yes	Yes	Yes	No	No	No
South Stanley & Craghead (Hustledown STW) – 03	Yes	Yes	No	Yes	Yes	Yes
South Stanley & Craghead (Hustledown STW) – 04	Yes	Yes	Yes	No	No	No
South Stanley & Craghead (Hustledown STW) – 05	Yes	Yes	Yes	No	No	No
South Stanley & Craghead (Hustledown STW) – 06	Yes	Yes	No	Yes	Yes	Yes
Spennymoor (Tudhoe Mill STW) – 05	Yes	Yes	Yes	Yes	No	No
Spennymoor (Tudhoe Mill STW) – 07	Yes	Yes	Yes	No	No	No
Spennymoor (Tudhoe Mill STW) – 10	Yes	Yes	Yes	No	Yes	No
Stockton East (Brand Sands STW) - 07	Yes	Yes	Yes	No	No	No
Stockton East (Brand Sands STW) - 09	Yes	Yes	Yes	Yes	No	No
Thornaby North (Bran Sands STW) - 31	Yes	Yes	Yes	No	Yes	No
Washington North – 10	Yes	Yes	Yes	No	No	No
Washington North – 11	Yes	Yes	No	No	No	No
West Rainton (Leamside STW) – 01	Yes	Yes	No	Yes	Yes	Yes
Whitton & Thorpe Thewles (Carlton & Redmarshall STW) - D15_DC_01	Yes	Yes	Yes	No	Yes	No
Whitton & Thorpe Thewles (Carlton & Redmarshall STW) – D61_DC_01	Yes	Yes	Yes	No	No	No
Whitton & Thorpe Thewles (Carlton & Redmarshall STW) – 10	Yes	Yes	Yes	Yes	Yes	No
Whitton & Thorpe Thewles (Carlton & Redmarshall STW) – 11	Yes	Yes	Yes	No	No	No
Willington & Hunwick – 02	Yes	Yes	Yes	No	Yes	No

Drainage community	Option 1 Green infrastructure	Option 2 Below ground storage only	Option 3 Green Infrastructure and below ground storage	Option 4 Smart networks and storage	Option 5 Surface water management and storage	Option 6 Surface water management and smart networks
Willington & Hunwick – 03	Yes	Yes	No	Yes	Yes	No
Willington & Hunwick – 06	Yes	Yes	No	No	Yes	No
Wooler – 01	Yes	No	No	No	No	No
Wooler – 04	Yes	Yes	Yes	Yes	No	No
Wooler – 06	Yes	Yes	No	Yes	Yes	Yes

3.4. OPTIONS FOR SCREENS AND CHAMBERS

Our options development process for screens and chambers sizes has been developed using inlet pipe diameters and the modelled peak spill flows. Three options for screens have been considered: static screens (for <500 L/s), powered single sided mechanical screens (for 500 – 2000 L/s) and powered double sided screens (for >2000 L/s). An investigation will be required at each site to determine the suitability of each screen type. For example, as powered screens require a smaller surface area, it may not be practical to install static single sided screens on large overflows. Of the 66 screens identified for investment, we know that:

- 58 screens are static.
- Seven screens are single sided powered screens.
- One screen is a double-sided powered screen.

3.5. BEST VALUE FOR CUSTOMERS

3.5.1 Benefit scoring

For each option in Table 11, we completed a benefits assessment using our Value Framework[17] which contains performance commitments, Wider Environmental Outcomes[18] and other metrics. For some measures we have supplemented benefits by using the Construction Industry Research and Information Association (CIRIA) Benefits Estimation Tool (B£st)[19] which helps with the assessment of blue/green benefits associated with drainage options such as SuDs. This tool makes is easier to quantify and track amenity, health and carbon sequestration benefits.

Our benefits assessment is embedded into our portfolio optimisation tool, Copperleaf, used to undertake appraisal of options. Table 13 shows the range of benefits quantification and monetisation values we have used for the assessment of storm overflows.

TABLE 13: RANGE OF BENEFITS IDENTIFIED FOR STORM OVERFLOWS

Value measures[20]	Description	Unit	Value	Performance Commitment
Number of spills[21]	Number of spills	Num	Scored but not valued	Yes
Internal flooding	Flooding failure quantity (hydraulic)	£	£13,998.89/property + £18,501.39/event	Yes
External flooding	Flooding failure quantity (hydraulic)	£	£859.87/property + £1,467.02/event	Yes
Biodiversity	Area (ha) of changed land use type.	£/ha	£685***	Yes

[17] Copperleaf Technologies Inc., 2002, Northumbrian Water Limited Value Framework Definition Document, v1.6.
[18] Environment Agency, March 2022, WINEP Options Assessment Guidance
[19] *** CIRIA, 2023, ciriabest
[20] ** indicates the value measures combined into a single monetised benefit.
[21] Number of spills over threshold is mentioned in our Value Framework. The absolute number of spills utilised in scoring as per the performance commitment.

Value measures[20]	Description	Unit	Value	Performance Commitment
Amenity	Estimated no. of residents living on a street that is 'greened'	£/resident	£426***	No
Health**	Number of visits per year for physical activity	£/Adult visit	£56***	No
	Health Benefits of reducing flood risk	£/Property	£6,002***	
Trees**	Carbon Sequestration - Number of trees – Small	£/tree	£75***	Yes – GHG
	Air Quality -Number of trees – Small	£/tree	£130***	No
Operational Emissions**	t/CO_2e /year	Societal £/tCO_2e	£256.2[22]	Yes - GHG
Embedded Emissions**	tCO_2e /year	Societal £/tCO_2e	£256.2[23]	No

For the benefits assessment, first we score the impact of continuing business as usual and then we score each of the options. Benefits are scored over a 30-year time horizon. This scoring considers the certainty of benefits being realised for different types of options. Carbon modelling has been performed for embedded and, where possible due to the granularity of costing information available, operational carbon. Examples of how we have assessed benefits are shown in the case studies in Section 3.11.

Our value model is currently based on PR19 values, which have been consistently applied across all options. For that reason we do not currently have a monetised value for spills. Each of the options has been scored against the number of spills so we are able to use to prioritise drainage communities relative to each other. Options for individual overflows are designed to address a specific level of spill reduction so the differentiator is on flooding, biodiversity, health/amenity, cost and carbon. We have scored them using the CIRIA B£st tool and then input them into our Copperleaf system which currently outputs these as a cost saving rather than numerical benefit. In accordance with the WINEP Options Development Guidance, we have not completed a benefits assessment for our investigations.

3.5.2 Cost benefit appraisal to select preferred option

For each of options in Copperleaf we have carried out a robust cost benefit appraisal within our portfolio optimisation tool to select the preferred option. This calculates an NPV over 30 years in accordance with the PR24 Guidance and cost to benefit ratio for each option. The ratio is calculated by dividing the present value of the profile of benefits by the present value of the profile of costs over the appraisal period of 30 years.

Costs and benefits have been adjusted to 2022-2023 prices using the CPIH[24] Index financial year average. The impact of financing is included in the benefit to cost ratio calculation. Capital expenditure has been converted to a stream of annual

[22] £ value per tonne of CO2e in 2025/26, annual increase (varying rate) reaching £378.6/t CO2e in 2054/55
[23] £ value per tonne of CO2e in 2025/26, annual increase (varying rate) reaching £378.6/t CO2e in 2054/55
[24] Consumer Prices Index including owner occupiers' housing costs.

costs, where the annual cost is made up of depreciation/RCV run-off costs and allowed returns over the life of the assets. Depreciation (or run-off) costs are calculated using the straight-line depreciation over the appraisal period. To discount the benefits and costs over time, we have used the social time preference rate as set out in 'The Green Book'.

We have run optimisations to select the least cost based on private values only and the best value using private and societal values. The output of this assessment and the cost benefit ratios are included in Appendix B. For 143 of the sites the least cost and best value alternatives were the same.

Our Company commitment is to invest in sustainable infrastructure. There were 16 sites where the totex costs for the grey and green options were similar and we chose the green option.

Our data tables CWW15 and 16 have been populated using the output from our Copperleaf tool which represents the scoring from the CIRIA B£st tool as a cost saving, which makes it difficult to see the additional green benefit. In Table 14 we have set out the additional benefit gained from choosing the green option, which was calculated using the CIRIA B£st tool to make it more visible.

TABLE 14: BENEFIT VALUES FOR SITES WITH DIFFERENT LEAST COST AND BEST VALUE OPTIONS[25]

Site	Least cost option	Best value option	Additional benefit compared with grey option £k
Barkers Haugh Stw_DC_08	Below-ground storage only	Surface Water Management and Smart Networks	3.813
Bran Sands Stw DC_09	Below-ground storage only	Green Infrastructure and Below Ground Storage	4.044
Bran Sands Stw_DC_25	Below-ground storage only	Surface Water Management and Storage	0.393
Cambois Stw_DC_09	Smart Networks and Storage	Green Infrastructure	24.795
Carlton & Redmarshall DC_10	Below-ground storage only	Surface Water Management and Storage	1.100
Consett DC_05	Below-ground storage only	Green Infrastructure	6.255
Hustledown Stw_DC_06	Smart Networks and Storage	Surface Water Management and Smart Networks	8.345
Leamside Stw_DC_01	Below-ground storage only	Green Infrastructure	2.417
Lockhaugh DC_02	Below-ground storage only	Green Infrastructure	7.017
Lockhaugh DC_03	Below-ground storage only	Surface Water Management and Smart Networks	3.021
Low Wadsworth Stw_DC_05	Smart Networks and Storage	Surface Water Management and Smart Networks	2.807
Marske Stw_DC_06	Below-ground storage only	Surface Water Management and Smart Networks	1.289
Marske Stw_DC_08	Below-ground storage only	Smart Networks and Storage	0*

[25] Benefits of Biodiversity, Amenity, Health and Trees assessed using CIRIA B£ST

Site	Least cost option	Best value option	Additional benefit compared with grey option £k
Seaton Carew Stw_DC_03	Smart Networks and Storage	Surface Water Management and Smart Networks	6.864
Tudhoe Mill Stw_DC_10	Below-ground storage only	Surface Water Management and Storage	6.221
Wooler Stw_DC_04	Below-ground storage only	Green Infrastructure and Below Ground Storage	1.110

*Chosen because of better benefit on carbon.

Table 15 shows the output of CIRIA B£st tool for all green solutions in our programme. Note that the benefits are only realised from AMP9 once the implementation of schemes is complete.

TABLE 15: BENEFITS ACHIEVED IN AMP9 FROM AMP8 INVESTMENT

EA/NRW environmental programme		AMP9 £m
Storm overflow - sustainable drainage / attenuation in the network	Biodiversity	0.001
	Amenity, Health, Trees, 'Additional Benefits'[26]	0.421
Storm overflow - source surface water separation	Biodiversity	0.008
	Amenity, Health, Trees, 'Additional Benefits'	1.912

The benefits and investment for our preferred option for storm overflows, as output from Copperleaf are included in Table 16 and Table 17. Profiling of benefits and expenditure will continue to be refined as we continue to work with our strategic delivery partner to carry out further design work and optimisation of the programme for delivery.

[26] 'Additional Benefits' were scored for the Berwick upon Tweed drainage communities. These correspond to the benefit of reduced stormwater treatment @ 25p per m3 of stormwater treated per year and the weighted annual average damages to flooding properties, based on the multi-coloured manual approach. The total for AMP9 of these additional benefits is £0.422m

TABLE 16: INPUTS FOR TABLE CWW15 – BENEFITS BEST VALUE OPTION

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	AMP9
Investigations, other - multiple surveys, and/or monitoring locations, and/or complex modelling	N/A		-	-	-	-	-	-	-
	N/A		-	-	-	-	-	-	-
	N/A		-	-	-	-	-	-	-
Storage schemes to reduce spill frequency at CSOs etc - grey solution	No. of spills	-	-	-	-	909.47	909.47	909.47	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	
	Internal flooding	£	-	-	-	-	-	£1,492	£29.841
	External flooding	£	-	-	-	-	-	£1,769	£35,375
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	1.12	15.36
	Embedded carbon	t/CO_2e	-	2415.74	1932.59	1932.59	1932.59	1449.44	-
Storage schemes to reduce spill frequency at CSOs etc – green solution	No. of spills	-	-	-	-	-	-	-	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	-	-
	External flooding	£	-	-	-	-	-	-	-
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	AMP9
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	-	-
	Embedded carbon	t/CO_2e	-	-	-	-	-	-	-
Storm overflow - discharge relocation	No. of spills	-	-	-	-	-	-	-	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-		-	-	-	-	-
	External flooding	£	-	-	-	-	-	-	-
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	-	-
	Embedded carbon	t/CO_2e	-	-	-	-	-	-	-
Storm overflow - increase in combined sewer / trunk sewer capacity	No. of spills	-	-	-	-	-	-	-	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	-	-
	External flooding	£	-	-	-	-	-	-	-
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	AMP9
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	-	-
	Embedded carbon	t/CO_2e	-	-	-	-	-	-	-
Storm overflow - sustainable drainage / attenuation in the network	No. of spills	-	-	-	-	207.21	207.21	207.21	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	£19,826	£396,518
	External flooding	£	-	-	-	-	-	£30,928	£618,556
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	0.01	0.15
	Embedded carbon	t/CO_2e	-	6118.62	4894.90	4894.90	4894.90	3671.17	-
Storm overflow - source surface water separation	No. of spills	-	-	-	-	379.77	379.77	379.77	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	£39,714	£794,275
	External flooding	£	-	-	-	-	-	£55,567	£1,111,347
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	AMP9
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	0.04	0.57
	Embedded carbon	t/CO_2e	-	35118.20	28094.56	28094.56	28094.56	21070.92	-
Storm overflow - infiltration management	No. of spills	-	-	-	-	-	-	-	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	-	-
	External flooding	£	-	-		-	-	-	-
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	-	-
	Embedded carbon	t/CO_2e	-	-	-	-	-	-	-
Storm overflow - sewer flow management and control	No. of spills	-	-	-	-	85.88	85.88	85.88	-
	Pollution	£/Cat. 3 Pollution Incident	-	-	-	-	-	-	-
	Internal flooding	£	-	-	-	-	-	£4,873	£97,463
	External flooding	£	-	-	-	-	-	£6,136	£122,717
	Biodiversity	£/ha	-	-	-	-	-	-	-
	Access, recreation, and amenity	£/resident	-	-	-	-	-	-	-
	Reduced Storm Water Treatment	Volume of stormwater not treated at STW	-	-	-	-	-	-	-

EA/NRW environmental programme	Benefit	Units	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	AMP9
	Damages to Flooding Properties	Weighted annual average damage (WAAD)	-	-	-	-	-	-	-
	Operational carbon	t/CO_2e	-	-	-	-	-	0.05	0.71
	Embedded carbon	t/CO_2e	-	1001.69	801.35	801.35	801.35	601.02	-
Storm overflow - New/upgraded screens	Operational carbon	t/CO_2e	-	-	-	-	-	23.62	461.29
	Embedded carbon	t/CO_2e	-	-	-	-	2285.69	6857.06	-

TABLE 17: INPUTS FOR TABLE CWW3 - ENHANCED EXPENDITURE

EA/NRW environmental programme		2023-2024	2024-2025	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Investigations, other - multiple surveys, and/or monitoring locations, and/or complex modelling	Capex	-	-	7.732	7.732	7.732	7.732	7.732	38.660
	Opex	-	-	0.000	0.000	0.000	0.000	0.000	0.000
	Totex	-	-	7.732	7.732	7.732	7.732	7.732	38.660
	Third party contributions	-	-	-	-	-	-	-	-
Storage schemes to reduce spill frequency at CSOs etc - grey solution	Capex	0.012	10.808	16.029	26.826	26.826	26.826	26.826	134.153
	Opex	0.000	0.000	0.000	0.000	0.000	0.000	0.495	0.495
	Totex	0.012	10.808	16.029	26.826	26.826	26.826	27.321	134.648
	Third party contributions	-	-	-	-	-	-	-	-
Storage schemes to reduce spill frequency at CSOs etc – green solution	Capex	-	-	-	-	-	-	-	-
	Opex	-	-	-	-	-	-	-	-
	Totex	-	-	-	-	-	-	-	-
	Third party contributions	-	-	-	-	-	-	-	-
Storm overflow - discharge relocation	Capex	-	-	-	-	-	-	-	-
	Opex	-	-	-	-	-	-	-	-
	Totex	-	-	-	-	-	-	-	-
	Third party contributions	-	-	-	-	-	-	-	-
Storm overflow - increase in combined sewer / trunk sewer capacity	Capex	-	-	-	-	-	-	-	-
	Opex	-	-	-	-	-	-	-	-
	Totex	-	-	-	-	-	-	-	-
	Third party contributions	-	-	-	-	-	-	-	-
Storm overflow - sustainable drainage / attenuation in the network	Capex	0.284	0.284	23.467	23.467	23.467	23.467	23.467	117.903
	Opex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Totex	0.284	0.284	23.467	23.467	23.467	23.467	23.467	117.903
	Third party contributions	-	-	-	-	-	-	-	-
Storm overflow - source surface water separation	Capex	0.607	0.607	118.303	118.303	118.303	118.303	118.303	592.729
	Opex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Totex	0.607	0.607	118.303	118.303	118.303	118.303	118.303	592.729
	Third party contributions	-	-	-	-	-	-	-	-

EA/NRW environmental programme		2023-2024	2024-2025	2025-26	2026-27	2027-28	2028-29	2029-30	Total
Storm overflow - infiltration management	Capex	-	-	-	-	-	-	-	-
	Opex	-	-	-	-	-	-	-	-
	Totex	-	-	-	-	-	-	-	-
	Third party contributions	-	-	-	-	-	-	-	-
Storm overflow - sewer flow management and control	Capex	0.023	0.023	5.635	5.635	5.635	5.635	5.635	28.221
	Opex	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Totex	0.023	0.023	5.635	5.635	5.635	5.635	5.635	28.221
	Third party contributions	-							
Storm overflow - New/upgraded screens	Capex	0.000	0.000	6.917	6.917	6.917	6.917	6.917	34.585
	Opex	0.000	0.000	0.028	0.055	0.083	0.110	0.138	0.414
	Totex	0.000	0.000	6.944	6.972	6.999	7.027	7.054	34.996
	Third party contributions	-	-	-	-	-	-	-	-

3.6. PARTNERSHIP WORKING AND THIRD PARTY FUNDING

As part of the production of the DWMP, we have worked with other organisations with an interest or responsibility for providing services related to drainage such as the Environment Agency, Local Authorities, Lead Local Flood Authorities, rivers trusts and housing developers. We held 18 engagement sessions in August and September 2021 to identify, record and map ongoing and future opportunities.

In March 2023, we engaged with a number of stakeholders to discuss our proposals for AMP8 and to identify opportunities to work together. The stakeholders included Lead Local Flood Authorities, Rivers Trusts, National Farmers Union, Natural England and the Northumbria Regional Flood and Coastal Committee (NRFCC).

More than 700 opportunities were captured and were assigned an owner, and timescale. Below we highlight some of the opportunities identified for collaborative working and third-party funding during AMP8.

3.6.1 Northumbria Integrated Drainage Partnership (NIDP)

We are members of the Northumbria Integrated Drainage Partnership (NIDP), with 14 Lead Local Flood Authorities and the Environment Agency. A key aim of this partnership is to identify opportunities to deliver surface water management schemes within catchments to contribute towards the reduction in spills from overflows and flooding. Catchments are taken from the investigation stages where opportunity areas are identified, through to the outline business case stage to determine funding sources and opportunities for collaboration.

In at least 14 of the drainage areas that are included in the AMP8 Plan, there have been NIDP investigations completed or ongoing studies looking at opportunities for flood risk reduction. The stakeholder engagement process highlighted drainage areas that had previously been considered non-cost beneficial and not progressed to Outline Business Case. The promotion of storm overflow spill frequency reduction schemes in these areas has the potential to improve the prospects of a collaborative scheme being approved for FDGiA funding and as the benefits of delivering a scheme are increased. A commitment has been made between all stakeholders of the NIDP to review the schemes that were developed to make sure that opportunities are realised.

3.6.2 Hartlepool Borough Council / Environment Agency Valley Beck Removal

A project is currently ongoing between Hartlepool Borough Council and the Environment Agency to investigate the feasibility of removing the Valley Beck watercourse from the combined sewer network. This presents a clear opportunity to work collaboratively and make sure that the benefits of the removal of the watercourse from the sewer network are maximised. The removal of the watercourse has the potential to reduce spill frequencies at storm overflows on the downstream network. Additionally, the new infrastructure that is constructed to re-direct the watercourse could be jointly designed to capitalise on any other surface water management opportunities and to reduce the volume of below-ground storage provided.

3.6.3 Newcastle City Council Surface Water Management

Opportunities for collaborative working were identified in the Gosforth, Kingston Park and Ouseburn areas. Newcastle City Council (NCC) have ongoing projects to deliver flood risk reduction. We plan to work with NCC to build an overview of the surface water management opportunities and to build cases for jointly funded schemes.

3.6.4 Guisborough Groundwater Impact

An opportunity to reduce groundwater infiltration into the sewer network was identified during our engagement with Redcar and Cleveland Borough Council. Working together on this project has the potential to reduce the below-ground storage requirements in the drainage area.

3.6.5 Lustrum Beck Opportunity Area

During our engagement with Stockton-on-Tees Borough Council, a number of opportunities were identified for collaborative working around the Lustrum Beck catchment. These included pockets of land owned by the council that have potential to be transformed into biodiversity areas.

3.6.6 Honeypot Wood Wet Woodland

Stockton-on-Tees Borough Council highlighted another opportunity during our engagement session with them as they aspire to transform an area of Honeypot Wood into a wet woodland. We intend to work closely with the council to identify opportunities to reduce the volume of below-ground storage needed for storm overflows and maximise surface water management in the catchment to help with the creation of the wetland and improve biodiversity.

We will continue to explore opportunities for third party funding in the delivery of the projects.

3.7. DIRECT PROCUREMENT FOR CUSTOMERS

We assessed the storm overflows programme against the DPC guidance (see our assessment report, NES38). This report concludes that the storm overflow programme is unlikely to be suitable for DPC. This is principally because none of the schemes individually are expected to be above the £200m totex threshold as the programme represents a very large number of smaller interventions. We considered some of our individual schemes that are larger and close to the threshold in our assessment report, and concluded these were not eligible for DPC.

3.8. CUSTOMERS VIEWS INFORMING OPTION SELECTION

Section 2.5 discusses our customer evidence, including the phasing of storm overflows and the use of more green solutions. We found that discussions about phasing and options are linked closely to the need for investment, particularly discussions about pace and the benefits customers expected to see.

3.9. DELIVERABILITY ASSESSMENT

In accordance with the WINEP options development guidance we have undertaken a deliverability assessment. This has considered:

- The technical feasibility of implementing options, as included in Section 3.3.2and 0. All of the preferred options are technically feasible to implement.
- The certainty that benefits for each option will be realised. This has been assessed as part of the likelihood scoring in our benefits assessment (Section 3.5.1).
- Lessons learned from AMP7 efforts (Section 2.2) to encourage efficiency.
- The confidence with which we can deliver by 2030.
- Capacity of the supply chain to deliver to support efficiency.
- Early start to ensure delivery by the due dates, including the early start programme for storm overflows as included in Section 2.2.

3.10. INDEPENDENT ASSURANCE

We have carried out two pieces of independent assurance. Jacobs have assured our compliance with the WINEP guidance which includes our process for best value. They have assured 1 options development report and 159 options assessment reports. These have been assessed as no issues identified. PwC have audited the benefits and costs as part of the data table audits.

3.11. CASE STUDIES

3.11.1 Surface water removal and blue/green corridor

The Berwick catchment encompasses the towns of Berwick upon Tweed, Tweedmouth, Spittal and the smaller village of Scremerston to the south, with a combined population of just over 12,000.

The town centre of Berwick upon Tweed is characterised by its rich history, in particular its medieval town walls, Georgian Town Hall, Elizabethan ramparts and Britain's earliest barracks buildings. These aspects make construction within the town centre extremely difficult and, in many instances, not viable.

There are 36 storm overflows within the Berwick catchment, 30 of which need interventions to meet the targets outlined in the Storm Overflow Reduction Plan (SODRP). Of these 30, 13 storm overflows discharge to a designated bathing water and have a target not to spill more than two times per bathing season (15 May to 30 September). The remaining storm overflows have a target of spilling on average no greater than ten times per annum. To achieve these targets different options have been considered.

Due to the architecture of Berwick town centre and limited space, building network storage in these areas is not technically viable. Green infrastructure has therefore been promoted. These options contain multiple elements to achieve an overall target including source control at residential and commercial properties, blue-green corridors and SuDS options.

The town centre of Berwick has been assessed as being able to support a blue green corridor. This option will include a large proportion of surface water removal from the existing sewer system via re-sewering (creating a blue green corridor) and discharging to the River Tweed and the North Sea at viable locations.

Storage of network flows is also not technically viable for the majority of the Berwick catchment due to the treatment capacity at the STW. If large volumes of flow were retained within the network and released slowly, it would take five days to fully empty the tanks with a significant impact on the treatment process at the STW. There is also the risk of further rainfall events occurring and resulting in either extra storm overflow discharges or sewer flooding. The identified option utilises storage through the creation of new assets and maximising the existing sewer capacity by taking a Smart Network approach.

For five of the drainage communities in Berwick the only technically feasible option was green infrastructure and for drainage community DC09 there is more than one option but we have chosen the least cost which involves storage only.

Although our plans for the area is between 2025 and 2045, we are looking at the whole drainage area to maximise the benefits achieved. This may result in accelerating the delivery of some interventions to shorten customer and environmental impacts. Figure 5 shows our plan for Berwick.

FIGURE 5: OUR PLAN FOR BERWICK

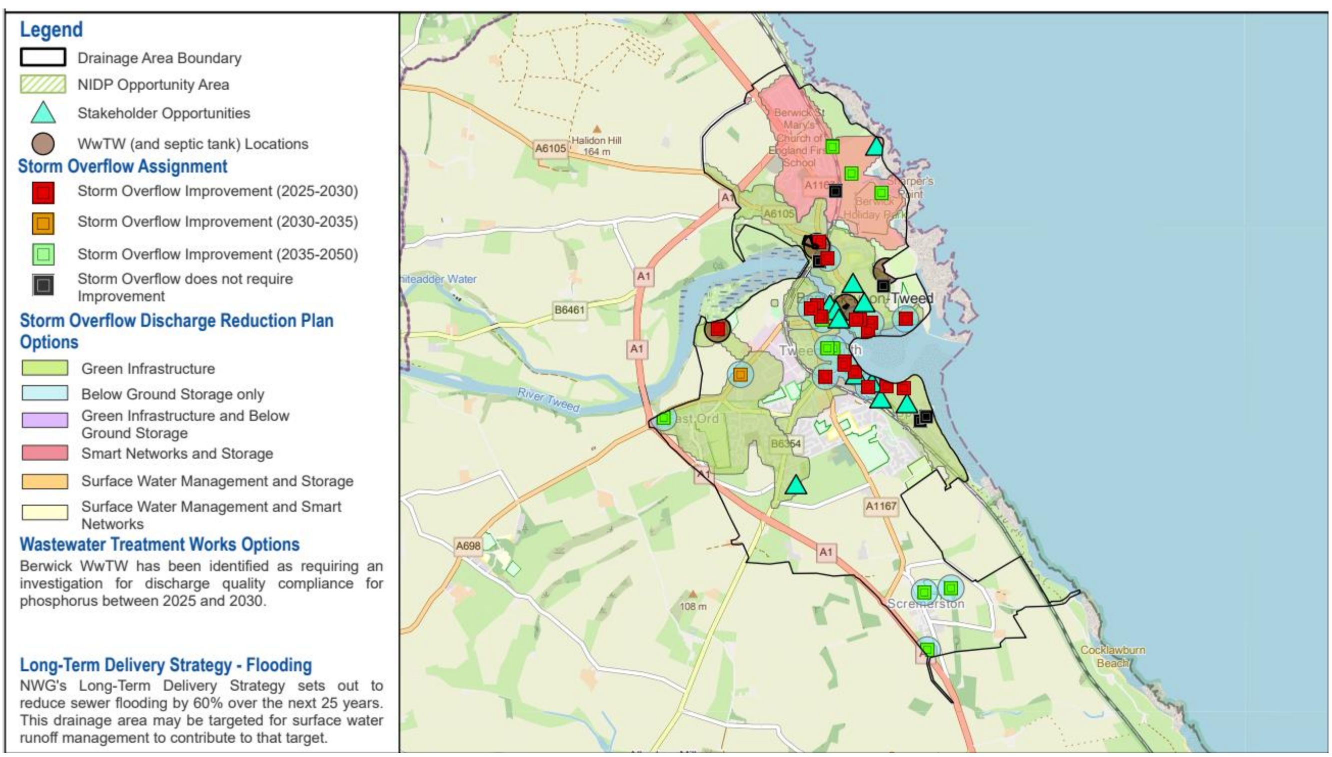


Table 18 shows our additional green benefits for Berwick which have been assessed using the CIRIA B£st tool.

TABLE 18: ADDITIONAL BENEFITS ASSESSMENT FOR BERWICK

Drainage Community	Least Cost Option	Additional £k	Amenity £k	Biodiversity £k	Health £k	Trees £k	Total £k
DC01	Option 1 – Green Infrastructure	156.317	0.009	0.013	0.002	1.050	**157.390**
DC04	Option 1 – Green Infrastructure	55.460	15.924	0.007	7.002	1.793	**80.186**
DC05	Option 1 – Green Infrastructure	62.946	0.000	0.002	0.000	0.410	**63.357**
DC07	Option 1 – Green Infrastructure	28.860	9.223	0.002	3.001	0.439	**41.525**
DC08	Option 1 – Green Infrastructure	118.822	4.550	0.040	25.008	0.768	**149.188**
DC09	Option 2 – Below-ground storage only	0.000	0.000	0.000	0.000	0.000	**0.000**

3.11.2 Redcar & Marske

The Marske and Redcar catchment encompasses the towns of Marske, New Marske, Redcar, Saltburn, Skelton Brotton, Guisborough, Dunsdale and Mount Pleasant with a combined population of close to 100,000. The STW for this large catchment is located in the Marske area of the catchment.

There are 40 storm overflows within the Marske and Redcar catchment, 31 of which need interventions to meet the targets outlined in the Storm Overflow Reduction Plan (SODRP). Of these 31, 18 storm overflows discharge to a designated bathing water and have a target to not spill more than two times per bathing season (15 May to 30 September). The remaining 13 storm overflows have a target of spilling on average ten times per annum. To achieve these targets different options have been considered.

The Marske and Redcar catchment has a 'No deterioration' driver for bathing water criteria. This means that the bathing water area cannot change classification due to any interventions by the DWMP or other programmes.

Storage of all overflow discharges is not technically viable for the majority of the Marske and Redcar catchment due to the treatment capacity at Marske STW. If large volumes of flow were retained within the network and released slowly, it would take ten days to fully empty the tanks with a significant impact on the treatment process at the STW. The overflow at the STW discharges on average 90 times a year, with the extra storage discharge volume being received at this location. It is possible that this number could increase. There is also the risk of further rainfall events occurring and resulting in either extra storm overflow discharges or sewer flooding.

The area of Marske has been identified as being suitable for a smart networks approach which would mean the creation of new assets and utilise the existing network capacity to maximise the benefits achieved. The remaining solution is to remove surface water from the existing network via re-sewering in the areas of Redcar and New Marske, with the surface water being discharged to the North Sea at a viable location. The estimated cost for this option is £270m. Figures 6 and 7 set out our plan for the Redcar and Marske areas.

FIGURE 6: OUR PLAN FOR REDCAR

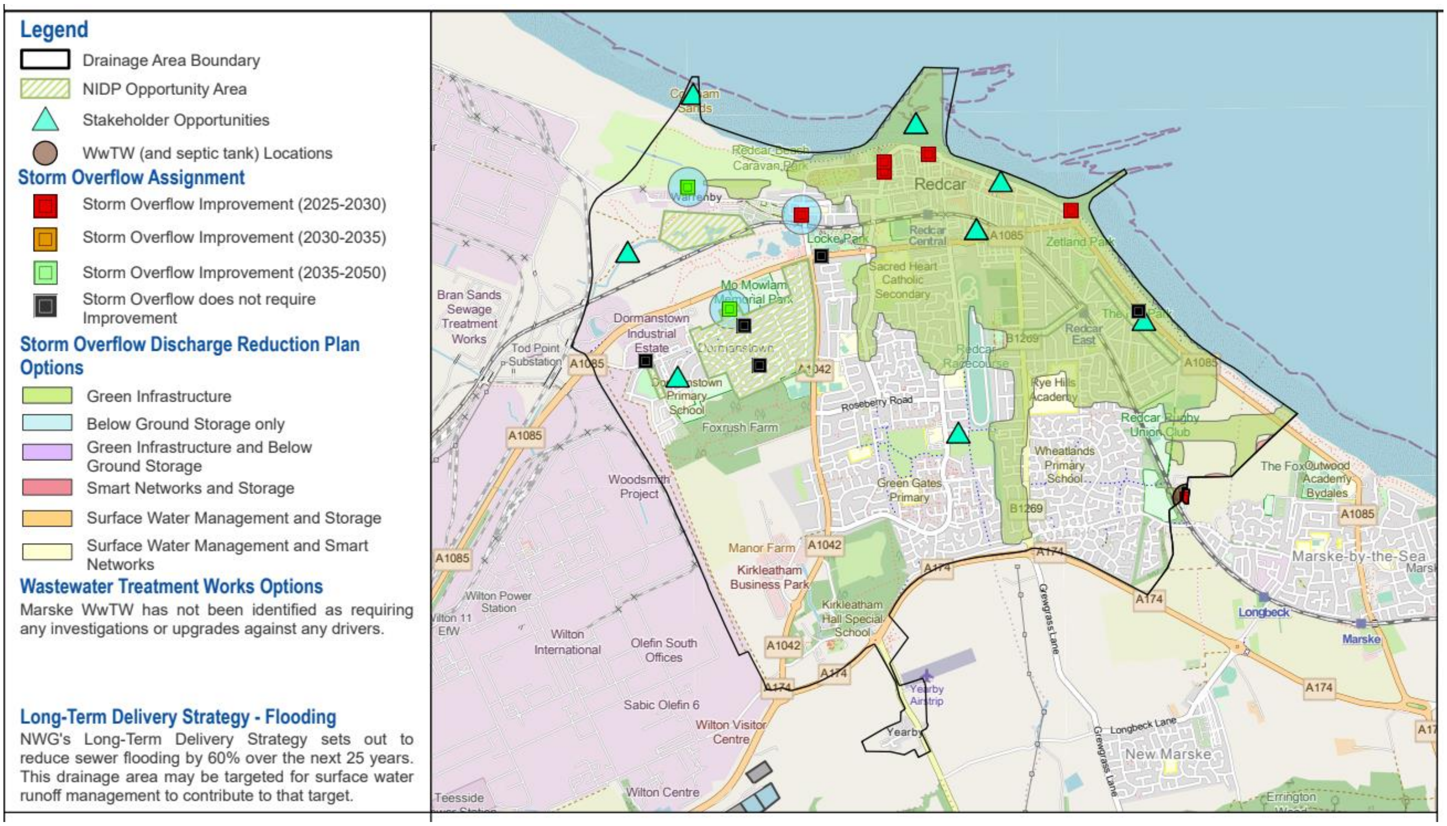


FIGURE 7: OUR PLAN FOR MARSKE

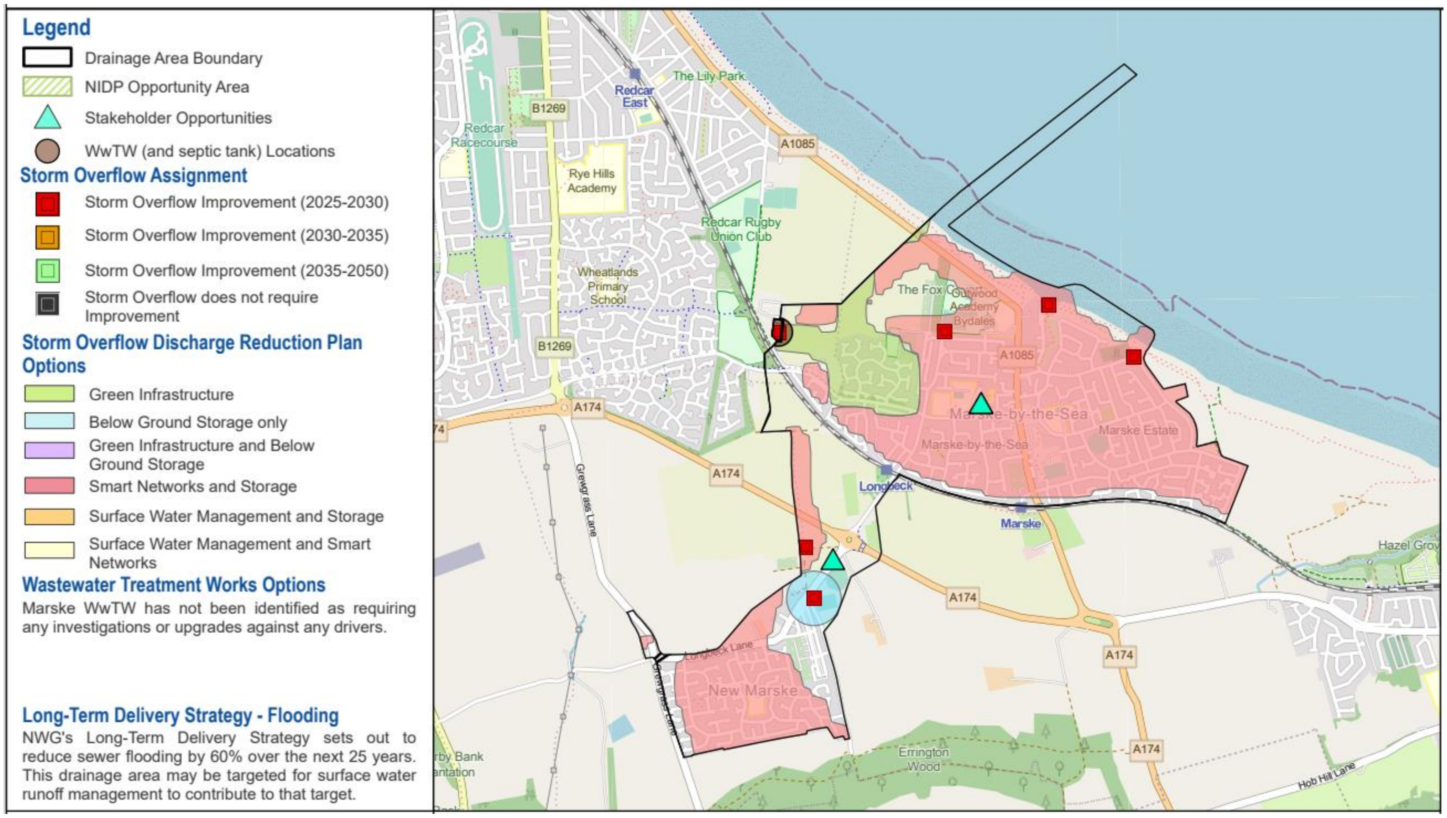


Table 19 shows the additional green benefits we have for the Marske area.

TABLE 19: ADDITIONAL BENEFITS ASSESSMENT[27] FOR MARSKE DRAINAGE COMMUNITIES

Drainage Community	Least Cost Option	Option 1 – Sustainable infrastructure £k	Option 2 – Below-ground storage only £k	Option 3 – Low expense separation and storage £k	Option 4 – Smart Networks plus Storage £k	Option 5 – Surface Water Separation plus Storage £k	Option 6 – Smart Networks plus Surface Water Separation £k
DC02	Option 3 – Low expense separation and storage	0.059	0	0	0	0	0
DC04	Option 1 – Sustainable infrastructure	66.819	0	0	0	0	31.761
DC06	Option 2 – Below ground storage only	6.276	0	0	0	1.766	1.289
DC08	Option 2 – Below ground storage only	19.588	0	7.179	0	0	0
DC09	Option 4 – Smart network plus storage	54.619	0	47.07	0	27.109	0
DC10	Option 2 – Below ground storage only	9.559	0	8.3	0	0	0
DC11	Option 5 – Surface water separation plus storage	AMP9 Investment					
DC14	Option 1 – Sustainable infrastructure	AMP9 Investment					
DC016	Option 1 – Sustainable infrastructure	8.686	0	0	0	0	0

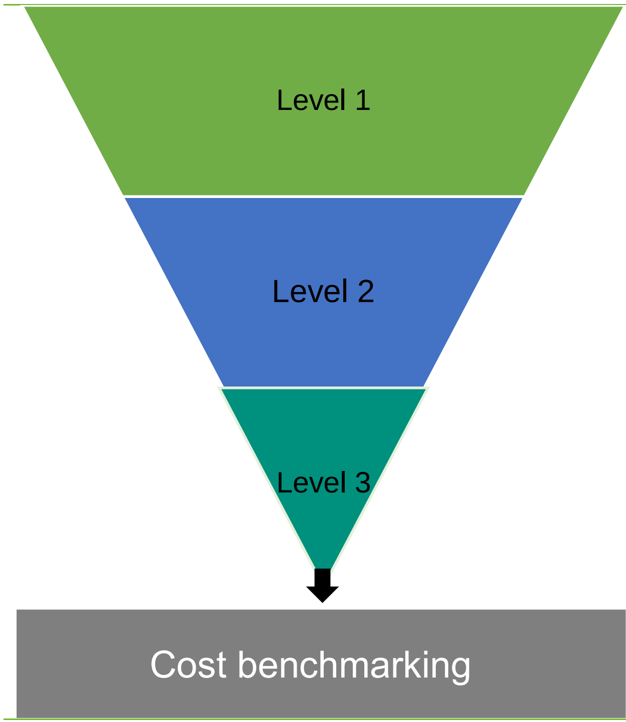
[27] Additional Benefits are Biodiversity, Amenity, Health and Trees. All assessed using CIRIA B£ST tool

4. COST EFFICIENCY

4.1. COST METHODOLOGY

A full description of our costing methodology is contained in Appendix A3 - Costs (NES04). We have used a three-level estimating approach for developing our PR24 costs, as outlined in Figure 8. Our constrained options have been scoped to a Level 1 or 2 and then costed using a combination of cost models and external quotes.

FIGURE 8: PROCESS COST ESTIMATION



Level – 1 (confidence: – 50% to +100%)

Costing is carried out using our costing curves. Costing occurs at an overall asset level. For example, storage tanks or screens.

Level – 2 (confidence: - 50% to + 50%)

Costing is carried out using our costing curves. Costing occurs for each of the main items of scope. For example, large diameter surface water sewers and the size of the pumps.

Level – 3 (confidence: - 20% to +30%)

Detailed bottom-up cost of all items taking into consideration factors such as ground conditions.

Cost benchmarking

We have benchmarked a sample of the preferred options against the available cost curves from other companies. Further detail is provided in Section 4.2.

Our costing has been carried out by our costing partners (Mott MacDonald) using our cost models. Our cost models are built up using our historical cost data which has been subject to competitive tendering processes and effects of efficiency incentives to effectively design, tender and deliver projects. Our costs have been benchmarked against our costing partner's cost database and independently assured by PwC and internal audit as they have been loaded into data tables.

Some novel options, such as a Smart Network, were not available in our existing cost curves, as we have not delivered these projects historically. In these cases, costs have been provided separately using external consultant databases. These external sources are similar to our cost database but include cost information from other companies that have delivered these interventions and have also been subject to competitive and efficiency incentive pressures.

Our investigations, as outlined in Section 2.3.3, have been costed to Level 1. These have been based on our assumptions for the activities expected for each UPM Level Investigation and dilution assessment. For example, we expect a UPM Level

1 Investigation to be desktop assessment, whereas a Level 3 Investigation will require more detailed assessment such as modelling, sampling and site surveys. They are included in Table 20.

TABLE 20: DIRECT UNIT COST RATES FOR INVESTIGATIONS

Investigation	Unit Cost Rate (£)	Number of Investigations	Total £m
UPM Level 3 Investigation	0.467m	3 comprising 42 overflows	1.4
UPM Level 2 Investigation	0.064m	36 comprising 132 overflows	2.3
UPM Level 1 Investigation	0.04m	Over 300 comprising 827 overflows	12
Dilution Assessment	0.00016m	381	0.06
Total			**16**

For screens capex has been assessed using our cost models and costs are at Level 2. For opex calculations, the static screens were allocated an annual estimate for maintenance visits and separate visits to remove screenings. Opex for powered screens also included inspection and maintenance visits, separate screenings removal visits and an allowance for power consumption.

For storage costs have been produced using our cost models and are at Level 2.

Costing of our options to remove surface water from the network has been developed on a bottom up unit cost basis. The scoping of options equates to between a Level 1 and Level 2 estimate depending on the nature of the solution. Options to remove surface water by laying additional pipes can be costed at Level 2, but disconnection of roof drainage is at Level 1. This would require detailed site surveys to be undertaken which are not cost effective for customers until delivery is confirmed. To improve the level of cost uncertainty we asked two contractors to independently estimate two of our largest projects Marske and Berwick.

4.2. COST BENCHMARKING

Two types of cost benchmarking exercises have been completed for our options:

- a comparison of a sample of options against comparable water and wastewater company cost curves – this is outlined in Section 4.2.1, and
- our contractor estimation for two of the largest projects: Marske and Berwick – this is outlined in Section 4.2.2.

4.2.1 Option cost benchmarking

We have benchmarked direct costs for each of the key asset types, and indirect costs against the cost curves for other companies in our costing partner's database.

As there is no standard asset hierarchy used for costing across all companies, there are differences in what each company includes and excludes. Storm overflows, our costing partner has benchmarked where it is possible to carry out an equitable comparison and this ranges between one and four other companies depending on the asset type, as shown in Table 21. A mean average of these companies has been used as the benchmark with a 25th percentile and 75th percentile provided as a suitable range.

TABLE 21: NUMBER OF COMPARATORS USED FOR BENCHMARK[28]

Scope Item Analysed	Comparators Used for Benchmark	Data Points Per Curve	Total Data Points Per Benchmarked Item
Combined Sewer Overflow CSO	1	28023	28023
Sewer - Rising Main	3	1600	4799
Storm Tanks, Circular	4	316	1264
Fencing- Timber panels	2	1	2
Roads	4	289	1156
Total			**37,734**

We have benchmarked six storage tanks of varying sizes and six screens (10%) to compare against the industry position. We have benchmarked on direct costs which are directly attributable to the project such as plant, labour, materials, and equipment, as well as on indirect costs which are related to design, site setup, professional support, and other costs not directly related to the construction aspect of a project. Our indirect costs have been benchmarked as 63.4% of direct costs, which is 10.46% below the industry average as describe in our Appendix A3 – Costs (NES04).

TABLE 22: BENCHMARK OF DIRECT COSTS

Investment Name	Option Type	Northumbrian	Benchmark	25th percentile	75th percentile	Delta[29]	Delta %[30]
Westbourne Drive CSO	Storm overflow – Storage tanks	£197,027	£212,332	£149,271	£295,963	-£15,306	-7%
Burton Beck CSO	Storm overflow – Storage tanks	£284,142	£276,112	£202,999	£356,319	£8,030	3%
Pelton Fell Road CSO	Storm overflow – Storage tanks	£453,475	£421,678	£333,552	£512,002	£31,797	8%
Peases West CO	Storm overflow – Storage tanks	£526,106	£449,023	£354,497	£530,102	£77,083	17%
Mainsforth Terrace PS	Storm overflow – Storage tanks	£1,377,311	£1,076,388	£636,494	£955,573	£300,922	28%

[28] Source: Northumbrian Water
[29] Delta = Northumbrian – Benchmark
[30] Delta % = Delta ÷ Benchmark

Investment Name	Option Type	Northumbrian	Benchmark	25th percentile	75th percentile	Delta[29]	Delta %[30]
Seaton Carew STW	Storm overflow – Storage tanks	£5,068,197	£3,579,171	£1,590,574	£3,340,218	£1,489,026	42%
The Middles CSO – Hustledown STW DC06	Storm overflow – screening and chamber	£118,825	£144,765	£116,023	£187,253	-£25,941	-18%
Teesbank Avenue CSO – Bran Sands STW DC28	Storm overflow – screening and chamber	£147,701	£232,942	£190,261	£296,768	-£85,241	-37%
Pelaw Bank CSO – Chester Le Street STW DC10	Storm overflow – screening and chamber	£163,810	£284,614	£228,027	£368,499	-£120,804	-42%
Bishopton Mill PS – Carlton & Redmarshall STW DC01	Storm overflow – screening and chamber	£177,710	£341,076	£273,258	£441,422	-£163,366	-48%
Brandywell CSO – Berwick Upton Tweed STW DC09	Storm overflow – screening and chamber	£304,027	£450,282	£360,524	£584,037	-£146,255	-32%
Cattle Market SSO – Bishop Auckland STW DC11	Storm overflow – screening and chamber	£410,943	£447,970	£358,431	£582,113	-£37,026	-8%

Our benchmarking shows that for direct costs (Table 22) our costs for screening are between 8% and 48% below the benchmark and that our costs for storage are above the benchmark. Seaton Carew STW is an outlier. This is a significantly large project with a circular volume of 10,511 m^3. Our Northumbrian cost model is based on previous delivery costs of actual projects this size, whereas the benchmark does not contain this size of assets within the cost curves.

TABLE 23: SUMMARY FOR STORM OVERFLOWS INCLUDING INDIRECT COSTS

Investment Name	Option Type	Northumbrian	Benchmark	Delta[31]	Delta[32] %
Westbourne Drive CSO	Storm overflow – Storage tanks	£321,941	£369,160	-£47,219	-13%
Burton Beck CSO	Storm overflow – Storage tanks	£464,287	£480,047	-£15,760	-3%
Pelton Fell Road CSO	Storm overflow – Storage tanks	£740,977	£733,128	£7,849	1%

[31] Delta = Northumbrian – Benchmark
[32] Delta % = Delta ÷ Benchmark

Investment Name	Option Type	Northumbrian	Benchmark	Delta[31]	Delta[32] %
Peases West CO	Storm overflow – Storage tanks	£859,657	£780,671	£78,985	10%
Mainsforth Terrace PS	Storm overflow – Storage tanks	£2,250,525	£1,871,408	£379,116	20%
The Middles CSO – Hustledown STW DC06	Storm overflow – screening and chamber	£194,159	£251,688	-£57,529	-23%
Teesbank Avenue CSO – Bran Sands STW DC28	Storm overflow – screening and chamber	£241,343	£404,992	-£163,648	-40%
Pelaw Bank CSO – Chester Le Street STW DC10	Storm overflow – screening and chamber	£267,665	£494,829	-£227,163	-46%
Bishopton Mill PS – Carlton & Redmarshall STW DC01	Storm overflow – screening and chamber	£290,377	£592,994	-£302,616	-51%
Brandywell CSO – Berwick Upton Tweed STW DC09	Storm overflow – screening and chamber	£496,780	£782,861	-£286,081	-37%
Cattle Market SSO – Bishop Auckland STW DC11	Storm overflow – screening and chamber	£671,481	£778,839	-£107,358	-14%
Total		**£6,799,196**	**£7,540,621**	**-£741,425**	**-10%**

When considering both direct and indirect costs for the selected projects, Table 23 shows our storage tank range is between -13% and +20% of the benchmark and that screens range is between -14% and -51% of the benchmark.

4.2.2 Area programme cost benchmarking

As a result of the DWMP, we expect to deliver a large number of smaller interventions in two specific locations, Marske and Berwick. We have carried out separate benchmarking of both programmes against the supply chain with two contractors providing a secondary and third estimate for the works.

These priority programmes at Marske and Berwick are under 4% below of the supply chain contractor benchmark as showed in Table 24. This direct comparison against contractor benchmark provides robustness to the costing exercise carried out for these drainage community programmes.

TABLE 24: SUMMARY OF DWMP PROGRAMME COST BENCHMARKING

DWMP Programme	Northumbrian Water	Contractor Benchmark	Delta
Marske	£330,260,242	£326,822,673	1.1%
Berwick	£164,822,575	£187,614,265	-12%
Total	**£495,082,818**	**£514,436,939**	**-3.8%**

4.3. FACTORS AFFECTING COST ALLOWANCES

We are not currently making a case for any factors affecting cost allowances.

4.4. THIRD PARTY ASSURANCE

Costing has been carried out by Mott MacDonald using our costing database and data. Costs are checked and reviewed by a senior member of Mott MacDonald's teams as part of their check and review process. Costs have then been benchmarked as described in section 4.2. PwC have carried out independent assurance on the population of costs into data tables.

5. CUSTOMER PROTECTION

5.1. PERFORMANCE COMMITMENT

This enhancement investment delivers an improvement in the number of spills from storm overflows, and so is partly protected by the ODI for the common performance commitment for reducing the average number of spills. However, this is very small compared to the size of the investment (£960,000 per average spill).

In some areas, flooding benefits will also be realised at the same time as addressing the storm overflow. Customers will be protected under the common performance commitment for internal and external flooding. These measures are defined as the number of internal sewer flooding incidents normalised by 10,000 sewer connections and include severe weather. These measures are based on a reporting year and have outperformance and underperformance payments.

Our performance commitments and ODIs do not sufficiently protect customers because the investment is very large compared to the potential penalties. So, we propose a PCD to protect customers.

5.2. PRICE CONTROL DELIVERABLES

Our approach to determining Price Control Deliverables (PCD) is outlined in Section 12.3 of A3 – Costs (NES04). In Table 25 below, we assess our storm overflow related enhancements to test if the benefits are linked to PCs, against Ofwat's materiality of 1%, and to understand if there are outcome measures that can be used.

TABLE 25: ASSESSMENT OF BENEFITS AGAINST THE PCD CRITERIA

Enhancement scheme	Benefits linked to PC?	Materiality	Possible outcomes?
Wastewater WINEP – storm overflows (NES27)	Partial fail – benefits to storm overflows Partial fail – benefits to sewer flooding	Pass – 32%	Outcome is measured by the storm overflows average flow PC – but this is not large enough to reflect the scale of this programme. An alternative outcome is "storm overflows improved" – that is, how many storm overflows are improved by 2030 to the requirements of SODRP. This is not as effective as an output measure because of the high variability in costs to tackle specific storm overflows.

Our assessment has highlighted that performance commitments do not – and cannot – adequately protect customers, as this investment is very large compared to the size of the ODI. So, we propose a PCD based on units rates for the number of storm overflows improved (159) and the number of screens installed (66). A PCD based on delivery of improvements will help to create an incentive to deliver against the Government's SODRP, which will protect customers from the risk of delays causing us to miss the 2035 targets (or requiring much larger increases in bills from 2030).

The Ofwat ODI, which focuses on average spills per overflow, incentivises companies to reduce the total number of spills but not necessarily to deliver against the SODRP – if taken on its own. This ODI supports efficiency and innovation in delivering system solutions, and so both are needed.

A summary of our PCD for storm overflows is outlined in Table 26.

TABLE 26: SUMMARY OF THE PRICE CONTROL DELIVERABLE FOR OUR STORM OVERFLOWS TO PROTECT CUSTOMERS

Description of price control deliverable	Delivery of **storm overflows** as a unit rate (one rate for storm overflows improved; one for screens delivered).
Measurement and reporting	We will report on the number of storm overflows improved and screens delivered as part of our Annual Performance Report. We expect that Ofwat will collect this information from all wastewater companies, as part of monitoring the sector's progress against the SODRP.
Conditions on allowance	Projects must deliver the specified improvements to storm overflows as set out in the SODRP.
Assurances	We will commission independent assurance, with a duty of care to Ofwat, to demonstrate the progress made by sampling improvements at storm overflows through inspections. This will advise on likely progress to 31 March 2025, and will be provided alongside our PR29 business plan.
Price control deliverable payment rate	We will return funds back to customers at two rates: **£5.70m** per storm overflow not improved (of a baseline of 159) **£0.540m** per screen not installed (of a baseline of 66).
Impact on performance in relation to performance commitments	There are some benefits to the storm overflows and sewer flooding performance commitments.

We have calculated these unit rates based on the totex for each of storm overflow improvements and screens installed, divided by the total number of each. This uses the number of sites as described in the Ofwat guidance in IN 23/05.

We think this is the right structure for this PCD, because:

- There is already an ODI for spill reductions.
- There is already cost sharing for the totex, capex, and opex. We considered whether or not a higher cost sharing rate was appropriate for this investment but concluded that this is not needed.
- Equivalent storage is difficult to calculate and estimate for schemes that are not grey storage. For example, optimisation of the network is an efficient solution that does not have an easy or established way to measure the equivalent storage – particularly when combined with other approaches to create a system solution for a drainage area.

We have provided Ofwat with the data they requested to develop this PCD, and we are willing to discuss this further to agree a common approach for the sector. We do not think this requires an additional time penalty because:

- There are already ODIs which incentivise timely delivery of improvements.
- We must meet the first SODRP targets by 2035. If wastewater companies do not deliver their programmes in 2025-30, they will need to do so in 2030-35 instead. This means Ofwat has the discretion to determine how any remaining storm overflows should be funded in the 2030-35 period and can propose penalties then. Unlike a PCD, this can also consider where efficient companies have exceeded their plans for delivering storm overflows in 2025-30.

6. APPENDIX A – STORM OVERFLOW SPILL FREQUENCY DATA

TABLE 27: STORM OVERFLOW SPILL FREQUENCY DATA

AMP8 site name (160)	Drainage area name	Draft category	2020 average annual spill frequency (modelled)	2025 average annual spill frequency (modelled)	2030 average annual spill frequency (modelled)	2045 average annual spill frequency (modelled)	2060 average annual spill frequency (modelled)	2020 average bw season spill frequency (modelled)	2025 average bw season spill frequency (modelled)	2030 average bw season spill frequency (modelled)	2045 average bw season spill frequency (modelled)	2060 average bw season spill frequency (modelled)
BERWICK STW	Berwick	Priority Inland >10 spills	73	70	76	81	85	25	25	26	25	24
CHURCH STREET CSO	Wooler	Priority Inland >10 spills	73	73	73	69	67					
SOUTH ROAD NO 18 CSO	Wooler	Priority Inland >10 spills	25	26	20	21	24					
WOOLER STW	Wooler	Priority Inland >10 spills	55	55	57	67	68					
BRANDYWELL CSO	Berwick	BW 1km >= 2 spills	42	42	44	52	54	17	17	18	18	16
SSO AT WEST END	Berwick	Priority Inland >10 spills	34	33	32	34	37					
CSO AT BLAKEWELL ROAD	Berwick	Priority Inland >10 spills	50	49	50	52	55					
MOUNT ROAD CSO BT003	Berwick	BW 1km >= 2 spills	40	40	41	43	44	16	16	16	15	13
QUEENS GARDENS CSO	Berwick	Priority Inland >10 spills	70	67	70	67	72					
TOWER ROAD CSO	Berwick	BW 1km >= 2 spills	0	0	0	0	1	0	0	0	0	1
33 DOCK ROAD CSO	Berwick	BW 1km >= 2 spills	83	81	84	87	90	30	31	31	27	25
DOCK ROAD CSO (BT44)	Berwick	BW 1km >= 2 spills	71	72	77	75	79	26	28	30	25	22
QUAY WALL SPS SANDGATE CSO	Berwick	BW 1km >= 2 spills	168	161	167	177	185	56	55	55	53	51
SHOREGATE CSO	Berwick	BW 1km >= 2 spills	1	1	1	1	2	1	1	1	0	1
PALACE STREET NORTH CSO 2	Berwick	BW 1km >= 2 spills	16	16	17	20	22	7	7	7	7	6
PALACE STREET NORTH CSO 1	Berwick	BW 1km >= 2 spills	9	9	9	11	14	4	4	4	4	4
CASTLE TERRACE 1 CSO	Berwick	Priority Inland >10 spills	91	88	92	96	99					
RAILWAY STREET	Berwick	Priority Inland >10 spills	17	16	17	20	24					
SPITTAL QUAY CSO (BT7)	Berwick	BW 1km >= 2 spills	110	105	110	120	121	39	39	39	36	32
CAR PARK CSO	Berwick	BW 1km >= 2 spills	60	58	58	67	69	21	21	21	22	19
BERWICK NO 4 SEWAGE PUMPING STATION	Berwick	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
NEW HALL FARM CSO	Felton	Priority Inland >10 spills	31	31	36	43	43					
MAIN STREET CSO	Felton	Priority Inland >10 spills	94	95	95	95	92					
FELTON RECREATION GROUND CSO	Felton	Priority Inland >10 spills	0	0	0	0	0					
FELTON STW CSO Storm Tank	Felton	Priority Inland >10 spills	33	35	36	35	36					
FELTON STW CSO INLET	Felton	Priority Inland >10 spills	58	61	172	169	170					
CHARE BANK CSO	Ebchester	Priority Inland >10 spills	74	74	74	135	66					
EBCHESTER SPS	Ebchester	Priority Inland >10 spills	105	108	108	197	99					
HAMSTERLEY COLLIERY PS	Ebchester	Priority Inland >10 spills	38	38	38	71	38					
HAMSTERLEY MILL PUMPING STATION	Ebchester	Priority Inland >10 spills	103	103	104	190	94					
HIGH SPEN PUMPING STATION	Rowlands Gill	Priority Inland >10 spills	18	30	31	31	32					
WITTON-LE-WEAR PS LOW LANE	Crook	Priority Inland >10 spills	72	73	73	70	70					
WHISKEY JACKS PUMPING STATION	Rowlands Gill	Priority Inland >10 spills	63	64	65	63	65					
THE HOLLOWS CSO WV50	Crook	Priority Inland >10 spills	59	59	59	56	56					
THE HOLLOWS CSO WV49	Crook	Priority Inland >10 spills	40	41	41	40	42					

AMP8 site name (160)	Drainage area name	Draft category	2020 average annual spill frequency (modelled)	2025 average annual spill frequency (modelled)	2030 average annual spill frequency (modelled)	2045 average annual spill frequency (modelled)	2060 average annual spill frequency (modelled)	2020 average bw season spill frequency (modelled)	2025 average bw season spill frequency (modelled)	2030 average bw season spill frequency (modelled)	2045 average bw season spill frequency (modelled)	2060 average bw season spill frequency (modelled)
WEST ROAD CSO	Crook	Priority Inland >10 spills	88	88	90	88	86					
ULSWATER CRESCENT CSO	Crook	Priority Inland >10 spills	15	15	15	16	19					
BLADESIDE CSO	Crook	Priority Inland >10 spills	83	83	84	76	78					
PEASES WEST CSO	Crook	Priority Inland >10 spills	37	38	38	36	39					
LYNWOOD HOUSE CSO DER44	Lanchester & Burnhope	Priority Inland >10 spills	38	38	39	46	48					
STATION ROAD CSO G020	Rowlands Gill	Priority Inland >10 spills	25	26	26	27	27					
CSO MANOR COURT	Lanchester & Burnhope	Priority Inland >10 spills	0	0	0	0	0					
BURNOPFIELD CSO	Rowlands Gill	Priority Inland >10 spills	35	36	37	35	36					
BUSTY BANK CSO	Rowlands Gill	Priority Inland >10 spills	88	88	89	82	82					
LOCKHAUGH STW	Rowlands Gill	Priority Inland >10 spills	0	0	0	0	0					
ETHERLEY LANE CSO	Bishop Auckland	Priority Inland >10 spills	4	4	4	4	6					
ESCOMB SPS	Bishop Auckland	Priority Inland >10 spills	12	12	13	15	19					
CSO WV80 DISUSED STW HUNWICK	Willington & Hunwick	Priority Inland >10 spills	90	90	90	87	84					
SUNNYBROW SEWAGE PUMPING STATION	Willington & Hunwick	Priority Inland >10 spills	78	79	79	71	74					
BURNISTON DRIVE PS	Willington & Hunwick	Priority Inland >10 spills	87	85	85	78	77					
BURNHOPE P.S. CSO & CER	Lanchester & Burnhope	Priority Inland >10 spills	81	80	81	74	73					
HUSTLEDOWN ROAD CSO	South Stanley & Craghead	Priority Inland >10 spills	45	46	46	44	45					
CSO ADJACENT 40 HOLLYHILL GARDENS	South Stanley & Craghead	Priority Inland >10 spills	34	34	34	33	35					
LOW WILLINGTON PARK CSO	Willington & Hunwick	Priority Inland >10 spills	77	79	80	72	71					
HOLYHILL GARDENS EAST CSO	South Stanley & Craghead	Priority Inland >10 spills	84	84	84	78	79					
NIGHTINGALE PLACE CSO	South Stanley & Craghead	Priority Inland >10 spills	1	1	1	3	2					
THE MIDDLES CSO	South Stanley & Craghead	Priority Inland >10 spills	11	11	11	12	14					
50 WOODSIDE GARDENS CSO	South Stanley & Craghead	Priority Inland >10 spills	72	7	7	9	11					
CATTLE MARKET B SSO	Bishop Auckland	Priority Inland >10 spills	87	89	90	81	84					
RIVERSIDE CSO	Bishop Auckland	Priority Inland >10 spills	88	89	89	80	82					
DELLWOOD PUMPED STORAGE TANK CSO	Bishop Auckland	Priority Inland >10 spills	88	88	89	80	80					
WEAR CHARE CSO	Bishop Auckland	Priority Inland >10 spills	46	46	46	44	45					
KIMBERLEY GARDENS CSO (DER 82)	South Stanley & Craghead	Priority Inland >10 spills	90	90	90	87	85					
HUSTLEDOWN STW	South Stanley & Craghead	Priority Inland >10 spills	23	24	24	23	24					
FRONT STREET CSO	South Stanley & Craghead	Priority Inland >10 spills	30	30	30	30	32					
BURTON BECK CSO	Spennymoor	Priority Inland >10 spills	17	29	30	28	29					
MAYFIELD CSO	Spennymoor	Priority Inland >10 spills	39	41	42	39	41					
COW PLANTATION CSO	Spennymoor	Priority Inland >10 spills	13	13	12	13	17					
TUDHOE MILL STW CSO INLET	Spennymoor	Priority Inland >10 spills	0	0	0	0	0					
TUDHOE MILL STW CSO INLET	Spennymoor	Priority Inland >10 spills	0	0	0	0	0					
PELTON FELL ROAD 3 CSO CH14	Chester le Street	Priority Inland >10 spills	63	64	66	63	65					
ELWIN PLACE CSO	Birtley	Priority Inland >10 spills	21	21	21	22	21					

AMP8 site name (160)	Drainage area name	Draft category	2020 average annual spill frequency (modelled)	2025 average annual spill frequency (modelled)	2030 average annual spill frequency (modelled)	2045 average annual spill frequency (modelled)	2060 average annual spill frequency (modelled)	2020 average bw season spill frequency (modelled)	2025 average bw season spill frequency (modelled)	2030 average bw season spill frequency (modelled)	2045 average bw season spill frequency (modelled)	2060 average bw season spill frequency (modelled)
SOUTHFIELDS CSO	Birtley	Priority Inland >10 spills	18	18	18	19	19					
SALTERS LANE CSO	Gosforth	Priority Inland >10 spills	26	26	26	21	22					
CLEASEWELL HILL SPS	Bedlington & Cambois	Priority Inland >10 spills	81	81	83	80	80					
HIGH CARR ROAD CSO	Durham City & Newton Hall	Priority Inland >10 spills	27	27	28	28	30					
PLAWSWORTH GATE CSO	Nettlesworth	Priority Inland >10 spills	11	11	11	15	16					
PLAWSWORTH CSO MH1	Nettlesworth	Priority Inland >10 spills	76	76	76	75	75					
PELTON FELL ROAD CSO	Chester le Street	Priority Inland >10 spills	15	15	16	17	17					
MILLBURNGATE CSO	Durham City & Newton Hall	Priority Inland >10 spills	25	25	25	26	25					
ELVET SYPHON CSO	Durham City & Newton Hall	Priority Inland >10 spills	31	40	40	38	40					
PELAW WOOD SEWER, NO 1 BATHS BRIDGE	Durham City & Newton Hall	Priority Inland >10 spills	0	0	0	0	0					
FRANKLAND LANE CSO	Durham City & Newton Hall	Priority Inland >10 spills	29	30	30	29	30					
SANDS SYPHON SSO	Durham City & Newton Hall	Priority Inland >10 spills	28	31	32	30	31					
BARKERS HAUGH STW	Durham City & Newton Hall	Priority Inland >10 spills	16	17	17	16	18					
BEVERLEY GARDENS CSO	Chester le Street	Priority Inland >10 spills	30	30	30	30	29					
CONE LANE (CHESTER NO 4) CSO	Chester le Street	Priority Inland >10 spills	14	14	14	15	16					
PELAW BANK CSO CH57	Chester le Street	Priority Inland >10 spills	24	24	24	26	26					
HOPGARTH GARDENS CSO	Chester le Street	Priority Inland >10 spills	13	12	13	13	14					
CHESTER LE STREET STW STORM TANK	Chester le Street	Priority Inland >10 spills	11	12	12	11	11					
SHIELDS ROAD CSO	Chester le Street	Priority Inland >10 spills	45	45	45	44	43					
BANK TOP CSO	Bedlington & Cambois	Priority Inland >10 spills	48	48	49	45	45					
EAST FORD ROAD PS	Bedlington & Cambois	Priority Inland >10 spills	14	14	18	15	16					
SHINCLIFFE (A177) CSO	Carrville & Belmont & Shincliffe	Priority Inland >10 spills	44	44	44	43	43					
LAUREL AVENUE CSO	Durham City & Newton Hall	Priority Inland >10 spills	53	53	53	51	53					
BARKERS HAUGH CSO NO. 10 Orchard Drive	Durham City & Newton Hall	Priority Inland >10 spills	32	32	33	33	33					
PARK ROAD CSO	Chester le Street	Priority Inland >10 spills	13	13	13	14	14					
ASH MEADOWS CSO CHESTER LE STREET	Chester le Street	Priority Inland >10 spills	13	13	13	13	14					
4 AYCLIFFE AVENUE CSO	Leam Lane,Wardley,Bill Quay	Priority Inland >10 spills	11	11	10	11	12					
GRANGE PARK CSO (WK016)	Bedlington & Cambois	Priority Inland >10 spills	114	115	116	114	116					
SLEEKBURN EAST CSO	Bedlington & Cambois	Priority Inland >10 spills	24	25	25	23	24					
GLAXO WEST CSO	Bedlington & Cambois	Priority Inland >10 spills	69	69	74	76	74					
NEASHAM ROAD CSO (Y5)	Darlington South	Priority Inland >10 spills	17	19	19	20	21					
WEST RAINTON STW LEAMSIDE	West Rainton	Priority Inland >10 spills	28	30	30	29	28					
YARM ROAD CSO (Y3)	Darlington South	Priority Inland >10 spills	16	16	16	18	19					
BELMONT STW	Carrville & Belmont & Shincliffe	Priority Inland >10 spills	3	3	3	3	4					
MANOR ROAD CSO GLENDALE AVENUE	Washington North	Priority Inland >10 spills	23	23	23	25	25					
COACH ROAD EST CSO DONWELL PRIMARY SCHOOL	Washington North	Priority Inland >10 spills	31	31	32	32	34					
NORTH BLYTH PUMPING STATION	Bedlington & Cambois	Priority Inland >10 spills	26	70	70	68	73					
PITHOUSE LANE CSO (WEST RAINTON 5)	West Rainton	Priority Inland >10 spills	32	33	34	34	34					

AMP8 site name (160)	Drainage area name	Draft category	2020 average annual spill frequency (modelled)	2025 average annual spill frequency (modelled)	2030 average annual spill frequency (modelled)	2045 average annual spill frequency (modelled)	2060 average annual spill frequency (modelled)	2020 average bw season spill frequency (modelled)	2025 average bw season spill frequency (modelled)	2030 average bw season spill frequency (modelled)	2045 average bw season spill frequency (modelled)	2060 average bw season spill frequency (modelled)
WEST RAINTON CSO DU085 STW MH21	West Rainton	Priority Inland >10 spills	13	13	13	14	14					
FINCHALE VIEW	West Rainton	Priority Inland >10 spills	20	21	20	24	26					
WEST RAINTON CSO DU085 STW MH21	West Rainton	Priority Inland >10 spills	25	25	25	26	25					
WASHINGTON CSO DON GARDENS	Washington North	Priority Inland >10 spills	17	18	18	20	20					
66 ROSS LEA CSO	Herrington	Priority Inland >10 spills	19	20	20	21	22					
WESTBOURNE DRIVE CSO	Herrington	Priority Inland >10 spills	20	19	20	21	22					
SHINEY ROW FOOTBRIDGE CSO	Herrington	Priority Inland >10 spills	49	48	49	47	49					
SPRINGWELL PARK CSO	Jarrow,Hedworth	Priority Inland >10 spills	26	27	27	26	27					
EDEN WALK CSO	Jarrow,Hedworth	Priority Inland >10 spills	30	31	32	32	32					
WEST OF HEDWORTH LANE CSO	Jarrow,Hedworth	Priority Inland >10 spills	73	75	75	75	77					
SOUTH SHIELDS INTERCEPTOR BS/104	Jarrow,Hedworth	Priority Inland >10 spills	40	40	40	41	42					
TYNESIDE CSO (NO B5/301) NEWLAND DRIVE	Jarrow,Hedworth	Priority Inland >10 spills	53	56	56	54	54					
NEW ROAD CSO	Jarrow,Hedworth	Priority Inland >10 spills	9	9	9	10	11					
BROOKE AVENUE (NO20) STY049 CSO	Jarrow,Hedworth	Priority Inland >10 spills	40	43	66	65	67					
WEST BOLDON CSO (NO 4)	Jarrow,Hedworth	Priority Inland >10 spills	68	70	83	79	80					
BISHOPTON MILL PS	Whitton & Thorpe Thewles	Priority Inland >10 spills	0	0	0	0	0					
STILLINGTON OLD WORKS CSO ST004	Whitton & Thorpe Thewles	Priority Inland >10 spills	18	19	20	20	23					
CARLTON & REDMARSHALL STW	Whitton & Thorpe Thewles	Priority Inland >10 spills	37	40	39	39	39					
CARLTON PUMPING STATION	Whitton & Thorpe Thewles	Priority Inland >10 spills	37	42	42	41	40					
THORPE THEWLES SPS	Whitton & Thorpe Thewles	Priority Inland >10 spills	81	88	88	88	87					
TILERY FARM STRAGE TANK CSO	Peterlee	Priority Inland >10 spills	37	40	40	38	41					
EGGLESCLIFFE BANK CSO	Eaglescliffe	Priority Inland >10 spills	23	23	24	27	30					
TEESSIDE HIGH SCHOOL PS	Eaglescliffe	Priority Inland >10 spills	19	12	18	23	24					
QUARRY PLANTATION (ABOVE CLIFTON GARDENS)	Eaglescliffe	Priority Inland >10 spills	176	180	182	198	193					
TEESBANK AVENUE CSO	Eaglescliffe	Priority Inland >10 spills	10	10	10	13	14					
SPRING WAY CSO ST021	Eaglescliffe	Priority Inland >10 spills	54	54	55	63	66					
DARLINGTON CSO	Eaglescliffe	Priority Inland >10 spills	No Model Data	No Model Data	No Model Data	No Model Data	No Model Data					
GRAYS ROAD CSO	Eastbourne	Priority Inland >10 spills	60	60	61	67	65					
LONDONDERRY ROAD/GREEN LANE CSO	Eastbourne	Priority Inland >10 spills	1	1	1	2	2					
STATION STREET CSO	Thornaby North	Priority Inland >10 spills	1	1	1	1	1					
TILERY STORM SEWAGE PUMPING STATION	Stockton East	Priority Inland >10 spills	102	103	105	119	116					
QUEENSPORT CLOSE CSO	Stockton East	Priority Inland >10 spills	0	0	0	0	0					
BLUEHOUSE GILL CSO	Peterlee	Priority Inland >10 spills	119	124	126	118	116					
GRAYTHORP STW	Hartlepool South	Priority Inland >10 spills	No Model Data	No Model Data	No Model Data	No Model Data	No Model Data					
SEATON CAREW STW	Hartlepool South	BW 1km >= 2 spills	64	66	66	66	62	26	26	27	23	17
MAINSFORTH TERRACE PS	Burn Valley	>5% impact at BW	43	44	44	42	42	18	18	18	15	14
MILLBURNGATE CSO SOUTH END	Hartlepool South	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0

AMP8 site name (160)	Drainage area name	Draft category	2020 average annual spill frequency (modelled)	2025 average annual spill frequency (modelled)	2030 average annual spill frequency (modelled)	2045 average annual spill frequency (modelled)	2060 average annual spill frequency (modelled)	2020 average bw season spill frequency (modelled)	2025 average bw season spill frequency (modelled)	2030 average bw season spill frequency (modelled)	2045 average bw season spill frequency (modelled)	2060 average bw season spill frequency (modelled)
HARWAL ROAD CSO (REF. L16)	Redcar	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
LAKES CSO	Redcar	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
NEW COATHAM CSO REF L73	Redcar	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
TUDOR CROFT COTTAGE CSO L017	Guisborough	Priority Inland >10 spills	0	0	0	0	0					
PARK LANE CSO	Guisborough	Priority Inland >10 spills	8	9	9	11	12					
STATION ROAD CSO	Redcar	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
GRANVILLE TCE SSO	Redcar	BW 1km >= 2 spills	0	0	0	0	0	0	0	0	0	0
NEW MARSKE METHODIST CHURCH LONGBECK	Marske	BW 1km >= 2 spills	13	13	13	15	19	8	8	8	7	7
DALE STREET CSO (REF.L27)	Marske	BW 1km >= 2 spills	3	4	4	4	5	2	2	2	2	2
MARSKE STW	Marske	BW 1km >= 2 spills	134	137	141	191	236	51	48	52	71	92
BYDALE SCHOOL CSO	Marske	BW 1km >= 2 spills	43	43	44	43	46	17	17	17	14	13
THE STRAY STORM RETENTION TANK	Marske	BW 1km >= 2 spills	2	2	2	2	3	1	1	1	1	2
HOWLE BECK OVERFLOWS (MARSKE CEMETE ST GERMAINS LANE)	Marske	BW 1km >= 2 spills	1	1	1	2	2	1	1	1	1	1

Source: Northumbrian Water

7. APPENDIX B – COST BENEFIT RATIOS AND PREFERRED OPTION

TABLE 28: COST BENEFIT RATIOS AND PREFERRED OPTIONS FOR STORM OVERFLOWS

Site Name	Option	NPV £m	Least Cost	Chosen Option
33 Dock Road CSO_NT99526102 – DC_07	Do nothing		N	Alternative option
33 Dock Road CSO_NT99526102 – DC_07	Static Screen	-0.366	Y	Preferred option
Ash Meadows CSO Chester Le Street_NZ28531301 – DC_11	Do nothing		N	Alternative option
Ash Meadows CSO Chester Le Street_NZ28531301 – DC_11	Static Screen	-0.31	Y	Preferred option
Barkers Haugh CSO No. 10 Orchard Drive_NZ28430101 – DC_06	Do nothing		N	Alternative option
Barkers Haugh CSO No. 10 Orchard Drive_NZ28430101 – DC_06	Static Screen	-1.212	Y	Preferred option
Barkers Haugh STW – DC_03	Do nothing		N	Alternative option
Barkers Haugh STW – DC_03	Option 1 – Green Infrastructure	-22.01	N	Alternative option
Barkers Haugh STW – DC_03	Option 2 – Below-ground storage only	-0.98	Y	Preferred option
Barkers Haugh STW – DC_03	Option 3 – Green Infrastructure and below ground storage	-1.673	N	Alternative option
Barkers Haugh STW – DC_05	Do nothing		N	Alternative option
Barkers Haugh STW – DC_05	Option 1 – Green Infrastructure	-12.257	N	Alternative option
Barkers Haugh STW – DC_05	Option 2 – Below-ground storage only	-1.857	Y	Preferred option
Barkers Haugh STW – DC_05	Option 4 – Smart Networks plus Storage	-2.474	N	Alternative option
Barkers Haugh STW – DC_05	Option 5 – Surface Water Separation plus Storage	-24.02	N	Alternative option
Barkers Haugh STW – DC_06	Do nothing		N	Alternative option
Barkers Haugh STW – DC_06	Option 1 – Green Infrastructure	-17.165	N	Alternative option
Barkers Haugh STW – DC_06	Option 2 – Below-ground storage only	-1.839	Y	Preferred option
Barkers Haugh STW – DC_06	Option 4 – Smart Networks plus Storage	-2.242	N	Alternative option
Barkers Haugh STW – DC_06	Option 5 – Surface Water Separation plus Storage	-20.983	N	Alternative option
Barkers Haugh STW – DC_06	Option 6 – Smart Networks plus Surface Water Separation	-17.302	N	Alternative option
Barkers Haugh STW – DC_08	Do nothing		N	Alternative option
Barkers Haugh STW – DC_08	Option 1 – Green Infrastructure	-6.474	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Barkers Haugh STW – DC_08	Option 2 – Below-ground storage only	-1.983	N	Alternative option
Barkers Haugh STW – DC_08	Option 4 – Smart Networks plus Storage	-2.684	N	Alternative option
Barkers Haugh STW – DC_08	Option 5 – Surface Water Separation plus Storage	-10.09	N	Alternative option
Barkers Haugh STW – DC_08	Option 6 – Smart Networks plus Surface Water Separation	-6.632	Y	Preferred option
Barkers Haugh STW – DC_10	Do nothing		N	Alternative option
Barkers Haugh STW – DC_10	Option 1 – Green Infrastructure	-10.093	N	Alternative option
Barkers Haugh STW – DC_10	Option 2 – Below-ground storage only	-0.694	Y	Preferred option
Barkers Haugh STW – DC_10	Option 4 – Smart Networks plus Storage	-1.267	N	Alternative option
Barkers Haugh STW – DC_10	Option 5 – Surface Water Separation plus Storage	-15.267	N	Alternative option
Barkers Haugh STW – DC_10	Option 6 – Smart Networks plus Surface Water Separation	-10.531	N	Alternative option
Barkers Haugh STW – DC_12	Do nothing		N	Alternative option
Barkers Haugh STW – DC_12	Option 1 – Green Infrastructure	-26.521	N	Alternative option
Barkers Haugh STW – DC_12	Option 2 – Below-ground storage only	-1.692	Y	Preferred option
Barkers Haugh STW – DC_12	Option 3 – Green Infrastructure and below ground storage	-3.016	N	Alternative option
Belmont STW – DC_01	Do nothing		N	Alternative option
Belmont STW – DC_01	Option 1 – Green Infrastructure	-19.569	N	Alternative option
Belmont STW – DC_01	Option 2 – Below-ground storage only	-0.697	Y	Preferred option
Belmont STW – DC_01	Option 3 – Green Infrastructure and below ground storage	-0.585	N	Alternative option
Belmont STW – DC_05	Do nothing		N	Alternative option
Belmont STW – DC_05	Option 1 – Green Infrastructure	-16.417	N	Alternative option
Belmont STW – DC_05	Option 2 – Below-ground storage only	-0.719	Y	Preferred option
Belmont STW – DC_05	Option 3 – Green Infrastructure and below ground storage	-7.297	N	Alternative option
Belmont STW – DC_05	Option 5 – Surface Water Separation plus Storage	-7.228	N	Alternative option
Belmont STW_ NZ30454101 – DC_05	Do nothing		N	Alternative option
Belmont STW_ NZ30454101 – DC_05	Static Screen	-1.033	Y	Preferred option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Berwick No 4 SPS_NU00523600 – DC_04	Do nothing		N	Alternative option
Berwick No 4 SPS_NU00523600 – DC_04	Static Screen	-0.442	Y	Preferred option
Berwick Upon Tweed STW – DC_01	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_01	Option 1 – Green Infrastructure	-58.29	Y	Preferred option
Berwick Upon Tweed STW – DC_04	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_04	Option 1 – Green Infrastructure	-31.72	Y	Preferred option
Berwick Upon Tweed STW – DC_05	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_05	Option 1 – Green Infrastructure	-24.819	Y	Preferred option
Berwick Upon Tweed STW – DC_07	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_07	Option 1 – Green Infrastructure	-11.155	Y	Preferred option
Berwick Upon Tweed STW – DC_08	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_08	Option 1 – Green Infrastructure	-16.361	Y	Preferred option
Berwick Upon Tweed STW – DC_09	Do nothing		N	Alternative option
Berwick Upon Tweed STW – DC_09	Option 2 – Below-ground storage only	-1.858	Y	Preferred option
Birtley STW – DC_05	Do nothing	0	N	Alternative option
Birtley STW – DC_05	Option 1 – Green Infrastructure	-5.128	N	Alternative option
Birtley STW – DC_05	Option 2 – Below-ground storage only	-1.296	Y	Preferred option
Birtley STW – DC_05	Option 3 – Green Infrastructure and below ground storage	-4.686	N	Alternative option
Birtley STW – DC_05	Option 4 – Smart Networks plus Storage	-1.454	N	Alternative option
Bishop Auckland STW – DC_06	Do nothing		N	Alternative option
Bishop Auckland STW – DC_06	Option 1 – Green Infrastructure	-16.971	N	Alternative option
Bishop Auckland STW – DC_06	Option 2 – Below-ground storage only	-0.916	Y	Preferred option
Bishop Auckland STW – DC_06	Option 3 – Green Infrastructure and below ground storage	-9.099	N	Alternative option
Bishop Auckland STW – DC_06	Option 5 – Surface Water Separation plus Storage	-6.069	N	Alternative option
Bishop Auckland STW – DC_07	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Bishop Auckland STW – DC_07	Option 1 – Green Infrastructure	-18.765	N	Alternative option
Bishop Auckland STW – DC_07	Option 2 – Below-ground storage only	-0.121	Y	Preferred option
Bishop Auckland STW – DC_07	Option 3 – Green Infrastructure and below ground storage	-0.708	N	Alternative option
Bishop Auckland STW – DC_11	Do nothing		N	Alternative option
Bishop Auckland STW – DC_11	Option 1 – Green Infrastructure	-8.166	N	Preferred option
Bishop Auckland STW – DC_11	Option 2 – Below-ground storage only	-10.594	N	Alternative option
Bishop Auckland STW – DC_11	Option 4 – Smart Networks plus Storage	-7.785	Y	Alternative option
Bishop Auckland STW – DC_11	Option 5 – Surface Water Separation plus Storage	-16.919	N	Alternative option
Bishop Auckland STW – DC_11	Option 6 – Smart Networks plus Surface Water Separation	-9.906	N	Alternative option
Bishop Auckland STW – DC_15	Do nothing		N	Alternative option
Bishop Auckland STW – DC_15	Option 1 – Green Infrastructure	-30.417	N	Alternative option
Bishop Auckland STW – DC_15	Option 2 – Below-ground storage only	-3.318	Y	Alternative option
Bishop Auckland STW – DC_15	Option 4 – Smart Networks plus Storage	-5.785	N	Preferred option
Bishop Auckland STW – DC_15	Option 5 – Surface Water Separation plus Storage	-57.565	N	Alternative option
Bishop Auckland STW – DC_15	Option 6 – Smart Networks plus Surface Water Separation	-36.083	N	Alternative option
Bishopton Mill PS_NZ37228501 – DC_01	Do nothing		N	Alternative option
Bishopton Mill PS_NZ37228501 – DC_01	Static Screen	-1.238	Y	Preferred option
Bran Sands STW – DC_07	Do nothing		N	Alternative option
Bran Sands STW – DC_07	Option 1 – Green Infrastructure	-11.263	N	Alternative option
Bran Sands STW – DC_07	Option 2 – Below-ground storage only	-1.682	N	Alternative option
Bran Sands STW – DC_07	Option 3 – Green Infrastructure and below ground storage	-1.481	Y	Preferred option
Bran Sands STW – DC_09	Do nothing		N	Alternative option
Bran Sands STW – DC_09	Option 1 – Green Infrastructure	-9.721	N	Alternative option
Bran Sands STW – DC_09	Option 2 – Below-ground storage only	-1.749	N	Alternative option
Bran Sands STW – DC_09	Option 3 – Green Infrastructure and below ground storage	-3.325	Y	Preferred option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Bran Sands STW – DC_09	Option 4 – Smart Networks plus Storage	-3.349	N	Alternative option
Bran Sands STW – DC_11	Do nothing		N	Alternative option
Bran Sands STW – DC_11	Option 1 – Green Infrastructure	-10.19	Y	Preferred option
Bran Sands STW – DC_12	Do nothing		N	Alternative option
Bran Sands STW – DC_12	Option 1 – Green Infrastructure	-7.907	Y	Preferred option
Bran Sands STW – DC_25	Do nothing		N	Alternative option
Bran Sands STW – DC_25	Option 1 – Green Infrastructure	-1.279	N	Alternative option
Bran Sands STW – DC_25	Option 2 – Below-ground storage only	-0.671	N	Alternative option
Bran Sands STW – DC_25	Option 5 – Surface Water Separation plus Storage	-1.292	Y	Preferred option
Bran Sands STW – DC_28	Do nothing		N	Alternative option
Bran Sands STW – DC_28	Option 1 – Green Infrastructure	-18.784	N	Alternative option
Bran Sands STW – DC_28	Option 2 – Below-ground storage only	-1.909	Y	Preferred option
Bran Sands STW – DC_28	Option 5 – Surface Water Separation plus Storage	-20	N	Alternative option
Bran Sands STW – DC_31	Do nothing		N	Alternative option
Bran Sands STW – DC_31	Option 1 – Green Infrastructure	-12.248	N	Alternative option
Bran Sands STW – DC_31	Option 2 – Below-ground storage only	-0.241	Y	Preferred option
Bran Sands STW – DC_31	Option 3 – Green Infrastructure and below ground storage	-11.491	N	Alternative option
Bran Sands STW – DC_31	Option 5 – Surface Water Separation plus Storage	-10.885	N	Alternative option
Brandywell_NT99519801 CSO – DC_09	Do nothing		N	Alternative option
Brandywell_NT99519801 CSO – DC_09	Mechanical Screen	-2.119	Y	Preferred option
Brooke Avenue (No 20) CSO_NZ35619702 – DC_09	Do nothing		N	Alternative option
Brooke Avenue (No 20) CSO_NZ35619702 – DC_09	Static Screen	-1.038	Y	Preferred option
Burnhope PS CSO & CER_NZ19481405 – DC_04	Do nothing		N	Alternative option
Burnhope PS CSO & CER_NZ19481405 – DC_04	Static Screen	-1.211	Y	Preferred option
Busty Bank CSO_NZ17576201 – DC_03	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Busty Bank CSO_NZ17576201 – DC_03	Static Screen	-1.36	Y	Preferred option
Cambois STW – DC_01	Do nothing		N	Alternative option
Cambois STW – DC_01	Option 1 – Green Infrastructure	-32.069	N	Alternative option
Cambois STW – DC_01	Option 2 – Below-ground storage only	-1.356	Y	Alternative option
Cambois STW – DC_01	Option 4 – Smart Networks plus Storage	-3.358	N	Preferred option
Cambois STW – DC_01	Option 5 – Surface Water Separation plus Storage	-28.312	N	Alternative option
Cambois STW – DC_02	Do nothing		N	Alternative option
Cambois STW – DC_02	Option 1 – Green Infrastructure	-32.162	N	Alternative option
Cambois STW – DC_02	Option 2 – Below-ground storage only	-2.907	Y	Preferred option
Cambois STW – DC_02	Option 3 – Green Infrastructure and below ground storage	-4.463	N	Alternative option
Cambois STW – DC_09	Do nothing		N	Alternative option
Cambois STW – DC_09	Option 1 – Green Infrastructure	-12.725	Y	Preferred option
Cambois STW – DC_09	Option 2 – Below-ground storage only	-4.666	N	Alternative option
Cambois STW – DC_09	Option 4 – Smart Networks plus Storage	-7.49	N	Alternative option
Cambois STW – DC_09	Option 5 – Surface Water Separation plus Storage	-23.794	N	Alternative option
Cambois STW – DC_10	Do nothing		N	Alternative option
Cambois STW – DC_10	Option 1 – Green Infrastructure	-20.793	N	Alternative option
Cambois STW – DC_10	Option 2 – Below-ground storage only	-1.008	Y	Preferred option
Cambois STW – DC_10	Option 3 – Green Infrastructure and below ground storage	-8.913	N	Alternative option
Cambois STW – DC_10	Option 4 – Smart Networks plus Storage	-2.223	N	Alternative option
Cambois STW – DC_10	Option 5 – Surface Water Separation plus Storage	-7.692	N	Alternative option
Car Park CSO_NU00513805 – DC_08	Do nothing		N	Alternative option
Car Park CSO_NU00513805 – DC_08	Static Screen	-0.393	Y	Preferred option
Carlton & Redmarshall STW_10 – DC_01	Do nothing	0	N	Alternative option
Carlton & Redmarshall STW_10 – DC_01	Option 1 – Green Infrastructure	-18.235	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Carlton & Redmarshall STW_10 – DC_01	Option 2 – Below-ground storage only	-0.878	Y	Preferred option
Carlton & Redmarshall STW_10 – DC_01	Option 3 – Green Infrastructure and below ground storage	-6.115	N	Alternative option
Carlton & Redmarshall STW_10 – DC_01	Option 5 – Surface Water Separation plus Storage	-5.893	N	Alternative option
Carlton & Redmarshall STW_11 – DC_01	Do nothing		N	Alternative option
Carlton & Redmarshall STW_11 – DC_01	Option 1 – Green Infrastructure	-19.049	N	Alternative option
Carlton & Redmarshall STW_11 – DC_01	Option 2 – Below-ground storage only	-0.154	Y	Preferred option
Carlton & Redmarshall STW_11 – DC_01	Option 3 – Green Infrastructure and below ground storage	-0.154	N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Do nothing		N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Option 1 – Green Infrastructure	-4.914	N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Option 2 – Below-ground storage only	-1.702	N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Option 3 – Green Infrastructure and below ground storage	-3.393	N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Option 4 – Smart Networks plus Storage	-1.879	N	Alternative option
Carlton & Redmarshall STW_11 – DC_10	Option 5 – Surface Water Separation plus Storage	-2.795	Y	Preferred option
Carlton & Redmarshall STW_11 – DC_11	Do nothing		N	Alternative option
Carlton & Redmarshall STW_11 – DC_11	Option 1 – Green Infrastructure	-20.409	N	Alternative option
Carlton & Redmarshall STW_11 – DC_11	Option 2 – Below-ground storage only	-0.776	Y	Preferred option
Carlton & Redmarshall STW_11 – DC_11	Option 3 – Green Infrastructure and below ground storage	-1.085	N	Alternative option
Carlton Pumping Station_NZ39214601 – DC_10	Do nothing		N	Alternative option
Carlton Pumping Station_NZ39214601 – DC_10	Static Screen	-1.02	Y	Preferred option
Castle Terrace 1 CSO_NT99534502 – DC_05	Do nothing		N	Alternative option
Castle Terrace 1 CSO_NT99534502 – DC_05	Static Screen	-0.262	Y	Preferred option
Cattle Market B SSO_NZ21284904 – DC_11	Do nothing		N	Alternative option
Cattle Market B SSO_NZ21284904 – DC_11	Mechanical Screen	-1.04	Y	Preferred option
Chester Le Street STW – DC_05	Do nothing		N	Alternative option
Chester Le Street STW – DC_05	Option 1 – Green Infrastructure	-13.399	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Chester Le Street STW – DC_05	Option 2 – Below-ground storage only	-0.779	Y	Preferred option
Chester Le Street STW – DC_05	Option 4 – Smart Networks plus Storage	-1.377	N	Alternative option
Chester Le Street STW – DC_05	Option 5 – Surface Water Separation plus Storage	-19.022	N	Alternative option
Chester Le Street STW – DC_05	Option 6 – Smart Networks plus Surface Water Separation	-15.1	N	Alternative option
Chester Le Street STW – DC_08	Do nothing		N	Alternative option
Chester Le Street STW – DC_08	Option 1 – Green Infrastructure	-23.245	N	Alternative option
Chester Le Street STW – DC_08	Option 2 – Below-ground storage only	-1.177	Y	Preferred option
Chester Le Street STW – DC_08	Option 3 – Green Infrastructure and below ground storage	-2.099	N	Alternative option
Chester Le Street STW – DC_10	Do nothing		N	Alternative option
Chester Le Street STW – DC_10	Option 1 – Green Infrastructure	-12.059	N	Alternative option
Chester Le Street STW – DC_10	Option 2 – Below-ground storage only	-0.871	Y	Preferred option
Chester Le Street STW – DC_10	Option 4 – Smart Networks plus Storage	-1.488	N	Alternative option
Chester Le Street STW – DC_10	Option 5 – Surface Water Separation plus Storage	-12.006	N	Alternative option
Chester Le Street STW – DC_11	Do nothing		N	Alternative option
Chester Le Street STW – DC_11	Option 1 – Green Infrastructure	-3.276	N	Alternative option
Chester Le Street STW – DC_11	Option 2 – Below-ground storage only	-0.056	Y	Preferred option
Chester Le Street STW – DC_11	Option 4 – Smart Networks plus Storage	-0.703	N	Alternative option
Chester Le Street STW – DC_11	Option 5 – Surface Water Separation plus Storage	-3.478	N	Alternative option
Chester Le Street STW – DC_11	Option 6 – Smart Networks plus Surface Water Separation	-3.063	N	Alternative option
Chester Le Street STW – DC_14	Do nothing		N	Alternative option
Chester Le Street STW – DC_14	Option 1 – Green Infrastructure	-41.641	Y	Preferred option
Chester Le Street STW – DC_15	Do nothing		N	Alternative option
Chester Le Street STW – DC_15	Option 1 – Green Infrastructure	-23.557	N	Alternative option
Chester Le Street STW – DC_15	Option 2 – Below-ground storage only	-1.915	Y	Preferred option
Chester Le Street STW – DC_15	Option 3 – Green Infrastructure and below ground storage	-2.381	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Consett STW – DC_03	Do nothing	0	N	Alternative option
Consett STW – DC_03	Option 1 – Green Infrastructure	-25.922	N	Alternative option
Consett STW – DC_03	Option 2 – Below-ground storage only	-1.722	Y	Preferred option
Consett STW – DC_03	Option 3 – Green Infrastructure and below ground storage	-5.363	N	Alternative option
Consett STW – DC_03	Option 5 – Surface Water Separation plus Storage	-4.114	N	Alternative option
Consett STW – DC_05	Do nothing		N	Alternative option
Consett STW – DC_05	Option 1 – Green Infrastructure	-3.643	Y	Preferred option
Consett STW – DC_05	Option 2 – Below-ground storage only	-1.492	N	Alternative option
Consett STW – DC_05	Option 4 – Smart Networks plus Storage	-2.837	N	Alternative option
Consett STW – DC_05	Option 5 – Surface Water Separation plus Storage	-6.924	N	Alternative option
Consett STW – DC_06	Do nothing		N	Alternative option
Consett STW – DC_06	Option 1 – Green Infrastructure	-22.814	N	Alternative option
Consett STW – DC_06	Option 2 – Below-ground storage only	-2.575	Y	Alternative option
Consett STW – DC_06	Option 3 – Green Infrastructure and below ground storage	-21.623	N	Alternative option
Consett STW – DC_06	Option 4 – Smart Networks plus Storage	-4.269	N	Preferred option
Consett STW – DC_06	Option 5 – Surface Water Separation plus Storage	-20.712	N	Alternative option
CSO At Blakewell Road_NT99523802 – DC_07	Do nothing		N	Alternative option
CSO At Blakewell Road_NT99523802 – DC_07	Static Screen	-0.438	Y	Preferred option
CSO Manor Court_NZ17460801 – DC_05	Do nothing		N	Alternative option
CSO Manor Court_NZ17460801 – DC_05	Static Screen	-0.958	Y	Preferred option
CSO Wv80 Disused STW Hunwick_NZ19336503 – DC_02	Do nothing		N	Alternative option
CSO Wv80 Disused STW Hunwick_NZ19336503 – DC_02	Static Screen	-1.366	Y	Preferred option
Darlington CSO_NZ43180001 – DC_12	Do nothing		N	Alternative option
Darlington CSO_NZ43180001 – DC_12	Static Screen	-0.313	Y	Preferred option
Dock Road CSO (BT44)_NT99528001 – DC_07	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Dock Road CSO (BT44)_NT99528001 – DC_07	Static Screen	-0.373	Y	Preferred option
Ebchester SPS_NZ10551505 – DC_06	Do nothing		N	Alternative option
Ebchester SPS_NZ10551505 – DC_06	Static Screen	-1.626	Y	Preferred option
Egglescliffe Bank CSO_NZ42130206 – DC_25	Do nothing		N	Alternative option
Egglescliffe Bank CSO_NZ42130206 – DC_25	Static Screen	-0.824	Y	Preferred option
Elwin Place CSO_NZ25533015 – DC_05	Do nothing		N	Alternative option
Elwin Place CSO_NZ25533015 – DC_05	Static Screen	-0.569	Y	Preferred option
Felton STW – DC_03	Do nothing		N	Alternative option
Felton STW – DC_03	Option 1 – Green Infrastructure	-5.058	Y	Preferred option
Felton STW – DC_05	Do nothing		N	Alternative option
Felton STW – DC_05	Option 1 – Green Infrastructure	-13.33	Y	Preferred option
Felton STW CSO Storm Tank_NU19001503 – DC_05	Do nothing		N	Alternative option
Felton STW CSO Storm Tank_NU19001503 – DC_05	Static Screen	-0.294	Y	Preferred option
Grays Road CSO_NZ43194301 – DC_11	Do nothing		N	Alternative option
Grays Road CSO_NZ43194301 – DC_11	Static Screen	-0.293	Y	Preferred option
Graythorpe STW – DC_01	Do nothing		N	Alternative option
Graythorpe STW – DC_01	Option 1 – Green Infrastructure	-20.004	N	Alternative option
Graythorpe STW – DC_01	Option 2 – Below-ground storage only	-0.779	Y	Preferred option
Graythorpe STW – DC_01	Option 3 – Green Infrastructure and below ground storage	-0.832	N	Alternative option
Hamsterley Mill Pumping Station_NZ14564601 – DC_03	Do nothing		N	Alternative option
Hamsterley Mill Pumping Station_NZ14564601 – DC_03	Static Screen	-0.546	Y	Preferred option
Hendon STW – DC_19	Do nothing	0	N	Alternative option
Hendon STW – DC_19	Option 1 – Green Infrastructure	-15.281	N	Alternative option
Hendon STW – DC_19	Option 2 – Below-ground storage only	-1.962	Y	Preferred option
Hendon STW – DC_19	Option 3 – Green Infrastructure and below ground storage	-2.605	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
High Spen Pumping Station_NZ14600403 – DC_01	Do nothing		N	Alternative option
High Spen Pumping Station_NZ14600403 – DC_01	Static Screen	-0.905	Y	Preferred option
Horden STW – DC_03	Do nothing		N	Alternative option
Horden STW – DC_03	Option 1 – Green Infrastructure	-24.695	N	Alternative option
Horden STW – DC_03	Option 2 – Below-ground storage only	-1.314	Y	Preferred option
Horden STW – DC_03	Option 3 – Green Infrastructure and below ground storage	-2.529	N	Alternative option
Horden STW – DC_07	Do nothing		N	Alternative option
Horden STW – DC_07	Option 1 – Green Infrastructure	-50.872	N	Alternative option
Horden STW – DC_07	Option 2 – Below-ground storage only	-8.382	Y	Alternative option
Horden STW – DC_07	Option 4 – Smart Networks plus Storage	-12.088	N	Preferred option
Horden STW – DC_07	Option 5 – Surface Water Separation plus Storage	-48.583	N	Alternative option
Howdon STW C-Leg – DC_07	Do nothing		N	Alternative option
Howdon STW C-Leg – DC_07	Option 1 – Green Infrastructure	-66.185	N	Alternative option
Howdon STW C-Leg – DC_07	Option 2 – Below-ground storage only	-1.497	Y	Preferred option
Howdon STW C-Leg – DC_07	Option 4 – Smart Networks plus Storage	-2.95	N	Alternative option
Howdon STW C-Leg – DC_07	Option 5 – Surface Water Separation plus Storage	-106.307	N	Alternative option
Howdon STW C-Leg – DC_07	Option 6 – Smart Networks plus Surface Water Separation	-68.029	N	Alternative option
Howdon STW D-Leg – DC_01	Do nothing		N	Alternative option
Howdon STW D-Leg – DC_01	Option 1 – Green Infrastructure	-36.956	N	Alternative option
Howdon STW D-Leg – DC_01	Option 2 – Below-ground storage only	-1.385	Y	Alternative option
Howdon STW D-Leg – DC_01	Option 4 – Smart Networks plus Storage	-3.795	N	Preferred option
Howdon STW D-Leg – DC_01	Option 5 – Surface Water Separation plus Storage	-82.999	N	Alternative option
Howdon STW D-Leg – DC_01	Option 6 – Smart Networks plus Surface Water Separation	-48.502	N	Alternative option
Howdon STW D-Leg – DC_02	Do nothing		N	Alternative option
Howdon STW D-Leg – DC_02	Option 1 – Green Infrastructure	-36.629	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Howdon STW D-Leg – DC_02	Option 2 – Below-ground storage only	-2.574	Y	Alternative option
Howdon STW D-Leg – DC_02	Option 4 – Smart Networks plus Storage	-5.159	N	Preferred option
Howdon STW D-Leg – DC_02	Option 5 – Surface Water Separation plus Storage	-40.161	N	Alternative option
Howdon STW D-Leg – DC_02	Option 6 – Smart Networks plus Surface Water Separation	-36.92	N	Alternative option
Howdon STW D-Leg – DC_03	Do nothing		N	Alternative option
Howdon STW D-Leg – DC_03	Option 1 – Green Infrastructure	-21.883	N	Alternative option
Howdon STW D-Leg – DC_03	Option 2 – Below-ground storage only	-1.275	Y	Preferred option
Howdon STW D-Leg – DC_03	Option 3 – Green Infrastructure and below ground storage	-2.477	N	Alternative option
Howdon STW D-Leg – DC_05	Do nothing		N	Alternative option
Howdon STW D-Leg – DC_05	Option 1 – Green Infrastructure	-26.571	N	Alternative option
Howdon STW D-Leg – DC_05	Option 2 – Below-ground storage only	-3.352	N	Preferred option
Howdon STW D-Leg – DC_05	Option 4 – Smart Networks plus Storage	-2.582	Y	Alternative option
Howdon STW D-Leg – DC_05	Option 5 – Surface Water Separation plus Storage	-124.559	N	Alternative option
Howdon STW D-Leg – DC_05	Option 6 – Smart Networks plus Surface Water Separation	-103.815	N	Alternative option
Howdon STW D-Leg – DC_15	Do nothing		N	Alternative option
Howdon STW D-Leg – DC_15	Option 1 – Green Infrastructure	-7.426	N	Alternative option
Howdon STW D-Leg – DC_15	Option 2 – Below-ground storage only	-0.081	Y	Preferred option
Howdon STW D-Leg – DC_15	Option 5 – Surface Water Separation plus Storage	-7.428	N	Alternative option
Hustledown STW – DC_03	Do nothing		N	Alternative option
Hustledown STW – DC_03	Option 1 – Green Infrastructure	-12.762	N	Alternative option
Hustledown STW – DC_03	Option 2 – Below-ground storage only	-1.031	Y	Preferred option
Hustledown STW – DC_03	Option 4 – Smart Networks plus Storage	-1.82	N	Alternative option
Hustledown STW – DC_03	Option 5 – Surface Water Separation plus Storage	-14.063	N	Alternative option
Hustledown STW – DC_03	Option 6 – Smart Networks plus Surface Water Separation	-12.88	N	Alternative option
Hustledown STW – DC_04	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Hustledown STW – DC_04	Option 1 – Green Infrastructure	-33.159	N	Alternative option
Hustledown STW – DC_04	Option 2 – Below-ground storage only	-3.138	Y	Preferred option
Hustledown STW – DC_04	Option 3 – Green Infrastructure and below ground storage	-4.632	N	Alternative option
Hustledown STW – DC_05	Do nothing		N	Alternative option
Hustledown STW – DC_05	Option 1 – Green Infrastructure	-16.766	N	Alternative option
Hustledown STW – DC_05	Option 2 – Below-ground storage only	-0.735	Y	Preferred option
Hustledown STW – DC_05	Option 3 – Green Infrastructure and below ground storage	-3.914	N	Alternative option
Hustledown STW – DC_06	Do nothing		N	Alternative option
Hustledown STW – DC_06	Option 1 – Green Infrastructure	-8.607	N	Alternative option
Hustledown STW – DC_06	Option 2 – Below-ground storage only	-2.097	N	Alternative option
Hustledown STW – DC_06	Option 4 – Smart Networks plus Storage	-3.535	N	Alternative option
Hustledown STW – DC_06	Option 5 – Surface Water Separation plus Storage	-11.532	N	Alternative option
Hustledown STW – DC_06	Option 6 – Smart Networks plus Surface Water Separation	-8.817	Y	Preferred option
Lanchester STW – DC_04	Do nothing		N	Alternative option
Lanchester STW – DC_04	Option 1 – Green Infrastructure	-17.522	N	Alternative option
Lanchester STW – DC_04	Option 2 – Below-ground storage only	-1.008	Y	Preferred option
Lanchester STW – DC_04	Option 4 – Smart Networks plus Storage	-1.877	N	Alternative option
Lanchester STW – DC_04	Option 5 – Surface Water Separation plus Storage	-18.543	N	Alternative option
Lanchester STW – DC_04	Option 6 – Smart Networks plus Surface Water Separation	-17.764	N	Alternative option
Lanchester STW – DC_05	Do nothing		N	Alternative option
Lanchester STW – DC_05	Option 1 – Green Infrastructure	-18.449	N	Alternative option
Lanchester STW – DC_05	Option 2 – Below-ground storage only	-1.506	Y	Preferred option
Lanchester STW – DC_05	Option 3 – Green Infrastructure and below ground storage	-6.787	N	Alternative option
Lanchester STW – DC_05	Option 5 – Surface Water Separation plus Storage	-5.927	N	Alternative option
Laurel Avenue CSO_NZ28429506 – DC_03	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Laurel Avenue CSO_NZ28429506 – DC_03	Static Screen	-1.151	Y	Preferred option
Leamside STW – DC_01	Do nothing		N	Alternative option
Leamside STW – DC_01	Option 1 – Green Infrastructure	-2.718	Y	Preferred option
Leamside STW – DC_01	Option 2 – Below-ground storage only	-2.781	N	Alternative option
Leamside STW – DC_01	Option 4 – Smart Networks plus Storage	-1.726	N	Alternative option
Leamside STW – DC_01	Option 5 – Surface Water Separation plus Storage	-4.196	N	Alternative option
Leamside STW – DC_01	Option 6 – Smart Networks plus Surface Water Separation	-3.575	N	Alternative option
Lockhaugh STW – DC_01	Do nothing		N	Alternative option
Lockhaugh STW – DC_01	Option 1 – Green Infrastructure	-68.991	N	Alternative option
Lockhaugh STW – DC_01	Option 2 – Below-ground storage only	-0.668	Y	Preferred option
Lockhaugh STW – DC_01	Option 3 – Green Infrastructure and below ground storage	-19.318	N	Alternative option
Lockhaugh STW – DC_01	Option 4 – Smart Networks plus Storage	-1.284	N	Alternative option
Lockhaugh STW – DC_01	Option 5 – Surface Water Separation plus Storage	-13.245	N	Alternative option
Lockhaugh STW – DC_02	Do nothing		N	Alternative option
Lockhaugh STW – DC_02	Option 1 – Green Infrastructure	-2.841	Y	Preferred option
Lockhaugh STW – DC_02	Option 2 – Below-ground storage only	-0.963	N	Alternative option
Lockhaugh STW – DC_02	Option 4 – Smart Networks plus Storage	-2.074	N	Alternative option
Lockhaugh STW – DC_02	Option 5 – Surface Water Separation plus Storage	-7.169	N	Alternative option
Lockhaugh STW – DC_03	Do nothing		N	Alternative option
Lockhaugh STW – DC_03	Option 1 – Green Infrastructure	-7.522	N	Alternative option
Lockhaugh STW – DC_03	Option 2 – Below-ground storage only	-1.06	N	Alternative option
Lockhaugh STW – DC_03	Option 4 – Smart Networks plus Storage	-1.98	N	Alternative option
Lockhaugh STW – DC_03	Option 5 – Surface Water Separation plus Storage	-10.022	N	Alternative option
Lockhaugh STW – DC_03	Option 6 – Smart Networks plus Surface Water Separation	-7.629	Y	Preferred option
Lockhaugh STW – DC_04	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Lockhaugh STW – DC_04	Option 1 – Green Infrastructure	-19.094	N	Alternative option
Lockhaugh STW – DC_04	Option 2 – Below-ground storage only	-1.15	Y	Preferred option
Lockhaugh STW – DC_04	Option 3 – Green Infrastructure and below ground storage	-1.976	N	Alternative option
Lockhaugh STW – DC_06	Do nothing	0	N	Alternative option
Lockhaugh STW – DC_06	Option 1 – Green Infrastructure	-20.637	N	Alternative option
Lockhaugh STW – DC_06	Option 2 – Below-ground storage only	-1.172	Y	Preferred option
Lockhaugh STW – DC_06	Option 3 – Green Infrastructure and below ground storage	-1.999	N	Alternative option
Londonderry Road/Green Lane CSO_NZ43197701 – DC_11	Do nothing		N	Alternative option
Londonderry Road/Green Lane CSO_NZ43197701 – DC_11	Static Screen	-0.297	Y	Preferred option
Low Wadsworth STW – DC_01	Do nothing		N	Alternative option
Low Wadsworth STW – DC_01	Option 1 – Green Infrastructure	-25.079	N	Alternative option
Low Wadsworth STW – DC_01	Option 2 – Below-ground storage only	-1.336	Y	Preferred option
Low Wadsworth STW – DC_01	Option 3 – Green Infrastructure and below ground storage	-2.633	N	Alternative option
Low Wadsworth STW – DC_05	Do nothing		N	Alternative option
Low Wadsworth STW – DC_05	Option 1 – Green Infrastructure	-5.163	N	Alternative option
Low Wadsworth STW – DC_05	Option 2 – Below-ground storage only	-3.498	N	Alternative option
Low Wadsworth STW – DC_05	Option 4 – Smart Networks plus Storage	-4.8	N	Alternative option
Low Wadsworth STW – DC_05	Option 5 – Surface Water Separation plus Storage	-6.696	N	Alternative option
Low Wadsworth STW – DC_05	Option 6 – Smart Networks plus Surface Water Separation	-5.452	Y	Preferred option
Low Wadsworth STW – DC_06	Do nothing		N	Alternative option
Low Wadsworth STW – DC_06	Option 1 – Green Infrastructure	-26.215	N	Alternative option
Low Wadsworth STW – DC_06	Option 2 – Below-ground storage only	-2.021	Y	Preferred option
Low Wadsworth STW – DC_06	Option 3 – Green Infrastructure and below ground storage	-16.761	N	Alternative option
Low Wadsworth STW – DC_06	Option 4 – Smart Networks plus Storage	-2.687	N	Alternative option
Low Wadsworth STW – DC_06	Option 5 – Surface Water Separation plus Storage	-15.047	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Low Wadsworth STW – DC_07	Do nothing		N	Alternative option
Low Wadsworth STW – DC_07	Option 1 – Green Infrastructure	-24.292	N	Alternative option
Low Wadsworth STW – DC_07	Option 2 – Below-ground storage only	-1.296	Y	Preferred option
Low Wadsworth STW – DC_07	Option 3 – Green Infrastructure and below ground storage	-2.422	N	Alternative option
Mainsforth Terrace PS_NZ51315810 – DC_11	Do nothing		N	Alternative option
Mainsforth Terrace PS_NZ51315810 – DC_11	Mechanical Screen	-3.684	Y	Preferred option
Marske STW – DC_02	Do nothing		N	Alternative option
Marske STW – DC_02	Option 1 – Green Infrastructure	-6.685	N	Alternative option
Marske STW – DC_02	Option 2 – Below-ground storage only	-0.807	Y	Preferred option
Marske STW – DC_02	Option 3 – Green Infrastructure and below ground storage	-1.091	N	Alternative option
Marske STW – DC_04	Do nothing		N	Alternative option
Marske STW – DC_04	Option 1 – Green Infrastructure	-43.483	Y	Preferred option
Marske STW – DC_04	Option 6 – Smart Networks plus Surface Water Separation	-45.468	N	Alternative option
Marske STW – DC_06	Do nothing		N	Alternative option
Marske STW – DC_06	Option 1 – Green Infrastructure	-4.094	N	Alternative option
Marske STW – DC_06	Option 2 – Below-ground storage only	-1.277	N	Alternative option
Marske STW – DC_06	Option 4 – Smart Networks plus Storage	-2.499	N	Alternative option
Marske STW – DC_06	Option 5 – Surface Water Separation plus Storage	-4.343	N	Alternative option
Marske STW – DC_06	Option 6 – Smart Networks plus Surface Water Separation	-3.742	Y	Preferred option
Marske STW – DC_08	Do nothing		N	Alternative option
Marske STW – DC_08	Option 1 – Green Infrastructure	-89.819	N	Alternative option
Marske STW – DC_08	Option 2 – Below-ground storage only	-0.908	Y	Alternative option
Marske STW – DC_08	Option 3 – Green Infrastructure and below ground storage	-3.663	N	Alternative option
Marske STW – DC_08	Option 4 – Smart Networks plus Storage	-1.133	N	Preferred option
Marske STW – DC_09	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Marske STW – DC_09	Option 1 – Green Infrastructure	-295.824	N	Alternative option
Marske STW – DC_09	Option 2 – Below-ground storage only	-3.618	Y	Alternative option
Marske STW – DC_09	Option 3 – Green Infrastructure and below ground storage	-81.45	N	Alternative option
Marske STW – DC_09	Option 4 – Smart Networks plus Storage	-5.175	N	Preferred option
Marske STW – DC_09	Option 5 – Surface Water Separation plus Storage	-76.122	N	Alternative option
Marske STW – DC_10	Do nothing		N	Alternative option
Marske STW – DC_10	Option 1 – Green Infrastructure	-18.861	N	Alternative option
Marske STW – DC_10	Option 2 – Below-ground storage only	-1.3	Y	Preferred option
Marske STW – DC_10	Option 3 – Green Infrastructure and below ground storage	-6.029	N	Alternative option
Marske STW – DC_10	Option 4 – Smart Networks plus Storage	-2.288	N	Alternative option
Marske STW – DC_16	Do nothing		N	Alternative option
Marske STW – DC_16	Option 1 – Green Infrastructure	-226.484	Y	Preferred option
Mayfield CSO_NZ25346506 – DC_07	Do nothing		N	Alternative option
Mayfield CSO_NZ25346506 – DC_07	Mechanical Screen	-1.236	Y	Preferred option
Millburngate CSO South End_NZ52295409 – DC_03	Do nothing		N	Alternative option
Millburngate CSO South End_NZ52295409 – DC_03	Static Screen	-1.792	Y	Preferred option
Mount Road CSO BT003_NT99524001 – DC_07	Do nothing		N	Alternative option
Mount Road CSO BT003_NT99524001 – DC_07	Static Screen	-0.302	Y	Preferred option
Neasham Road CSO (Y5)_NZ29146002 – DC_06	Do nothing		N	Alternative option
Neasham Road CSO (Y5)_NZ29146002 – DC_06	Static Screen	-0.325	Y	Preferred option
New Hall Farm CSO_NU13002888 – DC_03	Do nothing		N	Alternative option
New Hall Farm CSO_NU13002888 – DC_03	Static Screen	-0.817	Y	Preferred option
New Road CSO_NZ35613802 – DC_05	Do nothing		N	Alternative option
New Road CSO_NZ35613802 – DC_05	Static Screen	-1.493	Y	Preferred option
Palace Street North CSO 1_NT99529605 – DC_04	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Palace Street North CSO 1_NT99529605 – DC_04	Static Screen	-0.401	Y	Preferred option
Palace Street North CSO 2_NT99529506 – DC_04	Do nothing		N	Alternative option
Palace Street North CSO 2_NT99529506 – DC_04	Static Screen	-0.355	Y	Preferred option
Pelaw Bank CSO CH57_NZ27514702 – DC_10	Do nothing		N	Alternative option
Pelaw Bank CSO CH57_NZ27514702 – DC_10	Static Screen	-1.187	Y	Preferred option
Pelaw Wood Sewer, No 1 Baths Bridge_NZ27428506 – DC_05	Do nothing		N	Alternative option
Pelaw Wood Sewer, No 1 Baths Bridge_NZ27428506 – DC_05	Static Screen	-1.047	Y	Preferred option
Plawsworth CSO MH1_NZ26473401 – DC_03	Do nothing		N	Alternative option
Plawsworth CSO MH1_NZ26473401 – DC_03	Static Screen	-1.183	Y	Preferred option
Plawsworth Gate CSO_NZ26473170 – DC_03	Do nothing		N	Alternative option
Plawsworth Gate CSO_NZ26473170 – DC_03	Static Screen	-0.381	Y	Preferred option
Plawsworth STW – DC_03	Do nothing		N	Alternative option
Plawsworth STW – DC_03	Option 1 – Green Infrastructure	-18.208	N	Alternative option
Plawsworth STW – DC_03	Option 2 – Below-ground storage only	-0.968	Y	Preferred option
Plawsworth STW – DC_03	Option 3 – Green Infrastructure and below ground storage	-2.336	N	Alternative option
Plawsworth STW – DC_03	Option 5 – Surface Water Separation plus Storage	-2.042	N	Alternative option
Quarry Plantation (Above Clifton Gardens)_NZ42156304 – DC_28	Do nothing		N	Alternative option
Quarry Plantation (Above Clifton Gardens)_NZ42156304 – DC_28	Static Screen	-1.989	Y	Preferred option
Quay Wall SPS Sandgate CSO_NT99528600 – DC_04	Do nothing		N	Alternative option
Quay Wall SPS Sandgate CSO_NT99528600 – DC_04	Mechanical Screen	-1.006	Y	Preferred option
Queens Gardens CSO_NT99524600 – DC_04	Do nothing		N	Alternative option
Queens Gardens CSO_NT99524600 – DC_04	Static Screen	-0.325	Y	Preferred option
Railway Street_NT99535303 – DC_04	Do nothing		N	Alternative option
Railway Street_NT99535303 – DC_04	Static Screen	-0.323	Y	Preferred option
Riverside CSO_NZ21287605 – DC_11	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Riverside CSO_NZ21287605 – DC_11	Static Screen	-0.409	Y	Preferred option
Sands Syphon SSO_NZ27438001 – DC_06	Do nothing		N	Alternative option
Sands Syphon SSO_NZ27438001 – DC_06	Mechanical Screen	-1.622	Y	Preferred option
Seaton Carew STW – DC_02	Do nothing		N	Alternative option
Seaton Carew STW – DC_02	Option 1 – Green Infrastructure	-89.687	N	Alternative option
Seaton Carew STW – DC_02	Option 2 – Below-ground storage only	-10.941	Y	Preferred option
Seaton Carew STW – DC_02	Option 3 – Green Infrastructure and below ground storage	-45.135	N	Alternative option
Seaton Carew STW – DC_02	Option 5 – Surface Water Separation plus Storage	-45.05	N	Alternative option
Seaton Carew STW – DC_03	Do nothing		N	Alternative option
Seaton Carew STW – DC_03	Option 1 – Green Infrastructure	-8.507	N	Alternative option
Seaton Carew STW – DC_03	Option 2 – Below-ground storage only	-1.766	N	Alternative option
Seaton Carew STW – DC_03	Option 4 – Smart Networks plus Storage	-4.523	N	Alternative option
Seaton Carew STW – DC_03	Option 5 – Surface Water Separation plus Storage	-23.733	N	Alternative option
Seaton Carew STW – DC_03	Option 6 – Smart Networks plus Surface Water Separation	-9.019	Y	Preferred option
Seaton Carew STW – DC_11	Do nothing		N	Alternative option
Seaton Carew STW – DC_11	Option 1 – Green Infrastructure	-33.947	N	Alternative option
Seaton Carew STW – DC_11	Option 2 – Below-ground storage only	-5.166	Y	Alternative option
Seaton Carew STW – DC_11	Option 4 – Smart Networks plus Storage	-8.936	N	Preferred option
Seaton Carew STW – DC_11	Option 5 – Surface Water Separation plus Storage	-59.518	N	Alternative option
Seaton Carew STW – DC_11	Option 6 – Smart Networks plus Surface Water Separation	-35.766	N	Alternative option
Sedgeletch STW – DC_20	Do nothing		N	Alternative option
Sedgeletch STW – DC_20	Option 1 – Green Infrastructure	-14.386	N	Alternative option
Sedgeletch STW – DC_20	Option 2 – Below-ground storage only	-2.006	Y	Alternative option
Sedgeletch STW – DC_20	Option 4 – Smart Networks plus Storage	-3.807	N	Preferred option
Sedgeletch STW – DC_20	Option 5 – Surface Water Separation plus Storage	-24.875	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Sedgeletch STW – DC_20	Option 6 – Smart Networks plus Surface Water Separation	-15.232	N	Alternative option
Shoregate CSO_NT99528623 – DC_04	Do nothing		N	Alternative option
Shoregate CSO_NT99528623 – DC_04	Static Screen	-0.408	Y	Preferred option
South Road No 18 CSO_NT99284007 – DC_04	Do nothing		N	Alternative option
South Road No 18 CSO_NT99284007 – DC_04	Static Screen	-0.332	Y	Preferred option
South Shields Interceptor BS/104_NZ33644604 – DC_01	Do nothing		N	Alternative option
South Shields Interceptor BS/104_NZ33644604 – DC_01	Mechanical Screen	-1.628	Y	Preferred option
Spittal Quay CSO (BT7)_NU00511806 – DC_08	Do nothing		N	Alternative option
Spittal Quay CSO (BT7)_NU00511806 – DC_08	Static Screen	-0.371	Y	Preferred option
Springwell Park CSO_NZ32649014 – DC_03	Do nothing		N	Alternative option
Springwell Park CSO_NZ32649014 – DC_03	Mechanical Screen	-1.876	Y	Preferred option
Sso At West End_NT99523700 – DC_07	Do nothing		N	Alternative option
Sso At West End_NT99523700 – DC_07	Static Screen	-0.325	Y	Preferred option
Stressholme STW – DC_06	Do nothing		N	Alternative option
Stressholme STW – DC_06	Option 1 – Green Infrastructure	-4.384	Y	Preferred option
Teesbank Avenue CSO_NZ42157201 – DC_28	Do nothing		N	Alternative option
Teesbank Avenue CSO_NZ42157201 – DC_28	Static Screen	-0.399	Y	Preferred option
Teesside High School PS_NZ42147902 – DC_28	Do nothing		N	Alternative option
Teesside High School PS_NZ42147902 – DC_28	Static Screen	-0.468	Y	Preferred option
The Middles CSO_NZ20517602 – DC_06	Do nothing		N	Alternative option
The Middles CSO_NZ20517602 – DC_06	Static Screen	-0.335	Y	Preferred option
Thorpe Thewles SPS_NZ40230201 – DC_11	Do nothing		N	Alternative option
Thorpe Thewles SPS_NZ40230201 – DC_11	Static Screen	-1.002	Y	Preferred option
Tower Road CSO_NT99526101 – DC_07	Do nothing		N	Alternative option
Tower Road CSO_NT99526101 – DC_07	Static Screen	-0.342	Y	Preferred option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Tudhoe Mill STW – DC_05	Do nothing		N	Alternative option
Tudhoe Mill STW – DC_05	Option 1 – Green Infrastructure	-17.545	N	Alternative option
Tudhoe Mill STW – DC_05	Option 2 – Below-ground storage only	-0.814	Y	Preferred option
Tudhoe Mill STW – DC_05	Option 3 – Green Infrastructure and below ground storage	-5.581	N	Alternative option
Tudhoe Mill STW – DC_05	Option 4 – Smart Networks plus Storage	-1.152	N	Alternative option
Tudhoe Mill STW – DC_07	Do nothing		N	Alternative option
Tudhoe Mill STW – DC_07	Option 1 – Green Infrastructure	-25.241	N	Alternative option
Tudhoe Mill STW – DC_07	Option 2 – Below-ground storage only	-1.415	Y	Preferred option
Tudhoe Mill STW – DC_07	Option 3 – Green Infrastructure and below ground storage	-2.676	N	Alternative option
Tudhoe Mill STW – DC_10	Do nothing		N	Alternative option
Tudhoe Mill STW – DC_10	Option 1 – Green Infrastructure	-9.909	N	Alternative option
Tudhoe Mill STW – DC_10	Option 2 – Below-ground storage only	-1.887	N	Alternative option
Tudhoe Mill STW – DC_10	Option 3 – Green Infrastructure and below ground storage	-9.517	N	Alternative option
Tudhoe Mill STW – DC_10	Option 5 – Surface Water Separation plus Storage	-8.07	Y	Preferred option
Tyneside CSO (No B5/301) Newland Drive_NZ33645604 – DC_02	Do nothing		N	Alternative option
Tyneside CSO (No B5/301) Newland Drive_NZ33645604 – DC_02	Mechanical Screen	-2.781	Y	Preferred option
Washington CSO Don Gardens - NWL Name_NZ31580009 – DC_11	Do nothing		N	Alternative option
Washington CSO Don Gardens - NWL Name_NZ31580009 – DC_11	Static Screen	-0.969	Y	Preferred option
Washington STW – DC_10	Do nothing	0	N	Alternative option
Washington STW – DC_10	Option 1 – Green Infrastructure	-15.975	N	Alternative option
Washington STW – DC_10	Option 2 – Below-ground storage only	-0.821	Y	Preferred option
Washington STW – DC_10	Option 3 – Green Infrastructure and below ground storage	-1.192	N	Alternative option
Washington STW – DC_11	Do nothing	0	N	Alternative option
Washington STW – DC_11	Option 1 – Green Infrastructure	-1.453	Y	Preferred option
Washington STW – DC_11	Option 2 – Below-ground storage only	-1.481	N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
West Boldon CSO (No 4)_NZ35619709 – DC_19	Do nothing		N	Alternative option
West Boldon CSO (No 4)_NZ35619709 – DC_19	Static Screen	-1.558	Y	Preferred option
West Of Hedworth Lane CSO_NZ33635201 – DC_05	Do nothing		N	Alternative option
West Of Hedworth Lane CSO_NZ33635201 – DC_05	Static Screen	-1.063	Y	Preferred option
West Rainton CSO Du085 STW MH21_NZ31464503 – DC_01	Do nothing		N	Alternative option
West Rainton CSO Du085 STW MH21_NZ31464503 – DC_01	Static Screen 1	-1.19	Y	Preferred option
West Rainton CSO Du085 STW MH21B_NZ31464503 – DC_01	Do nothing		N	Alternative option
West Rainton CSO Du085 STW MH21B_NZ31464503 – DC_01	Static Screen 2	-0.433	Y	Preferred option
Willington STW – DC_02	Do nothing		N	Alternative option
Willington STW – DC_02	Option 1 – Green Infrastructure	-22.328	N	Alternative option
Willington STW – DC_02	Option 2 – Below-ground storage only	-1.097	Y	Preferred option
Willington STW – DC_02	Option 3 – Green Infrastructure and below ground storage	-9.835	N	Alternative option
Willington STW – DC_02	Option 5 – Surface Water Separation plus Storage	-8.553	N	Alternative option
Willington STW – DC_03	Do nothing		N	Alternative option
Willington STW – DC_03	Option 1 – Green Infrastructure	-9.527	N	Alternative option
Willington STW – DC_03	Option 2 – Below-ground storage only	-1.374	Y	Preferred option
Willington STW – DC_03	Option 4 – Smart Networks plus Storage	-2.628	N	Alternative option
Willington STW – DC_03	Option 5 – Surface Water Separation plus Storage	-9.042	N	Alternative option
Willington STW – DC_06	Do nothing		N	Alternative option
Willington STW – DC_06	Option 1 – Green Infrastructure	-33.815	N	Alternative option
Willington STW – DC_06	Option 2 – Below-ground storage only	-2.213	Y	Preferred option
Willington STW – DC_06	Option 5 – Surface Water Separation plus Storage	-34.723	N	Alternative option
Wooler STW – DC_01	Do nothing		N	Alternative option
Wooler STW – DC_01	Option 1 – Green Infrastructure	-32.995	Y	Preferred option
Wooler STW – DC_04	Do nothing		N	Alternative option

Site Name	Option	NPV £m	Least Cost	Chosen Option
Wooler STW – DC_04	Option 1 – Green Infrastructure	-2.698	N	Alternative option
Wooler STW – DC_04	Option 2 – Below-ground storage only	-0.281	N	Alternative option
Wooler STW – DC_04	Option 3 – Green Infrastructure and below ground storage	-0.939	Y	Preferred option
Wooler STW – DC_04	Option 4 – Smart Networks plus Storage	-0.675	N	Alternative option
Wooler STW – DC_06	Do nothing		N	Alternative option
Wooler STW – DC_06	Option 1 – Green Infrastructure	-16.363	N	Alternative option
Wooler STW – DC_06	Option 2 – Below-ground storage only	-1.174	Y	Preferred option
Wooler STW – DC_06	Option 4 – Smart Networks plus Storage	-2.235	N	Alternative option
Wooler STW – DC_06	Option 5 – Surface Water Separation plus Storage	-19.925	N	Alternative option
Wooler STW – DC_06	Option 6 – Smart Networks plus Surface Water Separation	-16.468	N	Alternative option
Wooler STW_NT99287901 – DC_01	Do nothing		N	Alternative option
Wooler STW_NT99287901 – DC_01	Static Screen	-0.614	Y	Preferred option
Yarm Road CSO (Y3)_NZ30140307 – DC_06	Do nothing		N	Alternative option
Yarm Road CSO (Y3)_NZ30140307 – DC_06	Static Screen	-0.442	Y	Preferred option

8. APPENDIX C – LIST OF AMP9 SITES

TABLE 29: LIST OF AMP9 SITES

Drainage area	STW	No. of drainage communities	No. of BW assets (Env_Act_IMP3)	No. of inland water assets (Env_Act_IMP4)	No of screens required (Env_Act_IMP5)
Alnwick	Alnwick STW	2	0	2	1
Alston	Alston STW	1	0	1	0
Amble & Warkworth	Amble STW	3	2	1	2
Annfield Plain & Stanley	East Tanfield STW	2	0	2	0
Ashington	Newbiggin STW	3	1	2	1
Bamburgh	Seahouses STW	3	4	0	1
Bedlington & Cambois	Cambois STW	1	0	1	1
Berwick	Berwick Upon Tweed STW	1	0	1	1
Bishop Auckland	Bishop Auckland STW	1	0	1	0
Blyth	Blyth STW	5	2	10	4
Blyth	Cramlington STW	1	0	2	0
Broomhill	Lynemouth STW	4	2	2	0
Chester le Street	Chester Le Street STW	2	0	2	0
Chopwell,Blackhall Mill	Consett STW	1	0	1	0
Crook	Low Wadsworth STW	3	0	3	1
Darlington South	Stressholme STW	4	0	6	5
Delves	Knitsley STW	1	0	1	0
Durham City & Newton Hall	Barkers Haugh STW	2	0	3	2
Elvet Hill	University STW	1	0	2	1
Fishburn	Fishburn STW	1	0	3	1
Great Broughton	Great Broughton STW	1	0	2	1
Greatham	Greatham STW	2	0	2	0
Guisborough	Marske STW	3	2	2	2
Haltwhistle	Haltwhistle STW	1	0	1	0
Haydon Bridge	Haydon Bridge STW	1	0	1	0
Hexham	Hexham STW	1	0	1	1
Horncliffe North	Horncliffe North STW	1	0	2	1
Herrington	Sedgeletch STW	2	0	3	1
Lanchester & Burnhope	Lanchester STW	1	0	1	1
Langley Park & Witton Gilbert	Witton Gilbert STW	2	0	2	2
Lesbury	Alnmouth STW	2	0	2	2
Longnewton	Longnewton STW	1	0	2	1

Drainage area	STW	No. of drainage communities	No. of BW assets (Env_Act_IMP3)	No. of inland water assets (Env_Act_IMP4)	No of screens required (Env_Act_IMP5)
Middleton St George	Teesside Airport STW	1	0	1	0
Morpeth	Morpeth STW	1	0	2	1
Murton	Seaham STW	4	6	1	6
Newton Aycliffe	Aycliffe STW	3	0	3	2
Pity Me	Pity Me STW	1	0	2	2
Benton	Howdon STW	13	5	15	12
Seaburn & Roker	Hendon STW	1	0	2	1
Sherburn	Sherburn STW	2	0	3	1
South Stanley & Craghead	Hustledown STW	1	0	1	1
Stanhope & Crawleyside	Stanhope STW	1	0	2	1
Sunderland Bridge	Sunderland Bridge STW	1	0	2	2
Trimdon Grange	Trimdon Village STW	1	0	2	0
Tynemouth	Howdon STW	4	2	2	
Ushaw Moor & Brandon	Browney STW	3	0	3	1
Whitley Bay	Howdon STW	1	1	0	
Eastbourne	Bran Sands STW	9	0	17	5
Total		**107**	**27**	**125**	**68**