Appendix
YKY40_Coastal Storm Overflows Enhancement Case

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YorkshireWater

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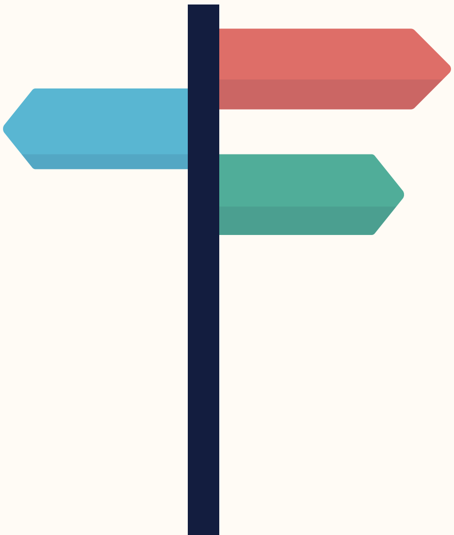
More detail on this subject can be found in **Chapter 8 Part 2: What our plan will deliver**



Contents

1. Enhancement Case: Coastal Storm Overflows (outside PR24 WINEP)

- This enhancement case proposes an ambitious early delivery of our coastal storm overflow programme to meet the targets set out under the Environment Act and Storm Overflow Discharge Reduction Plan. The total programme of £374.917m, delivers a forecast spill reduction of 330 spills on average in a typical year across 22 of our designated coastal storm overflows, with 20 sites delivered by standard delivery route at a total cost of £265.563m and a further 2 sites delivered via a DPC route. The scheme delivers spill reduction at 16 assets via grey infrastructure solutions with blue/green interventions incorporated at the remaining 6 sites.
- The activity in this proposal is all statutory activity that is required under the Storm Overflow Discharge Reduction Plan. Water companies have come under significant pressure in the media around discharges to bathing waters. We want to show greater ambition, above and beyond our PR24 Water Industry National Environment Programme (WINEP) submission, to meet the Storm Overflow Discharge Reduction Plan targets by 2030 and ahead of the governments 2035 deadline for our designated coastal bathing waters. Although this enhancement case sits outside our proposed AMP8 WINEP, the investment proposed in this enhancement case aligns to WINEP drivers.
- In our valuing water customer priority research treating wastewater to a high standard to ensure good quality water in Yorkshire's rivers and beaches, was considered in the top 6 priority service areas for both household and non-household customers when considered alongside 27 other priorities. We also found that customers felt our statutory duties were the bare minimum and they expect more from us. Our online customer community supported going above and beyond statutory obligations, with 86% of people agreeing that investigations should be carried out at coastal sites, and 83% agreeing improvements should be made at those sites. In terms of willingness to pay, 70% of people surveyed, suggested that they would accept a rise in their bills to pay for improvements for designated bathing sites.
- For each intervention, the components of the solution were identified, and costs were determined through application of our Unit Cost Database and consultant derived costs for blue-green interventions which was based on industry best practice and external cost information. We have acquired quotes from contractors to deliver solutions contained within this enhancement case and compared these to the cost allowances developed from our models. This has demonstrated our costs are efficient, as they are in line with the market rate. Least cost and best value options were determined for all sites within this enhancement case.
- Following the programme optimisation, no options incorporating blue/green techniques were selected as the preferred solution due to the costs outweighing the benefits. We have selected solutions with blue green techniques for 6 of the schemes in the programme in line with our ambition to deliver 20% of our spill reduction interventions with blue/green components and with the aim of refining these in detailed design and delivery stages to explore how broader benefits can be assessed and achieved.
- This enhancement case benefits our bathing water quality and storm overflow performance commitments. We propose a grouped PCD for this investment as it meets the 1% materiality threshold along with activities in other associated cases; storm overflow reduction plan and bathing waters. Given the overlap in measures and reporting, we have grouped the customer protection mechanisms.

1.1 Driver:

This enhancement case sits outside of our PR24 WINEP Programme, however, aligns to the following drivers: Storm Overflow Reduction Plan Drivers EnvAct_IMP3, EnvAct_IMP4, EnvAct_IMP5

1.1.1 Requested Investment:

Table 1.1: Coastal Bathing Waters AMP8 Expenditure

	£m	Table Line Ref.
Enhancement Expenditure Capex	265.400	CWW3.22, CWW3.34, CWW3.37, CWW3.46
Enhancement Expenditure Opex	0.163	CWW3.23, CWW3.35, CWW3.38, CWW3.47
Base Expenditure Capex	0	
DPC value	108.411	SUP12[1]
Total	**374.917**	

1.1.2 Associated Reporting lines in Data Table:

Table 1.2: CWW3 Reporting Lines

Line Number	Line Description
CWW3.22	Storage schemes to reduce spill frequency at CSOs etc - grey solution; (WINEP/NEP) wastewater capex
CWW3.23	Storage schemes to reduce spill frequency at CSOs etc - grey solution; (WINEP/NEP) wastewater opex
CWW3.24	Storage schemes to reduce spill frequency at CSOs etc - grey solution; (WINEP/NEP) wastewater totex
CWW3.34	Storm overflow - sustainable drainage / attenuation in the network; (WINEP/NEP) wastewater capex
CWW3.35	Storm overflow - sustainable drainage / attenuation in the network; (WINEP/NEP) wastewater opex
CWW3.36	Storm overflow - sustainable drainage / attenuation in the network; (WINEP/NEP) wastewater totex
CWW3.37	Storm overflow - source surface water separation; (WINEP/NEP) wastewater capex
CWW3.38	Storm overflow - source surface water separation; (WINEP/NEP) wastewater opex
CWW3.39	Storm overflow - source surface water separation; (WINEP/NEP) wastewater totex
CWW3.46	Storm overflow - new / upgraded screens (WINEP/NEP) wastewater capex
CWW3.47	Storm overflow - new / upgraded screens (WINEP/NEP) wastewater opex
CWW3.48	Storm overflow - new / upgraded screens (WINEP/NEP) wastewater totex

[1] The DPC value in SUP12 is combined with the element contained in the Storm Overflow Reduction Plan Enhancement Case

1.2 High Level Driver description:

The Environment Act (2021)[2] and government's Storm Overflow Discharge Reduction Plan[3] introduces a new target for water companies to address the harm to human health from storm overflow discharges in designated bathing waters. This target requires water companies to significantly reduce harmful pathogens from storm overflows discharging into and near designated bathing waters by either: applying disinfection; or reducing the frequency of discharges to meet Environment Agency spill standards by 2035.

Water companies have come under significant pressure in the media around discharges to bathing waters. We want to show greater ambition, above and beyond our PR24 Water Industry National Environment Programme (WINEP) submission, to include a further 22 storm overflow reduction schemes to meet the Storm Overflow Discharge Reduction Plan targets by 2030 and ahead of the governments 2035 deadline. This will address all our designated coastal storm overflows within AMP 8. We will reduce the frequency of their operation and aim to deliver the Environment Act spill targets of 2 spills per bathing season on average (to comply with Excellent bathing water quality) and 10 per year.

These coastal storm water overflows have been included to our Business Plan, in addition to those identified in the WINEP Environment Act drivers, to focus on reducing the frequency of storm overflows in, or near to, designated coastal bathing water. Although this enhancement case sits outside our proposed AMP 8 WINEP, the investment proposed in this enhancement case aligns to the following WINEP drivers:

Table 1.3: Drivers

Driver	Description	Legal Obligation
EnvAct_IMP3	Improvements to reduce storm overflows that spill to designated bathing waters to protect public health	Statutory
EnvAct_IMP4	Improvements to reduce storm overflow spills so that they do not discharge above an average of 10 rainfall events per year by 2050	Statutory
EnvAct_IMP5	Improvements to reduce storm overflow aesthetic impacts by installation of screens	Statutory

This enhancement case proposes storm overflow discharge reduction schemes at 22 of our designated coastal storm overflows to meet the targets set out under the Environment Act and Storm Overflow Discharge Reduction Plan. We propose to address 16 assets through grey infrastructure schemes and 6 assets to incorporate blue green infrastructure techniques.

1.3 Need for investment

1.3.1 The Need for the Proposed Investment

The Environment Act and introduction of the Government's Storm Overflow Discharge Reduction Plan requires water companies to significantly reduce harmful pathogens from any storm overflows that discharge into or near designated bathing waters. These improvements are required by 2035 under the Act.

A designated bathing water is a recreational water which has been formally designated by Defra under the Bathing Water Regulations 2013. This legislation aims to protect and improve bathing water quality to protect public health and improve the public information available at these spaces.
The Storm Overflow Discharge Reduction Plan introduces the option to either disinfect storm discharges or reduce spills to a new spill frequency target for assets discharging into or less

[2] https://www.legislation.gov.uk/ukpga/2021/30/contents/enacted
[3] https://www.gov.uk/government/publications/storm-overflows-discharge-reduction-plan

than 1km upstream in hydraulic continuity with a designated coastal bathing water. The targets are as follows:

- For coastal good/sufficient status, 3 spills per bathing water season
- For coastal excellent status, 2 spills per bathing water season

Under the PR24 WINEP driver guidance for storm overflow reductions, in addition to those assets discharging within 1km hydraulic continuity, the following can also be supported for inclusion within the targets:

- Spill reduction for storm overflows that are located greater than the distances set out above if there is substantive evidence that concludes the bathing water quality is limited by storm overflow discharges. In such cases the relevant spill thresholds listed above apply.
- Disinfection of discharges to enhance bathing water quality over and above spill reduction targets. (Disinfection schemes shall only be proposed in lieu of spill reduction where spill reduction is considered beyond Best Technical Knowledge Not Entailing Excessive Cost (BTKNEEC) requirements).

Our historic investment and our ambition is to achieve excellent bathing water quality on the Yorkshire coast, and therefore this enhancement case aligns to achieving the excellent standard of 2 spills per bathing water season.

1.3.2 The Scale and Timing of the Investment

In Yorkshire, we have 18 designated coastal bathing waters. To assess which assets require an improvement under the Storm Overflow Discharge Reduction Plan, we have undertaken a desktop assessment utilising the Environment Agency's published GIS overlays setting out the bathing water polygons[4],and assessed the hydraulic distance from the storm overflow discharge point to the bathing water polygon.

If the storm overflow is within 1km of hydraulic continuity, these assets have been flagged as required to meet the standards set out under the Storm Overflow Discharge Reduction Plan. We have also liaised with the Environment Agency on any assets outside the 1km which have been confirmed through previous modelling work to have a higher load contribution, and therefore a greater potential to impact on the bathing water quality. Excluding the assets which are already included within our PR24 WINEP and Storm Overflow Reduction Enhancement Case, these exercises have highlighted the below assets as requiring improvement under the Storm Overflow Discharge Reduction Plan:

Table 1.4: Coastal Storm Overflows requiring improvement under the Storm Overflow Discharge Reduction Plan

Asset Reference	Asset Name
S00511	FILEY TRANSFER/CSO
S00576	ENDEAVOUR WHARF/CSO
S00578	WHITBY PIER ROAD/CSO
S00582	ROBIN HOODS BAY LWR/CSO
S00585	NEW ROAD BRIDGE/CSO
S00587	UPGANG LANE/NO 2 CSO
S00595	EAST CRESCENT/CSO
S00597	CRESCENT TERRACE/CSO
S00603	ESPLANADE WHITBY/CSO
S00605	RUNSWICK BECK/CSO

[4] https://www.data.gov.uk/dataset/b6651950-baed-4565-ad0b-804bebf9cad7/areas-affecting-bathing-waters

Asset Reference	Asset Name
S00850	AQUARIUM TOP/CSO
S00931	HILDERTHORPE ROAD/CSO
S01002	SANDS LANE BRID/CSO
S01003	ST ANNES ROAD/CSO
S01144	LIMEKILN LANE/NO 2 CSO
S01373	SPRINGFIELD AVENUE/2 CSO
S01374	BESSINGBY ROAD/CSO
S01453	BRIDLINGTON/STW
S01482	HORNSEA/CSO
S01735	MEMORIAL GDNS/CSO
S02242	ROYAL HOTEL/CSO
S02243	SCARBOROUGH/STW/STORM TREATMENT

Although the investment proposed under this enhancement case is not included within our WINEP submission, it aligns to the targets and requirements of the Environment Act. Our customer engagement, detailed below under the 'Customer Support' section, highlights how our customers prioritise treating waste water to a high standard to ensure good quality water in Yorkshire's rivers and beaches. This was considered in the top 6 priority service areas for both household and non-household customers when considered alongside 27 other priorities Therefore, to align to our customer preferences, our company vision of 'A thriving Yorkshire. Right for customers. Right for the Environment' and the vision of the Yorkshire Bathing Water Partnership, we propose to deliver this investment by 2030, 5 years ahead of the governments requirements.

These proposals will include:

Table 1.5: Delivery Routes

Delivery Route	Number of Schemes
Standard Delivery	20
DPC Delivery	2

1.3.3 Interactions with Base Expenditure

Storm overflow discharges can occur due to a combination of hydraulic capacity, operational/ maintenance issues and infiltration. The investment proposed under this enhancement case is limited to the hydraulic capacity element and base funding will be used to address other elements.

We anticipate across AMP 8, base expenditure will allow a spill reduction of 16,775 spills, based on an average year across all our storm overflow assets, not just those discharging to coastal bathing waters. A significant proportion of which can be attributed to the additional £180 million of reinvestment, to address storm overflow reduction in AMP 7[5]. The benefits in spill reduction from this additional investment will be realised at the start of AMP8, due to the way that spill counts are calculated on a calendar year basis. The £180 million reinvestment accounts for 84%

[5] https://www.yorkshirewater.com/news-media/news-articles/2023/work-begins-on-yorkshire-water-s-180m-storm-overflow-reduction-plan/

of the base spill reduction quoted. It should be noted that this reinvestment is more akin to the proposed enhancement expenditure proposed, rather than traditional base expenditure improvements in this area.

1.3.4 Activities Funded in Previous Price Reviews

In AMP5, we undertook an Enhanced Level of Service (ELoS) coastal improvement programme to improve bathing water quality on the Yorkshire Coast. These improvements were driven by our investigation outputs from the Marine Impact Model (MIM). Schemes driven by the MIM were designed to a bathing water quality output rather than a spill frequency target.

The introduction of the Storm Overflow Discharge Reduction Plan, and associated PR24 WINEP driver guidance for storm overflow reduction introduces mandatory spill targets, regardless of historic investment. The driver guidance states:

> *"This approach removes the uncertainty and inconsistency of applying marine impact modelling. It makes the target simpler and more transparent for stakeholders to relate to event duration monitoring (EDM) performance and enables effective regulation."*

Therefore, the introduction of these targets introduces a new obligation for Yorkshire Water to deliver enhancements beyond those previously delivered through the ELoS programme.

1.3.5 Long-term Delivery Strategy Alignment

The Government's Storm Overflow Discharge Reduction Plan requires all eligible storm overflow to be addressed by 2050, and all eligible designated bathing water storm overflows to be addressed by 2035. Our Long-Term Delivery Strategy for storm overflows has therefore been developed to align to the targets set out under the SODRP.

Aligning to our company vision of a thriving Yorkshire, right for customers, right for the environment, and our customer research carried out under 'Exploring customer views on Designated Bathing Water sites' which is detailed below, this enhancement case proposes an ambitious early delivery of our coastal storm overflow programme. We propose to meet this target 5 years ahead of plan and deliver by 2030. This aligns to the next 5 years of our Long-Term Delivery Strategy, at which point, our bathing water requirements under the SODRP will have been completed.

Read more about this at
Long-Term Delivery Strategy

1.3.6 Customer Support

Through the Ofwat/CCWater customer preferences research, we understand that bathing water quality is ranked in the lowest group in terms of priority when considered across the range of performance commitments. The report found that people had a high level of trust in relation to bathing water safety and felt it was easy to avoid where bathing water was deemed to be questionable. While many recognised the potential health consequences of swimming in low quality bathing waters, individuals felt that this was minor and likely only to affect a very small number of individuals.

However, in contrast, in our own Valuing Water customer priorities research treating waste water to a high standard to ensure good quality water in Yorkshire's rivers and beaches, was considered in the top 6 priority service areas for both household and non-household customers when considered alongside 27 other priorities.

An example of a specific piece of customer engagement carried out on coastal bathing waters was in our research to explore customer views on designated coastal and inland bathing water sites. We used our online community in August 2022 to test customer views on supporting the statutory obligations we have at bathing sites in our regions, but also support for optional investigations to go beyond our statutory obligations. The research supported our valuing water research that this area was one of importance, and this was particularly salient for those that live near designated and non-designated bathing water sites. We also found that customers felt our statutory duties were the bare minimum and they expect more from us. The online community supported going above and beyond statutory obligations, with 86% of people agreeing that investigations should be carried out at coastal sites, and 83% agreeing improvements should be made at those sites. In terms of willingness to pay, 70% of people surveyed, suggested that they would accept a rise in their bills to pay for improvements for designated bathing sites.

The study found that the importance of bathing waters was enhanced for those that live in coastal areas, with a total of 93% of people rating the cleanliness of bathing sites as important, or very important, compared to 89% of those living in-land.

> *"The difference between 'satisfactory' and 'excellence' is huge and I expect a company like YW to always strive for excellence. Bathing in natural environments is very beneficial to health, both physical and mental, so every action should be taken to make this not just safe but enjoyable. Open water swimming needs to be encouraged, so adhering simply to 'statutory requirements' really doesn't scream 'commitment' or 'excellence'."*
> Online Community Member, Exploring customer views on Designated Bathing Water sites, Your Water, August 2022

Finally, in testing our plan with customers in the initial stages of qualitative testing, customers supported in the inclusion of the statutory storm overflow programme of work in our plan. We tested an option to include additional coastal storm overflows in our plan for an additional cost over and above the bill presented to customers to deliver the least-cost plan. More customers supported their inclusion than not and given the extent of support across all of our research to improve environmental water quality and reduce spills overall, we were confident it was the right decision to proceed with this element in our proposed plan in final testing.

In final quantitative affordability and acceptability testing research, investment in storm overflows was mentioned in both the affordability and acceptability testing study we undertook following Ofwat guidelines and also our own independent affordability and acceptability testing study, in both studies the vast majority of customers supported our plan, including this enhancement case – 78% and 79% respectively. In addition, the Yorkshire Leaders Board (a collective of the councils and Mayoral Combined Authorities within Yorkshire that work together to take a strategic approach to important issues affecting the Yorkshire and Humber area) have written a letter of support endorsing our plan, specifically mentioning the enhanced investment in Storm Overflows as an area of support. To learn more about our customer and stakeholder engagement, see Chapter 6 in our main business plan

More detail on this subject can be found in
Chapter 6: Customer and Stakeholder Engagement

1.3.7 Factors Outside Management Control

Although these storm overflows sit outside of our proposed PR24 WINEP, Section 1.3 of the WINEP appendix is still valid here on how we identify risks and assess the need for investment. We consider there are efficiencies in investigating and developing storm overflow solutions for coastal bathing waters alongside the WINEP programme. This could present opportunities for more efficient system-based solutions to be developed.

Read more about this at
WINEP Enhancement Case

1.4 Best Option for Customers

1.4.1 Options Considered

Although these storm overflows sit outside of our proposed PR24 WINEP, our approach to optioning follows the same methodology set out in section 1.4.1 of the WINEP Appendix.

An unconstrained list of 37 options was developed, options included conventional such as treatment and storage solutions through to surface water management and novel untested processes including smart wastewater networks. The full list of options is given in the table below, the constrained column indicates where the options were taken forward to the constrained list. The comments column provides information on why options weren't taken forward and where they are taken forward additional information. Where the comment is

'Outcome not delivered' this means the fundamental requirement to reduce spills to 2 spills per bathing season and 10 or fewer is not met.

Figure 1.1: Unconstrained List with assessment comments

Approach	Constrained	Comments
Built catchment flow reduction	✗	Outcome not delivered
Membrane filtration	✗	Outcome not delivered
Chemical disinfection	✗	Outcome not delivered
Chemical dosing	✗	Outcome not delivered
Dilution assessment	✗	Outcome not delivered
Increase treatment capacity	✓	Increase flow to full treatment
Industry collaboration	✗	Outcome not delivered
Trade effluent management	✗	Outcome not delivered
Nature Based Solutions - Wetlands	✓	e.g. Integrated Constructed Wetland to treat flows
Network storage	✓	Traditional concrete tanks
Permit trading	✗	Outcome not delivered
Rationalise assets	✓	Pump to network with available capacity
Side stream excess flows through passive systems (e.g. Reedbed to treat flows)	✓	
Work with other WASCS	✗	Outcome not delivered
Accelerated rollout of IOT / Smart monitors	✗	Outcome not delivered
Cross sector planning	✗	Outcome not delivered
Capture storm water, treat and use as sub-potable	✓	
Citizen science	✗	Outcome not delivered
Catchment Nutrient Balancing	✗	Outcome not delivered
Geographical synergies	✗	Outcome not delivered
Innovative treatment processes	!	Unidentified process
Catchment Partnership support	✓	Needs time to set up partnerships
Payment for ecosystem services	✗	Outcome not delivered
Political engagement	✗	Outcome not delivered
Removal at source	✓	
Full surface water separation	✓	
Infiltration reduction	✓	
Customer education	✓	Reduce spills due to blockages
Misconnections	✓	Surface water disconnecting from foul and combined
Impermeable area surface water management - SuDS	✓	
Property level surface water management	✓	
Per capita consumption reduction	✓	May not provide sufficient flow reduction
Smart Water Networks	✗	Outcome not delivered
System operator	✗	Outcome not delivered

Each option was tested to see if it delivered the outcome and could be delivered in the timescales required. Cost was not a consideration at this stage, but is considered in later process steps when all feasible options are subject to a cost benefit analysis which identified least cost and most beneficial options. The review of the constrained options list considered:

- PR24 driver guidance
- Current catchment evidence
- AMP 7 investment
- PR24 Profiling of WINEP actions
- YWS asset specific understanding
- Feasibility and deliverability
- Other PR24 WINEP investment proposed outside the drivers considered

The table below shows the assessment of each option on the constrained list and reason for not including in the feasible list.

Figure 1.2: Constrained List with feasibility assessment.

Approach	Feasible	Comments
Increase treatment capacity	!	To be considered across all workstreams and during delivery
Nature Based Solutions - Wetlands	!	Not developed sufficiently to deliver in PR24
Network storage	✓	
Rationalise assets	✗	SMART techniques not developed sufficiently to deliver in PR24
Side stream excess flows through passive systems (e.g. Reedbed to treat flows)	✗	Not developed sufficiently to deliver in PR24
Impermeable area surface water management - SuDS	✓	
Capture storm water, treat and use as sub-potable	✗	Not deliverable by 2026 regulatory compliance date
Catchment Partnership support	!	To be considered across all workstreams and during delivery
Impermeable area surface water management - Removal at source	!	To be considered across all workstreams and during delivery
Full surface water separation	✗	Not feasible to delivery in time available for PR24
Infiltration reduction	!	To be considered across all workstreams during delivery where appropriate
Customer education	✗	Unlikely to meet Storm Overflow Reduction Plan targets
Misconnections	✗	Unlikely to meet Storm Overflow Reduction Plan targets
Property level surface water management	✗	Unlikely to meet Storm Overflow Reduction Plan targets
Per capita consumption reduction	✗	Unlikely to meet Storm Overflow Reduction Plan targets

The feasible options are;

- Enhance/Grey network Storage – traditional storage solution, typically a concrete tank designed to decrease discharges to 1 spill per bathing water season and 10 spills in 2050 epoch, based on a typical year, using the 12/24 counting methodology.
- Reduce and Enhance/Impermeable area surface water management (SuDS) – This is a solution where 50% of impermeable contributing area has been removed from the combined system using a combination of blue/ green techniques. Where this does not achieve the spill target additional grey storage has been included, following the method outlined above. Where possible the solution has been refined for the benefits of reduction of flood risks for properties.

1.4.1.1 Solution Development and Costing

The basis for our storm overflow solution development and costing aligns to the work completed for the Drainage and Wastewater Management Plans (DWMP). Every storm overflow contained within a hydraulic model has been reviewed against the 2050 target spill performance to establish if there is an investment need against the targets set out under the Storm Overflow Discharge Reduction Plan. For this work, all overflows have been assessed independently.

1.4.1.2 Spill Targets

The storm overflows addressed in this enhancement case were assessed in line with the targets set out under the Storm Overflow Discharge Reduction Plan as follows:

- Storm overflows (including designated bathing water overflows) should spill on average no more than 10 times per year (over a 10-year period). All spills will be counted, including those that spilled less than 50 m^3. (EnvAct_IMP4)
- Storm overflows discharging directly into, or less than 1km upstream in hydraulic continuity of a designated bathing water must have no more than 2 spills per bathing water season on average, assessed over 10 years for Excellent status (EnvAct_IMP3)

1.4.1.3 Feasible Option Development

Where possible, two generic approaches have been considered:

- **Enhance/Grey network Storage:** increase the capacity of our network through traditional 'grey' solutions, i.e., building bigger pipes, storage tanks and upgrading our existing assets. This option approach considers network modification only.
- **Reduce and Enhance/Impermeable area surface water management utilising SuDS:** Adopt blue-green solutions to manage and reduce the amount of rainfall entering our network to reduce our levels of risk, then utilise traditional grey solutions to meet the scenario target if necessary. This option approach considers a reduction in rainfall induced flow and network modification.

For the enhance option, the storage volume was calculated based upon baseline model predictions. For the Reduce + Enhance option, the calculation was conducted on a model with 50% of the connected impermeable area removed from the model.

An allowance for screening provision has been made at every storm overflow. Where intervention is required, as part of the SODRP, an allowance for a screen and screening chamber has been made within the solution cost for both enhance and reduce and enhance options. Where no intervention is required to achieve the SODRP target spill frequency, a standard allowance for a screen and screening chamber has been made.

Process: Enhance

This approach is common to both the development of the enhance process and reduce and enhance.

1. Hydraulic modelling completed for the DWMP predicted yearly spill counts and volumes for each overflow in 2050. Solutions were developed to limit spill frequencies to the required standard for the specific asset.
2. The tank storage volumes were determined based on the spill volume of the frequency target+1 spill when spills are ranked by volume, for both the bathing season and annual target.
3. Storage volumes were translated to one of four standardised tank diameters, ranging from 3.05m to a maximum of 25m diameter.
4. High-level outline designs were created for the tank solutions to support the cost build up. An allowance for standard items such as; manholes, pumps, hydro ejectors, odour control units, MCC, power supply, screen and screen chamber were made.

5. Key metrics such as pipe size, length, pump return rate, tank size, screen size have been utilised to develop a high-level Bill of Quantities (BoQ) for each solution. The generated BoQ was supplied to our in-house costing team to allow company cost models (the Unit Cost Database, UCD) to be applied. This provided total CAPEX, OPEX, embodied carbon and operational carbon values for each storm overflow scheme.

Full details of the 'Enhance' process which is common to both 'Enhance' and 'Reduce and Enhance' followed can be found in Annex 1.A.

Process: Reduce and Enhance

Full details of the 'Reduce' process can be found in Annex 1.B.

For the Reduce and Enhance option, the calculation was conducted on a model with 50% of the connected impermeable area removed from the model. Sub-catchments connected to each storm overflow were assessed based on hydraulic models to understand the difference in impermeable area between the baseline model and the impermeable area reduction model. This assessment provides the total impermeable area for removal per storm overflow, when considering the sub-catchments connected to each overflow.

Standard designs were created for the SuDS intervention types listed below to provide a notional £/m^2 or £/m^3 of intervention:

- Detention basins
- Pocket basin
- Geocellular storage
- Bio-retention (road and verge)
- Permeable paving
- Commercial waterbutt

Indicative solutions were generated characterising varying housing densities and available green space. In each solution a blend of the SuDS features above was assumed with the proportional split of each SuDS feature varying in each solution.

Solutions were sized for 30 year return period events. The makeup of the SuDS features was based on housing density and the proportion of green space available within the sub-catchment area. A costing model was developed by Stantec using their engineering expertise and experience gained throughout the industry and the Spon's price guides.

All discharges that have modelling information in the DWMP were included for assessment of costs and benefits for both the storage and impermeable area removal options.

Due to a lack of model coverage at the time of assessment, the costs for the following two storm overflows have been extrapolated based on the average unit cost of the assessed overflows:

- MEMORIAL GDNS/CSO
- CRESCENT TERRACE/CSO

<u>Future Design Development</u>

Due to the late availability of WINEP guidance and the limited time this gave for the detailed assessments required, four approaches will be considered throughout the detailed design stage:

- Increase in flows treated
- Catchment Partnership
- Impermeable area surface water management – removal at source
- Infiltration Reduction

During the detailed design phase, to allow the above assessments to take place, we will continue to:

- review and update sewer models where required,
- assess the capacity of the receiving wastewater treatment works to accept additional flows,
- review information on any planned works the relevant local authority or agency has planned in the area

- Identify specific surface water removal opportunities

1.4.2 Cost-Benefit Appraisal

Our approach to the benefits assessment is fully set out under Section 6.2 in the Introduction to Enhancement Cases appendix. Our Decision Making Framework (DMF) was utilised with the aim of delivering a best value and optimal programme against service levels, performance commitments and statutory requirements. Least cost and best value options for all sites within this driver were identified for individual discharges.

We have overridden the preferred solution for 6 (27%) of the discharges selected in the programme to incorporate blue/green techniques. Following the programme optimisation carried out using the DMF, no options incorporating blue/green techniques were selected as the preferred solution due to the costs outweighing the benefits. Recognising the benefits solutions utilising blue green technologies can provide to the wider community and the environment, where the initial optioneering process identified alternative solutions a high-level screening check of the selected options was undertaken. This screening process was designed to identify sites where the storage volume or theoretical tank drain down may present the greatest risks. The adoption of blue/green solutions aide in the reduction of this risk.

Read more about this at
Introduction to Enhancement Cases

1.4.3 Preferred Option

To conclude, after reviewing all options considered above, this enhancement case proposes:

- 16 storm overflow reduction schemes through grey infrastructure
- 6 storm overflow reduction schemes incorporating blue green infrastructure techniques
- 22 storm overflow screens

We have developed these solutions on the basis of our modelling processes described above. Solutions may evolve once further modelling is complete and through the ground investigation and detailed design phase. We will continue to review the below approaches through design:

- Increase in flows treated
- Catchment Partnership
- Impermeable area surface water management – removal at source
- Infiltration Reduction

To date, we have not included any investment for increasing flow to full treatment at any receiving wastewater treatment works for the relevant wastewater catchments, other than Scarborough WwTW which is associated with improvements in our WINEP storm overflow enhancement case.

1.4.4 Carbon impact and best value

Further detail of our benefits assessment can be found in Table CWW15. For our storm overflow reduction improvements, we have associated benefits linked to:

- Reduction in spill frequency
- Reduction in spill volume
- Land use area restored or protected (bare ground/greenspace/wetland)
- Surface water separated from combined
- River water quality improved
- Number of bathing water compliance failures
- Number of bathing water classifications deteriorations avoided
- Number of non-compliance events
- Storm overflow – new / upgraded schemes

1.4.5 Impact Quantification

Bathing waters are highly complex and can be impacted by numerous sources of faecal indicator bacteria. These influences can include sewerage infrastructure, meteorological conditions, surface run off, traders and agriculture, local wildlife and beach usage.

For AMP8 we are proposing the below forecast against our bathing water performance commitment:

Table 1.6: Bathing Water PC Forecast

Year	2025-26	2026-27	2027-28	2028-29	2029-30
Forecast performance (%)	73.5	73.5	73.5	82.3	82.3

This forecast improvement in our bathing water quality performance is supported by this enhancement case, our WINEP Storm Overflow Reduction enhancement case and our WINEP inland bathing water quality enhancement case.

Read more about this at
Storm Overflow Enhancement Case

Read more about this at
Bathing Water Quality

These enhancement cases address bathing water quality through focussing our infrastructure improvements around three key themes which are discussed in our Bathing Water Performance Commitment appendix:

- Investigate: we will investigate new designations to ensure we have a robust understanding of the factors impacting bathing water quality. For our existing designations, we will continue to develop our understanding of the complexities of these bathing waters.
- Enhance: we will increase the capacity of our networks and seek opportunities for surface water management to ensure we meet the new bathing water spill reduction standards set out in the Government's Storm Overflow Discharge Reduction Plan (SODRP). We will also use advanced treatment technologies to enhance the quality of our final effluent discharges where required.
- Collaborate: we will continue to work in partnership to ensure bathing water quality is managed collaboratively. We will explore where we can collaborate on our investment proposals to deliver additional benefits and good value for our customers and communities.

Read more about the Bathing Water PC in
Detailed Performance Commitments Appendix

The expenditure detailed within this case also impacts upon our storm overflow performance. The table below shows the number of spills reduced on average in a typical year, from the proposed investment, which contributes to the performance commitment. Further details are contained within the Storm Overflow enhancement case.

Table 1.7: Proposed Spill Reduction

	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Coastal Storm Overflows outside of WINEP (No.)	0	0	0	46	32	260	**338**
Coastal Storm Overflows outside of WINEP – DPC Route (No.)	0	0	0	0	0	137	**137**

1.4.6 Cost and Benefit Uncertainties

Throughout the development of our coastal storm overflow enhancement programme, the following assumptions/risks have been captured:

- A key uncertainty, due to the time constraints, is we had to rapidly develop the storm overflow intervention programme, primarily caused by the late issuing of the specific WINEP storm overflow guidance. This means that we have not been able to assess the impact of our proposed solutions on the receiving wastewater treatment works (WwTW) for the wastewater catchments included in this enhancement case. We may find that we need to invest to increase capacity at WwTWs.
- Our modelling assessments have used a 2050 "typical year" rainfall adhering to UKCP09 standards. It was not possible to perturb the rainfall to reflect UKCP18 climate change predictions during the development of our programme as the RedUp v3 tool was not complete at the time of assessment.

During the detailed design phase, we will:

- Update our modelling assessments to align to UKCP18 climate change predictions and utilise the RedUp v3 tool to develop a 25 year time series for our assessments. This will provide greater certainty in our solution development but may increase storage volumes and solution requirements.
- Assess the impact of emptying storage on each WwTW to ensure no adverse impact is created downstream. This may also alter solution requirements.

We have forecast our delivery timescales based on:

- We will drive predominantly grey solutions that will impact on our net zero ambitions and will be less resilient to long term growth and climate change.
- Resources to deliver these outputs in the timescales throughout our current and future supply chains will be in high demand across the industry.
- Notional solutions and costs only consider spill frequency targets. There is currently a Defra consultation ongoing around assessing harm for coastal and estuarine assets, which may impact these solutions to deliver lower spill frequencies at increased storage volumes and therefore costs.

We also anticipate some industry learning:

- How spills vary across England and where there are regional and/or company-specific factors that influence company performance. See our Outcomes section where we explain why an expectation of 20 average spills is not suitable for companies such as ourselves and United Utilities. Link to Storm Overflow PC Long form.
- How and why performance commitment calculations and results for spills can be different to Data records from Event Duration Monitors (EDMs) return data, and also numbers for the Env Act targets.

Read more about the Storm Overflow PC in
Detailed Performance Commitments Appendix

1.4.7 Third Party Funding

Partnerships with local authorities and other third parties typically take a number of years to deliver improvements. There has been limited opportunity for partnership opportunities to be included in the programme for AMP8 and meet the delivery timescales, opportunities will continue to be explored and the programme may evolve to incorporate any identified opportunities. Our key learning from our past and current work is that partnership working can deliver broader benefits for our customers and the environment. Strong partnerships require time and resource to build trust and common goals, most often partnership opportunities for delivery and co-funding present themselves in the near and short term. Match funding is available to fund the priorities of our partners and not to offset water industry costs.
There is no third party included in this enhancement case.

1.4.8 Customer Views

We have not carried out specific customer engagement related to solutions for this enhancement case, but views on coastal bathing waters more generally can be found in the customer support section above.

1.4.9 Direct Procurement for Customers (DPC)

Under this enhancement case, the following assets are being considered for delivery through the DPC route:

Table 1.8: DPC Delivery

YW Discharge URN	Asset Name
S01453	BRIDLINGTON/STW
S02243	SCARBOROUGH/STW/STORM TREATMENT

For more information on the process followed and the cases that were ultimately judged as suitable for DPC please see section 6.3 in Introduction to Enhancement Cases.

1.5 Cost Efficiency

1.5.1 Option Costs

This section outlines how our overall approach to cost estimation and cost efficiency, as outlined in section 7.3 in Introduction to Enhancement Cases, has been applied to this enhancement case. Table 1.1 at the beginning of this document summarises the costs associated with this enhancement case:

Cost estimate for our preferred option

We are proposing £265.56m (totex, excluding DPC allowances) of enhancement expenditure in AMP8 as part of our coastal storm overflows outside of the WINEP.

The table below shows the split across the programme, excluding £108.41m for DPC. The costs are average Financial Year 22/23 CPIH (123.0).

Type of Scheme	Coastal Bathing Waters (£m)
Grey Schemes (storage in the network)	41.2
Schemes incorporating blue/green techniques (solutions in the network)	213.18
Screen	11.19
Total	**265.56***

*rounding

As outlined in our best option section, we are proposing a mixture of blue green and grey schemes for delivery in AMP8. We describe our costing approach for these schemes in detail below.

1.5.1.1 Grey solutions

These options were developed by our Strategic Planning Partner and costed and captured in our Enterprise Decision Analytics (EDA) tool. Unit Cost Database (UCD) cost models were applied within EDA using out-turn cost data from capital projects delivered by our main contract partners to derive cost estimates.

1.5.1.2 Blue Green solutions

Our UCD model has limited data on blue green solutions, we worked with Stantec to develop a SuDS costing tool to estimate the costs for our schemes. We used a weighted element to determine the amount of urbanisation, the proportion of urbanisation impacted the type and cost of the solution.

1.5.2 Efficient Cost Estimates

Section 7.3 in Introduction to Enhancement Cases outlines our approach to cost efficiency in enhancement cases, and how our internal process and delivery decisions are designed with efficiency in mind. This section outlines the application of this approach to this specific enhancement case.

We have assessed quotes from contractors to deliver solutions compared to the cost allowances developed from our models and outturn data described previously. This has demonstrated cost efficiency, through costs that are close to the market rate and in some instances, under the quotes from the contractors.

We assessed the efficiency of cost estimates by developing models using the DWMP data set. We discuss this modelling in more detail in the next section.

1.5.3 Third Party Assurance

The costs used in these enhancement case come from the work used to create our Drainage and Wastewater Management Plan (DWMP). The costs and processes to generate these have undergone 3rd party independent assurance as part of our DWMP.

For information on Assurance please see section 7.4 in Introduction to Enhancement Cases.

1.5.4 Need for enhancement model adjustment (modelled adjustment only)

We support Ofwat's approach of making use of benchmarking models to set efficient allowances where appropriate. The use of benchmarking models is based on company evidence-based data, and less regulatory judgment is involved when opting for deep dives and shallow dives assessments where companies' costs are comparable. However, without a view of the Ofwat approach to setting cost allowances to each driver, anticipating any model adjustment requirements is challenging.

We set out in detail in our Storm Overflow Reduction (EnvAct) cost appendix our views on how Ofwat should go about modelling storm overflow costs at PR24. Whilst the overall cost may vary for coastal bathing water overflows, a similar set of variables is likely to drive costs and hence our comments set out in that appendix are also valid for this enhancement driver.

In summary, we recommend the following models:

- ✓ For totex related to grey schemes in the network and in WwTW, Ofwat could consider two univariate models using the volume and the number of schemes as drivers.
- ✓ For totex related to green schemes in the network, YW could also suggest using two univariate models using the area inflow and the number of schemes as drivers.
- ✓ For totex related to green schemes in WwTW, Ofwat should assess the number of schemes when data from all companies is available.

1.6 Customer Protection

For information on the methodology we have used and the central assumptions we have applied for our Price Control Deliverables (PCDs) please see section 8.2 in Introduction to Enhancement Cases.

We reviewed our forecast enhancement totex for storm overflows and found we met the 1% materiality threshold as a result of activities under three enhancement cases: Storm overflow reduction plan, Bathing water quality and Coastal bathing water overflows (this case). We meet the materiality threshold for four PCD groupings:

- PCDWW4 – flow to full treatment
- PCDWW5 – storm tank capacity, storage, SuDS and other activities
- PCDWW6 – new / upgraded screens for storm overflows
- PCDWW18 – desktop studies, simple monitoring and multiple/complex monitoring

Please refer to the customer protection section of our WINEP storm overflow enhancement case for measures across coastal bathing. Given the overlap in measures and reporting, we have grouped the customer protection mechanisms.

Read more about this at
Storm Overflow Enhancement Case

1.6.1 Third Party Funding or Delivery Arrangements

There is no third party funding for this case.

Annexes

Annex 1.A: Enhance Process

The storage tank volumes were approximated based on the spill volume of the target+1 spill when spills are ranked by volume. Storage volumes were translated to one of four standardised tank diameters, ranging from 3.05m to a maximum of 25m diameter. An allowance for a site working area (proportional to shaft diameters) during construction was allowed for and is shown in Figure 1 below.

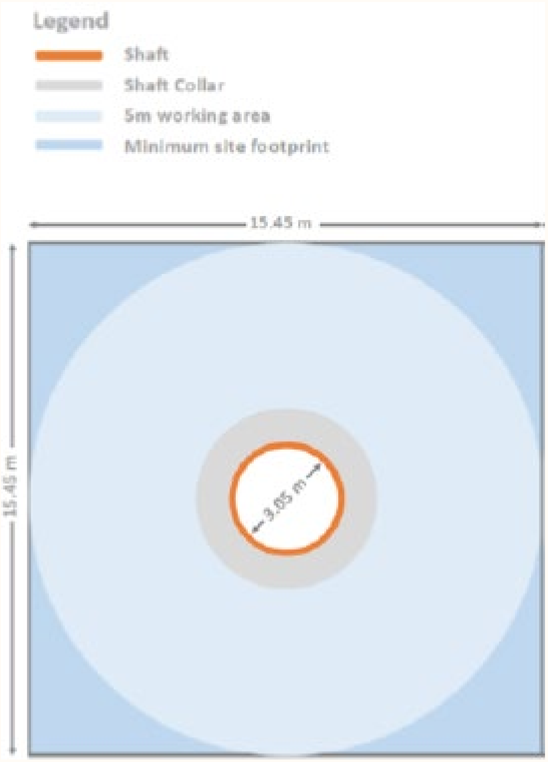


Figure 1: Example land parcel requirement for 3.05m dia. shaft

An automated GIS routine was run to compile a regional dataset of land parcels. These were discounted if there was intersection with any of the following sensitive site designations listed below:

- World heritage sites
- Ramsar sites
- Proposed/candidate Ramsar sites
- Special Protection Area (SPA)
- Possible/candidate Special Protection Area (cSPA)
- Special Area of Conservation (SAC)
- Possible/candidate Special Area of Conservation (cSAC)

Flags were placed on land parcels intersecting the following designations:

- Scheduled monument
- Listed building
- Registered battlefield
- Registered parks and gardens
- Archaeological important areas
- Locally listed heritage assets
- Conservation area (Built)
- Heritage coasts
- Sites of Special Scientific Interest (SSSI) and associated Impact Risk Zones
- Local and National Nature Reserves
- Ancient woodland
- Areas of Outstanding Natural Beauty (AONB)

- National Park
- Marine Conservation Zones
- Local Wildlife Sites (LWS)
- Site of Importance for Nature Conservation (SINC)
- Local Geological Site (LGS)
- Nature Improvement areas
- Priority Habitat Areas

Site designations were only included where information was available in nationally available datasets (as published in September 2022) and within a GIS format. Suitable land parcels were identified for each storm overflow solution. Land parcels had to:

- Have an area greater than the required plan area (constraints on circularity were included)
- Be within 1.6km search radius of the storm overflow (from centre point of the land parcel)

Where more than one suitable land parcel was identified a 'preferred' land parcel was assigned based on proximity to the storm overflow. This was a high-level assessment and some identified land parcels may not be suitable once construction constraints are considered.

Each overflow was assessed independently and there is a risk that the same land parcel is selected for multiple storm overflow solutions.

A further automated GIS routine was used to approximate a preferred pipe route from the storm overflow location to the centre point of the preferred land parcel. Pipe routes were excluded from intersecting certain key site designations (as per tank parcel routine) and from passing through buildings, structures and property curtilage identified within MasterMap. The shortest permissible path was selected as the preferred option.

It has been assumed that the pipe from the storm overflow to the storage tank will be a gravity pipe and at the same diameter as the existing overflow spill pipe. Tank emptying is assumed to be a pumped rising main, with pump and rising main size related to the proposed tank diameter. A comparison of the storage volume to the tank emptying rate was conducted, where this was found to be prohibitive, the option was rejected as unfeasible. This reduces the viable options available to address the need and a reduce and enhance solution was proposed.

High-level outline designs were created for the tank solutions to support the cost build up. An allowance for standard items such as; manholes, pumps, hydro ejectors, odour control units, MCC, power supply, screen and screen chamber were made.

Screens have been sized based on the incoming pipe diameter only. This may mean screens, and associated screening chambers, are over or under sized when local hydraulic conditions are factored in.

Where pipe routes cross key constraints such as watercourses, railway lines and major roads, these have been flagged within the generated schematic design. No adjustment is made within the cost build up at this stage, further assessment will be undertaken in any subsequent design stage. An additional depth of excavation was provided for to make allowance for the plug, cover slab and depth loss due to head losses or depth loss due to the weir height.

Key metrics such as pipe size, length, pump return rate, tank size, screen size have been utilised to develop a high-level Bill of Quantities (BoQ) for each solution. The generated BoQ was supplied to our in-house costing team to allow company cost models to be applied. This provided total CAPEX, OPEX, embodied carbon and operational carbon values for each storm overflow scheme.

The following standard assumptions were made within the cost build up:

- Gravity mains to be constructed from concrete at a depth of 2-4m within a Type 3/4 road (as defined in the New Roads and Street Works Act 1991).
- Rising mains to be constructed from plastic material within a Type 3/4 road.
- Hydro ejectors assume to be all duty except 1 standby
- Run time of return pumps and hydro ejectors assumed to be 4%
- M&E maintenance calculated as annual fraction of the capital value of the asset.

Annex 1.B: Reduce and Enhance

Where possible sub-catchments connected to each storm overflow were assessed defined by iteratively tracing upstream of each storm overflow within the available hydraulic models and identifying those sub-catchments connecting to the storm overflow (independent of any other overflow). Starting at the furthermost downstream point and working upstream, unique areas draining to each storm overflow were defined and removed from the next iteration. Iterations were completed until a unique area was defined or it was determined not possible to assign.

No hydraulic assessment of the network connectivity has been undertaken. Consequently, hydraulic break points may exist between storm overflows, and the effect of these has not been considered.

Once all the sub-catchments connected to a storm overflow had been identified the difference in connected impermeable area between the baseline model and the impermeable area reduction model for each sub-catchment can be summed. This provides the total impermeable area for removal per storm overflow.

The Impermeable Area reduction in the model, reduced area connected to both the foul/combined system and the storm system. Reduction in area connected to the storm network is not expected to significantly influence the operation of the storm overflow. However, it may bring wider benefits within the sub-catchments. Consequently, all modelled sub-catchments that were not assigned to a storm overflow were geospatially queried and where possible linked to storm overflow.

Whilst these areas may overlap geospatially, the impermeable area will have been assigned to either the foul/combined or the storm system within the hydraulic model and therefore the area is not double counted between system types.

Overflows at WwTWs were discounted from this approach. These were excluded, as the sub catchment area concept, i.e. the area between the last storm overflow(s) and the WwTW, was deemed unlikely to result in sufficient area reduction to significantly impact on the spill frequency from the WwTW overflows.

Standard designs were created for the SuDS intervention types listed below to provide a notional £/m2 or £/m3 of intervention:

- Detention basins
- Pocket basin
- Geocellular storage
- Bio-retention (road and verge)
- Permeable paving
- Commercial waterbutt

Indicative solutions were generated characterising varying housing densities and available green space. In each solution a blend of the SuDS features above was assumed with the proportional split of each SuDS feature varying in each solution.

A high-level BoQ was generated for each indicative solution. Required storage volumes were calculated based on the average M30-480minute winter rainfall depth for 2050 across the region. Conveyance features used indicative lengths based on the required area for removal. This provided an indicative £/ha to deliver a blended set of SuDS interventions which varies based on housing density and available green space.

Each sub-catchment was split into a 100m x 100m grid and each grid square queried to determine:

- The proportion of grid square covered by impermeable area
- The proportion of impermeable area assigned to the hydraulic model
- The housing density within the grid square
- The proportion of available green space within the grid square

Each grid square has been assigned to an indicative solution and the impermeable area removal within the model is used to factor the solution cost per hectare up or down. An area weighted average has then been used to determine a final £/ha.

No allowance of system type within the sub-catchments has been made. An estimate of operational costs has been made using nationally available unit costs. Estimates of embodied and operational carbon have been made using adapted in-house models.