

SRN53 Resilience - Coastal Enhancement Business Case

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from
**Southern
Water** 

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Executive Summary

We are working in partnership with the EA and Local Authorities to invest and protect our coastal assets.

The climate is changing, leading to sea level rise and coastal erosion. Without action, in the event of a storm, our treatment works, and sewer infrastructure may fail and cause pollution and bathing water incident. In a worst-case scenario, the Undercliff fails, and it results in a public safety incident.

At Southern Water, we have about 400 wastewater catchment areas with assets within 100m of the coast serving 60% (2.86m) of our customers¹. The risk of coastal erosion impacting our sites and community is increasing and real.

We have identified three sites that need investment in AMP 8 and a further four beyond AMP8. Our total investment need for AMP8 is £17.3m.

We want to invest to protect the Portobello Waste Pumping Station, in several assets in Ventnor the main ones include Lion Point Ventnor Wastewater Pumping Station (WPS) and 32km of sewer infrastructure and our Eastbourne Wastewater treatment works. Our sites are already experiencing some challenges as a result of coastal erosion, e.g. At Ventnor due to ground movement some of the sewer network is being impacted

We are working with local partners such as the Environmental Agency on their Flood and Coastal Erosion Risk Management (FCERM) schemes and Local Authorities to understand the risks and collaborate in developing appropriate solutions to improve our coastal defences and protect our customers and the wider community².

The collaborative working with the EA and local partners ensure that we have our customers and the wider community at heart.

Our customers are supportive of our investment in coastal flooding and erosion, during our customer engagement, 92.8% of our customers were willing to contribute £3 to reducing power and coastal erosion risks depending on the options presented to them. We have also seen 93.9% of our customers who struggle to pay their outgoings support this plan.

By delivering these schemes we will be reducing the risk of a pollution event and destruction of our beaches in the local area.

¹ Population Equivalent served at Coastal Sites from "Sewer Catchments.xlsx". This refers to customers being served by assets within 100m of coast and is different to our coastal population.

² Refer to Appendix A – Environment Agency letter of support

Summary of Enhancement Case	
Name of Enhancement Case	Coastal Erosion
Summary of Case	<ul style="list-style-type: none"> ▪ To improve coastal defences ▪ To reduce ground movement
Expected Benefits	<ul style="list-style-type: none"> ▪ Reduce risk of pollution ▪ Reduce risk of bathing water incidents ▪ Reduce risk of a public safety incidents ▪ Maintain, restore, and improve our beaches
Associated Price Control	Wastewater Network+
Enhancement TOTEX	£17.3m
Enhancement OPEX	N/A
Enhancement CAPEX	£17.3m
Is this enhancement proposed for a direct procurement for customer (DPC)?	No, this investment does not qualify for the DPC threshold.

1. Introduction and Background

Introduction

Sea level continues to rise as a result of climate change and according to the Met Office, the global mean sea level has risen by around 20cm in the past century³. The IPCC predicts global mean sea level rise between 0.26m (RCP 2.6) and 1m (RCP 8.5) by 2100⁴.

Rising sea levels increases the risk of coastal flooding and erosion causing significant damages to our customers and assets on or near the coast. Between 1993 and 2010, the annual rate of rise was about 3mm a year, considerably more than the rate for the preceding century⁵.

Sea level rise leads to increased coastal flooding, erosion, storms, cliff collapses and landslips. This represents a significant and increasing challenge for our assets and the service we provide for our customers at the coastal areas in our region which can be affected by these incidents.

This is a new permanent state of risk that is beyond management control, and we have identified sites at risk and in need of investment now and in the future.

Primary and Secondary drivers for the enhancement need

1. **Primary driver** – increasing risk of climate change leading to sea level rise and coastal erosion and cliff collapses.
2. **Secondary drivers** – coastal erosion exacerbating ground movement, (slope destabilisation, subsidence, and landslip) risks. Coastal flooding and erosion leading to pollution and impacts on bathing water quality in the community and environment.

Background

Coastal Erosion is an increasing area of challenge for our assets and customers at Southern Water. We have a long coastline, and this means some of our pumping stations and sewers are subject to subsidence and coastal erosion. We have nearly 400 wastewater catchment areas and 60% (2.86m) of our population in the region are served by assets within 100m of the coast ⁶. The majority of our customers will be impacted in the event of a coastal erosion or pollution incidence.

³ https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/climate/cop/sea_level_rise_final_v1.2.pdf

⁴ Sea Level Change (Chapter 13) - WG1AR5_Chapter13_FINAL.pdf
(https://www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter13_FINAL.pdf)

⁵ https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/climate/cop/sea_level_rise_final_v1.2.pdf

⁶Population Equivalent served at Coastal Sites from "Sewer Catchments.xlsx". This refers to customers being served by assets within 100m of coast and is different to our coastal population.

We take this seriously as the impact on our customers and the environment could have a devastating effect. We are collaborating with partners such as the Environmental Agency (EA) and Local Authorities to understand the risk and develop solutions that address this challenge now and in the future.

Together we have identified three sites that require additional resilience investments in AMP8 and some additional sites which may require investments in the long term. Please see detail on needs identification /site selection in Section 2.

Table 1: Table of investment needs identified for AMP8 and beyond

Ref	Site Impacted	Costs	Period
1	Portobello Waste Pumping Station (WPS)	£9.75m	AMP8
2	Ventnor Wastewater Pumping Station (WPS) and 32km of sewer infrastructure*	£2.25m	AMP8
		£4.1m	AMP8
3	Pevensy Bay to Eastbourne	£1.17m	AMP8
		£5.85m	APM 9-11
4	Sandown WTW - Yaverland & Embankment Road (Bembridge)	£12m	AMP 9
5	Farlington Flood & Coastal Erosion Risk Management Scheme	Under review	AMP9-11
6	Motney WTW	Under review	AMP9-11
7	Aylesford WTW	Under review	AMP9-11

*We provide further details on the reason for the split costs in Section 2.

For sites identified for AMP9-11 investments where costs are under review, the risks to these sites are still being understood and assessed, we expect our approach to mature as we secure additional evidence on coastal erosion and resilience risks.

This investment supports our broader plans to reduce pollution, the solutions proposed as low regret solutions and they are aligned with our priorities set out in our Long-Term Delivery Strategy (LTDS) to protect and improve the environment and to reduce spills (including storm overflows and bathing water pollution).

Our customers are supportive of our investment in coastal flooding and erosion, during our customer engagement, about 93% of our customers were willing to contribute between £1-3 to reducing coastal erosion risks depending on the options presented to them. In Section 3.3 we provide further detail on customer support.

Links to data table lines		
Enhancement	Table	Line
Wastewater network+ - Sewage treatment and disposal	CWW3	CWW3 168

2. Needs Case for Enhancement

There is a significant body of evidence that demonstrates an increasing sea level as a result of climate change. This presents a new state of risk to our coastal sites, and we have identified sites at risk.

IPCC view on sea level rise leading to coastal erosion

Our climate continues to change, and we need to adapt to those changes and ensure our assets and their operations are resilient so that we can continue to deliver services to our customers and protect the environment.

Based on the latest IPCC data⁷ the global mean temperature has increased by about 1°C and it is projected that there is a 50% chance that it increases to 1.5°C by the mid 2030's and 4°C by 2100 if we do not take appropriate measures.

One of the impacts of global mean temperatures is sea level rise which leads to strong wave action that results in coastal erosion, wearing away the coastline and potentially leading to ground movements or subsidence. Coastal erosion continues to be a major risk and sea-level rise is the primary mechanism by which we expect to understand the risk now and, in the future⁸.

The increase in coastal water level is driven primarily by melting of land-based ice and global mean thermosteric sea-level change (thermal expansion of the oceans as global temperatures rise). UKCP18 provides the relative sea-level rise, i.e., the local sea-level rise experienced at a particular location including vertical land movements (which considers subsidence or land rises).

Sea level rise directly impacts our assets in coastal areas as they are exposed to coastal erosion and where there is a landslip along the coast, the potential impact is even greater – as the coastal erosion risk exacerbates the risk of subsidence or landslip.

The UKCP18 data shows that global sea level has risen over the 20th century and will continue to rise over the coming centuries⁹. In general, greater sea level rise is projected for the south of the UK, where values are similar to the global mean projections¹⁰. This is also due to the post-glacial rebounding North, meaning the Mediterranean region (and Southern Britain) is subsiding by approximately 1mm per year¹¹.

The Met Office said “UK tide gauge records show substantial year-to-year changes in coastal water levels (typically several centimetres). We recommend that coastal decision makers account for this variability in risk assessments, particularly for shorter-term planning horizons”⁸.

⁷ SPM_version_report_LR

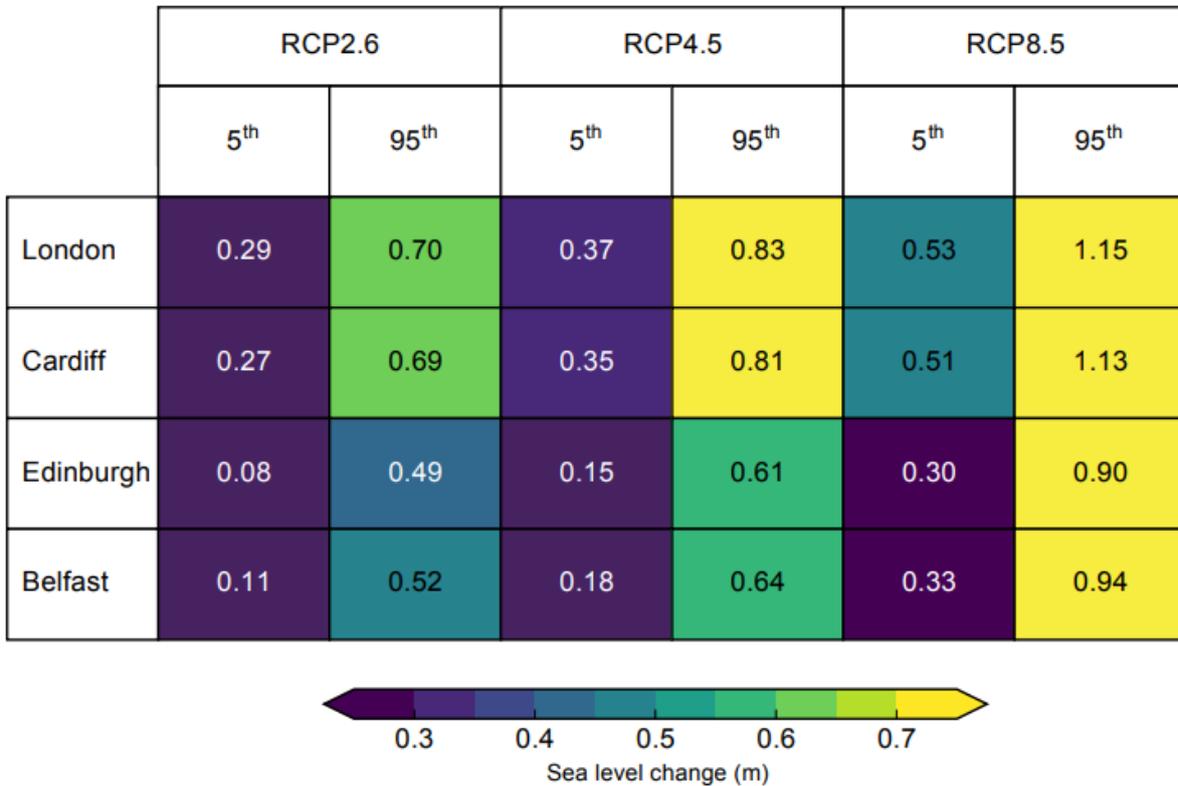
⁸ Howard et al, 2019; Fox-Kemper et al, 2021

⁹ ukcp18-fact-sheet-sea-level-rise-and-storm-surge.pdf

¹⁰ ukcp18-marine-report-updated.pdf

¹¹ <https://www.sciencedirect.com/topics/earth-and-planetary-sciences/postglacial-rebound>

Figure 1: Range of sea level change (m) at UK capital cities in 2100 relative to 1981-2000 average for a low (RCP2.6), medium (RCP4.5) and high (RCP8.5) emissions scenario from table in Section 1.2 in Palmer et al (2018)¹²



The Environmental Agency’s view on sea level rise and translation of UKCP18 data to support planning.

We have been working with the Environmental Agency (EA) who have translated the UKCP18¹³ data into epochs (time periods) and sea level “allowances” by river basin district using data from 1981 to 2000 as baseline. “Allowances” are predictions of anticipated change due to climate change. As shown in Figure 2, the sea level allowance in the South East is predicted to be 33.9cm (339mm) by 2065.

¹² ukcp18-fact-sheet-sea-level-rise-and-storm-surge.pdf

¹³ <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances>

Figure 2: Table showing sea level allowances by river basin district for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the sea level rise for each epoch is in brackets. Source: <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#sea-level-allowances>

<u>Area of England</u>	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20
Anglian	Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60
South east	Higher central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
South east	Upper end	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

Sea level is not only predicted to rise, but the rate of increase is accelerating.

We therefore need to respond to these predicted sea level allowances and the potential rate of increase. According to the University of Southampton who have supported the EA, sea levels have continued to rise due to climate change and between 1990 and 2018, it rose by 3.6mm per year on average, compared to 1.43mm per year between 1911 and 2018¹⁴. **The average rate of sea level rise has therefore accelerated in the last three decades to 2018. It is also predicted to continue to rise by up to 1.15 meters by 2100 under the higher climate change scenario (RCP 8.5) from UKCP18.**

This is the same data set that is being used to support the Thames Estuary 2100 Plan, the first UK flood risk management strategy that puts climate adaptation at its core, it has built it into an adaptive approach set out in the Environmental Agency’s National Flood and Coastal Erosion Risk Management (FCERM) Strategy published in 2020. It is actively monitored, and we believe this is a good dataset to support us in monitoring sea level rise to date and in the future.

¹⁴ <https://www.southampton.ac.uk/news/2021/02/thames-estuary-changes.page#:~:text=sea%20levels%20are%20increasing%20in,climate%20change%20scenario%20from%20UKCP18>

How we have considered this to support investment need identification

We have taken this (the UKCP18 data) into account as part of our resilience monitoring activities, working with the EA and local partners (Brighton and Hove Council, Lewes District Council) to understand the risk, and feeding this into our integrated risk and resilience process to understand the resilience risks to our assets, the community, and customers we serve.

To understand the risk presented to our operation, customers, community, and the environment, we have carried out an assessment of coastal erosion as part of our climate and resilience assessment. This builds on the Resilience framework we developed at PR19 and shared as part of our Resilience Action plan. We have continued to mature this framework and the supporting resilience processes through application in water and wastewater (details can be found in [SRN47 Resilience in the Round Technical Annex](#) and [SRN48 Operational Resilience Technical Annex](#) documents). As shown in Figure 3, we have integrated the resilience process with our investment planning process – Risk and Value process, to ensure resilience risks are fully considered in our business plans.

We recognise that any risks presented to our assets is unlikely to be isolated. The nature of coastal erosion risk means that when it happens it will impact our sites and multiple other businesses, households, and societal amenities, such as seen in the Dawlish Coastal Erosion incident in Feb 2014, where very strong winds and high seas severely damaged the railway line that runs through Dawlish impacting thousands in the community and commuters. The wall between the sea and the railway line breached; a section of the wall washed away, as did 80 metres of track, platforms at Dawlish railway station and sections of the coastal path which cut off the South West peninsular from the rest of the railway network in the country¹⁵. The government has since invested £25m as part of its £80m package of investment to create a more resilient railway¹⁶.

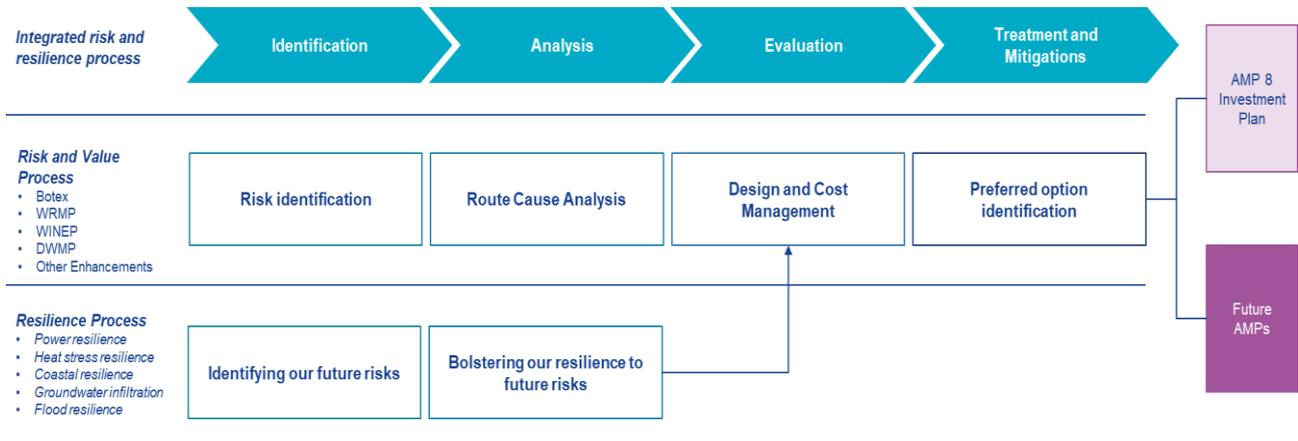
We have taken a systems-based approach (as described in our [SRN48 Operational Resilience Technical Annex](#)¹⁷) to ensure that we understand the full extent of the risks others may have observed and collaborate with partners on potential solutions. To that end, our asset management team have been working collaboratively with partners such as the Environmental Agency, Brighton and Hove Council and Lewes District Council to jointly assess the risks coastal erosion presents now and, in the future, and together we have identified three sites at risk of Coastal erosion and in need of investment in AMP8 and a further four that will require investment in AMP9.

¹⁵ <https://www.networkrail.co.uk/stories/five-years-since-we-reopened-dawlish/#:-:text=Over%20and%20February,sections%20of%20the%20coastal%20path>.

¹⁶ <https://www.gov.uk/government/news/first-phase-of-dawlish-seawall-completed-securing-south-wests-rail-links>

¹⁷ [SRN48 Operational Resilience Technical Annex](#) – “Our practical approach to resilience”

Figure 3: Our integrated risk and resilience process.



Through our assessment and in collaboration with our partners, we have identified seven sites at risk of coastal erosion potentially leading to environmental pollution, loss of site, land and of social amenities including any existing access to the beaches and the associated coastal access footpaths and other public infrastructure.

The table below shows a list of the sites impacted with a description of the coastal erosion risks, number of customers impacted and where relevant, we have provided a list of the partners we have worked with to identify these risks.

Table 2 :Table of investment needs, costs, and timings. All AMP9 onwards costs shown here are early estimates, subject to further design work

Ref	Site Impacted	Risk Description	Timing of intervention	Costs	Customers impacted
1	Portobello Waste Pumping Station (WPS)	Site at risk of Coastal Erosion in <50 years	AMP 8	£9.75m	280,000 ¹⁸
2	Ventnor Wastewater Pumping Station (WPS) and 32km of sewer infrastructure	Coastal Erosion and slope stabilisation.	AMP 8	£2.25m	2,606 and 543 commercial properties ¹⁹
		WPS and Sewer stabilisation	AMP 8	£4.1m	
3	Pevensey Bay to Eastbourne	Coastal Erosion and Inundation	AMP 8	£1.17m	10,000 ²⁰
		Coastal Erosion and Inundation	AMP 9 -11	£5.85m	
4	Sandown WTW - Yaverland & Embankment Road (Bembridge)	Flood and Coastal Erosion	AMP 9	£12m	180,000 ²¹
5	Farlington Flood & Coastal Erosion Risk Management Scheme	Farlington Flood and Coastal Erosion	Under investigation and working in partnership with the Environmental Agency		
6	Motney WTW	Coastal Erosion	Under investigation and working in partnership with the Environmental Agency		
7	Aylesford WTW	Coastal Erosion	Under investigation and working in partnership with the Environmental Agency		

The total investment need for AMP 8 is £17.3m and beyond AMP 8, we estimate a current investment need of £17.85m, we are continuing to work with the Environmental Agency on its Flood and Coastal Erosion Risk Management (FCERM) programme to take advantage of the potential cost efficiency that can be delivered in a combined programme.

¹⁸ Overview of proposal for Ventnor funding

¹⁹ Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme

²⁰ Pevensey Bay to Eastbourne Coastal Management Scheme Southern Water Business Case

²¹ Southern water business case for contributions to the Yaverland coastal defence scheme and Embankment Road (Bembridge) coastal defence scheme

These enhancements do not overlap with any other activity delivered through base because it is responding to a new risk that has materialised as a result of sea level rise leading to coastal erosion. In addition, we have assessed the Coastal Resilience programme against the criteria for low regret investment identified in the [LTDS guidance](#) and [Appendix 9](#) of the Final Methodology. The guidance identified that low regret investments meet the needs across a wide range of plausible scenarios, meet short-term requirements; or keep future options open, including cost minimisation.

We consider that the investments proposed in this enhancement case is a low regret investment for the following reasons:

- Sea level is continuing to rise, and estimates indicate a 1.15m rise by 2100²². Our sites are already exposed to coastal erosion and if the coastal defences are not enhanced, many customers are at risk of losing our service and the evidence leaves us in no doubt that it will lead to a significant pollution and bathing water quality incident.
- For sites such as Portobello, Ventnor, and Eastbourne, we need to intervene now, these sites will be needed in the future and there are no plans to relocate or abandon them, they are critical to future proofing our services and the coastal erosion impact is accelerating and could result in landslip. These assets will not be protected by assets owned by others at no cost. Given the level of evidence (as shown in [AMP8 Enhancement Needs](#) below) we have to take action, work with partners (Environmental Agency and Local Authorities) and intervene now—further details below under [AMP 8 Enhancement Needs](#).
- We are working in partnership with Local Authorities and the Environmental Agency (EA) as part of their FCERM Programme to ensure we consider the options at a system level and make appropriate contributions, ensuring that our sites are adequately protected. We will continue to work with the EA to identify a range of plausible futures for our coastal defences and slope stabilisation needs. See the [External Legislative assumptions](#).
- The solutions that are described in this enhancement case is required across a range of scenarios considered within our long-term delivery strategy, i.e.,
 - Adverse scenario: RCP 8.5 50th percentile probability level.
 - Benign scenario: RCP 2.6 50th percentile probability level
 - Time period: Through to 2050.

²² ²² ukcp18-fact-sheet-sea-level-rise-and-storm-surge.pdf

External legislative assumptions

The assets being considered are not all Southern Water assets. However, the impact on the environment and customers will be severe if we do nothing. Customers and the environment will be impacted as a result of pollution. Southern Water is a risk management authority ("RMA") for the purposes of the Flood and Water Management Act 2010. As such, it is subject to a duty to cooperate with other RMAs, including the EA, in the exercise of their flood and coastal erosion risk management ("FCERM") functions. This duty applies with respect to Southern Water's FCERM functions – i.e., its functions to provide a public sewer system that effectually drains the area it serves, including the drainage of surface water. We have considered this investment through the lens of our obligations to protect key strategic assets from erosion and inundation due to rising sea levels as a result of climate change – this is our basis for partnership with the EA.

AMP 8 Enhancement Needs

Portobello WPS and Coastal Cliff Erosion		
1	Site impacted	Portobello Waste Pumping Station (WPS)
	Type of site/asset	Wastewater network
	Location	Telscombe, East Sussex

Resilience risks and needs case for enhancement investment

Southern Water assets and their location

The Portobello WPS is immediately behind the coastal defence wall as shown in Figures 4 and 5. It serves 280,000 customers in the Brighton area, it is surrounded by chalk coastal cliffs and protected by two concrete block groynes (west and east) perpendicular to the coastline, approximately 50m long each. Within the Western Groyne is our 1.8 km long sea outfall which carries dilute wastewater at times of rainfall to the English Channel, and it provides protection for the outfall against wave and storms. This outfall serves approximately 136 200 domestic customers and 10 400 non-domestic customers in the Brighton area.

The area

The Portobello WPS serves 280,000 customers. The chalk coastal cliffs adjacent to the Portobello WPS in Telscombe, East Sussex are subject to ongoing coastal erosion as a result of sea level rise. The coastal defence wall, the western and eastern groyne, the promenade, public footpaths, and our assets are at risk of being lost over the next 50 years if there is no intervention. Figure 4 below shows the coastal erosion line in the next 20, 50, and 100 years if there is no intervention.

Figure 4: Future erosion lines along the western Telscombe frontage

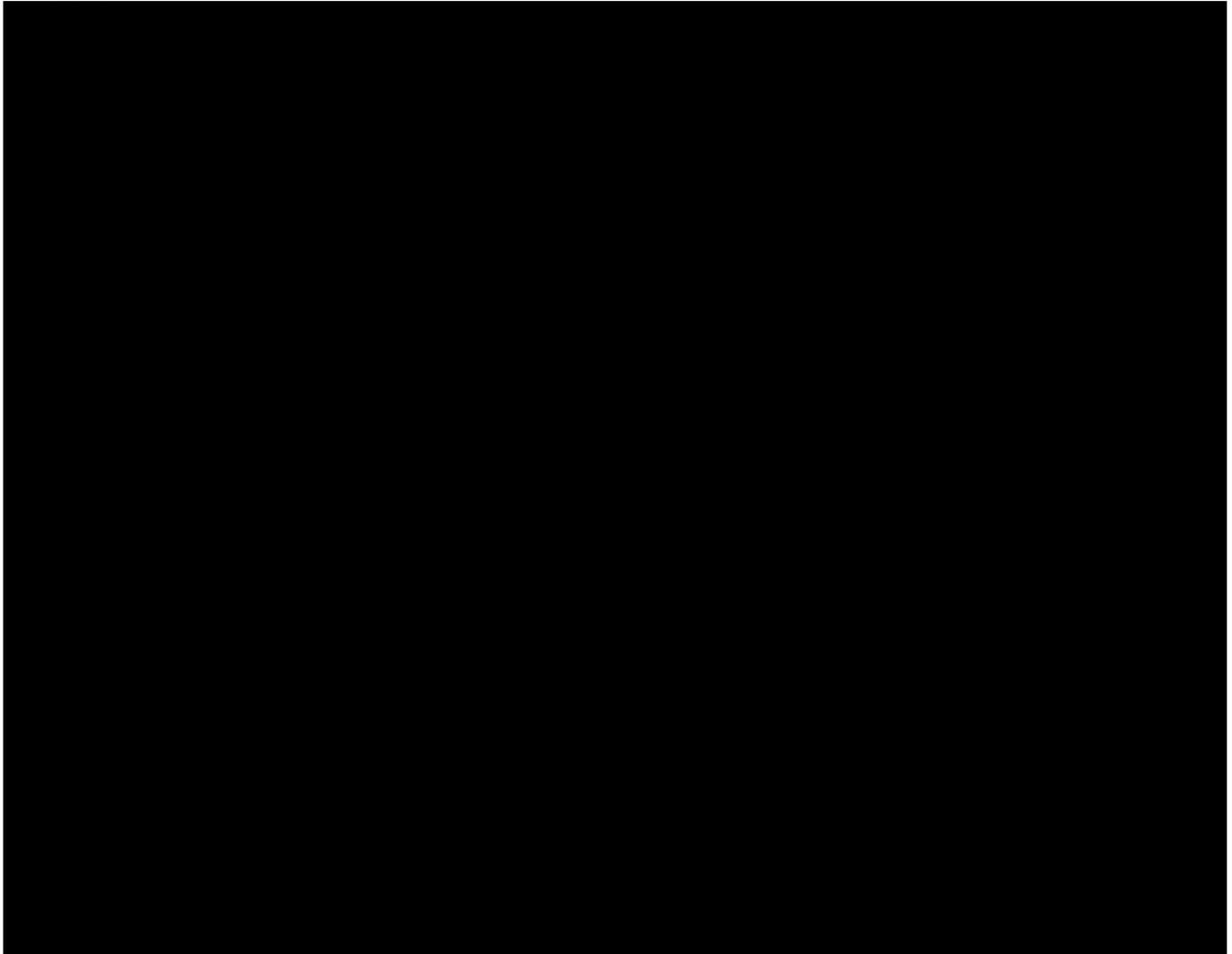


We have adopted a proactive approach to safeguard the public and relocated a part of the access footpath away from the cliff edge in line with the repositioned fence line proposed by Lewes District Council (16m landwards from the current cliff edge).

We have also commissioned further study (carried out by [REDACTED]) to understand the future coastal erosion of the cliff and costs of the various options available in order to stabilise the cliff locally and protect our assets in the short (5yrs) medium (10-20yrs) and long term (30yrs+). The report also indicated that the sooner these activities can begin, the smaller the risk associated with significant cliff fall occurring and causing further issues within the next 3 years²³. We therefore need to act now.

²³ Mott MacDonald | Portobello Groyne Sea Defence Cliff Stabilisation Options Report

Figure 5: The Telscombe cliff, the coastal defence wall, the groynes and Portobello Waste Pumping Station



The coastal defence wall and the groynes

Figure 6: Ongoing deterioration of the Eastern Groyne.



The site is characterised by undefended dry valley chalk cliffs which have been subject to continuous coastal erosion. The coastal defence wall and groyne are owned by Brighton and Hove Council, they have deteriorated, and their operational life needs to be extended.

Our Engineering Technical Services team carried out an assessment of the condition of the existing coastal defence wall as part of our risk assessment and optioneering process and confirmed it has approximately 5 years remaining life.

Figure 7: Damaged section of the Eastern Groyne



The groyne requires stabilisation, the supporting wall on the eastern groyne has deteriorated significantly as shown in Figures 6 and 7²⁴

During a large storm the area is particularly at risk as the coastal defence wall and promenade are undercut and in a poor condition. The failure mode will be sudden in nature and it is impossible to observe a gradual

²⁴ Portobello WTW Eastern Groyne Repair Briefing Paper and Methodology and supporting Eastern Groyne damage repair photographs pack

erosion and respond in an optimal time. The site is a health and safety hazard due to the large amounts of spalling and the large number of debris may exacerbate any further erosion of the structures through increased abrasion during a storm.

Our existing maintenance strategy which includes monitoring and maintenance of the condition of the access to the beach and footpaths along the top of the cliff is no longer sufficient to manage the coastal erosion risks at Portobello. The chalk coastal cliffs adjacent to Portobello WPS are subject to ongoing erosion due to increasing sea levels. Projecting future sea level rise over the next 20 years under a medium emission scenario (RCP4.5) 95th percentile shows that by 2040 cumulative sea level rise will be 0.14m. In a “Do nothing” scenario, the corresponding cumulative coastal erosion for different sections of the dry valley deposit will be between 15m and 18m²⁵ (██████████ Portobello Groyne Sea Defence Cliff Stabilisation Options Report). Under a “Do Nothing” scenario, part of the Portobello WPS could potentially be at risk of falling into the sea by year 2050. The east side of the eastern groyne will continue to erode even further, and it is likely to affect part of the existing footpath by 2030, making this access unsafe and the site non-operational as a result.

The options feasibility report prepared by ██████████ concluded that the risk of Telscombe Cliffs failing due to coastal erosion could result a significant incident, which will include operational shutdown of Portobello site, impacting 280,000 customers and leading to a Bathing Water quality or Pollution incident as the overflows are activated. In addition, it may also lead to the public's loss of access to the beach through the footpaths.

Our internal risk teams have also identified other assets at risk include the Victorian sewer now a stormwater sewer for Brighton and Hove and the sewers and water mains that serve the local communities. Recent assessments have indicated that without further interventions the A259 coast road could be impacted by around 2050. See Figure 5 above. This would be followed by the loss of the major Southern Water assets under the road and potentially lead to pollution.

Systems view of the resilience risk

The frontage of the wastewater site and defence is owned by the Brighton and Hove Council; however, we are a primary beneficiary of the coastal defence. In addition, as landowners of the Portobello site and the footpaths, we have responsibility to maintain the condition of the access to the beach and footpaths along the top of the cliff for the public use and to keep the groyne fully functional and attached to the cliff. See [External Legislative Assumptions](#) section above.

We are currently working with the Environmental Agency (EA), Brighton and Hove council and Lewes District Council to manage the risk of the undercliff failure and explore options for coastal erosion risk management at Telscombe Cliffs in East Sussex. There is scope for our cliff protection works in the area to be combined with potential works by Lewes District Council on the adjacent frontage. This will provide cost savings if a larger combined frontage scheme was constructed at the same time. There are ongoing discussions

²⁵ Mott MacDonald Portobello Groyne Sea Defence Cliff Stabilisation Options Report

²⁶ Mott MacDonald | Portobello Groyne Sea Defence Cliff Stabilisation Options Report

between Southern Water and Lewes District Council to rationalise the coastal management of the Portobello and Telscombe frontages.

Resilience enhancement investment is required in the areas below

We want to target our interventions at the far western end of the project area where our major assets (Portobello WPS and the Outfall in the Western Groyne) are most at risk and in the eastern part of the project area where properties and their associated utility connections are at risk.

Construction works may progress through an adaptation pathway approach with the potential for an initial investment during AMP8 and further interventions as erosion progresses. Through AMP8, we will continue to review the management of the existing defences and associated coastal erosion issues at Portobello which may lead to a bid for AMP9 funding for improvement works.

There are opportunities to share information and to align our work across this section of the UK coast. Collaborative working would enable us to develop a comprehensive and integrated approach to coastal erosion risk management and to achieve efficiencies. Alongside, Brighton and Hove and Lewes District Council, we are also working with East Sussex County Council who have included coastal erosion measures at Telscombe Cliffs in their list of options for Major Road Network funding.

The specific investment requirement is for:

- Stabilisation of the chalk core and recasting of the Western and Eastern Groyne to ensure the sewer outfall within the Western groyne is protected and to maintain beach stability.
- Stabilisation and repair of the coastal defence wall (both the sea wall and the wave wall)
- Resurfacing and repair of the Promenade and other enabling works.

Investment needs and programme timelines

The total cost estimate of the investment is £9.75m. This project needs to be completed in AMP8 given the remaining asset life is 5 years. When complete, it will protect the service to 280,000 customers in the area.

Ventnor		
2	Site impacted	Several assets, the main ones include Lion Point Ventnor Wastewater Pumping Station (WPS) and 32km of sewer infrastructure
	Type of site/asset	Non-Infrastructure and Infrastructure assets
	Location	Ventnor, Isle of Wight

Resilience risks and needs case for enhancement investment

Southern Water assets and their location

The Southern Water Ventnor wastewater drainage area covers an area of approximately 2.4km² on the south-east coast of the Isle of Wight. There are several pumping stations which pump to the Sandown treatment works via Lions Point, located under the area adjacent to the beach in Ventnor.



In addition, we have just over 32km of wastewater sewer assets, 27km of which are at risk of serious degradation due to land movement. Based on the Isle of Wight Coastal plan, the 27km of sewer at risk are within the potential landslide reactivation zone which has an estimated movement of 460mm per year (at a probability of 0.5 per annum), increasing to an estimated 610mm per year in 2025 (at a probability of 0.5 per annum).

Our assets including sewers housed within the defence structure would be impacted severely if the cliff fails or ground movement (landslip) is exacerbated through coastal erosion leading to a pollution incident or loss of service. In the event of a large landslide, a significant portion of our pumping stations and sewer network would be damaged, see Figure 8 below.

Figure 8: Southern Water Pumping Stations in Ventnor. The fault line is to the north of the catchment (red line). Any asset below the red line is most at risk.



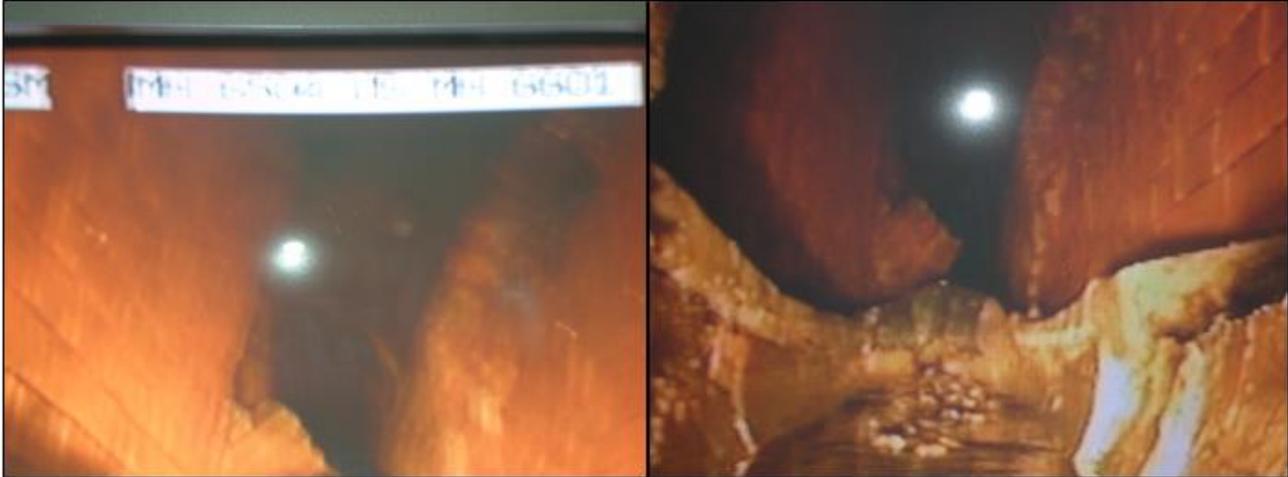
We are already experiencing the effects of ground movement. Currently the main 720mm trunk sewer, which extends from [redacted] sewer has partially collapsed between manholes, raising concern over the effect of released flows on the surrounding geology. See Fig 9 below.

Figure 9: Albans steps sewer – location of partial collapse.



We have been carrying out rehabilitation work on our sewer network in the landslide zone but we are working against an increasing risk and our assets continue to degrade at a faster rate than we can maintain them. CCTV data shows that despite our rehabilitation and maintenance works, only 14% of our assets in the sewer network in Ventnor are classified with a structural grade 4 or 5, that's down 44% points in 30 years (in 1993, it was 58% of our assets were grade 4 or 5 within the landslide zone²⁷).

Figure 10: recent CCTV footage of the partially collapsed St Albans steps tunnel.



The ongoing movement (from the active rotational slip) will continue to cause the sewerage system to fracture leading to a loss of sewer flow to ground which could further lubricate the landslide plane. The fault cannot be stabilised because it is a natural feature.

We have assessed this risk through our risk tool ARM, and we estimate a potential asset failure and a 50% chance it leads to Pollution and a Bathing Water quality incident at least once every 5 years.

The area

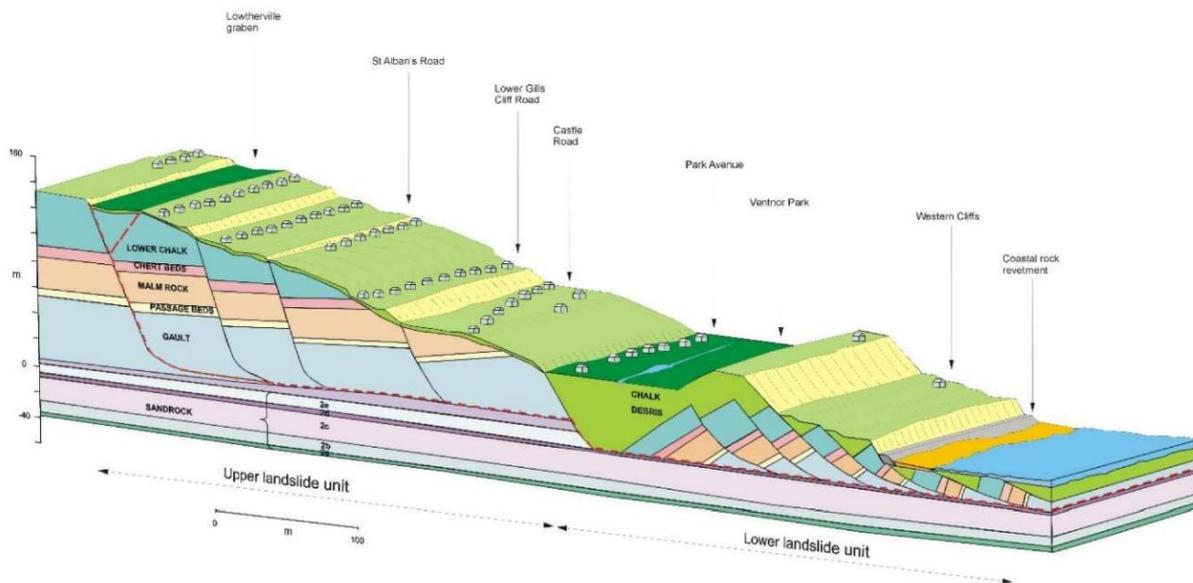
Ventnor and surrounding villages are located on 'the Undercliff', a large deep seated coastal landslide complex (including an active rotational slip plane). The Ventnor undercliff is approximately 12km in length and it is the largest urbanised landslide complex in England and Wales, and one of the largest in north-west Europe. Originally initiated by sea level rise at the end of the last ice age, parts of it are reactivating. There have been several studies on the Undercliff and in the Quarterly Journal of Engineering Geology and Hydrogeology, 2010, R Moore et al said "The impact of ground movement on property and services in the town has been significant in the past...Climate change projections over the next 100 years point to significant increases in sea level and winter rainfall, which are expected to result in accelerated ground movement rates and more frequent landslide events in the Undercliff. There are concerns that hitherto marginally stable areas of the Undercliff may become unstable as a result of reactivation of ground movement and the occurrence of new landslides. In areas previously affected by ground movement or landslides, the frequency and rate of ground movement and land sliding is expected to increase. The paper

²⁷ Ventnor Faultline Investigation report

presents historical and new data to demonstrate the relationships between rainfall and ground movement and uses these to predict the likely impacts of climate change on future landslide behaviour. The paper concludes that climate change poses a very real threat and significant challenge to the future management and mitigation of the ground instability risks in the Ventnor Undercliff²⁸.

This complex, pre-existing deep landslide system is subject to land instability caused by coastal erosion and excess groundwater levels and based on the Environmental Agency's (EA) current shoreline management practices, there are specific areas within the undercliff that are at risk of ground movement. Without coastal defences, and slope stability measures, the Undercliff landslide system will become more active with predicted increased winter rainfall and accelerated rates of coastal erosion at the toe. This will cause widespread ground movement, landslide reactivation and asset damage in Ventnor. Figure 11 below describes the landslide complex.

Figure 11: A cross section through the landslide complex at Ventnor Park demonstrating the landslide blocks.²⁹



This risk is increasingly outside management control and largely driven by sea level rise, leading to coastal erosion, the underlying geology, topography, seasonal fluctuations in groundwater levels and historical landslide movements. We know this has already caused significant damage in the area – as seen in the coastal defence failure on the Eastern Esplanade in Ventnor here; (<https://onthewight.com/read-full-details-of-extensive-work-planned-for-ventnors-collapsed-seawall-and-further-coastal-defences-to-2031-video/>).

²⁸ Quarterly Journal of Engineering Geology and Hydrogeology Volume 43 Pages 447 – 460 - Landslide behaviour and climate change: predictable consequences for the Ventnor Undercliff, Isle of Wight (<https://www.lyellcollection.org/doi/10.1144/1470-9236/08-086>)

²⁹ Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme

Systems view of the resilience risk

Whilst we do not own the coastal defences, our assets continue to be impacted due to coastal erosion and ground movement and they will be severely impacted in the event of a landslide. We have provided further [External legislative Assumption](#) to support investment. We understand the benefits of partnership working to our customers and the community. In its business case, the EA said “Partnership working is central to the development of the scheme. One of the critical success factors of the project is to ensure that we are working with all interested stakeholders to shape the development of the scheme”³⁰. As members of the Undercliff Landslip Management Committee, we have continued to play a key role in the management and monitoring of instability within the Ventnor undercliff to protect our infrastructure. We are working with the EA on their Flood and Coastal Risk Management (FCRM), local partners such as the Isle of Wight Council and we are an intrinsic part of the ongoing Ventnor Eastern Esplanade Emergency/Urgent Works steering group.

Together, we understand the resilience risks that coastal erosion and the landslip poses to our customers, the community, and the environment. We have worked collaboratively with the EA as part of its FCRM programme to agree the investment areas needed to create a sustainable future for the coastal frontage of Ventnor.

Resilience enhancement investment is required in two areas

- **Improve the coastal defences** by replacing or enhancing all four sections of the coastal defence, improving the capacity of the defences to cope with the increasing coastal erosion risks (the sections are Ventnor Park - Western Cliff Eastern section, Central Ventnor - Eastern Cliffs Western section, Wheelers Bay- Eastern section and Wheelers Bay- Eastern Cliffs Eastern Section).
- **Stabilise the landslip** – working with the EA and other partners, we are considering three areas for investment to reduce the ground movement.
 - **Enabling works:** The EA has already started urgent works to ensure that the risk of slope failure in the short term (through to 2028) is reduced, thereby protecting properties and infrastructure.
 - **Southern Water asset stabilisation** (the Grabben) – this is to respond to the immediate need at St Albans steps where the sewer has partially collapsed. We want to enhance the brick sewer. Delivering this as part of the wider programme with the EA and Isle of Wight Council will reduce the impact ground movement and coastal erosion which is the largest contributor to the landslides in Ventnor.
 - **Dewatering** – this is a trial to create a long-term solution. The aim of this solution is to alleviate the ground water pore pressure and enable the partners understand if ground water levels can be managed effectively i.e., maintained at summer levels all year-round to demonstrate it as an effective method of reducing land movement within Ventnor Undercliff. If successful, the dewatering scheme will be scaled up and delivered as part of the longer-term strategic solution.

³⁰ Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme

Investment needs and programme timelines

Investment needs 1, 2a and 2c

As part of our collaborative working and to deliver cost efficiencies to our customers, we want to make contributions to the EA programme on investment needs 1, 2a and 2c.

This is a scheme in development, with construction planned to start in 2028 and finish in 2031. The EA has secured £3.9m of central Government funding. The funding will enable appraisal of options to enhance the coastal defences and undertake a significant amount ground investigation as described in 2a. The data gathered will confirm the most appropriate approach of achieving increased stability of the landslide complex at Ventnor. Currently the whole life cost of the scheme is approximately £46m. Our contribution alongside other partners and beneficiaries locally to support this will be £2.25m. We estimate this represents good value for our customers. Partnership working is the most effective way of addressing this challenge and delivering a cost-efficient solution to customers and the community. Without partnership working and the necessary funding the EA may only be able to partially address the risks or not at all, and it will lead to increasing risks and costs. This investment is needed to take a systems-based view to address this risk. Further detail on our cost methodology is provided in the Cost Efficiency Section.

Investment need 2b

The enhancement investment need in 2b is directly protecting our assets to reinforce the sewer network and make more resistant to ground movements. We estimate the cost of this at £4.1m. This will extend the lifetime of the sewer network by 25 – 50 years and it will be delivered between 2028 and 2030. It is dependent on the enabling works which is designed to reduce the risk of ground movement in the short term. The longer-term solution is potentially Dewatering.

When complete, the overall scheme combining all our needs in Ventnor will provide improved protection from coastal erosion and associated landslide activity to 2606 residential and 543 commercial properties as well as infrastructure, local businesses, heritage assets and designated sites.

	Eastbourne	
3	Site impacted	Eastbourne Wastewater Treatment Works (WTW) and wider sewer network infrastructure
	Type of site/asset	Wastewater network
	Location	Pevensey Bay to Eastbourne

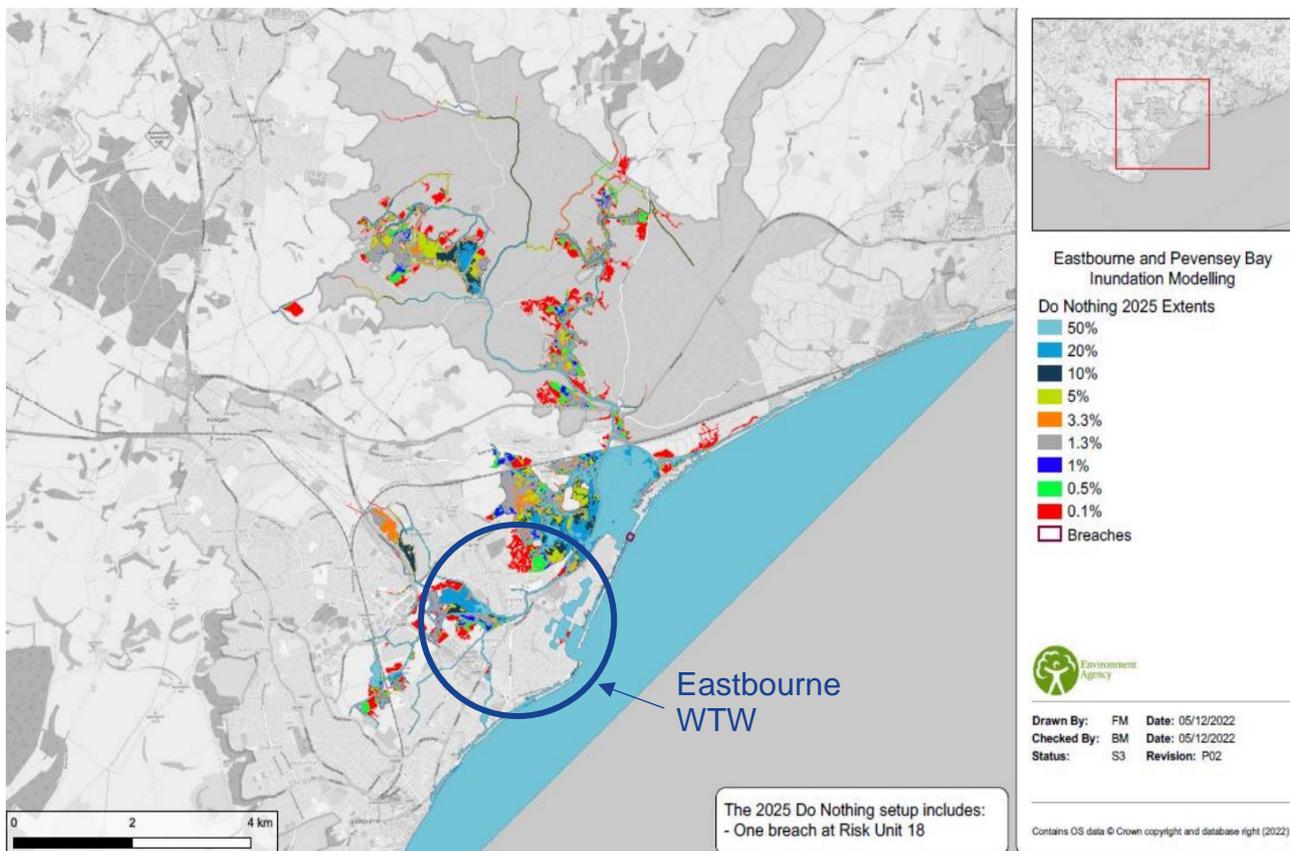
Resilience risks and needs case for enhancement investment

Southern Water assets and their location

The asset to be protected is Eastbourne wastewater treatment works. This is currently protected by the coastal defence which we do not own. The scheme will significantly reduce the risk of flooding to Eastbourne WTW. The scheme is integral to ensure that the works are resilient and adaptable to coastal flooding into the future, without this scheme the works would be at high risk of coastal flooding.

The EA Inundation Modelling of entire area in Figure 12 shows the coastal flood risk to Eastbourne WTW and wider sewer infrastructure network in a “Do nothing” flood scenario in 2025. The EA described that the current modelling indicates that in a ‘Do nothing’ scenario there are 10,000 residential properties at risk of coastal flooding. As well as residential properties there is significant wider infrastructure at risk such as, sewage treatment works and infrastructure.

Figure 12: EA Inundation Modelling map showing extent of coastal flood risk to the Wastewater treatment works.



The area

We are working in partnership with the EA and the Eastbourne Borough Council who are developing a new, £100+ million large flood coastal and erosion risk management (FCERM) scheme for Pevensey Bay to Eastbourne. This scheme is one of the largest in the country, covering 15km of coastline, seeking to make an estimated 10,000 properties and wider infrastructure resilient and adaptable to the risk of coastal flooding and erosion.

Due to climate change, sea level rise, and increased storms, there is an increasing likelihood of the sea defences being breached which would cause flooding to 10,000+ properties and the loss of critical infrastructure including rail, road and the WTW. The EA is putting together a 100-year adaptive plan for final submission in 2024.

There are currently two FCERM beach management schemes which provide coastal and erosion flood risk protection to Eastbourne and Pevensey Bay. Both of those current projects are coming to the end of their contracts in 2025, which is the reason why the new scheme is required. The current defence mainly is beach recycling, redistribution, and replenishing, with groyne maintenance.

The new Pevensey Bay to Eastbourne Coastal Management Scheme encompasses both frontages. The reason why both frontages are considered in the new scheme is due to how this area would respond to coastal flooding. Due to the topography of the area (i.e., being a valley), a breach to one area of the coastline represents a risk to the whole area.

Figure 13: Map of the area of coastline covered by the scheme (15km)



Systems view of the resilience risk

We are working in partnership with the EA and other organisations such as National Highways, Network Rail, and the local authorities on the FCERM strategy for Pevensy Bay to Eastbourne. We will continue to work with them on the 100-year adaptive plan to ensure that any future interventions are made visible in our long-term adaptive plans.

Resilience enhancement investment

The requirement is to contribute to work on the coastal defences which the EA are responsible for, and it is clear that our Eastbourne site is a major beneficiary of the coastal defence work. The main area of investment is to protect our assets through the coastal defence. See the [External Legislative framework section](#) which describes our role as a Risk Management Authority and sets out some expectations.

Investment needs and programme timelines

Based on the EA's estimation of current management costs, if the current practice of beach management were to continue, the cost over the next 20 years will be £70m (£3.5m/year). The EA estimates a contribution of £0.39m per annum over 20 years. This is based on Defra's requirement for the EA to aim for 20% partnership contributions. The contribution is allocated evenly across the main beneficiaries (Southern Water, National Highways and Network Rail). This represents £1.17m in AMP8 and a total contribution of £7.8m over the 20-year period. This represents good value for money for our customers if compared with the costs if the practice of beach management were to continue ignoring the potential risk and the cost of responding to any significant incident. As a Risk Management Authority (stated in our [External Legislative Assumptions](#) section), we have a duty to support and contribute to the delivery of these solutions. Without cooperating and partnering with the EA, the other potential options available are to individually build own defences or relocate the treatment works.

There are currently three strands of the scheme which the EA is developing with partners including Southern Water:

- **The immediate short-term risk mitigation (the 'interim' project):** this is a short duration piece of beach management work (shingle moving) which delivers flood risk management in a very similar way to how it has historically been delivered in Eastbourne, starting from 2025. This initial interim work allows time for the two other more complex strands to be developed to a stage where they can be delivered.
- **Phase 1 delivery of the 100-year adaptable plan:** first phase delivery period to be confirmed but likely around next 20 years. Over the next four years we will work with the EA to further develop the first phase of FCERM solutions for this area of coastline, with a view of starting work in 2027.
- **100-year adaptable plan development:** An adaptive management approach, which includes continued monitoring to determine future phased delivery of FCERM solutions. We will continue to work with the EA on this as part of our long-term planning.

Our investment in AMP8 (£1.17m) is primarily to contribute to the Phase 1 delivery of the 100-year adaptable plan, the project is scheduled to start in 2027.

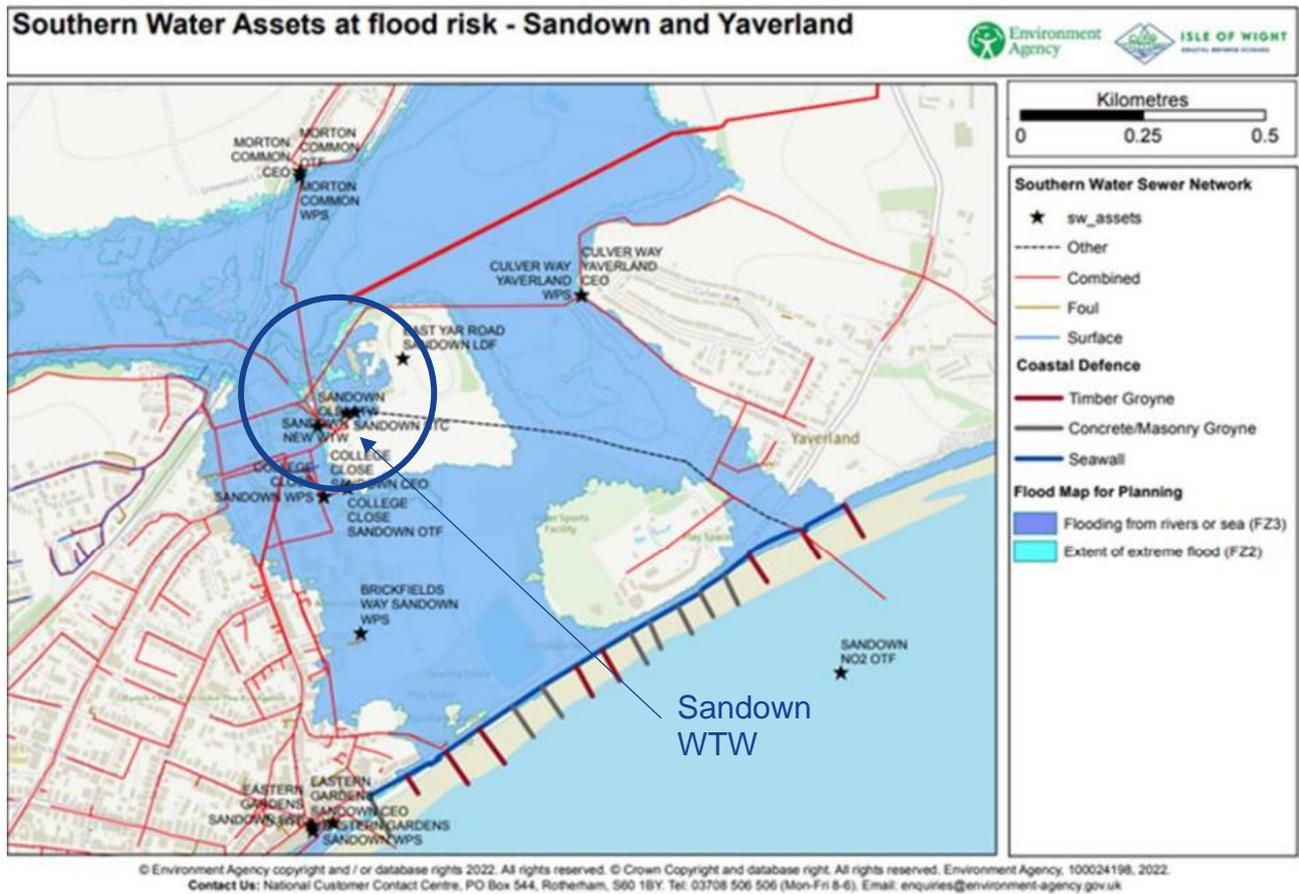
Enhancement Needs beyond AMP 8

There are two areas where we have identified investment needs for AMP 9.

1. **Eastbourne Wastewater Treatment Works** – the programme and investment for Eastbourne described above is for 20 years, so we will require the same level of annual contribution to the EA at £390k per year to AMP 11 to ensure the coastal defence which protects our Eastbourne WTW is reliable for the next 100 years (as part of an adaptable plan).
2. **Sandown Water Treatment Works** – the coastal defences currently reduce the risk of tidal flooding to Sandown Water Treatment Works which has 180,000 Population Equivalents. Current estimated investment required in AMP9 is £12m. The coastal defences need to be refurbished and repaired as there is a real risk of a significant breach in the future leading to rapid inundation of sea water into the Southern Water plant. [REDACTED] in a “do-nothing” scenario, The Environmental Agency predicts that the defence will fail by 2042³¹. We would therefore be looking to secure early transition funding in AMP9. The EA model results indicated that Sandown Water Treatment Works remains dry in the present day (2022 epoch) but is inundated by 2042 when failure of the frontage is estimated to occur. In addition, the model results suggest that during the 2042 0.5% AEP event, Sandown Water Treatment Works will be inundated with depths of approximately 0.1m. By 2082 flood depths are predicated to reach up to 0.5m at Sandown Water Treatment Works. It is anticipated that by 2121 Sandown Water Treatment Works could experience flood depths of over 2m. Whilst, the main flood risk to the water treatment works is from the Yaverland frontage, the defences at Embankment Road will also need to be repaired as flooding is also possible from this coastal frontage. Access to some of the Southern Water assets at Bembridge point may be made difficult if Embankment Road is submerged and Sandown Road is impassable at Yar Bridge. See Figure 14 below:

³¹ Southern water business case for contributions to the Yaverland coastal defence scheme and Embankment Road (Bembridge) coastal defence scheme (March 2023)

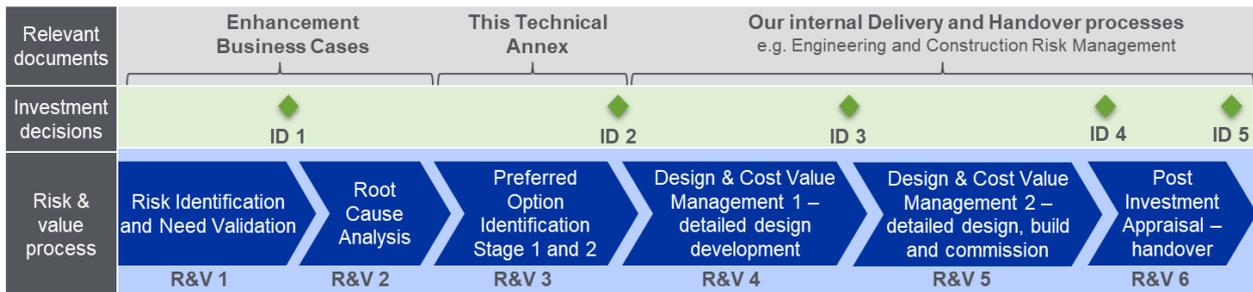
Figure 14: Southern Water Assets at risk – Sandown and Yaverland.



3. Best Option for Customers

To ensure best option for our customers, we have designed an end-to-end Risk and Value process for our investment planning. This optioneering process is governed by our Decision-Making Framework, which allows us to develop, compare and prioritise options and schemes across the PR24 wholesale programme on a common basis. This enables us to manage the process of optioneering from a scheme perspective as well from the viewpoint of the wholesale plan and how our various solutions work together. This process shown in Figure 15 is described in detail within our Enhancement Cost Technical Annex.

Figure 15: Overview of our Risk and Value process – our framework for decision making and investing in enhancements.



We have taken the options development for the investments at Portobello and Ventnor 2b schemes through our internal processes. For the investments at Ventnor 1, 2a, 2c and Eastbourne, we have tailored our process to enable us work with our partners who are delivering a broader programme level options development process to ensure the most cost-effective solution is selected.

3.1. For the investments at Portobello and Ventnor 2b

The Southern Water Optioneering process was applied as shown in Fig 17.0. Once the root cause is understood (as described in the Needs case section above), we developed a set of constrained options and assess these against defined criteria in our Decision-Making Framework (described in the Enhancement Cost Technical Annex).

3.1.1. Portobello Investment options considered

The risk at Portobello was registered in our ARM (Risk Management) system which led to the development of a Needs statement and the following options.

Table 3: Table of options and benefits – Portobello

Ref	Description	Benefit / Residual risk	Decision
1	Do Nothing Allow natural cliff erosion	<p>There is a high likelihood that this will lead to a pollution and bathing water incident. The natural capital and biodiversity impact would be significant as the beach will no longer be accessible by the public</p> <p>The cost of operating portobello is likely to increase. As shown in Figure 4, in 20 years the coastline will be further back, impacting the wall and site access and operation</p>	Considered
2	Do Minimum Local erosion management Allow cliff to fail but manage fall material into protection at cliff toe	<p>The natural capital and biodiversity impact would be significant as the beach will no longer be accessible by the public</p> <p>The cost of operating portobello is likely to increase. As shown in Figure 4, in 20 years the coastline will be further back, impacting the wall and site access and operation</p>	Considered
3	<p>Stabilisation of the chalk core and recasting of the Western and Eastern Groyne to ensure the sewer outfall within the Western groyne is protected and to maintain beach stability.</p> <p>Stabilisation and repair of the coastal defence wall (both the sea wall and the wave wall)</p> <p>Resurfacing and repair of the Promenade and other enabling works</p>	<p>Significantly reduces the risk of pollution and bathing water quality incident.</p> <p>Minimises the risk of a public safety incident.</p> <p>Protects the service provided to 280,000 customers.</p>	Adopted

The adopted Option 3 is the only option that will provide long term stabilisation of the chalk core and coastal defence wall whilst protecting service to 280,000 customers. Investment required £9.75m.

3.1.2. Ventnor 2b Investment options considered

The risk at Ventnor was registered in our ARM (Risk Management) system which led to the development of a Needs statement. The options to protect our site in Ventnor, particularly for Ventnor 2b investment are limited due to the ground movement.

Table 4: Table of options and benefits - Ventnor 2b

Ref	Description	Benefit / Residual risk	Decision
1	Do Nothing – continue carrying out reactive works on site as the ground continues to move due to ongoing lubrication of the slip	On the basis of the risks described in section 2, There is a high likelihood that this will lead to a pollution and bathing water incident. The natural capital and biodiversity impact would be significant as the beach will no longer be accessible by the public	Considered
2	The enhancement investment need in 2b is directly protecting our assets to reinforce the sewer network and make more resistant to ground movements.	This will extend the lifetime of the sewer network by 25 – 50 years and it will be delivered between 2028 and 2030. Avoiding high reactive costs in repairing the sewer; high-cost operational mitigation in providing a sewerage service whilst the system is repaired; potential for internal and external flooding; pollution to groundwater	Adopted

The adopted Option 2 to extend the lifetime of the sewer network and avoid high reactive costs. Investment required £4.1m.

3.2. For the investments at Ventnor 1, 2a, 2c and Eastbourne

We have worked with the EA to identify the needs and developed a Southern Water specific business case which outlines the impact to our sites and customers, benefits, and the potential consequence if the risk materialised.

The following options review and evaluation approach has been adopted where the technical, economic, and environmental considerations are made for each option. Each option is scored using the evaluation mechanism in Figure 16.

Figure 16: The parameters considered options evaluation for

		Technical				Economic		Environment			Conclusion				
Ref:	Option / Measure & Description	Risk Management	Technical Feasibility	Buildability	Service Life	Coastal Processes	Option Cost	Economic Suitability	Environment	Sustainability & Carbon	Health and Safety	Stakeholder/Broader Outcomes	Risks & Opportunities	Shortlisted	Reasoning

The evaluation scoping definitions developed by JBA consulting which has been applied.

Figure 17: Evaluation scoring applied to Ventnor and Eastbourne Investments

Evaluation Scoring

--ve	Unacceptable. Major Negative Impact. Does not achieve relevant minimum standard or results in unacceptable negative impacts
-ve	
0	Acceptable. Neither positive or negative impacts
+ve	
++ve	Preferable. Major Positive Impacts. Fully achieves the required standard or results in significant positive impacts

Please see in Appendix the EA letter of support.

3.2.1. Ventnor 1, 2a and 2c investment programme level options considered

The risk at Ventnor was registered in our ARM (Risk Management) system which led to the development of a Needs statement. We are working in collaboration with the EA who are leading on the options development of the programme, given the wider systemic risk and holistic solution that is required to protect our sites and assets owned by other organisations.

Table 5: Table of options and benefits – Ventnor 1, 2a and 2b

Ref	Description	Benefit / Residual risk	Decision
1	Do Minimum - Monitoring of asset condition - Patch repairs - Evacuate properties - Manage public H&S	<p>Technical: It does not address the main failure mechanisms identified. Risk of failure of the structures, coastal land loss, leading to increased erosion and landslip susceptibility.</p> <p>Economic: It will require regular ongoing monitoring and maintenance. Continued and rapid increase in damages associated with coastal erosion. Damages with increased climate change.</p> <p>Some temporary adverse impacts could be experienced during the periods of maintenance.</p> <p>Environmental impact Landscape: This option is unlikely to result in any permanent changes to the local landscape. Increased flood risk to people and property. Heritage: Maintenance unlikely to result in any permanent changes to the setting of any historic features within the study area. However, increased risk to assets over time with potential failure of structure. Ecology: Maintained protection of biodiversity. Potential for temporary adverse impacts due to disruption of designated habitat (South Wight Maritime SAC). Future coastal erosion may impact designated habitat. Increase in flood events may temporarily or permanently alter terrestrial and aquatic habitats and species abundance locally.</p>	Considered
2	Maintain - Maintain existing standard of protection of coastal defences through maintenance program	<p>Technical: It will require regular ongoing monitoring and maintenance.</p> <p>Economic: Capital: Low capital costs associated with repair and modification of defence to provide required standard of protection.</p> <p>Maintenance: Similar to existing</p> <p>Continued and rapid increase in damages associated with coastal erosion. Damages with increased climate change. A number of defences are beyond disrepair and maintenance costs would escalate with increased erosion rates.</p> <p>Environmental impact: same as option 1</p>	Considered

Ref	Description	Benefit / Residual risk	Decision
3	<p>Improve the coastal defences by replacing or enhancing all four sections of the coastal defences, improving the capacity of the defences to cope with the increasing coastal erosion risks (the sections are Ventnor Park - Western Cliff Eastern section, Central Ventnor - Eastern Cliffs Western section, Wheelers Bay- Eastern section and Wheelers Bay- Eastern Cliffs Eastern Section)</p> <p>Stabilise the landslip – working with the EA and other partners.</p>	<p>Technical: Improved resistance to coastal erosion up to 2100</p> <p>Economic: Eliminates high-cost reactive costs in repairing the sewer; high-cost operational mitigation in providing a sewerage service whilst the system is repaired.</p> <p>Environmental impact: Ventnor coastal protection reduces the risk of Category 1 pollution incidents to bathing waters</p>	Adopted

Whilst Option 3 has been adopted at a programme level, we are continuing to work with the EA to develop options for each element of the investment using the approach outlined in Figures 16 and 17. Investment required for Option 3 is £2.25m.

3.2.2 Eastbourne investment programme level options considered

The risk at Eastbourne was registered in our ARM (Risk Management) system which led to the development of a Needs statement. The options to protect our site in Eastbourne is described below:

Table 6: Table of options and benefits – Eastbourne

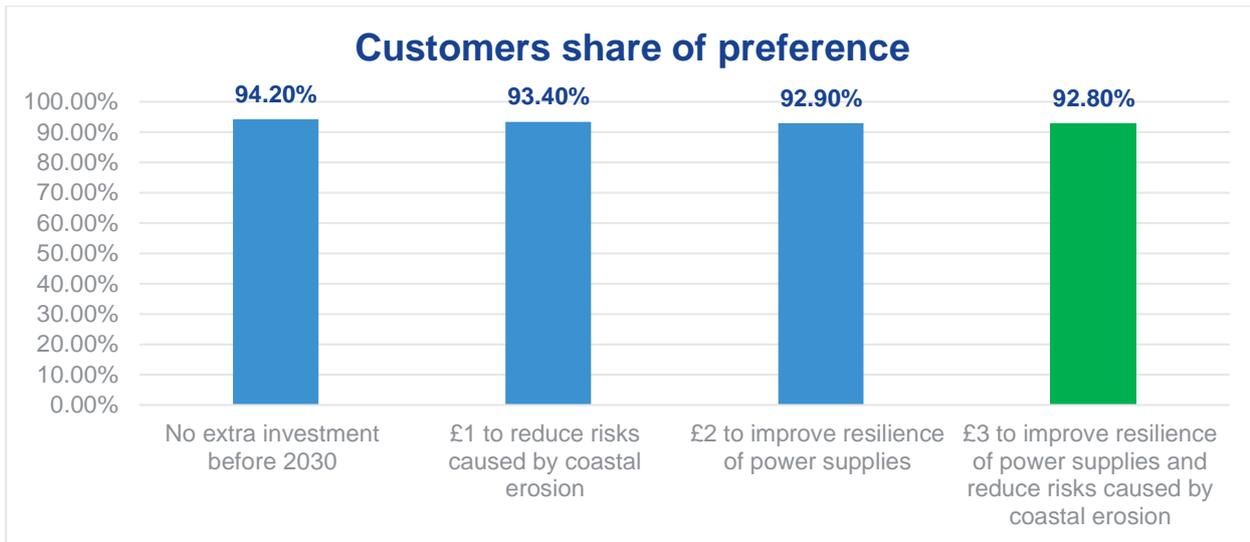
Ref	Description	Benefit / Residual risk	Decision
1	Do Nothing Allow coastal erosion and flooding	<p>Do Nothing Scenario' Modelling map in Figure 12 shows flood extent in 2025. A 'Do Nothing Scenario' means that we stop maintaining and managing the flood defences (our current beach management practices).</p> <p>In 2025 in a 'Do Nothing Scenario' significant chance of overtopping adjacent to works in any given year. Area behind works flooded from 1 breach would impact sewage network.</p> <p>In 2040 in a 'Do Nothing Scenario' significant risk of area of land flooded from multiple breach sites. This would cause significant flooding of sewage network. Flooding from overtopping adjacent to wastewater treatment works. Access to works impacted.</p>	Considered
2	Coastal Defence – Phase 1: Develop the coastal defence as part of the wider EA plan for Pevensey to Eastbourne Coastal Management Scheme	<p>Technical and Environmental: Eastbourne coastal protection reduces the risk of failing to treat flows to the required standard so affects both Final Effluent and DWF compliance; pollution to bathing waters; inability to deliver a sewerage service.</p> <p>Economic: the contribution to the EA scheme is significantly lower than current potential spend of about £3.5m per year (estimate based on current management costs)</p> <p>Economic: the contribution to the EA scheme is significantly lower than current potential spend of about £3.5m per year (estimate based on current management costs)</p>	Adopted

We have adopted Option 2 at a programme level, and we are continuing to work with the EA to develop the detailed options leading up to project start in 2027, however we do not expect our contributions to increase given the costs are based on EA's several years of experience of developing coastal management solutions. Investment required is £1.17m.

3.3. Customer support

Overall, our customers discussed funding resilience, most agreed that we need to invest in resilience in AMP8. The bill impact is low, and they acknowledged the importance of collaborative working, suggesting that coastal defences should not be our sole responsibility and given our work with the EA and Local Authorities, we are aligned.

Figure 18: Graph showing customer share of preference



Taken in the round, it is not surprising to see directionally higher share of preference for no extra investment in resilience before 2030, however, this feels like an area of ambition in which the more informed customers become, the more they believe that this work should be undertaken – particularly since the predicted bill impact is relatively low.

Overall, our customers are supportive of our investment in coastal flooding and erosion, during our customer engagement, about 93% our customers were willing to contribute between £1-3 to reducing power and coastal erosion risks depending on the options presented to them. Our customers who use coastal areas very often are more likely than others to support investment in storm overflows, resilience, and river water quality monitoring. 92.8% of our customers have recommended £3 to improve resilience of power supplies and reduce risks caused by coastal erosion. We have also seen 93.9% of our customers who struggle to pay their outgoings support this plan.³²

³² PR24 Environmental Ambition Prepared for Southern Water

4. Cost Efficiency

This chapter provides detail on how we have developed our options and the associated costs for our AMP 8 Coastal Erosion Resilience schemes by applying our standard Cost Estimation and Optioneering approaches to ensure they are based on robust cost-evidence and represent efficient delivery for our customers.

Whilst developing different schemes to increase the resilience of our key sites to coastal erosion we have applied our organisational optioneering process, which is governed by our Decision-Making Framework. This framework allows for a granular level of detailed optioneering and is aligned to our Risk and Value (R&V) process, which manages the full lifecycle delivery of a project. Information on how we've applied this Decision-Making Framework as part of our optioneering for each of the two types of Coastal Erosion Resilience Enhancement schemes are provided in the following section.

More information on the general approach to cost estimation and optioneering, which all the associated definitions is provided in [SRN15 Cost and Option Methodology Technical Annex](#).³³

As set out in the Technical Annex, we separate our capital expenditure into the following four categories:

- Direct Costs (or Net Direct Works)
- Indirect Costs
- Risk
- Corporate Overheads

Our organisational process builds up the full cost stack by applying cost multipliers for Indirect, Risk and Corporate Overhead cost categories onto the Direct Costs for each scheme. More information on the definitions and rationale for the criteria is provided in [SRN15 Cost and Option Methodology Technical Annex](#).

What cost multipliers have been applied for our Coastal Resilience Schemes?

Table 7 shows the overall Cost Multiplier for the two types of Coastal Resilience solutions we propose to deliver in AMP 8.

Table 7: Coastal Erosion Resilience Enhancement Scheme Cost Multiplier Breakdown

Scheme	Overall Cost Multiplier	Total AMP 8 Costs
Southern Water Delivered Coastal Erosion Schemes (Ventnor - The Grabben and Portobello Schemes)	2.05	£13.86m
EA Delivered Coastal Erosion Schemes (Ventnor and Eastbourne)	1.00	£3.42m

³³ [SRN15 Cost and Option Methodology Technical Annex](#)

For two of the schemes, we are providing direct financial contribution to schemes being planned and delivered by the Environment Agency. As such, these two schemes have no Project Related Cost multipliers attached.

The other two schemes, Ventnor – The Grabben and Portobello, are being delivered by ourselves and as such have gone through the cost estimation process described in the Technical Annex.

More information on how the overall cost multiplier and associated costs for our Southern Water delivered coastal erosion schemes is provided below.

Southern Water Coastal Erosion Resilience Schemes

Table 8 shows the breakdown of costs and Cost Category Multipliers for our Southern Water delivered Coastal Erosion Resilience Schemes solutions we propose to deliver in AMP 8.

Table 8: Southern Water Coastal Erosion Scheme Cost Multiplier Breakdown and Total Cost Contribution

Scheme	Direct Cost	Indirect Cost	Risk	Corporate Overhead	
Costs	£6.75m	£5.17m	£0.49m	£1.45m	£13.86m
Multiplier (%)	100.0%	76.5%	4.1%	11.7%	2.05

The Coastal Erosion resilience scheme's cost multipliers are based on the following criteria:

- The scheme involves delivery of **Non-Infrastructure** Projects
- The scheme is to be **'Traditionally Funded'**
- We have **high degrees of confidence in design maturity and medium degrees of confidence in scheme complexity** for the activity to be delivered at these sites.

Table 9: Southern Water Coastal Erosion Scheme Risk Cost Multiplier

Design Maturity	Complexity	Risk (%)
High	Medium	4.1%

The cost breakdown for each of the 2 sites is provided in Table 10.

Table 10: Site Specific Cost Breakdown – Southern Water Delivered Coastal Erosion Scheme Cost Breakdowns

Site	Direct	Indirect	Risk	Corporate Overhead	Total Cost
Ventnor (The Grabben)	£2.0m	£1.53m	£0.14m	£0.43m	£4.10m
Portobello WPS	£4.75m	£3.64m	£0.34m	£1.02m	£9.75m
Total	£6.75m	£5.17m	£0.49m	£1.45m	£13.86m

How we have approached developing options and estimating costs for our Coastal Resilience schemes

In developing our Coastal Resilience schemes, we have applied our general approach to optioneering and estimating costs within the wider PR24 planning process, where we have:

- identified the need to invest in our coastal resilience at sites through analysis of past events and future risks;
- engaged with our dedicated Engineering & Technical Solutions (ETS) team to develop a range of technically feasible options (Longlist) that enhance our resilience to coastal erosion;
- used our Cost Information Team (CIT) to estimate the costs of different options, before (Level 1 Optioneering and Cost Estimation); and
- refined designs and direct cost estimates (Level 2 Optioneering and Cost Estimation) and PRC multipliers as part of identifying our preferred solutions (Shortlist) to progress to deliver in AMP 8.

An example: how we applied this approach to our contributions to EA Coastal Erosion and Subsidence schemes:

- We have worked with the EA to understand the costs and how they have allocated the funds - the EA have been advised by DEFRA commercial to seek a minimum of 15% private contributions for the scheme.
- Our Engineering Technical Services Team (ETS) reviewed the contributions and based on our expert judgement both Eastbourne £390k per year and Ventnor 1, 2a, and 2c - £2.25m represents good value especially when compared to costs of repairing and replacing the asset in the event of a landslip, coastal erosion which leads to the Undercliff failing.
- We are able to manage delivery risk through the EA who (alongside their partners) are experts on the flood risk and coastal erosion management.

5. Customer Protection

About 60% (2.86m) of our customers in the region are served by assets within 100m of the coast. Within sea level rise (33.9cm by 2065, Source: EA), leading to increased storms and coastal erosion we are acting now to protect our customers from higher maintenance costs and repair in the near future.

With ongoing coastal erosion comes the increased risk of pollution and bathing water quality incidents – this is a major risk in all the areas and sites we want to invest in.

This investment does not pass the materiality threshold for a Price Control Deliverable. However, we have an ambitious and stretching target to reduce pollution incidents, this investment when considered in the round with our investments in Storm overflows will enable us deliver on our target by reducing the risk of undercliff failure and ground movements leading to pollution. These schemes will help improve the habitat and increase biodiversity and restore or maintain our beaches as safe environments for the community we serve.

6. Conclusion

Rising sea levels increases the risk of coastal flooding and erosion causing significant damages to our customers and assets on or near the coast. Between 1993 and 2010, the annual rate of rise was about 3mm a year, considerably more than the rate for the preceding century³⁴.

Our coastal sites require investment as a result of sea level rise leading to increased storms and coastal erosion which could result in pollution and bathing water quality incidents.

We have been working in partnership with the Environmental Agency and have identified seven areas and sites that require investment in AMP8 and beyond. We will continue to work collaboratively on these needs to ensure we deliver the best value for customers.

We have applied our Decision-Making Framework (DMF) and the Risk and Value processes as well as the EA optioneering process to identify the best options for customers at project and programme level.

The total investment required for AMP8 is £17.3m and we have identified a further £17.85m investment needed beyond AMP8 – we will continue to monitor and review the risks. Our investments for AMP8 represent a low regret investment that is aligned with our Long-Term Delivery Strategy (LTDS).

Our customers are supportive of our investment in coastal flooding and erosion, during our customer engagement, about two thirds of our customers were willing to contribute between £1-3 to reducing coastal erosion risks depending on the options presented to them.

This investment will provide protection to our customers reducing the risk of pollution, bathing water quality and public safety incidents.

³⁴ https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/climate/cop/sea_level_rise_final_v1.2.pdf

References

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- 2 Refer to Appendix A – Environment Agency letter of support
- 3 https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/climate/cop/sea_level_rise_final_v1.2.pdf
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- 18 Overview of proposal for Ventnor funding
- 19 Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme
- 20 Pevensey Bay to Eastbourne Coastal Management Scheme Southern Water Business Case
- 21 Southern water business case for contributions to the Yaverland coastal defence scheme and Embankment Road (Bembridge) coastal defence scheme
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- 23 Mott MacDonald | Portobello Groyne Sea Defence Cliff Stabilisation Options Report
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- 27 Ventnor Faultline Investigation report
- 28 Quarterly Journal of Engineering Geology and Hydrogeology Volume 43 Pages 447 – 460 - Landslide behaviour and climate change: predictable consequences for the Ventnor Undercliff, Isle of Wight (<https://www.lyellcollection.org/doi/10.1144/1470-9236/08-086>)
- 29 Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme
- 30 Southern Water Business Case for Contribution to the Ventnor Coastal Protection and Slope Stabilisation Scheme
- 31 Southern water business case for contributions to the Yaverland coastal defence scheme and Embankment Road (Bembridge) coastal defence scheme (March 2023)
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- 33 SRN15 Cost and Option Methodology Technical Annex
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Appendix

Environment Agency Letter

creating a better place
for people and wildlife



Southern Water
Southern House, Yeoman Road
Worthing
West Sussex
BN13 3NX

Our ref: EA PR24
Your ref:
Date: 14 Sep 2023

Attn: [REDACTED]

To Whom It May Concern

Southern Water PR24 Resilience bid

The climate crisis and associated increased risk of flooding and coastal erosion to Southern Water critical assets are real and together we need to act and plan accordingly.

Over the past two years the Environment Agency has worked closely with Southern Water to help prepare a resilience bid for their PR24 Business Case. We have identified together three major flood and erosion risk management schemes which will reduce the risk to critical Southern Water assets. If these were to fail the consequences would be catastrophic bringing misery to customers and high pollution risk to the environment.

The three schemes identified are Ventnor (Isle of Wight), Yaverland (Isle of Wight) and Pevensey to Eastbourne (East Sussex). These schemes will reduce flooding and coastal risk to over 13,200 homes but it will also reduce the risk to key Southern Water assets such as waste water treatment works and major pipelines which are critical to the conveyance and treatment of wastewater for a population of circa 300,000. The schemes will also bring other social and economic benefits, protecting businesses, railway lines, roads, heritage sites and conservation areas, playing a key role in the regeneration of the coastal communities.

Combining financial contributions from Southern Water with Flood and Coastal Erosion Risk Management Grant in Aid will show an efficient delivery to both organisation's services, unlocking these opportunities. It will enable costs to be

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shared to deliver joint outcomes and give value for money for water bill payers, ensuring infrastructure is resilient to flooding and coastal change.

The identified schemes are programmed for construction from 2025, requiring financial contributions to be made between 2025 to 2030. In line with DEFRA guidelines, we are working with other key infrastructure providers to secure contributions for these critical asset improvements.

This local initiative reflects the strategic commitments in Ofwat's strategy 'Time to Act, Together', and the Environment Agency's 'National Flood and Coastal Erosion Risk Management Strategy for England' and will be a major step for the two organisations, working in partnership to ensure our communities are resilient to the challenges we face in the coming decades.

Yours faithfully



Environment Agency, Guildbourne House, Chatsworth Road, Worthing, West Sussex, BN11 1LD.

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