SRN49 Resilience - Power Enhancement Business Case

2nd October 2023
Version 1.0

from Southern Water

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Executive Summary

This business case details our plan to invest £31.7m at 30 of our most critical water and wastewater sites to enhance our resilience to power supply interruptions.

We are proposing to deliver two types of power resilience schemes during AMP 8. These schemes will:

- increase the level of redundancy, reliability, and resistance in our power infrastructure, to enable us to deliver our critical services in the event of wider power supply interruptions; and
- support us to mitigate the impacts of power supply interruptions caused by more frequent and severe extreme weather events, an increasing risk due to the impacts of Climate Change; and
- provide a suitable level of redundancy to mitigate the potential impact of future changes in the electricity networks caused by geopolitical energy security challenges and decarbonisation.

Needs Case for Enhancement

Extreme weather events are becoming increasingly frequent due to climate change. These storms have resulted interruptions in our power supplies from the distribution network operator (DNO), which has then resulted in asset downtime that has disabled our operations and caused poor customer and environmental impacts across our water and wastewater networks.

As a water company, to limit the environmental impact from the problems caused by these extreme weather events and the impact they can have on our DNO power supply to our sites, it is critical to improve the asset base and continue to strengthen our preparedness processes.

Additionally, we are experiencing changes in the energy system, through incorporation of more renewable energy sources and political energy security considerations. These changes are increasing the level of risks we are exposed to.

These two causal factors indicate the importance of this investment, to address the immediate short-term need at the sites we are proposing, and to future-proof our operations against the increasing risks to reliable mains power supplies.

Best Option for Customers

Four groups of investment areas were considered across a longlist of 96 prioritised water and wastewater sites.

1. River Stour Catchment and Eastbourne WTW Power Resilience Scheme
2. Fixed Standby Generator Enhancement Scheme
3. HV Ring Enhancement Schemes
4. Dual Transformer Enhancement Scheme

We are proposing to deliver two types of solution during AMP 8:

- Enhancing 10 selected critical wastewater sites to improve their reliability; and
- Install fixed standby generators at 9 high-risk water and 11 high-risk wastewater sites to enhance their redundancy to impacts following power supply interruptions.

The investment across our 30 water and wastewater sites require a total £31.7m which will deliver a wider benefit of £9.05m in environmental and social value over a five-year period of the installed asset.

Our customer engagement activity to understand customer's priorities for environmental ambition, Resilience was ranked 3rd in priority, behind Sewer Infiltration and Storm Overflows.

Our extensive customer engagement activity shows us that:

- Informed customers would be willing to fund £3 per bill per annum on schemes to enhance Power and Coastal Erosion resilience
  - with £2 per bill per annum for Power Resilience receiving 'Stronger support'.
- Schemes to resolve power issues are considered low risk, as solutions appear to be tangible and relatively easy to implement
- Customers support proactive and preventative investment in power related equipment, given the potential impact of non-action.

Cost Efficiency

As part of developing our Power Resilience schemes, we have applied our general approach to estimating costs within the wider PR24 planning process, where we have:

- identified the need to invest in our power 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 that enhance our resilience to power supply interruptions
- used our Cost Intelligence Team (CIT) to estimate the costs of different options, before (Level 1 Optioneering and Cost Estimation)
- refining designs and cost estimates (Level 2 Optioneering and Cost Estimation) as part of identifying our preferred solutions to progress to deliver.

For our proposed Power Resilience solutions, we have completed Level 1 and Level 2 solution optioneering and cost estimation. This Level 2 process has taken into account the updated direct costs following more granular understanding of the numbers of each type of new asset that will be required to deliver the solution; as well as updated indirect cost, corporate overhead and risk multipliers based on updated estimates on confidence in design and capability.

Customer Protection

We understand that this is a significant investment for our customers, and we need to provide appropriate confidence in delivery of the proposed enhancements to protect them from unjustified costs or non-delivery of the schemes we have identified.

There are several reasons why it is difficult to specifically identify the Performance Commitment (PC) impact the collective of these schemes will have, these are outline below:

1. the scale of our network (several thousand sites) relative to the volume of sites (30) identified for power resilience enhancement as part of this enhancement case
2. the increase in frequency and intensity of extreme weather events could accelerate the impact on our other sites which have been deferred from AMP 8 based on the information we have available (as per section 2.4)
3. the various number of causes for a pollution, or supply interruption, event could offset the benefits delivered in power resilience across our wider network

However, these schemes have been considered in the round of PC targets for the PR24 submission.

We expect to see a material impact to the reduced variability of performance at these sites specifically throughout all weather conditions across the following areas:

- reduced unmitigated power interruptions which impact asset operations
- reduced pollution events
- reduced customer supply interruptions

Summary of Enhancement Case	
Name of Enhancement Case	Power Resilience Enhancement Business Case
Summary of Case	Business case to enhance resilience of critical water and wastewater sites to the impact of power supply interruptions due to increasing risks from: ▪ extreme weather events (storms) that are increasing in frequency and severity due to climate change; and ▪ changes in the energy system associated with decarbonisation and energy security considerations. The investment will be used to: ▪ enhance 10 highly critical wastewater sites near environmentally sensitive areas to improve their reliability and prevent pollution incidents; and ▪ install fixed standby generators at 9 water and 11 wastewater sites to build additional redundancy into our water and wastewater systems in the event of mains power interruptions. The investment has been prioritised to address sites where we are currently experiencing poor operational performance, with solutions that can be delivered quickly to address this immediate need, whilst also supporting future investment need.
Expected Benefits	The primary benefits of this investment are expected to be: ▪ Reduction in the number of pollution incidents ▪ Reduction in the number of customer supply interruptions as a result of power supply interruptions Secondary benefits include: ▪ Reduction in the volume of storm overflows
Associated Price Control	AMP 8
Enhancement TOTEX	£31.70m
Enhancement OPEX	N/A
Enhancement CAPEX	£31.70m
Is this enhancement proposed for a direct procurement for customer (DPC)?	No - DPC has not been proposed for this enhancement case as the Capex investment is less than £200m, so it does not pass the materiality threshold for DPC.

1. Introduction and Background

Improving resilience to pollution and water supply interruptions by enhancing our power infrastructure.

We are committed to safeguarding resources and making sure our customers have access to a supply of high-quality water and access to good wastewater services now and into the future. To deliver on that commitment, we need our sites to be resilient to the threat of power interruptions to the national transmission and local distribution networks. We are highly dependent on these networks and need to ensure service interruptions are minimised and our customers and the environment are not impacted negatively in the event of a power outage that we cannot control. We actively work with the network operators through the Local Resilience Forums (LRF) and regularly review potential resilience risks that may impact our customers and the environment and identify solutions that mitigate the risks.

We are experiencing an increase in climate risks and policy changes to support the net-zero transition plan.

As a business, we are facing unprecedented threats to our power supply. (1) Climate Change is driving the increasing frequency of extreme weather events, such as severe storms. Severe storms can impact our power supplies through extreme wind speeds toppling overhead lines or lead to trees falling onto those lines. Additionally, extreme temperatures can impact on overhead line cable's ability to carry power, due to transmission lines swelling from excessive heat. (2) At the same time, there are significant changes in the approach from the Transmission and DNOs nationally, all of which reduces confidence in the likelihood of uninterrupted power supply. The drive to decarbonise our electricity system will create increased uncertainty over continuous power supply as more variable forms of electricity generation are brought into the energy system. Similarly, increased geopolitical tension, such as the conflict between Russia and Ukraine, is impacting the availability of natural resources, such as oil and natural gas, and consequently, may lead to further impacts in electricity supply. There are also increasing concerns over the constraints for the DNOs to reinforce their networks and install sufficient capacity at speed to meet our requirements.

The potential impacts on our operations associated with these two factors is outside of our direct control, and as such it is critical that we invest in enhancing and adding additional resilience and redundancy in our Power Infrastructure to reduce the number of single points of failure and give ourselves more redundancy in our power systems to increase the amount of control we have over our operations.

These external factors are compounding the increasing risk of power supply interruptions. Additionally, the current asset configuration is not equipped to mitigate against these new risks, which leads to an increased risk of customer supply interruptions, pollution events and storm overflows. For example, across February 2022, the UK suffered eleven days of the largest storm events the UK has seen in 35 years. This included Storm Eunice, which resulted in over 43,000 power alarms across c. 550 of our sites caused by power supply interruptions across our network. Electrical distribution networks were also heavily impacted and, in our region, over 70,000 customers and business remained without mains connected power 2 days after the Storm. We have seen an increasing number of these extreme weather events in the past 5 years and we need to protect our customers and the environment from the potential consequences.

We have been taking steps to improve the resilience of our power infrastructure.

As part of our Pollution Incident Reductions Programme (PIRP), which started in 2020, we analysed our 2018 and 2019 pollutions data and using 'Causal Analysis based on System Theory' (CAST)[1] looked for the root-cause of pollution across our network. Our analysis identified that the reliability of electrical equipment at our Wastewater Pumping Stations was an area needing further investigation against the risks of 'brownouts' (temporary reduction in power quality, such as voltage or frequency, that causes lights to dim and other electrical appliances to malfunction or shut down) and 'blackouts' (a complete loss of electrical power supply), that can cause pumps to stop working, as well as other ancillary plant to stop[2], and result in Pollution incidents.

Related to our power infrastructure and extreme weather events, As stated in our PIRP 2023[3] document, in 2022 we delivered the schemes relating to Power Resilience:

- **WPS Platinum Health Checks and Remedials** – surveys carried out at our 280 **highest** risk WPS sites. Risk criteria based on sites repeat historical pollution incidents over the last 3 years. Remedial work is underway at the highest priority 55 WPS sites, which will continue into 2023.
- **The Wastewater Pumping Station Black Start programme –** Completion of our Black Start programme for WPS sites, with ongoing work now forming part of our daily maintenance activities. The programme has increased our ability to recover after a blackout and restart the pumps on site.
- **Storm Readiness improvements –** We have strengthened our systems and processes related to preparing for storm weather events. This has included the following activities to address the risk of rolling blackouts:
  - Developing and implementing seasonal readiness plans,
  - Ensuring there is close cooperation and liaison between ourselves, SSE and UKPN for planning and blackout notifications,
  - Creating a risk visualisation model to identify wastewater sites which are at risk of spilling during a given blackout event, enabling more robust incident and resource planning,
  - Engaging with our supply chain increasing the in-house mobile generation resources and providing greater site coverage,
  - Creating of a blackout cross functional team to assist planning and coordination between Operations and supply chain.

As part of developing our PIRP plan for 2023[4], we analysed the root causes of the 358 Category 1-3 pollutions during 2022 and found that 25% were caused by electrical faults at WTWs and WPSs. This was down from 31% as a proportion of pollution incidents in 2021.

[1] Causal Analysis based on System Theory (CAST) is an accident analysis technique that maximizes learning from accidents and incidents. The goal of analysis is to identify the limitations of the safety control structure that allowed the loss and identify how to strengthen the structure in the future.

[2] Telemetry assets are protected with temporary battery back up

[3] Effectiveness of Previous Interventions - : pirp-july-2023.pdf (southernwater.co.uk)

[4] pirp-july-2023.pdf (southernwater.co.uk)

Learning from 2022 and previous years, we have selected three additional areas of work for 2023 to focus on our power infrastructure and WPS sites. These areas aim to build resilience in wet weather and storm conditions with an emphasis on power resilience improvements, they cover the use of generator alarms, the installation of auto reset systems, maximising intelligence from Platinum Health Check surveys.

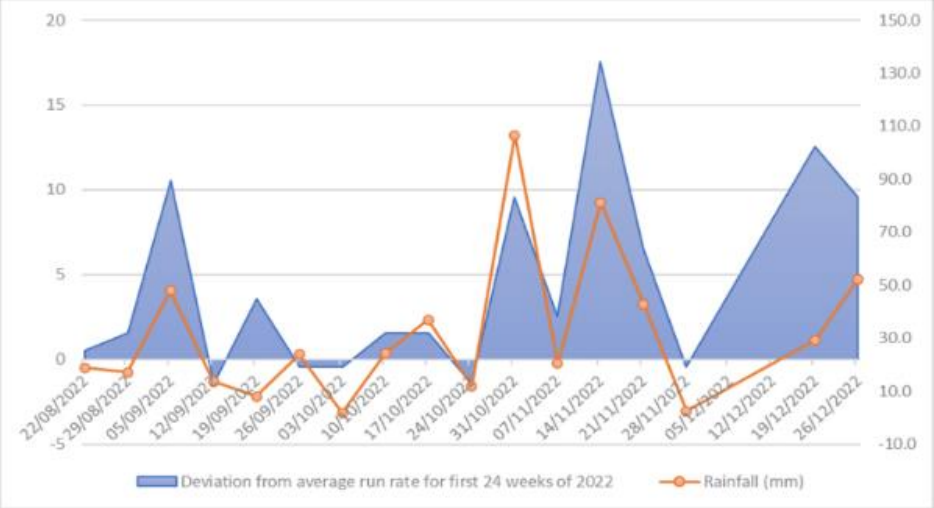
Our PIRP 2023 plan includes the following schemes:

- **Wastewater Pumping Station Resilience** – Building on the WPS Platinum Health Checks and Remedials we will deliver a sprint style initiative on the next top 60 risk WPS sites using our in-house M&E (mechanical and electrical) experts.
- **Generator Alarm Upgrades** - Feeding into existing weather readiness processes, we will upgrade selected sites to make sure there is full visibility of generators and their operational status in the control room. The root cause analysis identified a weakness in our generator assets, with 23 pollutions including those from Storm Eunice, occurring due to generator failure.
- **Installation of Auto Reset Systems -** Upgrade to 47 sites identified following Storm Eunice where we will install and commission an auto reset system and an upgraded telemetry unit, if required.

When delivered, these schemes are anticipated to result in a benefit of a reduction of between 58-108 in Cat 1-3 pollution incidents.

Figure 1 shows the links between storm conditions and pollution incidents, and we have built a variety of additional plans into our 2023 PIRP. In fact, we have calculated that 79% of the benefits from the 2023 PIRP will directly contribute to improving resilience in weather events, with 70% of the PIRP 2023 benefits from these projects expected by the end of October 2023.

Figure 1 - Link between Rainfall and Pollution Events



Our investments in AMP7 have focused on our response and recovery capability, through delivering a number of inspection and remedial improvement programmes on our power infrastructure assets to minimise the impact of any event on our customers. This investment will build on what we have done in previous AMPs and enable us tackle the resilience risks that are out of management control, ensuring that there is sufficient redundancy in our system for critical sites that are functioning beyond their original design parameters.

More information on our work from AMP 7 and wider AMP 8 plans to improve our Operational Resilience is available in SRN48 Operational Resilience Technical Annex

Our customers want us to continue to do everything in our control to ensure our assets are able to operate through these disruptions by investing in our power infrastructure to minimise the risk of events which impact them; such as reducing the frequency of pollution incidents and customer supply interruptions caused by any interruptions to the power supplies at our critical wastewater treatment works, wastewater pumping stations, water supply works, water booster stations and water service reservoirs. Customer feedback sessions revealed that power is seen as the area of resilience customers saw most benefit. The impact of assets not being operational, due to any form of power supply interruption, was seen as a critical area for investment to secure against supply interruption and pollution events.

We now need additional investment to increase the level of power resilience in a storm event and to reduce our single points of failure so we can adequately support the transition arrangements.

In response to these challenges, we have carried out a power resilience assessment across our asset base and identified two types of solutions to address the risks described, protect our customers and the environment. We want to invest in 30 sites across our water and wastewater sites and require a total £31.66m which will deliver a wider benefit of £9.05m in environmental and social value over the next AMP. Additionally, we have built power resilience assumptions into our Water Resources Management Plan (WRMP) and our Drainage and Wastewater Management Plan (DWMP) to secure the long-term ambition of having a resilient power supply for our assets.

This enhancement business case is focussed on delivering two types of schemes.

1. Enhancing the existing Power Infrastructure at 10 of our most vulnerable Wastewater sites in River Stour Catchment in North Kent and Eastbourne WTW, after receiving Regulation 26 and 27 enforcement orders from Defra
2. Installing Fixed Standby Diesel Generators at 20 of our critical water and wastewater sites identified as single points of failure across our region.

These schemes provide good value for money for the additional level of protection they offer across our network and will help us provide better services for our customers.

Links to data table lines		
Enhancement	Table	Line
Resilience; enhancement wastewater capex, opex and totex	CWW3	168

2. Needs Case for Enhancement

Overview of the need to enhance our assets to increase our Operational Resilience to Power Supply Interruptions

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 data[5] 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-2030s and a possibility it increases to 4°C if we do not take appropriate measures by 2100. The UK Meteorological Office climate change projections update (UKCP18) sets out that the UK climate will continue to be characterised by warmer, wetter winters and hotter, drier summers, with these will be accompanied by an increase in the frequency and magnitude of extreme weather events.

Specifically, we have identified two drivers for resilience enhancement needs. External changes to the Electricity Networks and the frequency and severity of extreme weather events. We will discuss this in detail over the sub-sections within this chapter and how we have integrated lessons learnt from storm events with our forward-looking analysis to develop a system level programme to improve our resilience to power interruptions.

Extreme weather events are becoming increasingly frequent due to climate change. As a water company, to limit the environmental impact from the problems this causes, it is critical to improve the asset base and continue to strengthen our preparedness processes.

2.1. External changes to the Electricity Networks

There are three significant challenges being faced and changes being implemented by the Transmission and DNOs that has the potential to impact the continuous supply of Power to our sites.

- Decarbonisation of electricity – incorporation of more variable renewable energy sources
- Political energy security considerations - the availability of gas resources to continue to match supply and demand in the current energy system; and
- Local network capacity constrains – significant delays to upgrade electrical networks to incorporate additional capacity

The UK's energy mix is changing, which brings additional risks for the potential for power blackouts and enforced outages caused by political instability affecting traditional thermal electricity generation and the increasing penetration of variable renewable energy sources being integrated into the electricity networks. We have already experienced external changes to Triad mitigation planning, and through the decarbonisation policies, anticipate power companies may request us to temporarily reduce demand on the grid during overcast and windless winter days.

[5] SPM_version_report_LR

Our regulators recognise the fragility of the long-term national energy supply. As mitigation, DEFRA have held discussions with DESNZ (Department for Energy Security and Net Zero) on the ESEC (Energy Supply and Emergency Code) process for priority reconnection of sites after a rolling power outage. As of August 2023, the priority service list (PSL) for the water industry has only **128 sites** registered. This shows the regulators expectation that there will be rolling power outages impacting the water sector in the future. As further mitigation, Defra has asked Southern Water to look at the resilience of key strategic sites in "a *scenario of a complete loss of power to your whole company affecting all elements of the water treatment process which will last for a minimum of 24 hours*"[6]. They've made the request on the back of "*energy disruption experienced last year during storms Arwen and Eunice and against the backdrop of rising energy prices*". These communications outline the need to prepare for the possibility of power interruptions and comply to regulatory strategy.

There are currently significant constraints on the timelines for upgrading electrical networks, to allow additional capacity to be built in, which limits the number of feasible options we can consider to ensure our sites are suitably resilient to power interruptions, so they can operate as intended.

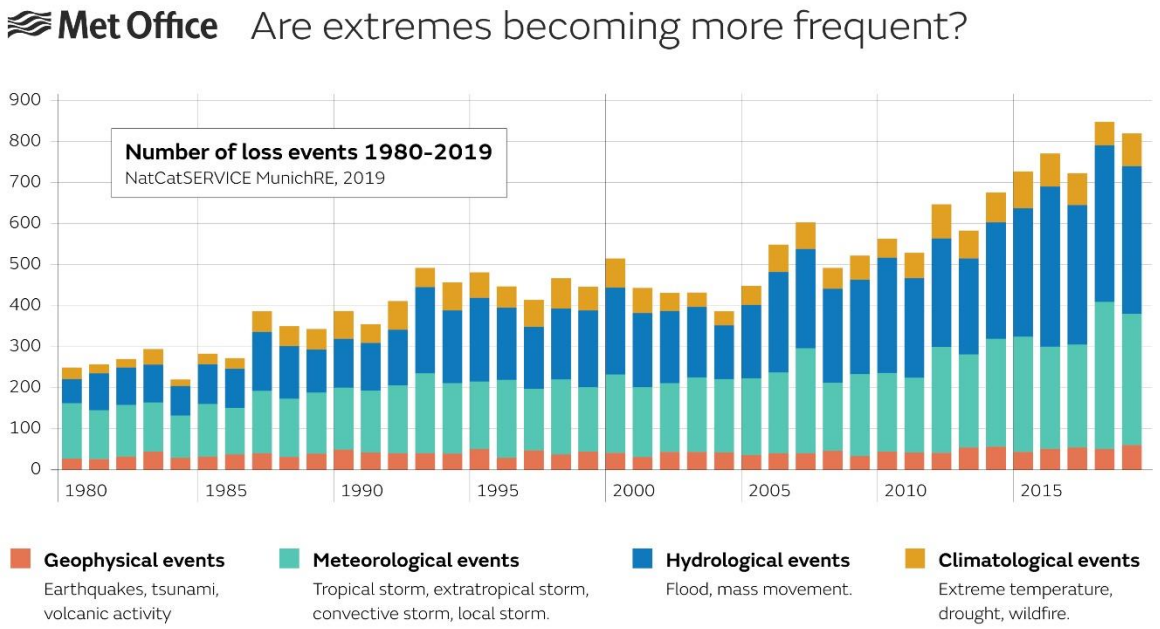
These challenges introduce higher risk of there being instances where national and local electricity generation is unable to meet the demand, leading to the potential for forced and unforced interruptions to power supply.

[6] Letter from Defra Head of Flooding and Water Emergencies – full copy in Appendix E

2.2. Frequency and severity of extreme weather events

Extreme weather events are becoming more common and more difficult to predict. The severity of these events mean that they often lead to losses due to increasing population, increasing infrastructure and the natural variability of the climate. According to the Met Office, the frequency of some extreme events has changed, particularly there is evidence that increasing sea temperatures increase the intensity of storms[7]. Over the past 5 years we have been impacted by 33 named storms, which has resulted in disruption to a significant number of customers water supply and 414 pollution events.

Figure 2: Increasing number of extreme weather events from 1980 to 2019



Our experience and data indicate clearly that extreme weather events have impacted the power infrastructure we rely on and led to interruptions to the main power supply. Extreme weather, such as severe storms can impact our power supplies through extreme wind causing trees and debris to impact on overhead transmission cables and pylons. Aside from this debris potentially severing the Overhead transmission line, an added risk comes from these lines normally being bare (uninsulated) and if an object gets too close, it is possible that a 'flashover' can occur, where electricity will jump over a distance to reach earth via the object. Additionally, extreme temperatures can impact on overhead line cable's ability to carry power, due to transmission lines swelling from excessive heat. For assets where we do not operate an auxiliary power supply, this can result in our assets Booster Stations and Service Reservoirs being unable to provide safe drinking water for our customers and our Pumping Stations and Waste Treatment Works being unable to transport Waste through our network resulting in Pollution events and discharges to watercourses and the sea.

[7] Met Office Extreme Weather Events and Climate

2.2.1. Our experience of previous extreme weather events – a case study

We have been actively learning from previous extreme weather events, such as Storm Arwen and the Storms of February 2022 (including Storm Eunice), which have caused power supply interruptions to affect our operations.

The UK Government ***'Storm Arwen review: final report'*** identified the water sector ***"experienced impacts due to electricity disruption during Storm Arwen where sites lacked back-up electricity supplies."***[8]

Throughout February 2022, the UK suffered eleven days of the largest storm events the UK has seen in 35 years through three major storms in quick succession, causing widespread damage and disruption across the country. These included: **Storm Dudley – 16th February**, **Storm Eunice – 18th February** and **Storm Franklin – 21st February**.

Across our region our two DNOs (UKPN and SSEN) suffered significant disruption caused by the extreme weather.

- UKPN suffered a month's worth of faults in a single day across 1,800 locations, resulting in damage to 46,000km of overhead power lines. [9]
- SSEN were impacted by over 1,000 points of damage across their network, the equivalent of 6 months typical overhead line faults. [10]

Due to the succession of storm events, over 70,000 customers and businesses across Southern England remained without power two days after Storm Eunice.

For our operations, during the storm events of February 2022, we suffered significant asset downtime across our wastewater network as a result of the widespread network power disruption issues. Across the 11 days of storm events, more than 550 of our sites had periods of time without power and we had over 43,000 asset alarms triggered.

Table 1: Summary of impact from Storm Eunice

Asset Type	Total No. Sites Impacted by loss of Mains Power	No. Sites with continued Asset Downtime	Asset Downtime
Wastewater Treatment Works	131	67	23,817
Wastewater Pumping Station	365	79	5,485

During these events we had 387 fixed on-site generators operating across our network to provide power supply to our sites. In addition, we deployed 47 mobile generators and utilised 42 generators from our supply chain.

[8] Storm Arwen review: final report (publishing.service.gov.uk)
[9] Engineers work to restore power after Storm Eunice hit the South East | UK Power Networks
[10] Looking back at Storm Eunice - SSEN

2.2.2. Lessons Learnt from these storm events

One of the crucial findings from reviewing our response was that the availability of securing temporary standby generators from the supply chain was limited due to demand from other utilities and private enterprises.

Over the past 5 years, the UK has been impacted by 33 'Named' storms. The criteria used for naming storms is based on the Met Office's 'National Severe Weather Warnings service'. This is based on a combination of both the impact the weather may have, and the likelihood of those impacts occurring. A storm will be named when it has the potential to cause an amber or red warning.

Table 2: UK Names Storms[11]

Year	Number of Named Storms	Storm Names
2018-19	8	Ali, Bronagh, Callum, Deirdre, Erik, Freya, Gareth, Hannah
2019-20	7	Atiyah, Brendan, Ciara, Dennis, Jorge, Ellen, Francis
2020-21	7	Alex, Baranara, Aiden, Bella, Cristoph, Darcy, Evert
2021-22	7	Arwen, Barra, Malik, Corrie, Dudley, Eunice, Franklin
2022-23	4	Otto, Noa, Antoni, Betty
Total	33	

As previously highlighted through the UK Met Office climate change projections update (UKCP18), it is widely accepted that the frequency and magnitude of extreme weather events will continue to increase. These same projections have been used in Ofwat's common reference scenarios for climate change and are the basis for the Ofwat selected Representative Concentration Pathways (RCPs) 2.6 and 8.5[12]. Under these scenarios, extreme weather events are expected to increase in frequency, and we consider our proposals here as a demonstration of our intention to invest in the right long-term solutions, collaborate and work with nature to deliver better outcomes, enhance our resilience and protect and improve the environment.

The need to undertake enhancements of our critical sites is further supported by National Security Strategy (NSS) to improve the resilience of critical infrastructure. The cabinet office's "Keeping the Country Running: Natural Hazards & Infrastructure"[13] documents UK governments desire to encourage an 'ability in organisations and their infrastructure networks and systems to absorb shocks and recover; and enabling an effective local and national response to emergencies'.

Learning the lessons from these Storm events has shown us the strategic importance of building redundancy, resistance and reliability into the power systems at our critical sites to enable us to continue to provide our essential services to customers and protect the environment during significant storm events where our DNOs suffer power outages.

[11] UK Storm Centre – Meteorological Office
[12] PR24 and beyond: Long-term delivery strategies and common reference scenarios – Section 3.2.1 Climate Change
[13] Cabinet Office "Keeping the Country Running: Natural Hazards and Infrastructure"

Thorough our monitoring and continuous improvement activities, learning from our past experiences we have identified the need to enhance our power infrastructure across our water and wastewater network.

2.3. AMP 8 Enhancement Needs

2.3.1. Integrating our learnings with our forward-looking analysis

The increasing severity of extreme storm events exceeds the original design requirements of these sites, and as such we must enhance them as part of future-proofing our operations. We have learned lessons from historical events and our response, these lessons have been integrated with our forward-looking risk analysis. As a result of that, we have identified single point of failure risks and an increasing likelihood of water supply interruptions due to loss of power supply from the DNO. Our analysis indicates that 21 Wastewater sites and 9 Water sites should be prioritised for resilience enhancement investment during AMP 8.

These enhancements take the form of two types of schemes:

- **Installing fixed standby generators** at a number of our highest priority water and wastewater sites to provide contingency power during DNO supply interruptions and extreme weather events; and
- **Enhancing our power systems and assets at 10 high-priority wastewater sites** in the River Stour Catchment in North Kent and Eastbourne WTW to mitigate and prevent the negative environmental impacts caused by power supply interruptions that disable our assets and interrupt our operations.

Given the continued steady increase in external risk, we predict our operations will be impacted in AMP 8 and beyond without mitigation. We believe these investments are enhancements and not suitable to be covered by base maintenance investments as our critical sites are being impacted by changes in the current operating environment compared to their original designs.

2.3.2. Our systems approach to resolving power interruption challenges

To mitigate the increasing risks of power supply interruptions and ensure we invest appropriately and in a timely manner, we have carried out risk and resilience assessments across our network to identify our highest-risk sites, develop a number of solutions and prioritise investment.

We have applied our maturing Systems-based approach to identifying the need for Operational Resilience enhancements as shown in Figure 2. Our practical approach draws from the integrated resilience framework to define a cost-effective strategy to addressing our challenges whilst maximising the beneficial impact for our customers and wider environment. Our approach describes a roadmap to ensuring we are compounding the benefits we are already delivering from our ‘quick win’ solutions whilst considering the impact of future pressures on our operations to identify sustainable solutions. In the current AMP, we have taken steps to invest in our Response and Recovery capability (details can be found in the Technical Annex), going forward we need to invest in better resistance, reliability, and redundancy solutions.

To support that, we have identified some common risks and established a ‘Black Start Planning Programme’ to take a deep dive and better understand the vulnerability of our sites and networks to Blackout Power supply interruptions. The programme is designed to identify weaknesses in our current sites, assets and systems and opportunities to reduce our dependency on power being supplied from the DNOs to help prioritise our investment for AMP 8 and deliver better, more reliable services for our customers.

Scope of 'Black Start Programme'

Region	Number of Sites
Sussex	15
Kent	36
Hampshire	35
Isle of Wight	10

How we are measuring the success of resilience enhancements

Delivering our proposed power enhancement schemes align with and will contribute to our core commitments of:

- Reducing number of pollution events
- Reduce the number of supply interruptions our customers face

Specifically, success for our enhancement schemes will be identified by their impact on following outcomes:

- Primary outcome:
  - We expect to see a significant reduction in the number of times our assets trigger a 'No Power' alarm and fail to automatically reset at these investment sites
- Secondary outcomes:
  - Reduced number of supply incidents caused by Booster Station and Service Reservoir power faults
  - Reduced number of pollution incidents caused by Pumping Station and Wastewater Treatment Works power faults.

This aligns well with our priorities and commitments in our 'Turnaround Plan 2023-23'. Improvements in power resilience at our Wastewater sites will help us deliver 'Healthy rivers and seas' through building resilience at our Wastewater treatment works and ensuring our pumping stations continue to operate effectively as our climate changes. In addition, improvements in power resilience at our Water sites will help us 'Improve the reliability of our water supply' to customers and align to our published organisational objectives[14].

[14] 'A reliable supply of water for our customers' is the first stated objective within 'Our Plans' and demonstrates our commitment to invest in the right long-term solutions, collaborate and work with nature to deliver better outcomes, enhance our resilience and protect and improve the environment

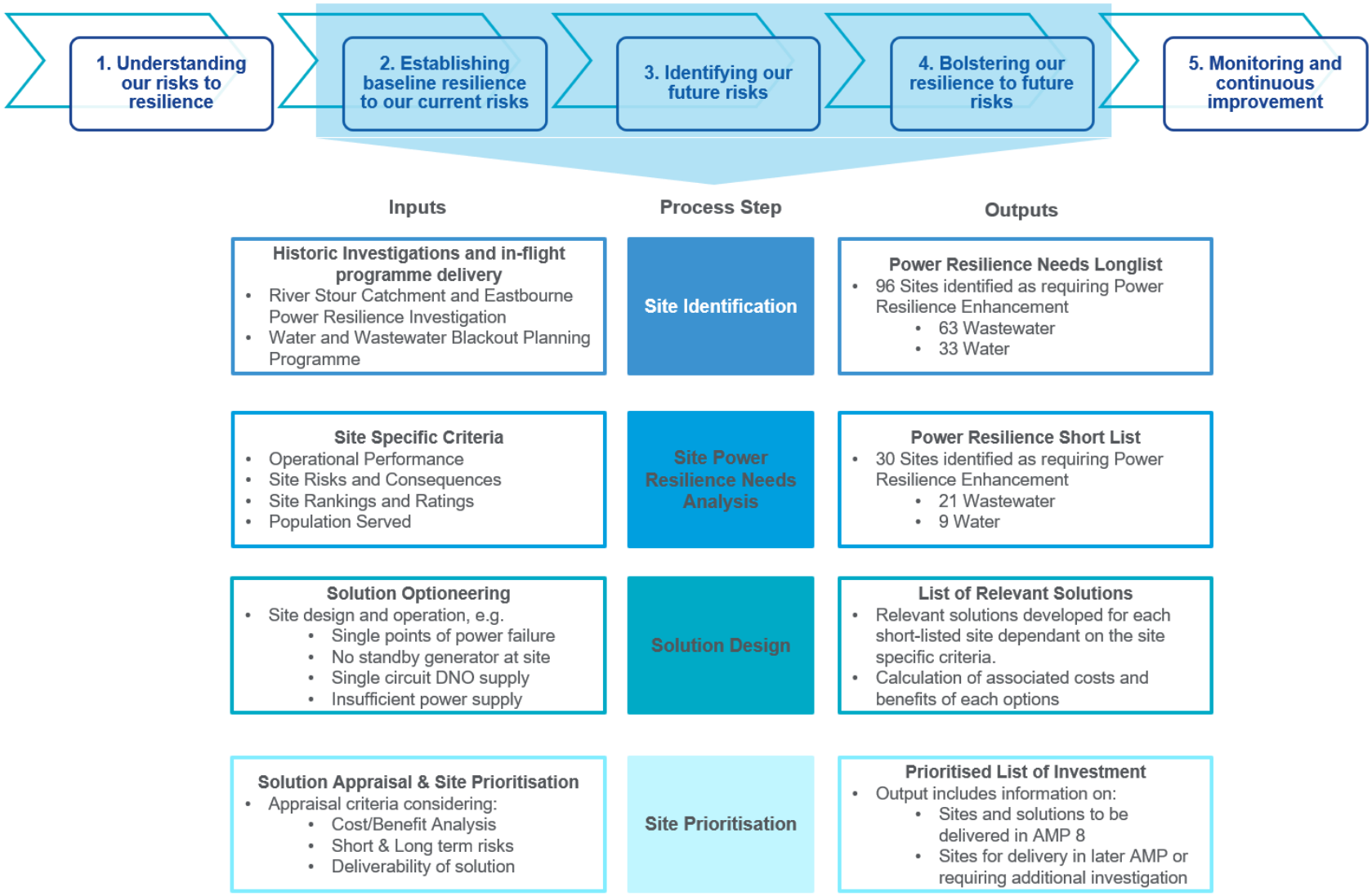
2.3.3. Developing the needs from the Blackout Planning Programme through our integrated resilience framework for planning investments.

The needs identified through the systems approach we have taken with the Blackout Planning Programme has been fed into our integrated resilience framework for investment planning as described in the Operational Resilience Technical Annex (Context and Background section) to determine when to invest in the sites identified and ensure the solutions are prioritised and optimised for delivery in AMP8 and beyond.

The approach we have applied to identify sites, assess the risks, develop solutions and prioritise our investment is illustrated in Figure 3. To identify the needs at specific sites and develop solutions to make our assets and systems more resilient, we have:

- Applied assessment criteria developed as part of our deep dive which is informed by our delivery experience and lesson learnt over the past two AMPs to identify and baseline our current level of resilience to the current risks, to develop a longlist of sites requiring enhancing
- Assessed which of our sites are most vulnerable, most critical and highest risk for our customers and the environment, to develop a shortlist
- Identified potential solutions for our highest risk sites to prioritise our sites and consider delivery programmes

Figure 3: Illustration of how we have applied our Systems Based Operational Resilience Process to identify, analyse and prioritise our Power Resilience Investments for AMP 8 and future AMPs



Site Identification

Using the findings from our assessments and investigations and a review of recent operational performance we identified the longlist of 96 sites that will need investment in our power infrastructure to increase our resilience to power supply interruptions in next 2 AMPs. A summary of the sites contained in the Longlist is available in Table 3 and 4 below, with more details on all sites and the outcome of the initial assessment results provided in Appendix B & C.

Table 3: Longlist of Wastewater Sites

Albion Street Portslade WPS	Eastney	Millbrook WTW
Appley Park Ryde Transfer WPS	Elizabeth Street Dover WPS	Motney Hill WTW
Archery Eastbourne WPS	Fairlee	Newgate Lane Peel Common WPS
Ashford WTW	Folkestone Junction WPS	Newhaven East WPS
Bethersden WTW	Fort Cumberland	Peel Common WTW
Bexhill & Hastings WTW	Gainsborough Drive Herne Bay WPS	Queenborough WTW
Black Rock Brighton WPS	Garnier Road Winchester WPS	Rock A Nore Hastings WPS
Brielle Way Westminster WPS	Goddards Green WTW	Sandown New WTW
Broadstairs WPS	Gravesend WTW	School Lane Hamble WPS
Broomfield Bank WTW	Grove Road Gosport WPS	Shoreham WTW
Browndown WPS	Horsham New WTW	Slowhill Copse Marchwood WTW
Budds Farm Havant WTW	Kings Hall Herne Bay WPS	Station Road Whitstable WPS
Bulverhythe WPS	Lion Point Ventnor WPS	Swalecliffe WTW
Cambridge Road Gosport WPS	Little Ann Bridge WPS	The Stade Folkestone WPS
Canterbury WTW	Liverpool Road Deal WPS	The Wharf Midhurst WPS
Castle Road Allington WPS	Lottbridge Drove Eastbourne WPS	Weathelees Hill A WTW
Chestnut Avenue Eastleigh WPS	Margate WPS	Weatherlees Hill B (MGATE & Bstairs) WTW
Dibles Road Warsash WPS	Marine Terrace Margate WPS	West Park Bognor Regis WPS
Drove Road Sheerness WPS	May Street Herne Bay WTW	Westbrook Grove Purbrook WPS
East Worthing WTW	Medina Road Cowes WPS	Whiteley Lane Whiteley WPS
Eastbourne WTW	Military Road Ramsgate WPS	Woolston WTW

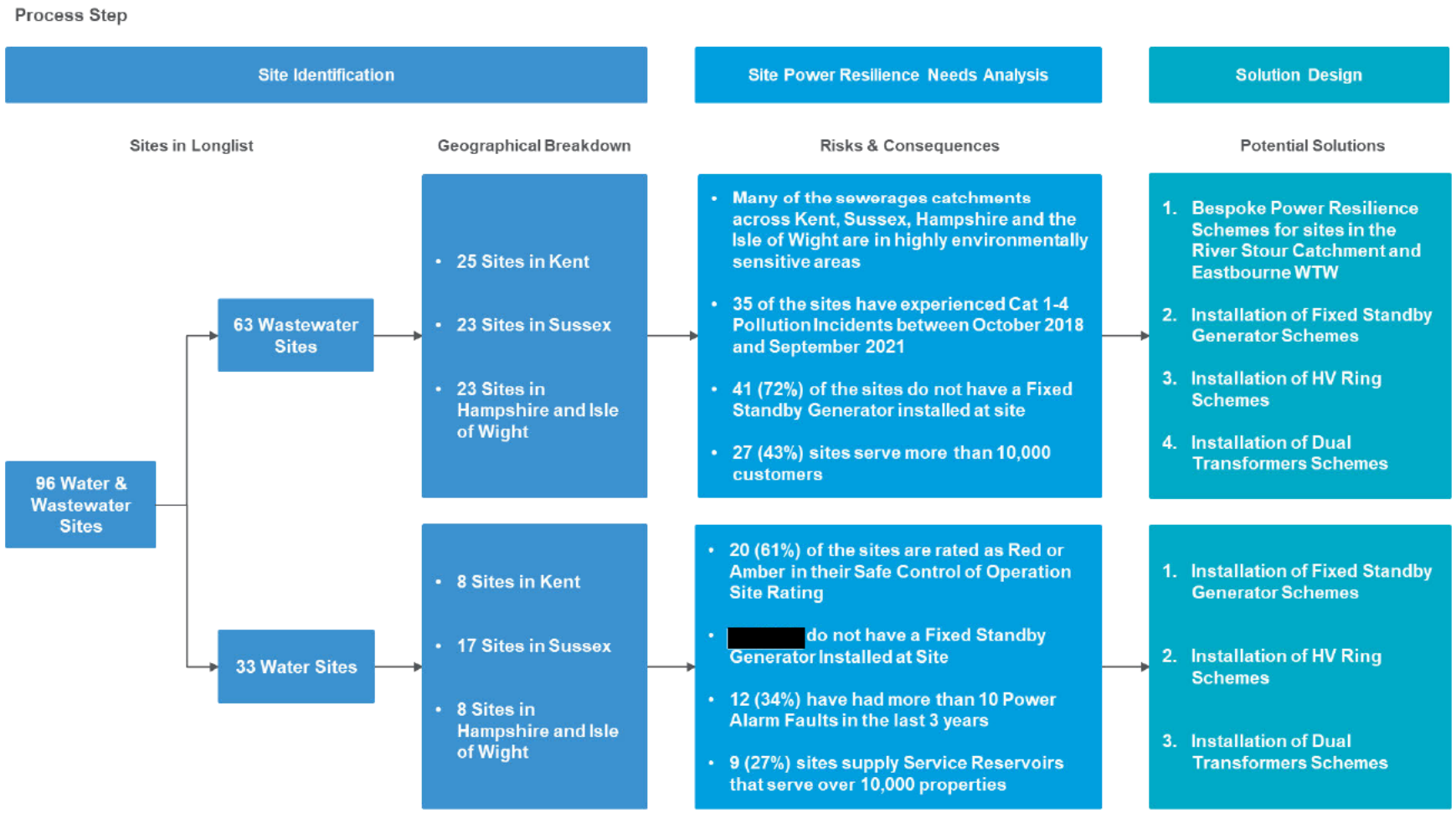
Table 4: Longlist of Water Sites

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

Site Specific Analysis and Unconstrained Solutions Identification

We analysed each of the 96 sites identified in the longlist to understand the site characteristics and historical issues to develop a list of potential solutions that could be applied to increase the resilience of each site to power supply interruptions. Figure 4 illustrates our detailed process, along with the risks and consequences and potential solutions that we have identified.

Figure 4: Summary of the breakdown in Sites contained in the Longlist, associated risks and consequences and potential solutions



Through these deep-dive investigations we identified four types of asset investment solutions to improve the Power Resilience of our assets. These are:

1. **River Stour Catchment and Eastbourne WTW Power Resilience Schemes** – A selection of bespoke schemes (such as the installation of Uninterruptible Power Systems (UPS) and Automatic Transfer Switch (ATS) solutions) to upgrade and improve our Power Infrastructure at 9 of our Wastewater sites in the River Stour Catchment and Eastbourne WTW.
2. **Standby Generators -** Installation of Fixed Standby Generators at sites to provide auxiliary back-up power supply across our water and wastewater sites
3. **HV Rings** - Upgrading existing SWS Power infrastructure to reduce numbers of single points of failure at our sites
4. **Dual Transformers** - Upgrading existing SWS Power infrastructure to reduce numbers of single points of failure at our sites

We also considered options to increase our supply of Mobile Generators, through purchasing and contracting requirements with our supply chain. However, our experience of there being supply chain shortages during the Storms of February 2022 and our analysis identifying the need for longer term, permanent solutions resulted in this being discounted for our critical sites for delivery in AMP 8.

As part of this assessment to determine the feasibility and suitability of each potential solution on the site we analysed the criteria shown in Table 5, depending on whether it is a Water or Wastewater site.

Table 5: Summary of criteria used to identify feasibility of solutions

Criteria	Wastewater	Water
Standby Generator on Site	X	X
Single Points of Failure Identified on Site	X	X
Properties/Customers Served	X	X
No. Cat 1-4 Pollution Events in past 3 years	X	
Environmental Consequence Site Ranking	X	
Time to Spill	X	
Safe Control of Operation RAG Status		X
Estimated Available Storage of Reservoirs Served		X
Power Alarm Data		X

Following this analysis, one of four types of solutions were identified for each site based on their individual characteristics. More information is provided in **Appendix B and C**.

Site Prioritisation

Following the outcome of this process we have identified a total of 21 Wastewater and 9 Water sites that need immediate investment in their power infrastructure to increase our resilience to power supply interruptions during AMP 8.

Figure 5: Site and Solution Prioritisation Process Conceptual Model

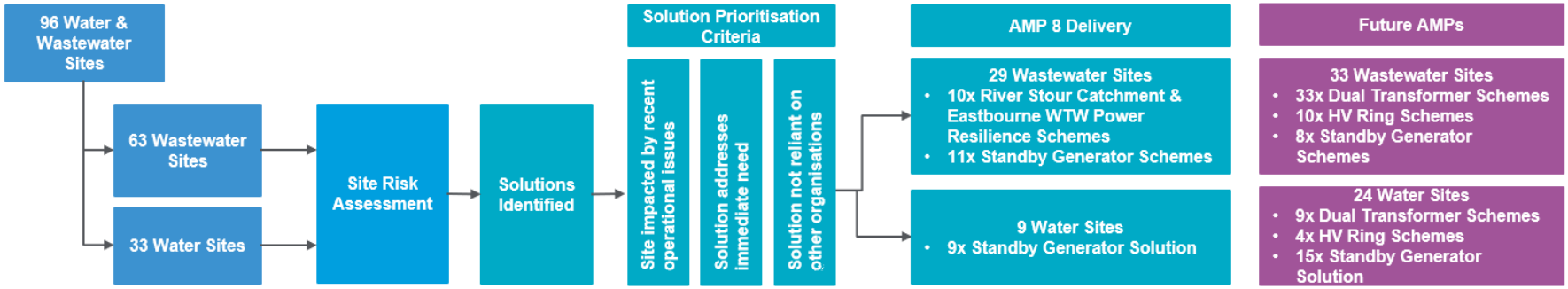


Figure 5 illustrates the conceptual model we have applied as part of assessing the suitability and need for each potential solution. A summary of the rationale for the two types of solution we proposed delivering in AMP 8, River Stour Catchment and Eastbourne WTW Power Resilience schemes and the Standby Generator schemes is provided below.

River Stour Catchment and Eastbourne WTW Power Resilience Schemes

Following a high number of serious pollution incidents in the geographical areas, we conducted a series of investigations at ten wastewater sites in the River Stour Catchment and Eastbourne WTW to assess how resilient the sites currently are to power supply interruptions. Within the River Stour Catchment, we operate 455 Wastewater Pumping Stations and 21 Wastewater Treatment Works and serve approximately 591,000 people who live in the catchment[15].

There are numerous important environmental sites throughout the Stour catchment that have been designated as nationally or internationally important. The landscape is varied from the rolling chalk hills of the North Downs to the flat marshes around Thanet. There are internationally important coastal habitats at Sandwich and Pegwell Bay and near Reculver, and rare chalk downlands in the nationally protected Kent Downs. The Thanet Coast, Sandwich Bay and Dover to Kingsdown Cliffs are Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI) for their ecological values. Extensive Forestry Commission woodlands and many historical sites and pretty villages all contribute to the character of this varied and beautiful part of England.

Table 6: Sites mapped to their sewerage network catchment

Sewerage Network Catchment	Site Name
Rother & Ouse	Eastbourne WTW
Broomfield Bank	Broomfield Bank WTW
	Elizabeth Street WPS
	The Stade WPS
	Folkstone Junction WPS -
Swalecliffe	Swalecliffe WTW
May Street Herne Bay	May Street Herne Bay WTW
Weatherlees Hill B	Weatherlees Hill A & B WTW
	Margate WPS
	Broadstairs WPS

Investigation Outcomes

All sites within the region were assessed against their history of previous pollution events. 10 sites with some of the highest pollution events were found to have issues and limitations with their power assets that resulted in the sites having very limited resilience to blackout and brownout power supply issues.

Many of the sites have recently been impacted by Pollution incidents following power supply issues and as such each site requires significant work to upgrade their assets to be more resilient to the threat of power supply interruptions and prevent pollution incidents occurring.

[15] Stour catchment DWMP (southernwater.co.uk)

A description of each site and a summary of the key findings from the investigations at each site is provided in **Appendix D.**

Standby Generator Schemes

Our analysis indicated that [redacted] of the 96 sites assessed do not currently have an operational fixed standby generator installed. In previous investigations this has formed part of our resilience terms of reference, as we understand how important it is for our sites to have back-up power supplies available, to continue to function, when we experience power outages with the electrical distribution networks.

We have actively chosen to prioritise the delivery of Fixed Standby Generator schemes at our 20 highest risk sites (11 wastewater and 9 water) in AMP 8 to address the immediate need to prevent ongoing incidents and protect us from worsening conditions. These solutions are deliverable, and less dependent on input from some of our other key stakeholders, such as our DNOs.

We have assessed our sites against the criteria within Table 5, but also applied a prioritisation to identify sites with the shortest duration to an event affecting our customers and the environment. This prioritisation has been based on the time until a power failure impacted the site, but also the severity of the impact of power failure in terms of number of customers and impact of a pollution event on the environment.

Tables 7 and 8 list the wastewater and water sites we have proposed to deliver in AMP 8.

Table 7: Proposed Wastewater Sites for Standby Generator Solution

Gainsborough Drive WPS	Chestnut Avenue Eastleigh WPS	School Lane Hamble WPS
Liverpool Road Deal WPS	Little Anne Bridge WPS	Grove Road Gosport WPS
Drove Road Sheerness WPS	Dibles Road Warsash WPS	Cambridge Road Gosport WPS
Newgate Lane Peel Common WPS	The Wharf Midhurst WPS	

Table 8: Proposed Water Sites for Standby Generator Solution

[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

Alignment to DWMP and WRMP Objectives

Investment in these sites and assets will ensure alignment with our published DWMP and WRMP objectives to reduce pollution risk (Planning Objective 2)[16] and increase the resilience of our existing sources of water[17]. These documents define our long-term strategy to improve performance against key performance indicators. Ensuring alignment of our short-term investment with our publicly stated objectives ensures the longer term strategy is delivered.

2.4. Enhancement Needs Beyond AMP 8

Following our site identification and optioneering processes, we have made the decision to defer investment in:

- 23 sites considered for Installation of Fixed Standby Generators,
- 16 sites considered for HV Ring Enhancement Schemes and
- 49 sites considered for Dual Transformer Enhancement schemes.

This decision has been based on our understanding of the need to address our sites that are at the highest short-term risk, whilst balancing the costs for our customers, allowing us to deliver significant improvements to our performance, affordably. However, we still recognise that the HV Ring and Dual Transformer schemes will be critical to enhance our long-term power resilience and as such we plan to carry out additional investigations into these schemes with a view to incorporate them in our Long-Term Delivery Strategy (LTDS) and future AMPs. This will help us work with DNOs and other stakeholders to plan and deliver power resilience solutions that deliver long-term benefits for the environment and our customers across our network.

We have additionally deferred several Fixed Standby Generator solutions at sites based on prioritisation. All sites under consideration were assessed against Table 5 criteria, however, to establish the immediate priority to be addressed as part of AMP 8, we have applied a prioritisation to the criteria to identify the sites which pose the greatest risk to our customers and the environment. Sites within our shortlist without the data to suggest that a significant impact is posed imminently, have been deferred to a later AMP; which is in line with our LTDS. The priority criteria identified, is the time it would take for a power outage to affect our service, either leading to a pollution event or an interruption to customer water supply. The other prioritised criteria being the scale of impact to the environment and total number of customers. These criteria have been prioritised due to the lack of mitigation. At sites where a power failure is likely to occur, but a longer dwell time to an event, we will continue to deploy our temporary mobile generators, where possible. However, to systemically enhance our long-term power resilience, we will need to invest in more permanent solutions in later AMPs.

Identification of these sites now allows us to progressively monitor performance and employ adaptive planning at key decision points in the lead up to future AMPs, to assess the requirement for investment

[16] Southern Water Drainage and Wastewater Management Plan https://www.southernwater.co.uk/media/8541/a0003_dwmp_regional_plan_final.pdf
[17] Southern Water Draft Water Resources Management Plan 2024 https://www.southernwater.co.uk/our-story/water-resources-management-plan/our-draft-water-resources-management-plan

levels and continuously invest in assets which will deliver the greatest benefit to our customers and the environment.

Tables 9 and 10 show the sites that have not been taken forward for delivery in AMP 8.

Table 9: Wastewater Sites and Solutions Deferred from AMP 8

Site Name	Considered Solution Type		
	Standby Generator	HV Ring	Dual Transformer
Appley Park Ryde Transfer WPS			X
Archery Eastbourne WPS			X
Ashford WTW		X	X
Bexhill & Hastings WTW		X	X
Black Rock Brighton WPS			X
Brielle Way Westminster WPS			X
Browndown WPS			X
Budds Farm Havant WTW			X
Canterbury WTW			X
Castle Road Allington WPS			X
East Worthing WTW		X	X
Eastney			X
Fairlee			X
Fort Cumberland			X
Garnier Road Winchester WPS			X
Goddards Green WTW		X	X
Gravesend WTW			X
Horsham New WTW		X	X
Kings Hall Herne Bay WPS			X
Medina Road Cowes WPS			X
Military Road Ramsgate WPS			X
Millbrook WTW		X	X
Motney Hill WTW		X	X
Newhaven East WPS			X
Peel Common WTW		X	X

Site Name	Considered Solution Type		
	Standby Generator	HV Ring	Dual Transformer
Queensborough WTW			X
Rock A Nore Hastings WPS			X
Sandown New WTW			X
Shoreham WTW		X	X
Slowhill Copse Marchwood WTW		X	X
West Park Bognor Regis WPS			X
Whiteley Lane Whiteley WPS			X
Woolston WTW			X
Lion Point Ventnor WPS	X		
Lottbridge Drove Eastbourne WPS	X		
Station Road Whitstable WPS	X		
Bulverhythe WPS	X		
Marine Terrace Margate WPS	X		
Bethersden WTW	X		
Albion Street Portslade WPS	X		
Westbrook Grove Purbrook WPS	X		

Table 10: Water Sites and Solutions Deferred from AMP 8

Site Name	Considered Solution Type		
	Standby Generator	HV Ring	Dual Transformer
[redacted]			X
[redacted]		X	X
[redacted]			X
[redacted]		X	X
[redacted]		X	X
[redacted]			X
[redacted]		X	X
[redacted]			X
[redacted]			X

Site Name	Considered Solution Type		
	Standby Generator	HV Ring	Dual Transformer
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		
[redacted]	X		

2.5. Low regrets assessment

We have assessed this programme against the criteria for low regret investment identified in the LTDS guidance[18] and Appendix 9[19] 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 investment proposed in this enhancement case is a low regret investment for the following reasons:

- Needs – Power supply interruptions lead to pollution and water supply interruption events which results in high customer and environmentally impacting operational mitigation. The instance of power supply interruptions is increasing due to climate change and external changes to the energy supply
- Timing – The research shows that customers are willing to pay +£3 on bills per year to support resilience across Power and Coastal Erosion.
- Optioneering – We have explored a wide range of possible solutions to address these power supply interruptions. We've followed a process-driven approach to identify the highest impacted sites and subsequently the appropriate solution to address the root-cause. These solutions have been tested for cost benefit against our value framework to understand the solution which provides the 'best value' for the customer. Customer research has also fed into the solution selection process.
- Future scenarios – Our investment plan includes for 96 sites to be enhanced between AMP 8 and AMP 9. During AMP 8 we will deliver solutions to 30 sites with the greatest impacted catchments.

[18] Ofwat PR24 and Beyond: Final Guidance on long-term delivery strategies
[19] PR25 Final Methodology – Appendix 9

3. Best Option for Customers

To ensure best option for our customers, we have applied our organisational end-to-end Risk and Value process for 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. More information on this process is provided in **SRN15 Cost and Option Methodology Technical Annex**.

Ref	Description	Benefit / Residual risk	Decision
1	Do Nothing: ▪ No enhancement activity ▪ Continued delivery of maintenance activities and use of temporary mobile generators during power supply issues	▪ No additional benefit ▪ High-likelihood of deteriorating performance caused by more frequent and severe extreme weather events impacting power supplies due to climate change	**Discounted** due to unacceptable levels of residual risk for customers and performance
2	**Do Minimum:** ▪ Deliver River Stour Catchment & Eastbourne WTW Power Resilience Solutions; and ▪ Install Standby Generators at - 11 Wastewater sites - 9 Water sites	▪ Enhancement activity focussed on most critical environmental wastewater and highest impact water sites. ▪ Providing benefits listed in Section 3.3 ▪ Residual risk reduced, whilst protecting customer affordability challenges	**Progressed** due to reduction in residual risk at critical sites whilst carefully considering customer cost impacts
3	**Do More:** ▪ Deliver River Stour Catchment & Eastbourne WTW Power Resilience Solutions; and ▪ Install Standby Generators at - 19 Wastewater sites - 18 Water sites	▪ Enhancement activity focussed on wider portfolio of critical environmental wastewater and highest impact water sites. ▪ Providing more benefits and reducing residual risk further than Option 2. ▪ Increase cost for customers and affordability challenges.	**Discounted** due to prohibitive cost and customer bill impact
4	**Do Everything:** • Deliver River Stour Catchment & Eastbourne WTW Power Resilience Solutions and • Deliver enhancement schemes at the 96 identified sites: • Install Standby Generators at - HV Ring Enhancements - Dual Transformer Installations	• Enhancement activity provides maximum benefits across the water and wastewater portfolio, - Some schemes reliant on external parties (DNOs). • Additional deliverability risk caused by scale of the programme over a 5 year period. • Unacceptable impact on customer affordability.	**Discounted** due to prohibitive cost and customer bill impact

3.1. Our Proposed Solutions for AMP 8

As stated in Section 2, we have identified the need to invest in two type of power resilience enhancement solutions at our critical sites during AMP 8. These are:

- The River Stour Catchment Wastewater Power Enhancement scheme and Eastbourne WTW upgrade – A suite of power infrastructure upgrades to our critical sites in the River Stour Catchment and at Eastbourne (including Uninterruptable Power Supply (UPS) systems, dual transformers etc.)
- Installation of Fixed Standby Generators at 20 of our highest risk water and wastewater sites across our region

How we measure the performance and value of our services

We use the Service Measure Framework (SMF) to measure delivery performance of our core services and the impact of our services on the environment, our customers and public health.

Our SMF contains the key performance metrics we can measure that underpins our service provision and is used to calculate a value for Service Impact Risk for when our services are disrupted. This risk determined by assessing:

- Probability of the service provision being disrupted in the year
- Probability that a service will result in being impacted, and
- Severity of that service impact

The value assigned to each service provision is made up of three components:

- Customer Value - These represent the value that customers place on a particular element of service
- Social Value - These represent how broader society can be expected to value certain service risks.
- Private Cost Value - These values are known as costs of consequence or costs of (service) failure

Our SMF allows us to prioritise and address preventative measures to our highest risk service interruptions across the organisation, due to the risk value that is assigned.

Each service measure has a total cost value for service failure, that we have used to estimate the potential benefits of delivering our AMP 8 enhancement solutions. We have quantified the value of benefit as the avoidance of defined risks being realised.

3.2. Impact of our Solutions on our Resilience challenges

Delivering our Power Resilience schemes in AMP 8 will help us prepare for and tackle our Climate Change, Population and Demand growth and Aging Asset challenges. This will help us deliver improved Pollutions and Unplanned Outage outcomes. Table 11 illustrates the links between these schemes and the Resilience Challenges we face.

Figure 6: Our Resilience Challenges

Table 11: How our solutions impact our challenges and how it will help us improve performance

Our Challenges	Power Resilience Schemes we are doing in AMP 8		What are the expected AMP 8 performance outcomes						
	Standby Generators	River Stour Catchment Power Enhancement Schemes	Pollutions	Leakage	Flooding	People Capability	Unplanned Outage	Sewer collapse	Mains repairs
Drought									
Climate change (Extreme Weather Impacts)	X	X							
Population & Demand Growth	X	X							
Transition to Net Zero									
Cyber security									
Ageing Assets		X							
Alignment to 4Rs + A									
Anticipation									
Reliability		X							
Resistance		X							
Redundancy	X	X							
Response & Recovery									

Key	
	Mapping between Power Resilience schemes and our Challenges
	Alignment between Power Resilience schemes to 4R's +A
	Alignment between Power Resilience schemes and our expected performance outcomes

3.3. Scheme Cost Benefit Analysis

Table 12: Whole Power Resilience Scheme Cost Benefit Analysis

Solution Type	Water/Wastewater	Number of Sites	Investment Cost	Benefits (across 5 years)
River Stour Catchment Power Resilience Scheme	Wastewater	10	£20,967,844	£3,386,607
Standby Generators	Water	9	£4,813,018	£4,121,330
	Wastewater	11	£5,822,577	£1,542,740
Total		30	£31,663,439	£9,050,677

How we have calculated the benefits of our proposed solutions

3.3.1. Wastewater Solutions

The main quantifiable benefits for our wastewater power solutions are through cost savings associated with stopping Pollution events. We have analysed historical pollution events at the sites we have proposed investing in and calculated the cost if these incidents were to happen during AMP 8, using AMP 8 costs for Pollution events from our SMF, as shown in Table 13.

Table 13: SMF AMP8 Costs for Pollution Incidents

	Pollution Category	SMF Cost / Event
_AMP8 Pollution	AMP8 - Major (Cat 1 definition) Incident	£574,976 / event
	AMP8 - Significant (Cat 2 definition) Incident	£276,193 / event
	AMP8 - Minor (Cat 3 definition) Incident	£199,049 / event
	AMP8 - Insignificant (Cat 4 definition) Incident	£441 / event

Assumptions made:

- All historical Pollution events at each specified site could be avoided
- 25% of historical Pollution events were a result of Power Supply issues, as indicated from our Root-Cause Analysis as part of our PIRP 2023 report[20]

[20] pirp-july-2023.pdf (southernwater.co.uk)

3.3.2. Wider benefits of investing in the River Stour Catchment and Eastbourne WTW

Investing in the 10 identified wastewater sites in the River Stour Catchment Power Resilience schemes enables us deliver £3.39m in environmental and social benefits over a 5-year period, based on using the 2018-2023 data as a baseline and the SMF costs for AMP 8. The costs avoided are 25% of the total cost for the pollution event by category – as this is the number attributed to power issues.

Table 14: Benefits Calculation at River Stour Catchment Sites and Eastbourne WTW based on Historical Pollution Incidents (Jan 2018 – Aug 2023) and AMP 8 SMF costs per pollution event

Site	Total Cat 1	Cat 1 Costs Avoided (25% of total £)	Total Cat 2	Cost 2 Costs Avoided (25% of total £)	Total Cat 3	Cost 3 Costs Avoided (25% of total £)	Total Cat 4	Cost 4 Costs Avoided (25% of total £)	Total (25% of total £)
Broadstairs WPS	-	-	3	£207,145	8	£398,098		£0	£605,243
Broomfield Bank WTW	-	-	-	-	10	£497,623		£0	£497,623
Eastbourne WTW	-	-	-	-	6	£298,574	1	£110	£298,684
Elizabeth Street Dover WPS	-	-	-	-	8	£398,098	1	£110	£398,208
Folkestone Junction WPS	-	-	-	-	4	£199,049		£0	£199,049
Margate WPS	1	£143,744	-	-	9	£447,860		£0	£591,604
May Street Herne Bay WTW	-	-	-	-	1	£49,762		£0	£49,762
Swalecliffe WTW	-	-	-	-	10	£497,623		£0	£497,623
The Stade Folkestone WPS	-	-	-	-	1	£49,762		£0	£49,762
Weatherlees Hill B (MGATE & Bstairs) WTW	-	-	-	-	4	£199,049		£0	£199,049
	1	£143,744	1	£207,145	61	£3,035,497	2	£221	£3,386,607

3.3.3. Benefits of investing in Wastewater Fixed Standby Generator Schemes

Investing in the identified Fixed Standby Generator Power Resilience schemes at these sites enables us to deliver £1.54m in environmental and social benefits over the next five years using the 2018-2023 data as a baseline. Assumes that the rate of pollution events stays flat or gets worse if we do nothing as external factors will continue to impact our assets without mitigation at a similar or increasingly worse rate. The costs avoided are 25% of the total cost for the pollution event by category – as this is the number attributed to power issues.

Table 15: Benefits Calculation for Wastewater Standby Generator Sites based on Historical Pollution Incidents (Jan 2018 – Aug 2023) and AMP 8 SMF costs per pollution event

Site	Total Cat 1	Cat 1 Costs Avoided (25% of total £)	Total Cat 2	Cost 2 Costs Avoided (25% of total £)	Total Cat 3	Cost 3 Costs Avoided (25% of total £)	Total Cat 4	Cost 4 Costs Avoided (25% of total £)	Total (25% of total £)
Gainsborough Drive Herne Bay WPS	-	-	-	-	2	£99,525	-	-	£99,525
Liverpool Road Deal WPS	-	-	-	-	-	-	-	-	-
Drove Road Sheerness WPS	-	-	-	-	5	£248,811	-	-	£248,811
Chestnut Avenue Eastleigh WPS	-	-	-	-	2	£99,525	-	-	£99,525
Little Ann Bridge WPS	-	-	-	-	-	-	-	-	-
Dibles Road Warsash WPS	-	-	-	-	4	£199,049	-	-	£199,049
School Lane Hamble WPS	-	-	-	-	4	£199,049	-	-	£199,049
Grove Road Gosport WPS	-	-	-	-	2	£99,525	-	-	£99,525
Cambridge Road Gosport WPS	-	-	-	-	3	£149,287	-	-	£149,287
Newgate Lane Peel Common WPS	-	-	-	-	4	£199,049	1	£110	£199,159
The Wharf Midhurst WPS	-	-	-	-	5	£248,811	-	-	£248,811
	-	-	-	-	31	£1,542,630	1	£110	£1,542,740

3.3.4. Benefits of investing in Fixed Standby Generators for Water sites.

Water Solutions

Investing in the identified Standby Generator Power Resilience schemes at these sites enables us to deliver £4.1m in environmental and social benefits over the next three years using the 2018-2021 data as a baseline. Assumes that the rate of power interruptions stays flat or gets worse if we do nothing, as external factors will continue to impact our assets without mitigation at a similar or increasingly worse rate as indicated by the analysis in Section 2 of this document.

The main quantifiable benefits for our water sites are through cost savings associated with stopping water supply interruptions. We have analysed historical water supply interruptions at the sites we have proposed investing in and calculated the cost if these incidents were to happen during AMP 8, using AMP 8 costs for water supply interruptions from our SMF, as shown in Table 16.

Table 16: SMF AMP 8 costs for supply interruptions

AMP8	SMF Category	SMF Cost / Event
	AMP8 – Water Supply Interruption Event	£2 / per day per property

Assumptions made:

- Power Alarms at site resulted in a power blackout event – this is the purpose of these alarms and is a reasonable assumption
- Power blackout event led to a supply interruption which impacted the number of properties identified at risk
- Properties at risk have been identified through our Water Criticality Framework – this is reasonable to assume as analysis in the Water Criticality Framework identifies the properties, and associated sites, where a supply interruption could not be mitigated by another site in the network
- Each supply interruption led to a £2 impact per property affected – as per our SMF calculations
- Properties at risk are the identified properties which would be affected during a power supply interruption – those without properties at risk are assumed to be part of a wider network which could mitigate in the short term

Site	Properties at Risk	Power Alarms over 5-year period	Total Cost
[redacted]	43936	7	£615,104
[redacted]	12485	19	£474,411
[redacted]	14021	27	£757,134
[redacted]	2089	35	£146,223
[redacted]	35776	25	£1,788,790
[redacted]		85	£-
[redacted]	21808	7	£305,313
[redacted]	2863	6	£34,354
[redacted]		18	£-
			£4,121,330

Regulatory Compliance

A key intangible benefit of investment in these water sites is compliance with our regulators. As per the notification received from Defra 28th September 2022 (**Appendix E**), Southern Water have been instructed to assess the power resilience of strategic sites within our water network. Proactively seeking to improve the resilience of our network by securing an alternative power supply during extreme weather events will reduce the pressure on the network and allow for appropriate allocation of power. Enhancement in these critical sites will support our regulators wider strategy of securing important national infrastructure against energy uncertainties.

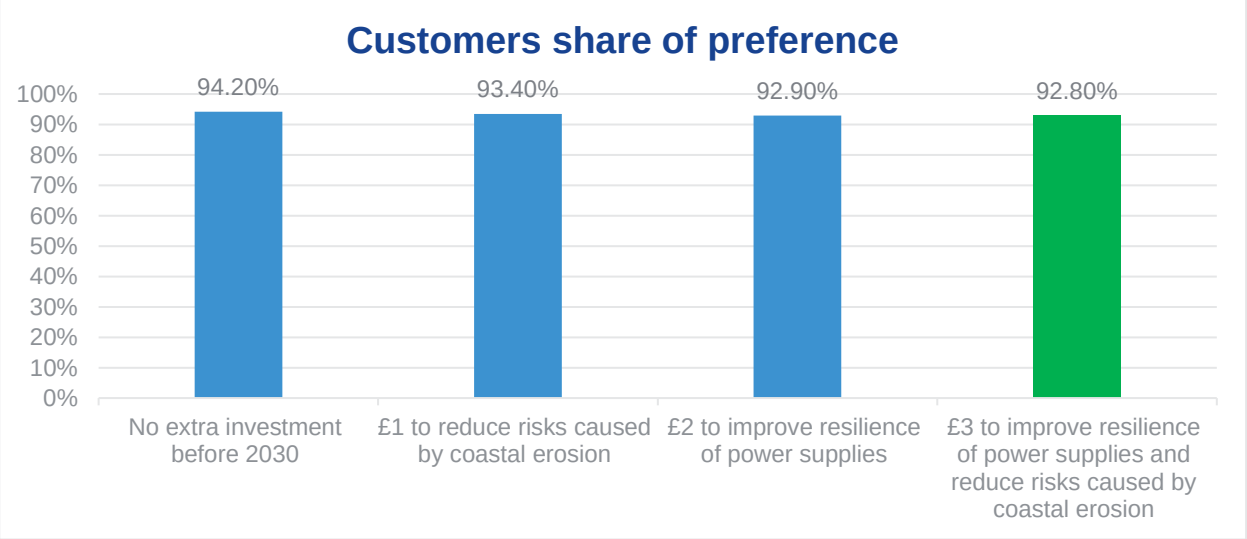
Summary of Water sites investment

Investment in these sites is part of a broader package of investment in water non-infrastructure which will reduce the risk of water supply interruptions to our customers. As part of our Water Criticality Framework[21], we've identified the strategically important sites to our overall supply and this coupled with power alarm data has identified the sites in greatest need of additional redundancy resilience.

3.4. Customer support for power resilience solutions

Through our customer engagement activity to understand customer's priorities for environmental ambition, Resilience was ranked 3rd in priority, behind Sewer Infiltration and Storm Overflows.

Figure 7 - Customer Preference for Investment in Power Resilience



[21] Our Water Criticality Framework is a resilience assessment tool which assesses the relative ability of other assets within the water network to mitigate a supply interruption. It calculates the likely volume of properties being served by that site that would be impacted by such an event

Our extensive customer engagement activity shows us that:

- Informed customers would be willing to fund £3 per bill per annum on schemes to enhance Power and Coastal Erosion resilience
- Schemes to resolve power issues were considered to be low risk due to the solutions appearing to be tangible and relatively easy to implement
- Customers support proactive and preventative investment in power related equipment, given the potential impact of inaction
- Whilst customers do not welcome bill increases or advocate a bigger bill increase than is predicted, they accept that it does feel like the right time to be investing in the infrastructure
- Customers want to see us push hard when addressing pollution in particular and feedback on the proposed plan shows that customers want us to be even more ambitious in driving pollution events down

A high priority for our customers is around affordability. Although customer feedback told us bills are currently felt to be relatively affordable by a significant majority of customers (86%), they want fair bills that won't push the costs out for future generations to pick up the cost. Through our site identification process to prioritise those sites requiring additional resilience investment, we've taken a pragmatic approach to our proposed investment across the next 2 AMPs. We recognise the wider WINEP and WRMP enhancement investment will significantly impact bills, therefore we are proposing to phase this work over 2 AMPs. Sites where the resilience need is critical to address issues, which are already occurring, have been prioritised for AMP 8. Sites with a high-risk profile, but limited evidence of issues already affecting the sites, have been deferred to AMP 9. The purpose of this approach is to reduce the impact on bills and support vulnerable customers afford the marginal increases, whilst delivering the greatest positive impact to resilience.

Summary of the investment

The investment we propose to deliver during AMP 8 provides a balance of limiting the negative consequences and impacts that power supply interruptions have on our most critical sites. These schemes help reduce our reliance on external power sources and provide us with additional contingency that will allow us to continue to operate more effectively during extreme weather events and other power supply interruptions. They will enhance the level of redundancy in our system, build-in additional resistance to impacts from external events and improve the reliability of our systems as their operating environment changes with climate change, wider energy system developments and increase in demand for our services.

4. Cost Efficiency

This chapter provides detail on how we have developed our options and the associated costs for our AMP 8 Power 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 power supply interruptions 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 Power 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**[22]

As set out in **SRN15 Cost and Option Methodology 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**.

Our Approach to Estimating the Direct Costs and Benchmarking for our Power Resilience schemes

We have used a combination of approaches to attempt to make sure our costs are comparatively efficient and will not negatively impact our customers. These approaches include:

- Using our Engineering Technical Solutions (ETS) team to develop the initial scope for our two types of proposed solution
- Engaging with our expert Cost Intelligence Team (CIT) to use their cost estimating workbook to calculate net direct costs
- Using the outputs of this tool within our solution optioneering process to increase our operational resilience, whilst considering the impact on customer affordability.

Specifically for our Power Resilience solutions we have applied the following process:

- ETS developed initial list of scope items across all types of schemes that are required to enhance our resilience to power supply interruptions at our WTW and WPS sites;

[22] SRN15 Cost and Option Methodology Technical Annex

- The scope items were provided to our Cost Intelligence Team to use the cost estimating workbook to calculate the Net Direct Costs through a combination of
  - Southern Water Cost Curves; and
  - Initial estimated costs based on historic quotes for similar equipment received from suppliers and delivery partners from previous projects.

Our Power Resilience Scheme Cost Multipliers for our Power Resilience Schemes

Table 17 shows the overall Cost Multiplier for the two types of Power Resilience solutions we propose to deliver in AMP 8.

Table 17: Power resilience enhancement scheme cost multiplier breakdown and total costs

Scheme	Overall Cost Multiplier	Total AMP 8 Cost
River Stour Catchment and Eastbourne WTW Power Resilience Schemes	2.00	£20.97m
Water and Wastewater Standby Generator Schemes	2.11	£10.70m

As part of calculating the cost multipliers for our Power Resilience schemes, we have considered them as two portfolios due to the nature of enhancement activity to take place at each site. This aligns with our Optioneering process (More information available in **SRN15 Cost and Option Methodology Technical Annex**).

More information on how the overall cost multiplier and associated costs for each of the two power resilience schemes is provided below.

River Stour Catchment and Eastbourne WTW Power Resilience Schemes

Table 18 shows the breakdown of costs and Cost Category Multipliers for our River Stour Catchment and Eastbourne WTW Power Resilience Schemes solutions we propose to deliver in AMP 8.

Table 18: River Stour catchment and Eastbourne WTW power resilience enhancement scheme cost multiplier breakdown and total cost contribution

Scheme	Direct Cost	Indirect Cost	Risk	Corporate Overhead	Total
Costs	£10.50m	£8.03m	£0.24m	£2.20m	£20.97m
Multiplier (%)	100.0%	76.5%	1.3%	11.7%	2.00

The River Stour Catchment and Eastbourne WTW Power 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 complexity** for the activity to be delivered at each site.

Table 19: River Stour catchment and Eastbourne WTW power resilience schemes risk cost multiplier

Design Maturity	Complexity	Risk (%)
High	High	1.3%

The cost breakdown for the 10 sites included in this scheme is provided in Table 20.

Table 20: Site specific cost breakdown – River Stour catchment and Eastbourne WTW sites

Site	Direct	Indirect	Risk	Corporate Overhead	Total Cost
Eastbourne WTW	£4.39m	£3.36m	£0.10m	£0.92m	£8.77m
Broomfield Bank WTW	£0.20m	£0.15m	£0.0m	£0.04m	£0.40m
Elizabeth Street WPS	£0.43m	£0.33m	£0.01m	£0.09m	£0.86m
The Stade WPS	£0.33m	£0.25m	£0.01m	£0.07m	£0.66m
Folkstone Junction WPS	£0.63m	£0.48m	£0.01m	£0.13m	£1.26m
Swalecliffe WTW	£0.98m	£0.75m	£0.02m	£0.20m	£1.95m
May Street Herne Bay WTW	£0.49m	£0.38m	£0.01m	£0.10m	£0.98m
Weatherlees Hill A & B WTW	£1.09m	£0.83m	£0.02m	£0.23m	£2.17m
Margate WPS	£1.40m	£1.07m	£0.03m	£0.29m	£2.80m
Broadstairs WPS	£0.56m	£0.43m	£0.01m	£0.12m	£1.13m
Total	£10.50m	£8.03m	£0.24m	£2.20m	£20.97m

How we have applied our optioneering approach to our River Stour Catchment and Eastbourne WTW Power Resilience Schemes Solution

- Need for investment identified following series of high-profile and serious pollution incidents in and around environmentally sensitive and bathing water locations
- Detailed investigation into Power Resilience issues commenced to assess the current level of resilience against black-out and brownout power supply interruption events
- Investigation identified a list of issues across the portfolio of sites, that was provided to ETS to recommended engineering enhancements and other operational improvements
- Level 1 Direct Costs for each site calculated by CIT using Southern Water Cost Models (More information on these cost models is available in **SRN15 Cost and Option Methodology Technical Annex**), based on information provided from ETS on the enhancement work that is required. Within initial PRC cost multipliers applied.
- ETS reviewed designs and CIT applied updated PRC cost multipliers that considered confidence weightings on the Maturity of Design and Scheme Complexity.
- Providing an output of Level 2 capital costs for our proposed enhancement activity at each site identified in the River Stour Catchment and Eastbourne WTW Power Resilience schemes

River Stour Catchment & Eastbourne WTW Power Resilience Schemes Carbon and Operational Costs

The River Stour Catchment and Eastbourne WTW Power Resilience schemes carbon and operational costs have currently been assessed to be negligible at this stage of the scheme design. There is not expected to be any significant change in the operating costs of the new, enhanced assets being installed and commissioned as part of these schemes.

As part of our Level 3 costing approach, as set out in the Cost Estimation and Optioneering annex, we will give further consideration to Opex and Carbon costs for each specific site once PR24 has concluded.

More information on our Optioneering process can be found in **SRN15 Cost and Option Methodology Technical Annex**.

Water and Wastewater Standby Generator Power Resilience Schemes

Table 21 shows the breakdown of costs and Cost Category Multipliers for our Standby Generator Power Resilience Scheme solutions we propose to deliver in AMP 8.

Table 21: Standby Generator Power Resilience enhancement scheme cost multiplier breakdown and total cost contribution

Scheme	Direct Cost	Indirect Cost	Risk	Corporate Overhead	Total
Costs	£5.07m	£3.88m	£0.63m	£1.12m	£10.70m
Multiplier (%)	100.0%	76.5%	7.0%	11.7%	2.11

The Standby Generator 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 **Medium degrees of confidence in design maturity and complexity** for the activity to be delivered at each site.

Table 22: River Stour Catchment and Eastbourne WTW Power Resilience schemes risk cost multiplier

Design Maturity	Complexity	Risk (%)
Medium	Medium	7.0%

At this stage, in-line with our wider cost estimation process, our Standby Generator scheme costs have assumed the same direct costs being applied to each site.

The breakdown of each cost multiplier category for 11 wastewater and 9 water sites included in this scheme is provided in Table 23.

Table 23: Site specific cost breakdown – Standby generator schemes

	Direct	Indirect	Risk	Corporate Overhead	Total Cost
Wastewater	£2.79m	£2.13m	£0.34m	£0.62m	£5.88m
Water	£2.28m	£1.75m	£0.28m	£0.50m	£4.81m
Total	£5.07m	£3.88m	£0.63m	£1.12m	£10.70m

How we have applied our optioneering approach to our Standby Generator Power Resilience Schemes

- Need for investment identified following outcomes of the Power Resilience investigations and delivery of Black Start and Platinum Health Check programmes across assets in our water and wastewater networks.
- Assessment of all sites to identify sites with no standby generators and vulnerability to negative pollution and supply interruption impacts for the environment and our customers.
- Assessment identified a prioritised list of 96 sites that was provided to ETS to recommended feasible engineering enhancements and other operational improvements
- Level 1 direct costs for each site calculated by CIT using Southern Water Cost Models (More information on these cost models is available in **SRN15 Cost and Option Methodology Technical Annex**), based on information provided from ETS on the enhancement work that is required. With initial Project Related Cost (PRC) multipliers applied.
- ETS reviewed designs and CIT applied updated PRC cost multipliers that considered confidence weightings on the Maturity of Design and Scheme Complexity for Risk. Applying an assumption of a standard size generator at each site.
- Unconstrained list was further assessed on suitability for delivery, with a prioritised solution of installing Standby Generators prioritised for AMP 8.
- Further refinement of site selection carried out based on updated cost multipliers as an output.

Standby Generator Power Resilience Schemes Carbon and Operational Costs

The standby generator schemes carbon and operational costs have currently been assessed to be negligible at this stage of the scheme design.

This is based on the premise that the standby generators are designed to be used only at times when there has been a significant interruption to the power supply from the Distribution Network Operator (DNO). As such, they will not be used in a scheduled capacity, only by exception.

Summary of our approach to Cost Efficiency for our Power Resilience schemes

As part of considering different options to address our Power Resilience needs, we have applied our organisational approach to optioneering for both types of schemes being proposed. These have been further refined using our Cost Models to understand likely scheme costs more accurately and how the different options impact customer affordability.

We have used lessons learnt from power resilience investigations and our operational experience to:

- identify the sites in urgent need for investment in power infrastructure to ensure customer interruptions and environmental impacts are minimised
- consider a broad range of solutions to increase the level of power resilience across our network
- assess the different options from a financial, operational and strategic lens to consider the most appropriate investment portfolio for AMP 8, whilst considering future investment need into AMP 9 and as part of our LTDS.

Overall, we have actively considered customer affordability and have proposed enhancing a smaller number of our high-risk water and wastewater sites, to improve our performance and mitigate the future risks to power supply interruptions that we anticipate will impact our operations in the future.

5. Customer Protection

The principal benefit of this enhancement investment case is to increase the level of resilience to storms and energy security. This in turn will contribute to improved performance on environmental pollution incidents and reduce the risk of supply interruptions for our customers.

These investments will increase the level of redundancy we have at sites where we have already experienced negative customer and environmental impacts and will give our stakeholders confidence that we will be more able to deliver our services during times of significant wider disruption at our highest priority sites.

The proposed power resilience enhancement schemes are below the threshold applicable for a Price Control deliverable to be set.

Performance Commitments

We understand this is a significant investment for our customers and we need to provide appropriate assurances of a realisation of benefit. As such, we have taken consideration for these schemes into our overall Performance Commitments (PC) targets as stated within the PR24 submission.

It is immensely complex to attribute the exact PC benefit from each of these schemes for a variety of reasons:

1. the scale of our network (several thousand sites) relative to the volume of sites (30) identified for power resilience enhancement as part of this enhancement case
2. the increase in frequency and intensity of extreme weather events could accelerate the impact on our other sites which have been deferred from AMP 8 based on the information we have available (as per section 2.4)
3. the various number of causes for a pollution, or supply interruption, event could offset the benefits delivered in power resilience across our wider network

The sites proposed in this enhancement case are our highest priority due to the impact a power interruption event would likely have on our customers or the environment. We have taken a system-based approach to resilience, accounting for the system interactions and interdependencies. Overlaps between other enhancement cases and with base investment have been considered as part of this enhancement case. We have calculated the likely volume of benefit these enhancements will make to pollution events and customer supply interruptions in section 3 of this document. We are confident that through the proposed investment in these key strategic sites, we will mitigate the site-specific risks of pollution events and supply interruptions.

Variability During Extreme Weather Events

The tangible benefit we expect to see from these enhancements, is the reduced level of variability between the site performance in wet weather versus dry. During these adverse weather conditions, we expect to see the following benefits:

- reduced unmitigated power interruptions which impact asset operations
- reduced pollution events
- reduced customer supply interruptions

Deliverability Low-Risk

We consider the deliverability of these schemes as low risk on the following basis:

- These solutions are well understood, and we have a track record of being able to deliver these successfully
- We have the resources (either internally or through our supply chain) with the skills necessary to complete the works – these schemes fall well below the threshold for Direct Procurement for Customers (DPC)
- We do not anticipate any issues with securing the materials or units necessary to enable the works
- We do not anticipate any issues with securing consent due to these being minor works

6. Conclusion

Section	Key Commentary	Page
Introduction & Background	▪ Our exposure to risks of suffering power supply interruptions across our network is increasing due to more frequent and severe storms and changes in the electricity network. ▪ These power supply interruptions can result in environmental pollution incidents or customer supply interruptions, and we are already seeing these impacts across our network ▪ The need is aligned with the DWMP planning objectives for the reduction of pollution events	8
Need for Enhancement Investment	▪ Combining the outcomes of several studies and programmes we have identified 96 sites that need enhancing to mitigate future risks and impacts of power supply interruptions. ▪ We have analysed the risks and impacts at each site to identify appropriate solutions that will mitigate the risks they are facing ▪ A prioritised list of 30 sites for investment in AMP 8 has been identified, based on criticality to our customers and the environment. These include the following types of schemes: ▪ Delivering Power Resilience improvements to wastewater sites in the environmentally sensitive River Stour Catchment and Eastbourne ▪ Installing standby generators at 9 high-risk water and 11 high-risk wastewater sites	12
Best Option for Customers	▪ We have a followed a process-drive approach to identify and assess a variety of options for each site with a consideration for the cost benefit of each solution ▪ Using our Service Measure Framework we have been able to quantify the anticipated benefit the solutions will bring for each site, based on previous site performance ▪ We have well extensively engaged with our customers to understand their preferences for investment and their willingness to pay for these enhancements	32
Cost Efficiency	▪ We have applied our organisational approach to optioneering for both types of schemes being proposed. These have been further refined using our Cost Models to understand likely scheme costs more accurately and how the different options impact customer affordability ▪ We have actively considered customer affordability and have proposed enhancing a smaller number of our high-risk water and wastewater sites, to improve our performance and mitigate the future risks to power supply interruptions that we anticipate will impact our operations in the future	41
Customer Protection	▪ We are unable to identify specific PC impact of these enhancements, but they have been considered when looking at the overall targets being set for the PR24 submission ▪ We expect to see tangible benefit at the sites we have identified and a reduction in the variability in performance associated with storms	46

References

1 Causal Analysis based on System Theory (CAST) is an accident analysis technique that maximizes learning from accidents and incidents. The goal of analysis is to identify the limitations of the safety control structure that allowed the loss and identify how to strengthen the structure in the future.
2 Telemetry assets are protected with temporary battery back up
3 Effectiveness of Previous Interventions - : pirp-july-2023.pdf (southernwater.co.uk)
4 pirp-july-2023.pdf (southernwater.co.uk)
5 SPM_version_report_LR
6 Letter from Defra Head of Flooding and Water Emergencies – full copy in Appendix E
7 Met Office Extreme Weather Events and Climate
8 Storm Arwen review: final report (publishing.service.gov.uk)
9 Engineers work to restore power after Storm Eunice hit the South East | UK Power Networks
10 Looking back at Storm Eunice - SSEN
11 UK Storm Centre – Meteorological Office
12 PR24 and beyond: Long-term delivery strategies and common reference scenarios – Section 3.2.1 Climate Change
13 Cabinet Office “Keeping the Country Running: Natural Hazards and Infrastructure”
14 ‘A reliable supply of water for our customers’ is the first stated objective within ‘Our Plans’ and demonstrates our commitment to invest in the right long-term solutions, collaborate and work with nature to deliver better outcomes, enhance our resilience and protect and improve the environment
15 Stour catchment DWMP (southernwater.co.uk)
16 Southern Water Drainage and Wastewater Management Plan https://www.southernwater.co.uk/media/8541/a0003_dwmp_regional_plan_final.pdf
17 Southern Water Draft Water Resources Management Plan 2024 https://www.southernwater.co.uk/our-story/water-resources-management-plan/our-draft-water-resources-management-plan
18 Ofwat PR24 and Beyond: Final Guidance on long-term delivery strategies
19 PR25 Final Methodology – Appendix 9
20 pirp-july-2023.pdf (southernwater.co.uk)
21 SRN15 Cost and Option Methodology Technical Annex

Appendices

Appendix A	Additional Information on Storm Events and the Lessons we've learnt
Appendix B	Wastewater Site Assessment and Proposed Solution
Appendix C	Water Site Assessment and Proposed Solution
Appendix D	Detailed Solution Information by Site
Appendix E	Commissioning Letter to Water Companies for Power Resilience Questionnaire

Appendix A - Additional Information on Storm Events and the Lessons We Have Learnt

Frequency and Severity of Extreme Weather Events

Over the past 5 years we have been impacted by 33 named storms, which has resulted in disruption to a significant number of customers water supply and 414 pollution events

The UK Meteorological Office climate change projections update (UKCP18)[23] sets out that the UK climate will continue to be characterised by warmer, wetter winters and hotter, drier summers, with these will be accompanied by an increase in the frequency and magnitude of extreme weather events.

Specifically, interruptions to the main power supply, without an operating auxiliary power supply, can result in our Booster Stations and Service Reservoirs being unable to provide safe drinking water for our customers and our Pumping Stations and Waste Treatment Works being unable to transport Waste through our network resulting in Pollution events and discharges to watercourses and the sea.

Lessons Learnt from previous extreme weather events

We have been actively learning from previous extreme weather events, such as Storm Arwen and the Storms of February 2022 (including Storm Eunice), which have caused power supply interruptions to affect our operations.

The UK Government ***'Storm Arwen review: final report'*** identified the water sector ***"experienced impacts due to electricity disruption during Storm Arwen where sites lacked back-up electricity supplies."***.

Storms of February 2022

Across February 2022, the UK suffered eleven days of the largest storm events the UK has seen in 35 years through three major storms in quick succession, causing widespread damage and disruption across the country. These included: Storm Dudley – 16th February, Storm Eunice – 18th February and Storm Franklin – 21st February.

Of these three individual storms, Storm Eunice was the most severe, with Red weather warnings issued across the country and across our region. Eunice set a record for the fastest wind gust speed recorded in England and caused at least £360m in damage across the UK.

Across our region our two DNOs (UKPN and SSEN) suffered significant disruption caused by the extreme weather. UKPN suffered a month's worth of faults in a single day across 1,800 locations, resulting in damage to 46,000km of overhead power lines. SSEN were impacted by over 1,000 points of damage across their network, the equivalent of 6 months typical overhead line faults. Due to the succession of storm events, over

[23] ukcp18_headline_findings_v4_aug22.pdf (metoffice.gov.uk)

70,000 customers and businesses across Southern England remained without power 2 days after Storm Eunice.

Specifically for our operations, during the storm events of February 2022, we suffered significant asset downtime across our wastewater network as a result of the widespread network power disruption issues. Across the 11 days of storm events, more than 550 of our sites had periods of time without power and we had over 43,000 asset alarms triggered.

Across our network of Wastewater Treatment Works, 131 suffered a loss of Mains Power supply. In total 715 Power instrument alarms were triggered during this mains power outage at 67 of these sites. In total across the 67 sites, we suffered asset failure time (downtime) of 23817 hours (992 days), causing significant disruption to our operations from an event outside of our control.

Across our network of Wastewater Pumping Stations 365 suffered a loss of Mains Power Supply. 22% (79) of these sites continued to have pump failure alarms triggered following restoration of the power supply. This asset downtime resulted in 5485 hours (228 days) of operational disruption.

During these storm events, we had 387 fixed on-site generators operating across our network to provide power supply to our sites. In addition, we deployed 47 mobile generators and utilised 42 generators from our supply chain. This helped us keep our highest priority, critical sites in use and operational to minimise disruption for our customers and the environment.

One of the crucial findings from reviewing our response was that the availability of securing temporary standby generators from the supply chain was limited due to demand from other utilities and private enterprises.

Appendix B – Wastewater Site Assessment and Proposed Solution

Solution References

1. River Stour Catchment and Eastbourne WTW Power Resilience Scheme
2. Standby Generator Scheme
3. HV Ring scheme
4. Dual Transformer Scheme

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Albion Street Portslade WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Appley Park Ryde Transfer WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Archery Eastbourne WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Ashford WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Bethersden WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Bexhill & Hastings WTW	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Black Rock Brighton WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Brielle Way Westminster WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Broadstairs WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Broomfield Bank WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Browndown WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Budds Farm Havant WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Bulverhythe WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Cambridge Road Gosport WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Canterbury WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Castle Road Allington WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Chestnut Avenue Eastleigh WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Dibles Road Warsash WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Drove Road Sheerness WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
East Worthing WTW	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Eastbourne WTW	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Eastney	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Elizabeth Street dover wps	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fairlee	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Folkestone Junction WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Fort Cumberland	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Gainsborough Drive Herne Bay WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Garnier Road Winchester WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Goddards Green WTW	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Gravesent WTW	#N/A	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Grove Road Gosport WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Horesham New WTW	#N/A	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Kings Hall Herne Bay WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Lion Point Ventnor WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Little Ann Bridge WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Liverpool Road Deal WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Lottbridge Drove Eastbourne WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Margate WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Marine Terrace Margate WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
May Street Herne Bay WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Medina Road Cowes WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Military Road Ramsgate WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Millbrook WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Motney Hill WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Newgate Lane Peel Common WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Newhaven East WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Peel Common WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Queensborough WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Rock A Nore Hastings WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]
Sandown New WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
School Lane Hamble WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Shoreham WTW	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Slowhill Copse Marchwood WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Station Road Whitstable WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Swalecliffe WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
The Stade Folkestone WPS	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
The Wharf Midhurst WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Weathelees Hill A WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Weatherlees Hill B (MGATE & Bstairs) WTW	Kent	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
West Park Bognor Regis WPS	Sussex	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Westbrook Grove Purbrook WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	WPS Environmental Consequence Ranking?	Risk Assessed as Priority from previous Power resiliecne assessment (Y/N)	Priority Level	Number of Cat 1 Pollutions (2018 – 2023)	Number of Cat 2 Pollutions (2018 - 2023)	Number of Cat 3 Pollutions (2018 - 2023)	Number of Cat 4 Pollutions (2018 - 2023)	Time to Spill (1DWF) (For WPS assets)	Likely to spill if Interruption <3 hours	Proposed Solution:	Proposed Delivery AMP
Whiteley Lane Whiteley WPS	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Woolston WTW	Hampshire/ Isle of Wight	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Appendix C – Water Site Assessment and Proposed Solution

Solution References

2. Standby Generator Scheme
3. HV Ring scheme
4. Dual Transformer Scheme

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	What is the Site Safe Control of Operations (SCO) RAG Status	Reservoir Served Estimated Operationally Available Storage (hrs)	Properties at Risk (Water Criticality Framework)	Alarm Data (Power Supply events within last 3 years)	Proposed Solution:	Proposed Delivery AMP
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]
[redacted]	[redacted]	[redacted]		[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	What is the Site Safe Control of Operations (SCO) RAG Status	Reservoir Served Estimated Operationally Available Storage (hrs)	Properties at Risk (Water Criticality Framework)	Alarm Data (Power Supply events within last 3 years)	Proposed Solution:	Proposed Delivery AMP
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]					[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]				[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

												Site Name
												County
												Fixed Operational Standby Generator on Site (Yes/No)
												What is the Site Safe Control of Operations (SCO) RAG Status
												Reservoir Served Estimated Operationally Available Storage (hrs)
												Properties at Risk (Water Criticality Framework)
												Alarm Data (Power Supply events within last 3 years)
												Proposed Solution:
												Proposed Delivery AMP

Site Name	County	Fixed Operational Standby Generator on Site (Yes/No)	What is the Site Safe Control of Operations (SCO) RAG Status	Reservoir Served Estimated Operationally Available Storage (hrs)	Properties at Risk (Water Criticality Framework)	Alarm Data (Power Supply events within last 3 years)	Proposed Solution:	Proposed Delivery AMP
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]					[redacted]	[redacted]

Appendix D – Detailed Solution Information by Site

Detailed Solution Information

River Stour Catchment & Eastbourne WTW Power Enhancement Schemes

Following our investigations into the Power Resilience vulnerability of the 10 sites in the River Stour Catchment and Eastbourne WTW we have identified the need to upgrade all sites to reduce the risk of environmental impacts through Pollution incidents caused by interruptions to power supplies.

This scheme covers 10 sites across our sewerage networks in the catchment area and Eastbourne WTW. Each site will have specific enhancement activities delivered to upgrade their power assets, systems and processes to reduce their vulnerability to power supply interruptions.

Detail on the specific investments within each Sewerage Network is provided below. Focus on enhancing and upgrading HV and LV assets, at these locations, will allow us to meet the expected future demands and risks.

These investments will enhance our assets condition, capacity and reliability to help us reduce the risks and impacts of pollution incidents on the diverse and environmentally sensitive catchment area. Helping us deliver improved services for our customers and meeting their expectations and requirements.

We will treat each of those impacted sewerage network and Eastbourne WTW as individual schemes to be delivered across AMP 8.

Summary details of each of these schemes are provided below.

Table 24: Summary of Eastbourne WTW Power Resilience Scheme

Eastbourne WTW Power Resilience Enhancement Scheme - Wastewater	AMP 8 Budget: £8,768,935
Solution Description	[redacted]
Detailed Costs	Eastbourne WTW - £8,768,935

Table 25: Summary of Broomfield Bank Sewerage Catchment Power Resilience Scheme

Broomfield Bank Sewerage Catchment Power Enhancement Scheme	AMP 8 Budget: £3,173,447
Solution Description	[redacted]
Detailed Costs	▪ Broomfield Bank WTW - £399,427 ▪ Elizabeth Street WPS - £856,771 ▪ The Stade WPS - £659,054 ▪ Folkstone Junction WPS - £1,258,195

Table 26: Summary of Swalecliffe Sewerage Catchment Power Resilience Scheme

Swalecliffe Sewerage Catchment Power Enhancement Scheme	AMP 8 Budget: £1,950,170
Solution Description	[redacted]
Detailed Costs	▪ Swalecliffe WTW - £1,950,170

Table 27: Summary of May Street Herne Bay Sewerage Catchment Power Resilience Scheme

May Street Herne Bay Sewerage Catchment Power Enhancement Scheme	AMP 8 Budget: £979,693
Solution Description	[redacted]
Detailed Costs	▪ May Street Herne Bay WTW - £979,693

Table 28: Summary of Weathelees Hill 'A' & 'B' Sewerage Catchment Power Resilience Scheme

Weatherlees Hill A & B Sewerage Catchments Power Enhancement Scheme	AMP 8 Budget: £6,095,600
Solution Description	[redacted]
Detailed Costs	▪ Weatherlees Hill A & B WTW - £2,166,891 ▪ Margate WPS - £2,803,293 ▪ Broadstairs WPS - £1,125,416

Installing Fixed Standby Generator Schemes

We have identified **20 sites, 11 wastewater and 9 water**, in our region that require urgent installation of fixed standby generators to the site. This work will provide additional redundancy and reliability in our wastewater systems to prevent environmental pollution and customer supply interruptions when they are impacted by power supply interruptions.

The water and wastewater sites that we have identified are all high risk and all wastewater sites are already experiencing operational issues. This drives the need for us to invest immediately in these sites to mitigate future changes in operating environment brought around by changes in weather extremes caused by Climate Change.

The installation of fixed standby generators at these sites is the best option for customers as it is deliverable, cost effective and provides suitable levels of system resilience to address our short-term requirements to mitigate the threat of pollution and customer supply interruptions as a result of interruptions to the power supply.

As stated in Section 2, we have chosen to defer installing standby generators at 17 of the water sites we assessed. Whilst these sites do not have a standby generator installed, they have not experienced significant power alarm volumes, and a combination of low negative impacts across the other criteria. For this reason, we are not proposing to enhance them at this stage but will incorporate them into our long-term strategy. This represents about £3m investment in future AMPs', and we will continue to consider further enhancements

This solution enables us to adapt in the future to the rapidly changing energy landscape, it is a low regret solution that builds redundancy into our sites. It provides our customers and stakeholders with increased assurance that we are addressing their immediate needs, whilst also planning for future investments in other solutions that can align with our future net-zero and energy strategies.

Table 29: Summary of Wastewater Standby Generator Power Resilience Scheme

Standby Generator Installation Scheme - Wastewater	AMP 8 Budget: £5,882,577
Solution Description	Installation of fixed standby diesel generators at 11 of our most critical wastewater pumping stations and treatment works across our region to provide additional redundancy to mitigate the impacts of power supply interruptions from DNO power supplies.
	Sites to be enhanced include: ▪ Gainsborough Drive WPS ▪ Liverpool Road Deal WPS ▪ Drove Road Sheerness WPS ▪ Chestnut Avenue Eastleigh WPS ▪ Little Anne Bridge WPS ▪ Dibles Road Warsash WPS ▪ School Lane Hamble WPS ▪ Grove Road Gosport WPS ▪ Cambridge Road Gosport WPS ▪ Newgate Lane Peel Common WPS ▪ The Wharf Midhurst WPS
Detailed Costs	Total Cost per site - £534,780 (includes unit cost and typical installation costs)
Expected Benefits	£1,542,740 over 5 years

Table 30: Summary of Water Standby Generator Power Resilience Scheme

Standby Generator Installation Scheme - Water	AMP 8 Budget: £4,813,018
Solution Description	Installation of fixed standby diesel generators at 9 of our highest risk water booster stations and supply works across our region to provide additional redundancy to mitigate the impacts of power supply interruptions from DNO power supplies. Sites to be enhanced include: ▪ [redacted] – fixed standby generator currently installed at site. This was decommissioned in 2005 as it was insufficient to power the site and the generator had become life expired. A mobile generator connection point was installed in 2017 to power the site, although for unexpected blackout events, there is not sufficient time to prevent a pollution event ▪ [redacted] - fixed standby generator currently installed at site. This was decommissioned in 2005 as it was insufficient to power the site and the generator had become life expired. A mobile generator connection point was installed in 2017 to power the site, although for unexpected blackout events, there is not sufficient time to prevent a pollution event ▪ [redacted]
Detailed Costs	Total Cost per site - £534,780 (includes unit cost and typical installation costs)
Expected Benefits	£4,121,330/ 3 years

Appendix E – Commissioning Letter to Water Companies for Power Resilience Questionnaire

Department for Environment Food & Rural Affairs

2 Marsham Street
London
SW1P 4DF
T: 03459 335577
helpline@defra.gov.uk
www.gov.uk/defra

Date: 28 September

Dear Colleague,

Power Resilience Commission

I wanted to update you on Defra's winter risk planning and to commission a sector wide questionnaire to understand water companies' preparedness and resilience in the unlikely event of energy disruption over the winter.

Every year we assess a range of risks our key sector's face over the winter period and in the coming weeks, we will be convening our annual winter risks workshop to discuss water companies' preparations for the winter, learn lessons from significant incidents faced in 2022 and examine any emerging risks the UK may face in the future.

Owing to the energy disruption experienced last year during storms Arwen and Eunice and against the backdrop of rising energy prices, we will be including energy resilience in this year's assessment. As part of standard practice contingency planning processes, HMG has explored the potential scenarios that could lead to energy disruption. These scenarios are considered to be highly unlikely but, as is appropriate for a responsible government, our aim is to ensure our preparations and plans enable us the readiness to respond.

We have developed a short self-assessment which will assist with assessing and advising HMG ministers on each water companies' preparedness and resilience to energy disruption. To aid the completion we have provided a purely hypothetical planning scenario of a complete loss of power to your whole company affecting all elements of the water treatment process which will last for a minimum of 24 hours.

Information received will be password protected and treated as commercially sensitive. Limited access will only be provided to contingency planners in Water UK or government on a need-to-know basis. The survey is intended to capture a high-level overview of your processes and plans. As such we have set a short deadline of **COP 7 October** for completion. Completed returns should be sent to wsr.emergencies@defra.gov.uk

Thank you very much in advance for your support with this important workstream given the current competing priorities.

Yours sincerely,

Kris Carr
Head of Flooding and Water Emergencies
kris.carr@defra.gov.uk