SRN30 Raw Water Deterioration Enhancement Business Case

2 October 2023

Version 1.0

WATER for LIFE

from Southern Water

Contents

Glossary

Acronym	Term	Definition
AMP	Asset Management Period	Water company business plan
	Catchment	The area from which rainfall and groundwater would naturally collect and join the flow of a river
	Central Area	Supply area made up of the Sussex North, Sussex Brighton and Sussex Worthing Water Resource Zones
DWI	Drinking Water Inspectorate	The government's drinking water quality regulator
	Eastern Area	Supply area comprising the Kent Thanet, Kent Medway East, Kent Medway West and Sussex Hastings Water Resource Zones
EA	Environment Agency	The government's environmental regulator
Ml/d	Mega litres per day	Millions of litres per day. Unit of measurement for flow in a river or pipeline
	National Framework	The Environment Agency's national framework for managing future water need for England by the means of regional planning introduced in March 2020.
Ofwat	Office of Water Services	The economic regulator of the water sector in England and Wales
	Source	A named input to a water resource zone where water is abstracted from a well, spring or borehole, or from a river or reservoir
LTDS	Long Term Delivery Strategy	Long term strategy which indicates the types of future investment likely to be required by Southern Water alongside indicative costs.

Executive Summary

We need to invest £97.906m of enhancement capex funding to address raw water quality deterioration in AMP8. This investment is supported by the DWI who issued decision letters to confirm their support of the need for investment and the proposed solutions on 31st August 2023. The investment breaks down into two areas.

1. £94.0m to counteract raw water deterioration, split across:
   - Nitrate interventions
   - Disinfection improvements (Protozoa and Virus deactivation)

Without interventions at the sites identified, the treatment challenge will exceed the current capabilities of the existing treatment processes leading to potential Water Quality Compliance Risk Index (CRI) failures and/or the loss of output from the sites, resulting in interruptions to customer supplies.

2. £3.9m to improve understanding and planning for current and future risks, we will undertake two studies:
   - Climate change adaptation study
   - Emerging contaminants study

The studies will provide us with further information to enhance our ability to identify and quantify risks to raw water quality and to plan for their mitigation where required.

We have ensured our costs are efficient through validation of our cost curves and benchmarking of our nitrate removal costs.

Table 1: Summary of enhancement case

Summary of Enhancement Case	
Name of Enhancement Case	Water Quality Enhancements
Summary of Case	This Business Case addresses: • Raw water deterioration from increasing Nitrate levels • Improves resilience at our sites with the highest disinfection risks through our Disinfection Future Resilience Programme (DFRP) • Initiates studies into climate change adaptation and emerging contaminants
Expected Benefits	• Improved drinking water quality • Reduced future CRI risk • Reduced future customer interruptions risk • Improved planning for PR29 and AMP9
Associated Price Control	Water Networks+

Enhancement TOTEX	£100.409m
Enhancement OPEX (annual)	£2.504m
Enhancement CAPEX	£97.906m
Is this enhancement proposed for a direct procurement for customer (DPC)?	No This investment does not meet the investment threshold for DPC

1. Introduction and Background

This business case sets out the enhancements required to address raw water quality deterioration in AMP8. This investment is supported by the DWI who issued decision letters to confirm their support for the need and solutions on 31st August 2023. Compliance with these requirements will become mandatory within AMP8 due to the issue of Notices by the DWI. This investment breaks down into two broad areas as follows:

1. Counteracting raw water deterioration
    1.1. Nitrate interventions
    1.2. Disinfection improvements (Protozoa and Virus deactivation)
2. Improved understanding and planning for current and future risks
    2.1. Climate change adaptation study
    2.2. Emerging contaminants study

Delivery of this work will reduce future water quality risk to customers. This work maintains future CRI and interruptions performance within the context of deteriorating raw water quality. Meaning that the treatment challenge is increasing, so additional treatment is necessary. This work will also allow us to plan future water quality interventions more efficiently.

In the first of these areas, we have seen raw water quality continue to deteriorate over recent AMPs due to increasing nitrate concentrations. During AMP6, 5 nitrate removal plants were installed across our region at 5 sites. In AMP7 a more holistic approach was taken. Nitrate concentrations were reduced for 14 raw water sources through the installation of nitrate removal plants at a small number of these sites and blending either raw or treated flows.

Increasing nitrate concentrations in our source waters are predominantly due to the historical overuse of nitrate by farmers, which peaked in the 1980s. This peak in nitrate loading is moving through the ground and causing raw water nitrate concentrations to continue to rise. We need to remove nitrate to ensure the water we supply is safe to drink. We sample and model nitrate trends throughout our region, this allows us to determine which sites will breach our trigger levels and the DWI's Prescribed Concentration Value (PCV) and when this is likely to occur. This allows us to plan suitable interventions based on predicted concentrations. In addition to interventions such as blending and treatment, we carryout catchment management which reduces the magnitude of short-term peaks and reduces overall nitrate levels in the long term.

We also experience raw water deterioration due to the presence of protozoa and viruses. Detection of these in treated water at a site, results in the loss of that site until appropriate mitigation can be put in place. For our Disinfection Future Resilience Programme, we identified sites with indicators of decreasing raw water quality such as E.Coli, Clostridia, Enterococci, oocysts and somatic coliphages. We then ranked the sites according to criticality (population served and sites which must remain in service to ensure customers remain in constant supply). We propose to enhance the disinfection processes at the most critical of these sites in AMP8. This will prevent deterioration of these sources leading to interruptions for customers.

In the second area we propose carrying out two studies to provide us with further information to enhance our ability to identify and quantify risks to raw water quality and to plan for their mitigation where required.

The first study is on Climate Change Adaptation to assess the impact that climate change is having on our water supplies and how we will need to adapt our network and treatment processes to accommodate it in the future. This could be due to changes in temperature, rainfall patterns and intensity, flooding or other factors.

The second study is into emerging contaminants. These are substances such as pharmaceuticals, pesticides or other chemicals which are not currently sampled for, but which could be present in our source waters. These may be present due to historical or current land use, changes in farming practises or illegal chemical discharges. Through the study we will first screen for the presence of contaminants, then we will sample to determine the concentrations. Finally, we will analyse the results to determine if additional monitoring or treatment might be required in the future.

The proposed AMP8 spend for water quality enhancements is set out in following table:

Table 2: Data table references

Area of investment		Table	Row/s	Line description	Capex	Opex	Totex
Raw Water Deterioration	Nitrate	CW3	97/98/99	Raw Water Deterioration	48.311	1.019	49.330
	Disinfection	CW3	118/119/120	Resilience	45.708	1.485	47.193
Improving understanding and planning	Studies	CW3	132*	Additional Line	3.887	0	3.887
					97.906	**2.504**	**100.410**

*CW3.132 also contains Reservoir Safety costs

2. Needs Case for Enhancement

In this section, we set out the need for the enhancement. We first provide the needs case for counteracting raw water deterioration. This enhancement reduces the water quality risk to our customers through site specific interventions.

The second needs case covers the enhancement for improved understanding and planning for current and future risks. This enhancement provides us with further information to enhance our ability to identify and quantify future water quality risk to our customers and to plan for mitigation where required.

Our customers have made it very clear that they expect us to maximise the use of and protect our existing sources of water and only develop new sources where absolutely necessary. It is therefore important that we carry out this work to counteract deterioration of our sources as well as continuing the catchment management work which also helps to protect and improve our raw water sources. The catchment management which is carried out in conjunction with this work is also supported by our customers, because it reflects their desire that those who pollute our environment and our water sources play their part in improving it.

2.1. Counteracting Raw Water Deterioration – Needs Case

We are proposing interventions in two areas to counteract raw water deterioration, they are as follows:

1. Nitrate interventions
2. Disinfection improvements – Disinfection Future Resilience Programme (DFRP)

In both these areas we have data which shows that the raw water quality is deteriorating. We predict that without interventions at these sites during AMP8, the treatment challenge will exceed the current capabilities of the existing treatment processes leading to potential CRI failures and/or the loss of output from the sites, resulting in interruptions to customer supplies.

Our analysis of this data and our conclusions for the required interventions are supported by the DWI as demonstrated by the following decision letters:

Table 3: DWI Decision letters

Area	Group/Ref	DWI Decision letter reference	DWI Completion date
Nitrate	Group A – Isle of Wight	SRN11 not supported	-
	Group B – West Sussex	SRN12	Mar-27
	Group C – East Sussex	SRN13	Mar-27
	Group D1 – Kent Medway 1	SRN14-1	Mar-30
	Group D2 – Kent Medway 2	SRN14-2	Mar-30
	Group E – Kent Thanet	SRN15	Mar-30
Disinfection Future Resilience Programme	Cryptosporidium	SRN08	Mar-30
	Viruses		
Studies	Climate Change Adaptation Study	SRN16	Mar-30
	Emerging Contaminants Study		

Interventions at Bowcombe are not proposed for AMP8.

2.1.1. Nitrate – Needs

Nitrate is present in varying concentrations in both ground and surface water sources throughout our supply area. Nitrate in water reduces to nitrite which inhibits oxygen transport in blood leading to Methemoglobinemia or 'Blue Baby Disease'. This is particularly harmful to babies due to the relatively large proportion of their diet which can come from water. Using our Drinking Water Safety Plans (DWSPs) we have identified that Nitrate concentrations are continuing to increase in our raw water sources. We have identified several sites at risk of exceeding our internal action trigger level and the DWIs Prescribed Concentration Value (PCV) during AMP8. Consequently, we need to intervene to ensure treated water concentrations remain below the limit set by the Drinking Water Inspectorate (DWI).

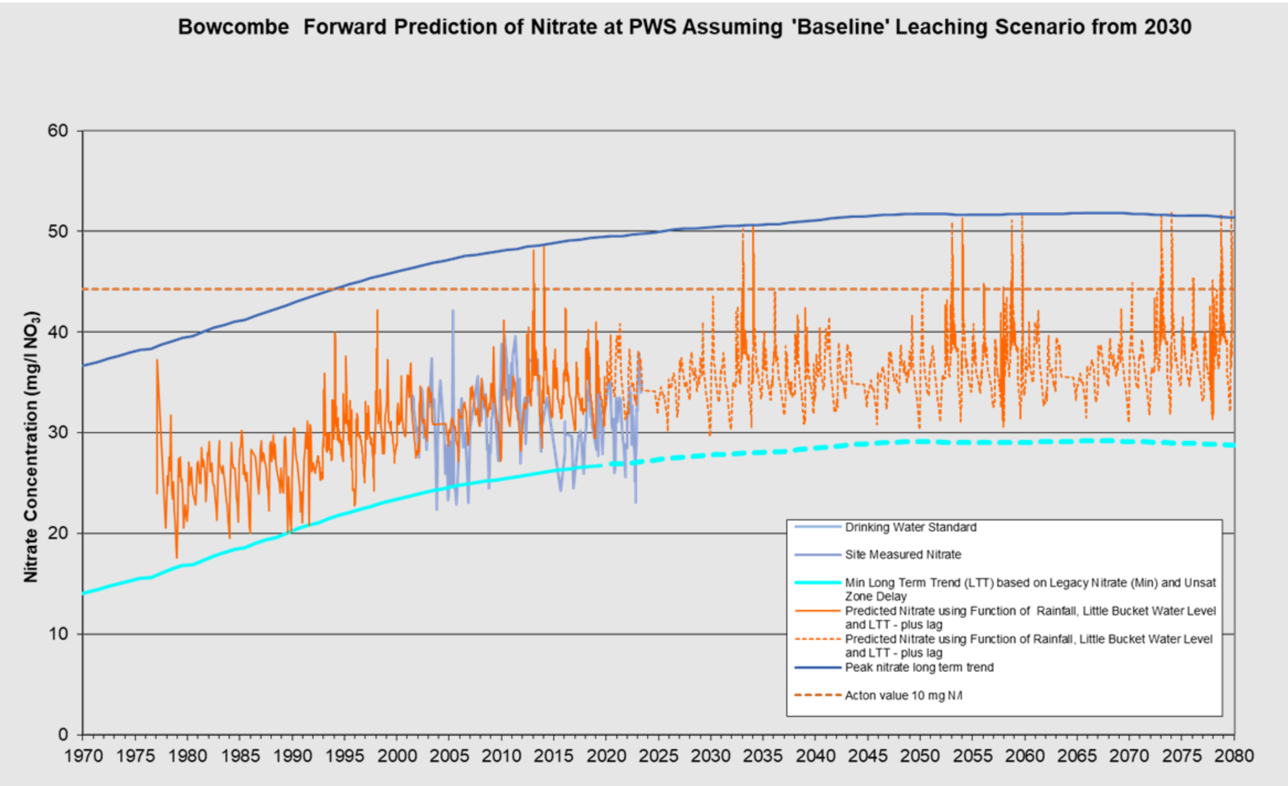
In addition to the physical geology surrounding a water source, raw water nitrate concentrations vary on a daily basis depending on a multitude of different factors such as ground water levels, rainfall duration and intensity, land use, the proximity of pollution sources etc. This wide variety of factors mean that predicting future nitrate concentrations is very complicated. In order to assist with our forecasting of future nitrate concentrations, we have developed nitrate models with Woods for all of our 'at risk' sources. The model outputs for each of the above sites can be seen below.

The sites where raw water nitrate concentrations are increasing and forecast to breach the action trigger level in AMP8 are as follows:

Group A – Isle of Wight (IoW)

- Bowcombe

Figure 1: Bowcombe nitrate model output



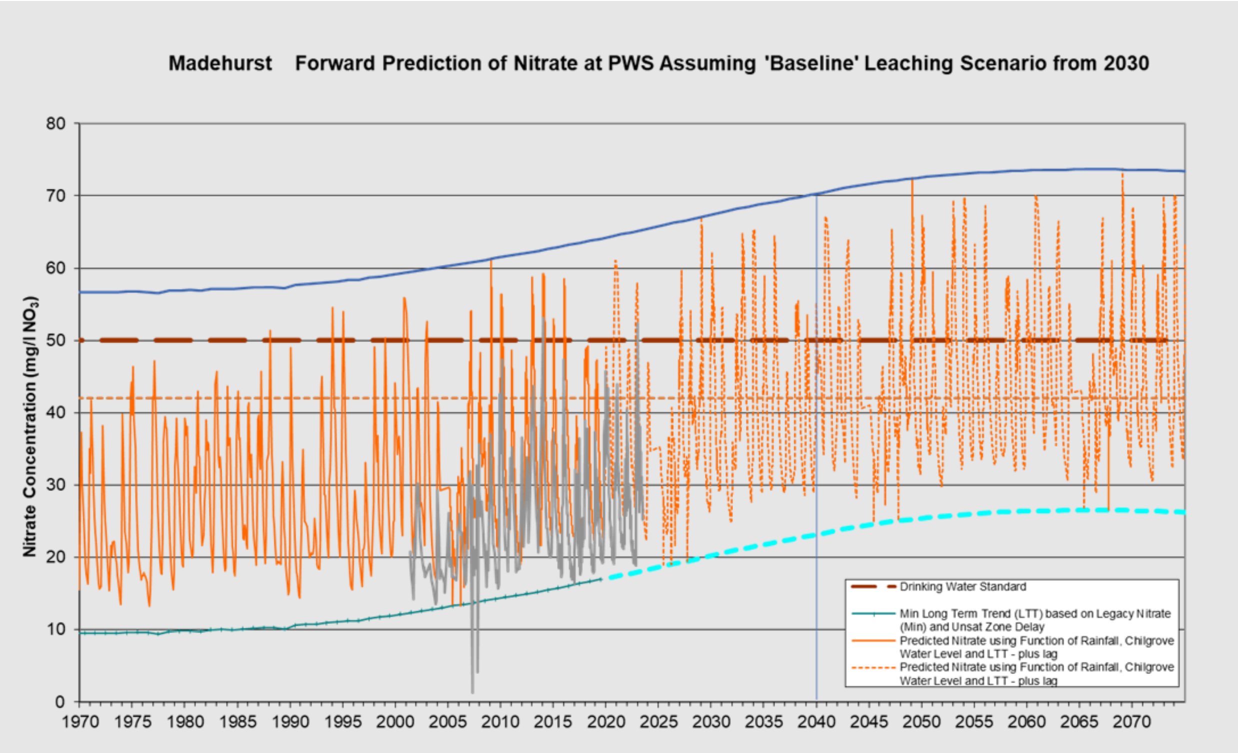
The modelling (carried out by [redacted] shows an increasing trend for Nitrate at Bowcombe which is forecast to breach the PCV around 2025 and plateau around 2045. Historic concentrations have exceeded our trigger level of 42mgNO3/l we therefore need to consider what actions are appropriate. Historic data fits the model reasonably well however recorded data is generally below the model predictions, meaning that the PCV breach predicted by the model is likely to occur later than forecast. Having reviewed this internally we agree with the DWIs assessment that the PCV is unlikely to be breached in AMP8, therefore no intervention is required in AMP8.

Group B – West Sussex

- Madehurst
- Stanhope Lodge
- Patching

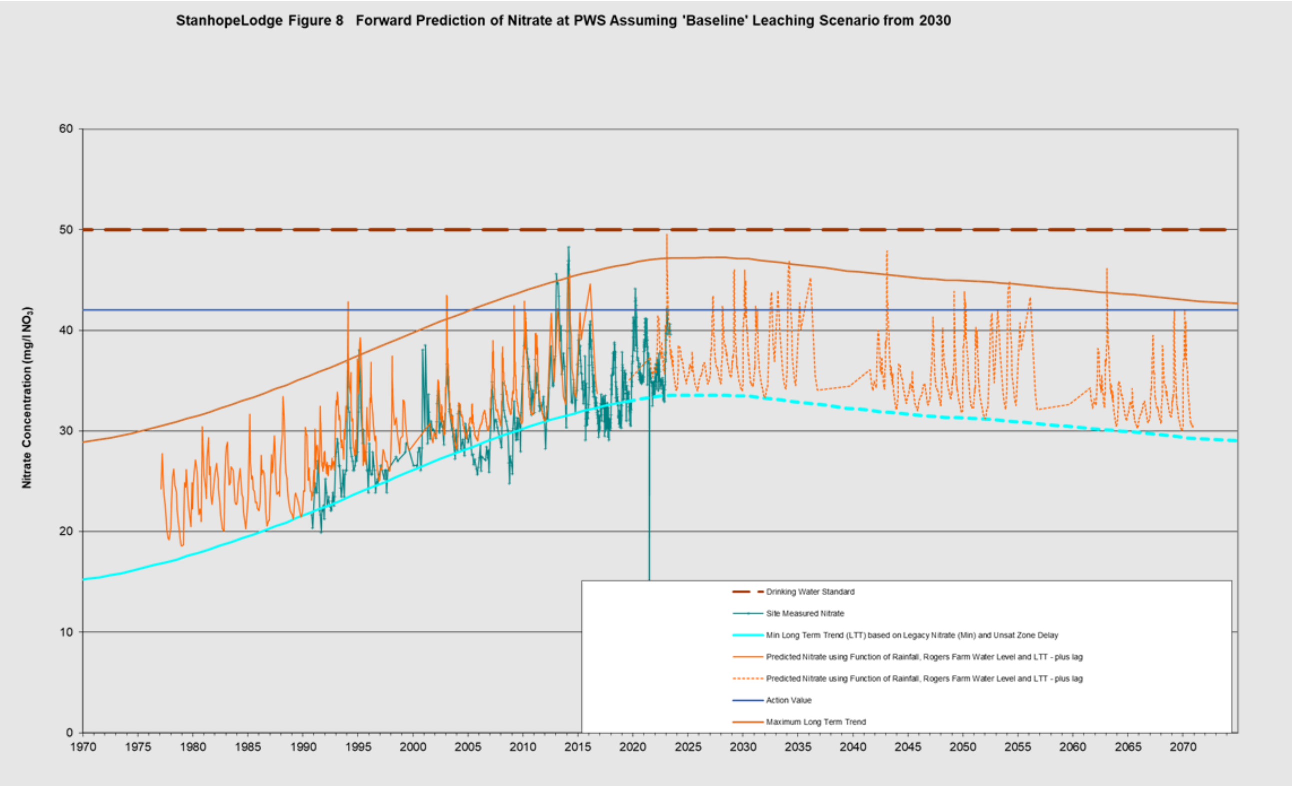
The modelling (carried out by [redacted]) shows an increasing trend for Nitrate at Patcham, Madehurst and Stanhope Lodge. A blending scheme is being implemented in AMP7 to allow the Nitrate removal plant at Patching to be postponed until AMP8. Nitrate levels at Patching and Madehurst are above PCV, they will both require reducing in AMP8 so that supplies to customers are maintained below the PCV. The nitrate level at Stanhope Lodge is forecast to be above Southern Water's action trigger level.

Figure 2: Madehurst nitrate model output



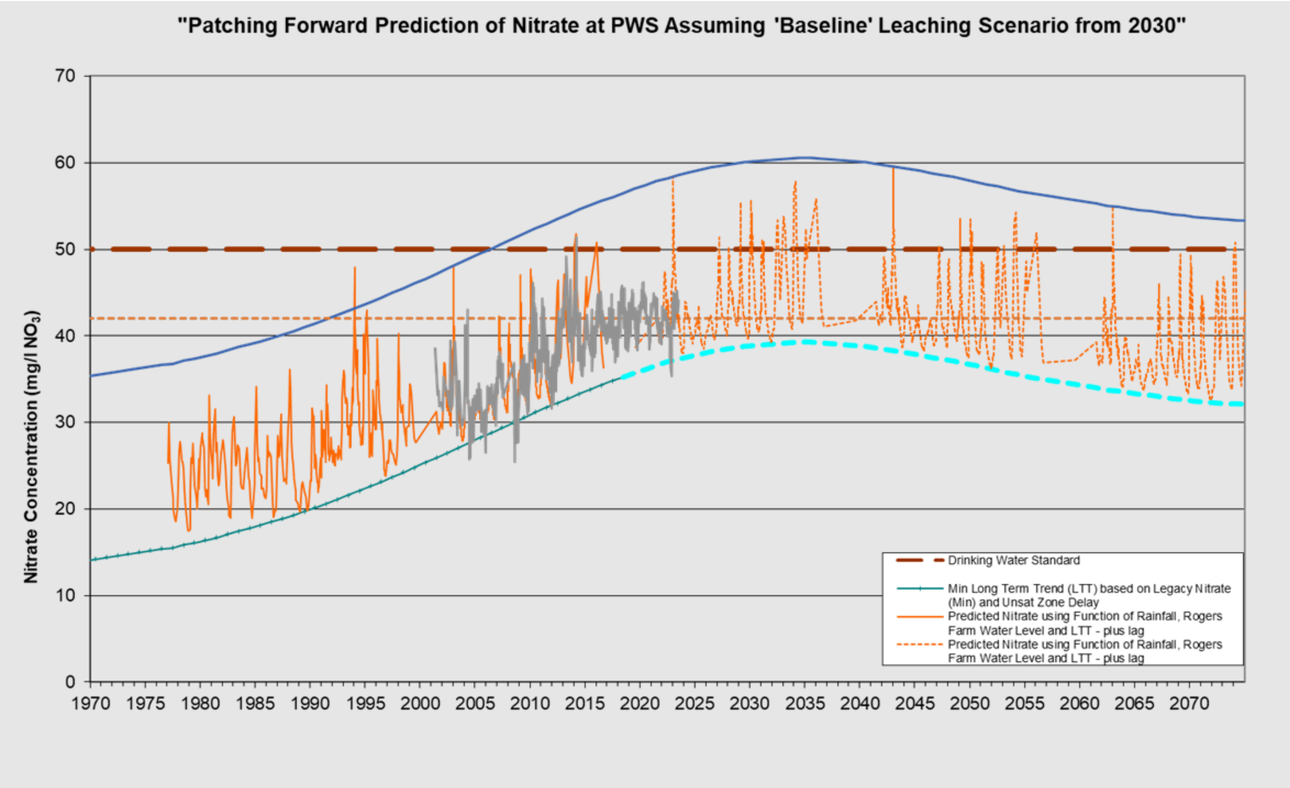
The fit between the model and the site data is very good. The recorded nitrate levels frequently exceeded the action value of 42mg NO3/l. The most recent peak is just exceeding the PCV of 52.3mg NO3/l (2023). At 2040, the predicted maximum concentration is 70mg NO3/l.

Figure 3: Stanhope Lodge nitrate model output



The fit between the model and the site data is generally very good. The most recent peak is at 42.84mg NO3/l (2023). At 2040, the predicted maximum concentration is 45.83mg NO3/l, therefore intervention is required.

Figure 4: Patching nitrate model output

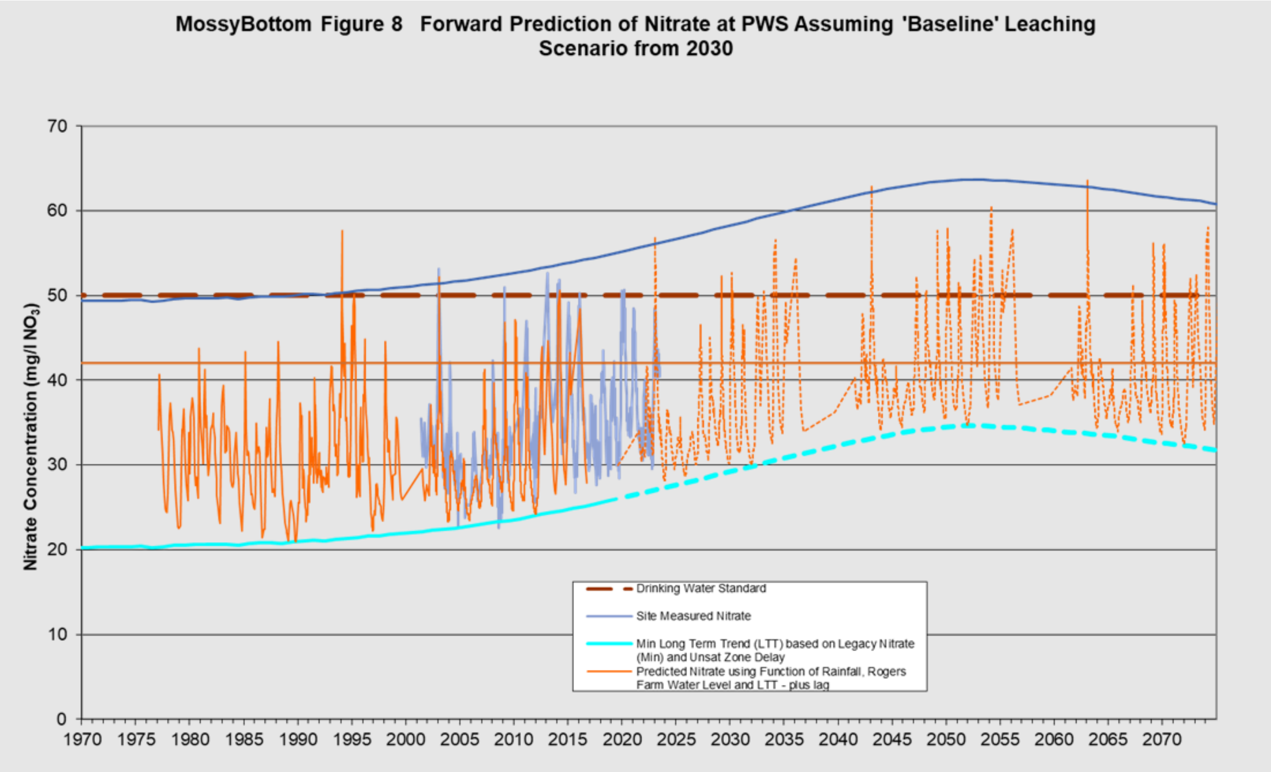


The fit between the model and the site data is very good. The recorded nitrate levels fluctuate around the action value of 42mg NO3/l. The most recent peak is just exceeding the PCV of 51.4mg NO3/l (2014). At 2040, the predicted maximum concentration is 60mg NO3/l.

Group C – East Sussex

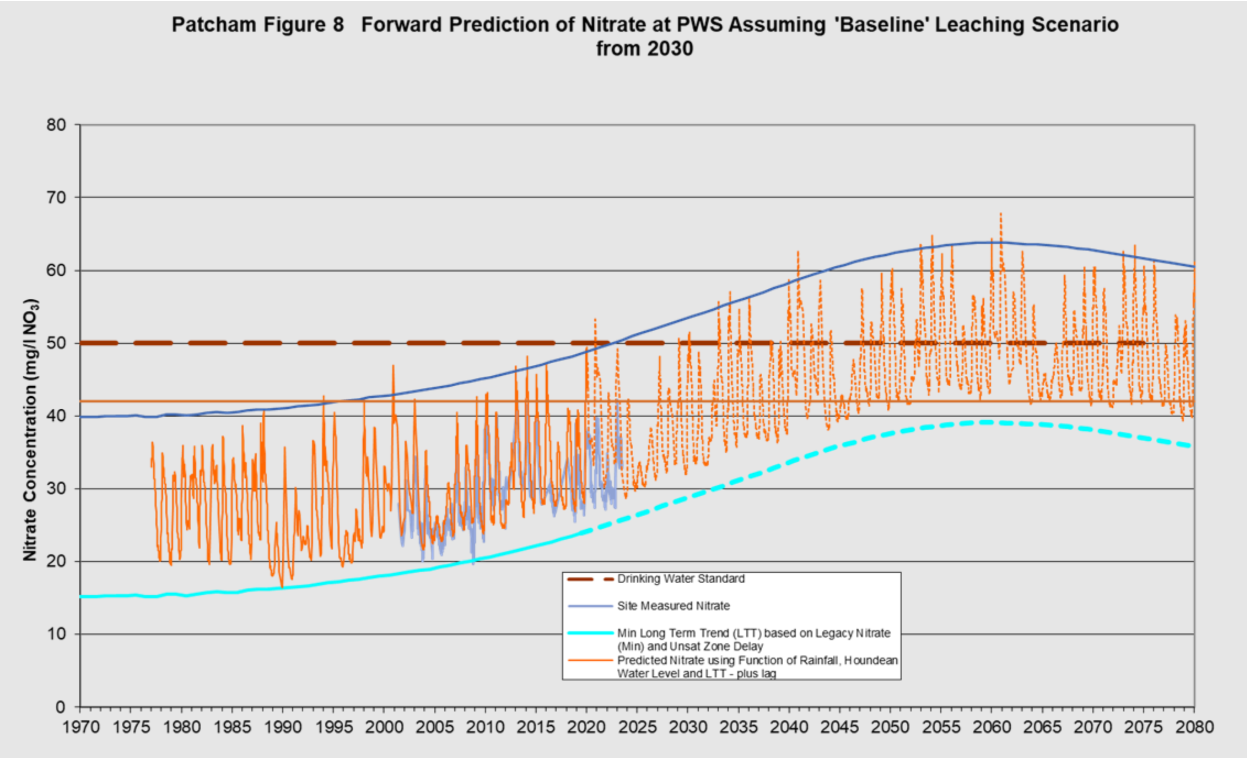
- Mossy Bottom
- Patcham

Figure 5: Mossy Bottom nitrate model output



The fit between the model and the site data is very good. The recorded data constantly exceed the action trigger point of 42mg NO3/l. The most recent peak is at 48.61mg NO3/l (2023). At 2040, the predicted maximum concentration is 61.5mg NO3/l, therefore intervention is required.

Figure 6: Patcham nitrate model output

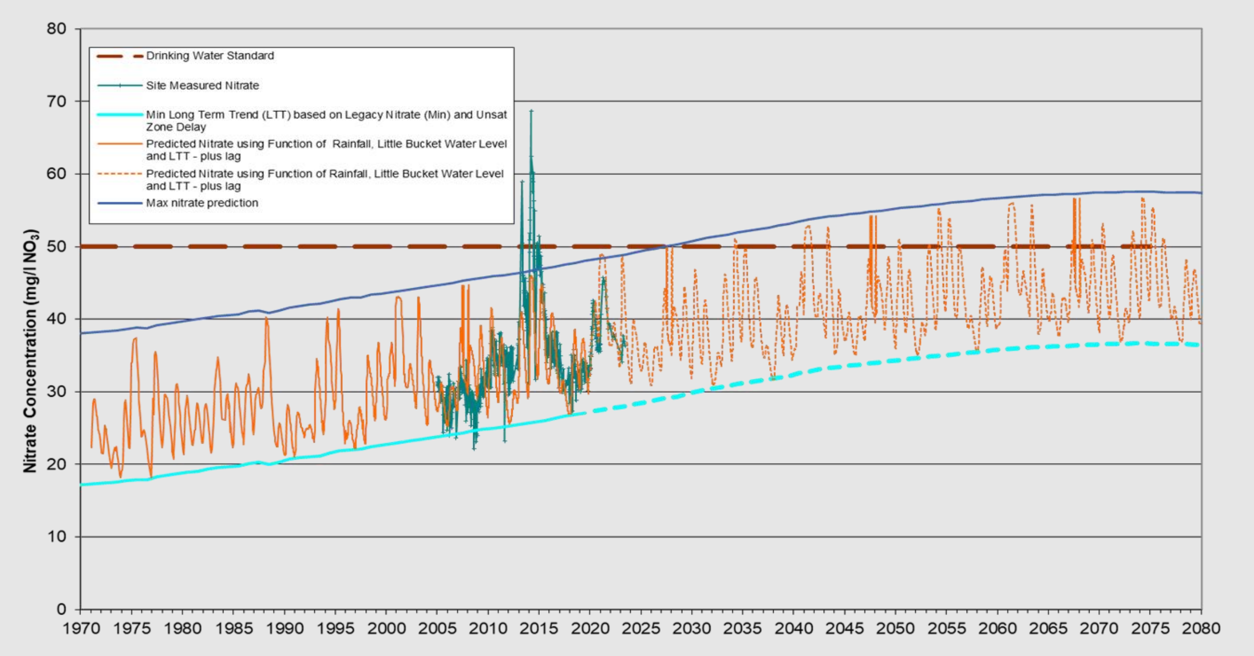


The fit between the model and the site data is very good. The most recent peak is at 42.18mg NO_3/l (2023). At 2040, the predicted maximum concentration is 58.5mg NO_3/l, therefore intervention is required.

Group D – Kent Medway

- Hazells – D1 Medway West
- Fawkham – D1 Medway West
- Keycol – D2 Medway East

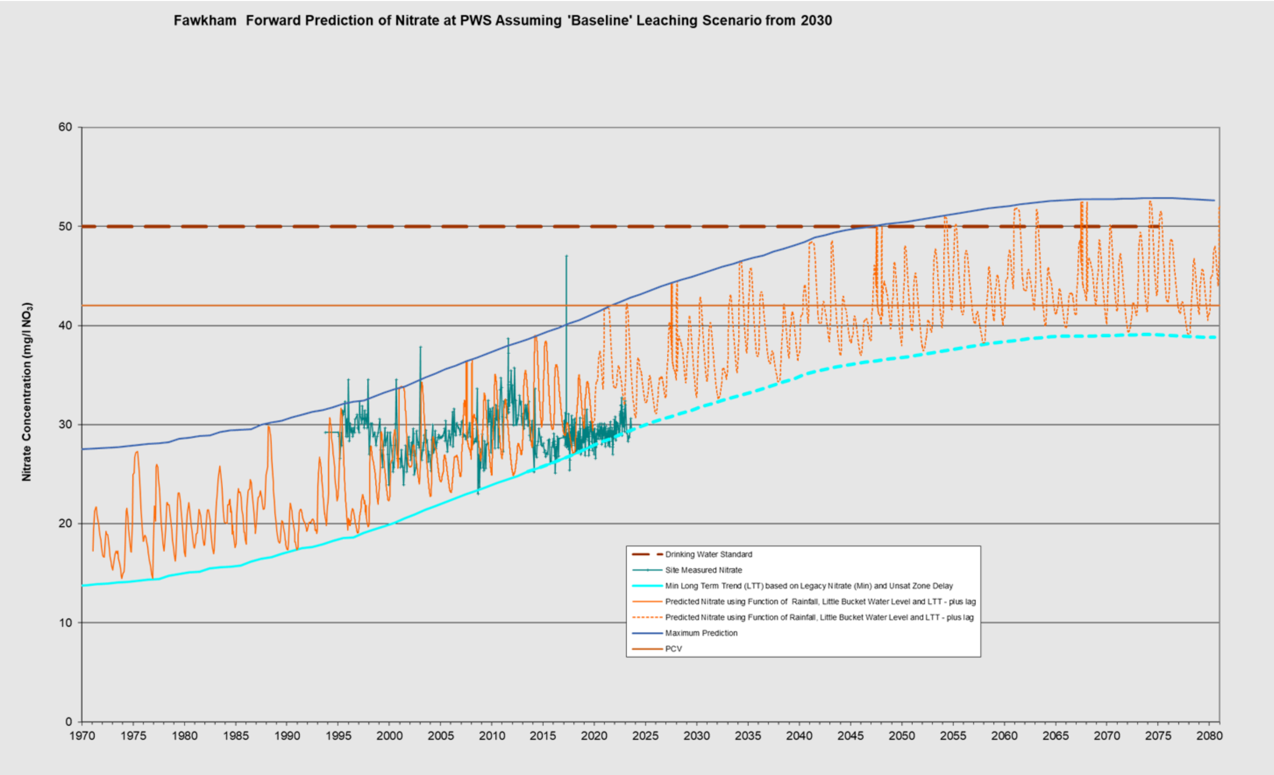
Figure 7: Hazells nitrate model output



Hazells: The fit between the model and site data is generally good with an exception for a period in 2015. We have been unable to determine the root cause of this event, we continue to investigate.

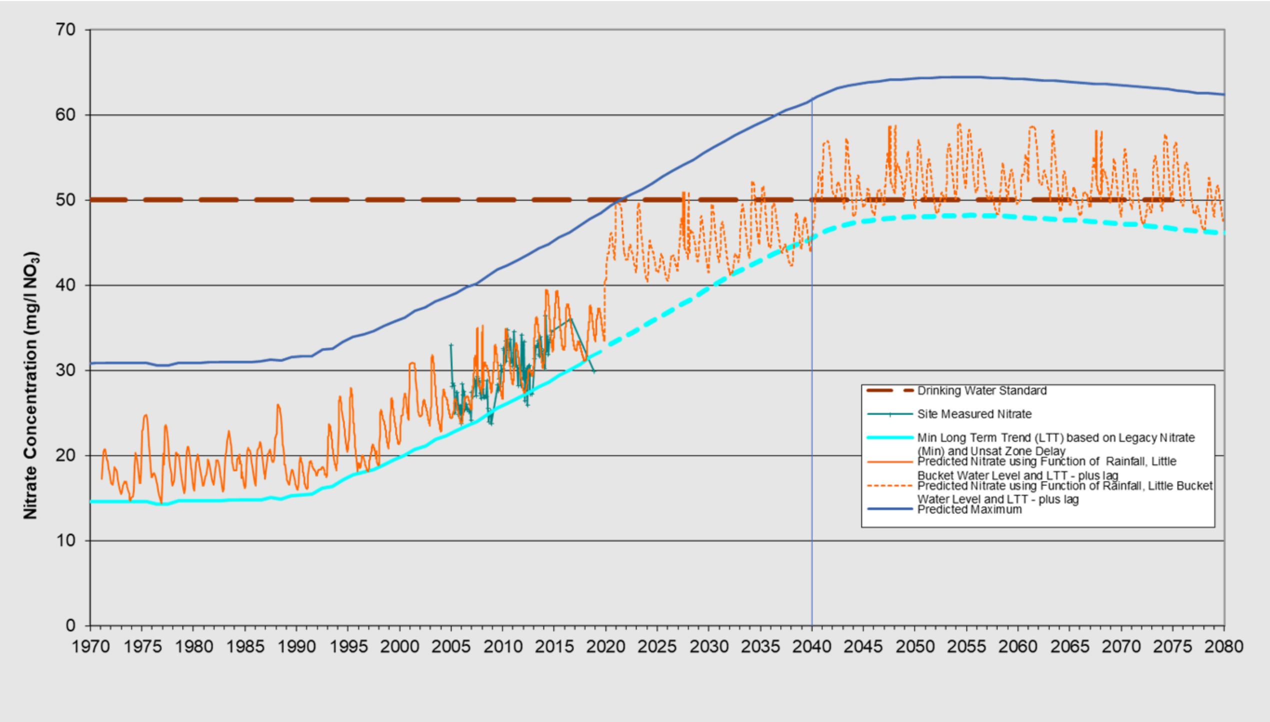
Recently peak at 45.7 mg NO3/l(2021).

Figure 8: Fawkham nitrate model output



A single historic concentration reading exceeded our internal trigger level of 42mgNO3/l in April 2017. We therefore considered if action was required. The Fawkham model output indicates that the trigger level would be reached in 2020 and the PCV would be breeched around 2040. However, other than the single point in April 2017, the historic nitrate concentration data is generally slightly below the predicted model. We therefore do not believe that an intervention will be required at Fawkham during AMP8.

Figure 9: Keycol nitrate model output



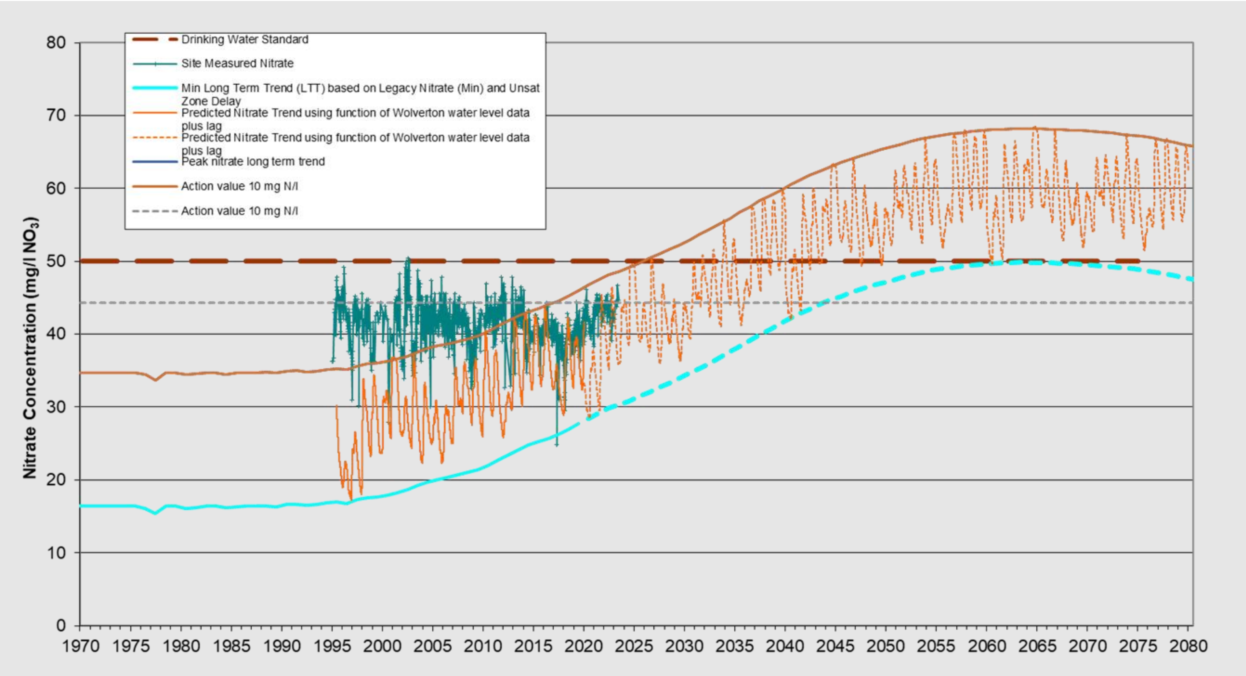
Keycol: Site not in use since 2014, so no recent data available. Historically good fit between data and the [redacted] model.

Group E – Kent Thanet South

- Martin Mill
- Martin Gorse
- Ringwould

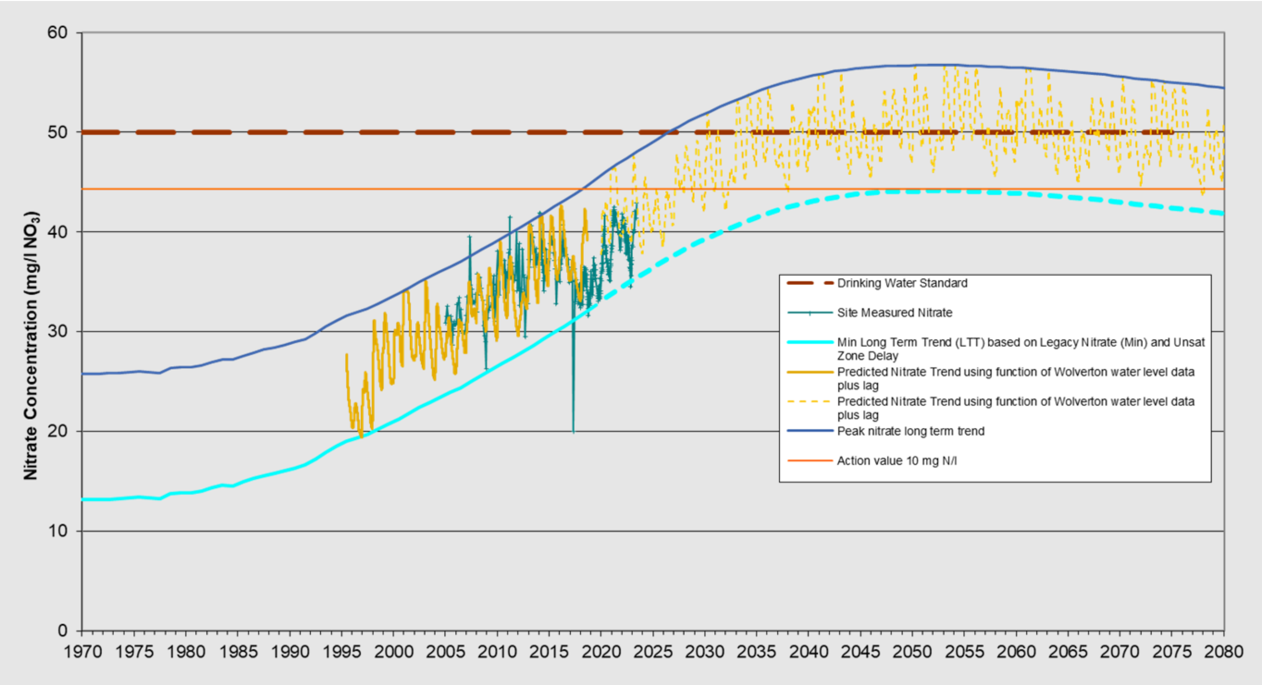
The [redacted] modelling predicts that all three sites have rising trends. Martin Gorse and Martin Mill are shown to be already breaching PCV. The Ringwould forecast shows that PCV will be breached around 2030, however the historic sampling data is slightly higher than the modelled data, indicating that a breach could occur slightly ahead of the modelled prediction.

Figure 10: Martin Mill nitrate model output



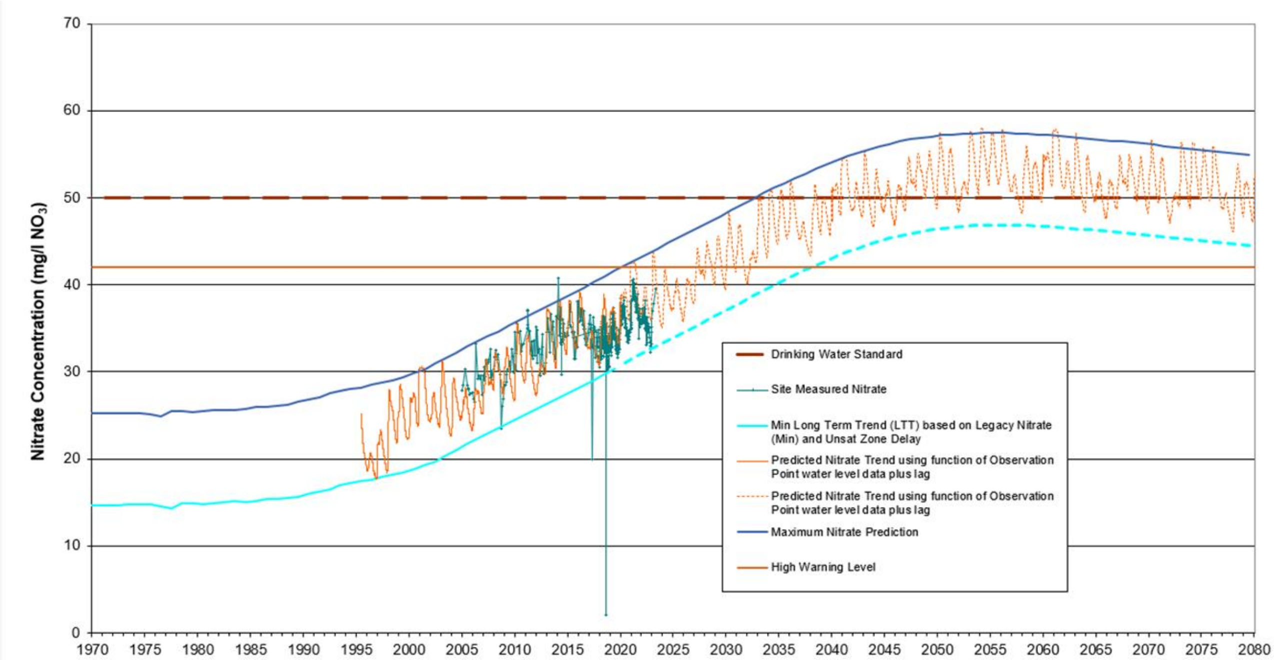
Martin Mill - Measured values suggests one-off incidence of PCV breach in 2000's, however, the measured values are consistently above SWS action trigger level (42mgNO3/l or 10mgN/l), therefore needing some intervention.

Figure 11: Martin Gorse nitrate model output



Martin Gorse - Measured values consistently near SW action trigger point of 42mgNO3/l or 10mgN/l. Good fit between the data and the Wood model.

Figure 12: Ringwould nitrate model output



Ringwould: Good fit between the data and the Wood model. The Ringwould forecast shows that PCV will be breached around 2030, however the historic sampling data is slightly higher than the modelled data, indicating that a breach could occur slightly ahead of the modelled prediction.

As can be seen in the above graphs and analysis, all of the sites require interventions to reduce nitrate concentrations during AMP8.

Rising nitrate trends are present throughout our region. Further interventions will be required in future AMPs to mitigate these rising trends. This is reflected in the forecasted future spend in this area as shown in our Long Term Delivery Strategy (LTDS).

2.1.2. Disinfection – Needs

We also experience raw water deterioration due to the presence of protozoa and viruses. Protozoa and virus detections are increasing in the raw water at a number of our sites. Detection of these in treated water at a site, results in the loss of that site until appropriate mitigation can be put in place. Upgrading of disinfection processes is required to mitigate the risks posed by protozoa and viruses.

With this programme we are looking to predict where future failures will occur and intervene, to protect public health, ahead of those failures occurring. We have used risk indicators and our drinking water safety planning process to identify which of our sites are most at risk from future failures. Because of the predictive nature of this programme, we don't always have recorded failures from Protozoa and viruses. We have used risk indicators which have been detected to help us predict where there is a significant risk that a future failure is likely to be detected. The criteria we used to identify and prioritise our most at risk sites were as follows:

- Raw water challenge at the site
  - Catchment risk
  - Raw water quality sampling data
    - Protozoa – cryptosporidium or other faecal indicators (including E.Coli, Clostridia and Enterococci) are used as a proxy for protozoas such as cryptosporidium and giardia
    - Viruses – somatic coliphage used as a proxy for virus risk.
- Current site processes
  - Installed assets – is sufficient treatment installed to meet the site's raw water challenge;
  - Quality of installation – is permanent or temporary plant installed;
- Drinking Water Safety Plan (DWSP) scores for sites
- Site criticality, in terms of both resilience and population served we have identified tiers of criticality:
  - Tier 1: site is critical for resilience, removal of the site would cause a definite loss of supply
  - Tier 2: Grade 2B asset or higher (i.e. 30,000 population impacted)
  - Tier 3: Grade 2A asset or lower (under 30,000 population impacted)

The above criteria were applied and generated a list of 13 sites where we expect to detect failures due to protozoa and/or viruses in the future. It must also be borne in mind that not every litre of water produced is sampled, therefore it is possible that some of these sites have already failed. The list of sites was prioritised in terms of customer impact using site criticality.

Table 4: Sites with cryptosporidium failures and insufficient disinfection provision and Table 5 below contain sampling results for the 13 at risk sites which are in criticality tiers 1 and 2. The sampling results show where faecal indicators have been recorded (Cryptosporidium, E.Coli, Clostridia and Enterococci) and also where viral indicators have been recorded (somatic coliphage).

Table 4: Sites with cryptosporidium failures and insufficient disinfection provision

				Cryptosporidium			
		Treatment works	Number of raw water sources	Catchment risk - i.e. Abstraction UHL	No. samples in raw water	Max concentration	Number of positive detections
Tier 1	UV	[redacted]	4 (1 OOS)	10	624	0	0
Tier 1	UV		3	1	36	0	0
Tier 1	UV		1	1	44	0	0
Tier 1	UV		2 (1 OOS)	1	35	0	0
Tier 1	Contact time increase		1	-	-	-	-
Tier 1	Contact time increase		5 (2 OOS)	-	-	-	-
Tier 1	Contact time increase		1	-	-	-	-
Tier 1	Contact time increase		4 (2 OOS)	-	-	-	-
Tier 2	UV		2	1	152	0	0
Tier 2	Crypto install to permanent		2	5	67	0	0
Tier 2	Crypto install to permanent		2 (1 OOS)	10	83	0	0
Tier 2	Crypto install to permanent		3	10	1085	0.0618	31
Tier 2	Contact time increase		3 (1 OOS)	-	-	-	-

Table 5: Sites with E.coli failures and insufficient disinfection provision

			E.coli			
		Treatment works	Catchment risk - i.e. Abstraction UHL	No. samples in raw water	Max concentration	Number of positive detections
Tier 1	UV	[redacted]	10	455	2	5
Tier 1	UV		10	229	7	8
Tier 1	UV		10	155	1	2
Tier 1	UV		3	162	0	0
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 2	UV		10	307	9	13
Tier 2	Crypto install to permanent		10	155	2	1
Tier 2	Crypto install to permanent		10	156	7	20
Tier 2	Crypto install to permanent		10	1113	280	444
Tier 2	Contact time increase		-	-	-	-

Table 6: Sites with Clostridia failures and insufficient disinfection provision

			Clostridia			
		Treatment works	Catchment risk - i.e. Abstraction UHL	No. samples in raw water	Max concentration	Number of positive detections
Tier 1	UV	[redacted]	10	163	0	0
Tier 1	UV		10	102	1	2
Tier 1	UV		3	43	0	0
Tier 1	UV		3	60	1	2
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 2	UV		10	109	0	0
Tier 2	Crypto install to permanent		3	43	0	0
Tier 2	Crypto install to permanent		10	84	1	3
Tier 2	Crypto install to permanent		10	893	>100	140
Tier 2	Contact time increase		-	-	-	-

Table 7: Sites with Enterococci failures and insufficient disinfection provision

			Enterococci			
		Treatment works	Catchment risk - i.e. Abstraction UHL	No. samples in raw water	Max concentration	Number of positive detections
Tier 1	UV	[redacted]	10	157	8	4
Tier 1	UV		10	53	1	1
Tier 1	UV		10	83	1	2
Tier 1	UV		3	59	0	0
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 1	Contact time increase		-	-	-	-
Tier 2	UV		10	162	1	2
Tier 2	Crypto install to permanent		3	43	1	1
Tier 2	Crypto install to permanent		10	84	46	8
Tier 2	Crypto install to permanent		10	894	820	379
Tier 2	Contact time increase		-	-	-	-

Table 8: Sites with somatic coliphage failures and insufficient disinfection provision

			Somatic Coliphage (raw)			Somatic Coliphage (treated)		
		Treatment works	No. samples	No. detections	Max concentration	No. samples	No. detections	Max concentration
Tier 1	UV	[redacted]	-	-	-	-	-	-
Tier 1	UV		-	-	-	-	-	-
Tier 1	UV		-	-	-	-	-	-
Tier 1	UV		-	-	-	-	-	-
Tier 1	Contact time increase		26	1	10	15	0	0
Tier 1	Contact time increase		262	3	29	25	0	0
Tier 1	Contact time increase		32	1	1	97	4	25
Tier 1	Contact time increase		7	0	0	15	1	1
Tier 2	UV		-	-	-	-	-	-
Tier 2	Crypto install to permanent		-	-	-	-	-	-
Tier 2	Crypto install to permanent		-	-	-	-	-	-
Tier 2	Crypto install to permanent		-	-	-	-	-	-
Tier 2	Contact time increase		46	2	79	19	2	1

The above needs are summarised below in Table 9. Mitigation of these disinfection risks during AMP8 will reduce the risks to water supplies at our critical and strategically important sites. Further data can be gathered to enable prioritisation of Criticality Tier 3 sites during AMP8, so that interventions can be prioritised and planned for AMP9.

Table 9: Sites in criticality Tiers 1 and 2 with disinfection risks

Ref	Site	Site capacity [PWPC]	Site criticality	Parameter
1	[redacted]	[redacted]	Tier 1: Critical	Protozoa/Crypto
2	[redacted]	[redacted]	Tier 1: Critical	Protozoa/Crypto
3	[redacted]	[redacted]	Tier 1: Critical	Protozoa/Crypto
4	[redacted]	[redacted]	Tier 1: Critical	Protozoa/Crypto
5	[redacted]	[redacted]	Tier 1: Critical	Viruses
6	[redacted]	[redacted]	Tier 1: Critical	Viruses
7	[redacted]	[redacted]	Tier 1: Critical	Viruses
8	[redacted]	[redacted]	Tier 1: Critical	Viruses
9	[redacted]	[redacted]	Tier 2: Strategically important	Protozoa/Crypto
10	[redacted]	[redacted]	Tier 2: Strategically important	Protozoa/Crypto
11	[redacted]	[redacted]	Tier 2: Strategically important	Protozoa/Crypto
12	[redacted]	[redacted]	Tier 2: Strategically important	Protozoa/Crypto
13	[redacted]	[redacted]	Tier 2: Strategically important	Viruses
		165.8		

*a temporary crypto barrier is present on site which needs replacement

Investment in this area will continue in future AMPs. Less critical sites are likely to require interventions in the future. This investment is reflected in our Long Term Delivery Strategy (LTDS).

2.2. Improved understanding and planning for current and future risks – needs case

We are proposing studies in two areas to improve our understanding and planning for current and future risks to raw water quality. The studies are:

1. Climate change adaptation
2. Emerging contaminants

In both these areas we require further information to enhance our ability to identify and quantify the risks to raw water quality and to plan for mitigation where required. The need for both these studies is supported by the DWI, as demonstrated by the decision letter SRN16 dated 30th September 2023.

2.2.1. Climate change adaptation study

Climate change impacts present huge challenges to our industry, particularly in the South East of England. Identifying, quantifying and planning mitigation to counteract the risk climate change poses to raw water quality is critical to maintaining water supplies now and in the future.

We need to identify where and quantify how climate change is impacting our water operations. With this information, we will be able to better plan future investment to mitigate the impacts of climate change, which protects public health and avoids interruptions to supply.

Our 2021 report on Climate Change Adaptation identifies many of the hazards and risks associated with climate change. We need to build on this previous work to determine the hazards and risks most relevant to water treatment and supply. We need to better understand the likelihood and consequences of future climate change impacts. The previous report can be viewed using the following link:
5670_climatechangeadaptation_2021_v13.pdf (southernwater.co.uk)

There are four key climate drivers that we're already experiencing the impact of, and which we expect to increase in severity and/or frequency over the coming years. These four climate drivers are backed up by many scientific sources. The below references are taken from the Met Office UK Climate Projections (UKCP18) for the year 2100. The figures are based on a 'Medium emissions scenario', which assumes global mean warming is 2°C.

- Increased temperature and more extreme variations in temperature
  - The South East of England will experience higher than average warming with average summer temperatures rising by 3 to 4°C (relative to 1981-2010 baseline)
- Less rainfall or longer dry periods (drought)
  - 50% chance of 20-30% drier than average summer
  - 10% chance of 50-60% drier than average summer
- More rainfall, or more intense rainfall (including an increasing number of extreme storms and lightning strikes)
  - Frequency of short, high intensity rainfall events will increase in summer and winter
  - 50% chance of 10-20% wetter than average winter
  - 10% chance of 50-60% wetter than average winter
- Sea level rise
  - Sea levels will increase in all scenarios.

The above climate drivers impact our ability to efficiently provide a safe and reliable supply of wholesome water to our customers. Below are some of the main ways that they do this:

- Increased temperature and more extreme variations in temperature
  - damage to plant and infrastructure from rapid changes in temperature such as freeze thaw events,
  - overheating of plant, changes in soil composition and detritivores activity
  - changing farming practises (new crops and livestock, new pests requiring new pesticides, changes to irrigation)
  - Increased rate of algal growth in surface waters and storage reservoirs
- Less rainfall or longer dry periods (drought)
  - changing farming practises (new crops and livestock, new pests requiring new pesticides, changes to irrigation)
  - damage to infrastructure from ground movement due to prolonged dry spells
  - Increased surface run-off after prolonged dry spells
  - reduced flow in rivers increasing concentrations of contaminants
  - changes to water quality as a direct result of changing groundwater capture zones, taking water from lower quality areas of aquifers
- More rainfall, or more intense rainfall (including an increasing number of extreme storms and lightning strikes)
  - Increased surface water run-off causing increased concentrations of nutrients (leading to algal blooms in storage reservoirs) or other humic material (which can negatively impact disinfection and reduce the capacity of absorption processes)

  - Increased turbidity in surface and groundwater sources
  - Power interruptions
  - Increased incidence of fluvial and pluvial flooding
- Sea level rise
  - Saline intrusion into boreholes which could lead to permanent loss of fresh water sources
  - Inundation of coastal assets

We need to further develop our understanding in this area to be better prepared to deal with the impacts of climate change on our ability to efficiently provide our customers with a reliable supply of drinking water.

2.2.2. Emerging contaminants study

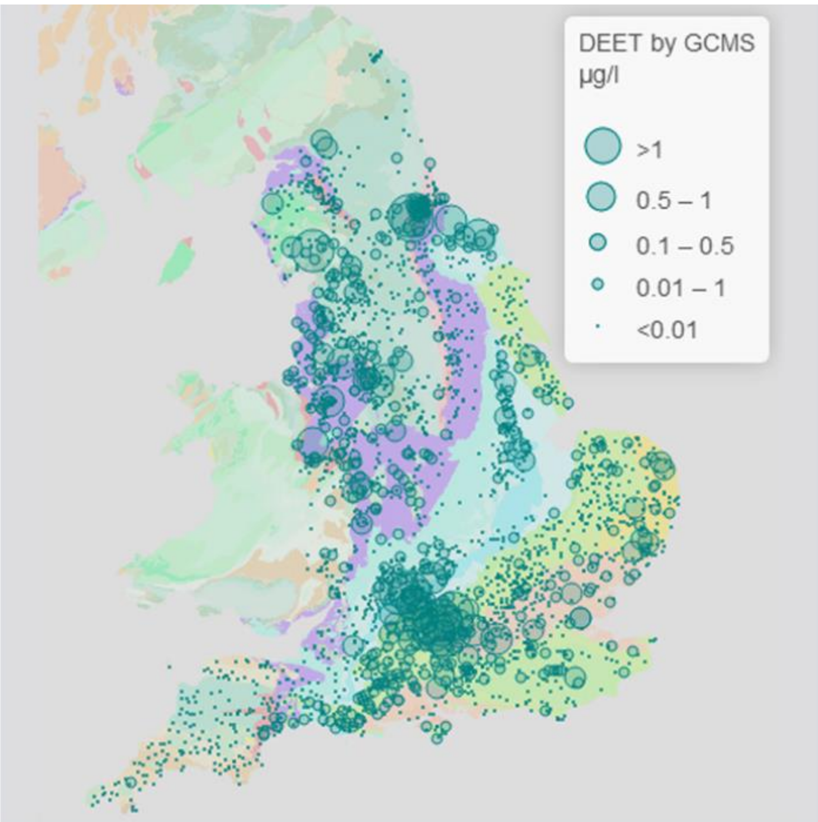
Emerging contaminants encompasses substances which are not yet regulated but may be of environmental or human health concern. Limited information is currently available on concentrations of these substances in source/treated water.

Peer-reviewed and grey literature verifies the occurrence of 17-Beta-estradiol (E2), Nonyl phenol (NP) and Bisphenol A (BPA) in both surface and groundwater. The rate of incidence of these three EDCs in wide scale surface/groundwater monitoring programmes such as the [UKWIR] Chemical Investigation Programme (CIP) and The British Geological Survey (BGS)1 surveys suggests that their occurrence could be expected at low levels in drinking water sources across England and Wales2.

The BGS has also analysed The Environment Agency's (EA) groundwater screening data, which shows that the insect repellent DEET was the seventh most frequently detected compound (by gas chromatography mass spectrometry(GCMS)), being detected in over five percent of samples and is present throughout the South East of England. See below for UK map showing DEET concentration in samples. In addition, Pharmaceuticals such as carbamazepine and clopidol were detected in over a third of samples.

[1] British Geological Survey (BGS)
[2] DWI Report - Likelihood of three endocrine disrupting substances reaching drinking water DWI 70/2/328 (25853)

Figure 13: Concentrations of DEET in groundwater



N,N-diethyl-m-toluamide (DEET) by GCMS across England. © BGS/UKRI incorporating Environment Agency data.

These and many other substances are not currently monitored for at our water treatment works, we are therefore at risk of exposing our customers to an unknown mix of contaminants in unknown quantities. We need to determine what contaminants are present at each of our sources and in what concentrations. We then need to determine if any treatment or monitoring interventions are required to protect public health.

3. Best Option for Customers

In this section, we summarise the approach we have taken to identify options for each of the needs identified. DWI decision letters issued on the 31st of August 2023 confirm their support of the proposed solutions.

3.1. Counteracting Raw Water Deterioration – Options

3.1.1. Nitrate – Options

At all these locations we are carrying out Catchment Management to reduce nitrate peaks and reduce the risk of high concentrations of nitrate within the groundwater. Unfortunately this is insufficient to control nitrate in the short term and bring concentrations down to the required levels. We therefore need additional interventions at all of the identified sources.

In order to meet the nitrate needs identified in section 2.1.1 above we looked at a number of options in addition to catchment management. Firstly we considered not mitigating any of the risks. Secondly we considered if resolution of any of the risks could be delayed. Both of these options were discounted because the data provided to the DWI has been reviewed and resulted in them issuing Decision letters supporting the need to reduce nitrate concentrations for all 11 of these sites during AMP8. Having confirmed that interventions were required for all of these sites, we considered different ways to reduce nitrate concentrations at the sites, we considered raw water blending solutions, treated water blending solutions, Ion exchange nitrate removal solutions and combinations of blending and nitrate removal.

We started by grouping the sites according to geography. We then looked at whether or not there were other low or lower nitrate sources near to the identified sites. We then determined a list of viable blending, treatment or blending/treatment solutions. We then used our engineering teams to design and cost solutions based on these potentially viable options. The results of these assessments can be seen below in Table 10.

Table 10: Options considered to meet nitrate needs

Group	Site	PWPC (Ml/d)	Preferred option			Alternative option	
Group	Site	PWPC (Ml/d)	Scope	Capex Costs (£m)		Scope	Cost comments
B	Madehurst	4.16	Install Nitrate Removal Plant	7.9	18.2	Alternative source from Portsmouth Water Co	PWCo nitrate levels close to SWS trigger level
	Stanhope Lodge	6.2	Blend with flows to Highdown Hill WSR	2.4		Install Nitrate Removal Plant	£8.4m
	Patching	4.57	Install Nitrate Removal Plant	8.0		Zonal Review with Patching	Low risk reduction
C	Mossy Bottom	3.38	Install Nitrate Removal Plant	7.8	16.6	Transfer Mossy Bottom to Sompting or goldstone for blending,	High Totex – NRP upgrades and pipeline
	Patcham	17.5	Install Nitrate Removal Plant	8.8		Source Management - On/off – direct fed customers	Loss of resilience
D1	Hazells	7.62	Blend with Northfleet, with enhanced monitoring	1.4	1.4	Install Nitrate Removal Plant at Hazell or Northfleet	£8.5m
	Fawkham	5.2	Enhanced monitoring			None	-
D2	Keycol	1.8	Blend in Sheppey main	1.6	1.6	Install Nitrate Removal Plant	High Totex
E	Martin Mill	1.8	Install Nitrate Removal Plant at Martin Gorse and blend with Martin Mill's treated flows		18.3	Install Nitrate Removal Plant at Martin Mill Install NRP at Martin Gorse	£16.6m
	Martin Gorse	4.7		10.5			
	Ringwould	4.36	Install Nitrate Removal Plant	7.7		Blending – Blend Sutton, Deal and Ringwould flows prior to feeding Deal High Level WSR - Risk of high Nitrate from Deal Low WSW to Deal High WSR if Ringwould is OOS	£1.2m Lower resilience option, all NRPs in west of area
		64.29		**58.4**	**58.4**		

In addition to the above options, source management was considered for each of the sites. This means that the source is not used during high nitrate periods. This alternative was not possible for any of the options due to the reduction in supply headroom that this caused. Due to the water stressed nature of the South East of England, each of the sites is required to be in operation all year round to meet our supply demand balance.

3.1.2. Disinfection – Options

In order to meet the disinfection needs identified in section 2.1.2 above we looked at a number of options. Firstly we considered not mitigating any of the risks. Secondly we considered only mitigating the risks at the most critical Tier 1 sites. Thirdly we considered mitigating risks at Tier 3 sites as well as Tier 1 and Tier 2 sites. All these options were discounted, because the DWI have issued Decision letters supporting the need to mitigate at all 13 of these Tier 1 and Tier 2 sites in AMP8. Having reviewed the above programme level options, we then considered the different types of solutions which could be implemented on the sites.

Where protozoa/crypto barriers were required to enhance disinfection, we considered UV, Cartridge filters and microfiltration. Microfiltration was discounted at the design reviews because at this scale, both the Opex and Capex costs exceed the other two options.

Where increased contact time was required to enhance disinfection, we considered provision of contact time and provision of medium pressure UV.

The options which were considered for each site are shown in table 11 below.

Table 11: Schemes in the AMP8 Disinfection Future Resilience Programme (DFRP)

					Preferred Option	Alternative 1		Alternative 2	
Ref	Site	Site capacity [PWPC] (Ml/d)	Site criticality Tier	Parameter	Intervention	Intervention	Comment	Intervention	Comment
1	[redacted]	[redacted]	1	Protozoa/ Crypto	UV installation for crypto treatment	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
2	[redacted]	[redacted]	1	Protozoa/ Crypto	UV installation for crypto treatment	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
3	[redacted]	[redacted]	1	Protozoa/ Crypto	UV installation for crypto treatment	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
4	[redacted]	[redacted]	1	Protozoa/ Crypto	UV installation for crypto treatment	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
5	[redacted]	[redacted]	1	Viruses	Chlorine contact provision for virus treatment	Install Medium Pressure UV	Less effective and more expensive than contact extension		
6	[redacted]	[redacted]	1	Viruses	Chlorine contact provision	Install Medium	Less effective and more		

					Preferred Option	Alternative 1		Alternative 2	
Ref	Site	Site capacity [PWPC] (Ml/d)	Site criticality Tier	Parameter	Intervention	Intervention	Comment	Intervention	Comment
					for virus treatment	Pressure UV	expensive than contact extension		
7	[redacted]	[redacted]	1	Viruses	Chlorine contact provision for virus treatment	Install Medium Pressure UV	Less effective and more expensive than contact extension		
8	[redacted]	[redacted]	1	Viruses	Chlorine contact extension for virus treatment	New contact tank	Less effective than chlorine	Install Medium Pressure UV	Less effective and more expensive than contact extension
9	[redacted]	[redacted]	2	Protozoa/ Crypto	UV installation for crypto treatment	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
10	[redacted]	[redacted]	2	Protozoa/ Crypto	UV to replace temporary Amazon installation	Install Cartridge Filters	Lower treatment reliability than UV	Install Microfiltration	Higher totex than Cartridge filters or UV
11	[redacted]	[redacted]	2	Protozoa/ Crypto	UV to replace temporary Amazon installation	Install low pressure UV		Install Microfiltration	Higher totex than Cartridge filters or UV
12	[redacted]	[redacted]	2	Protozoa/ Crypto	UV to replace temporary Amazon installation	Install low pressure UV		Install Microfiltration	Higher totex than Cartridge filters or UV
13	[redacted]	[redacted]	2	Viruses	Chlorine contact provision for virus treatment	Install Medium Pressure UV	Less effective and more expensive than contact extension		
		165.8							

For crypto/protozoa sites we opted for UV irradiation due to it's effectiveness at deactivating protozoa such as cryptosporidium. UV is a recognised (by the DWI) control measure against Cryptosporidium, and there is clear guidance on the process that, if followed, provides a robust audit trail of verifiable appropriate treatment. Whilst on paper, Amazon cartridge filters provide a barrier, they are not robustly viable, and it is a challenge to ensure that cartridges can be installed in a sanitary manner on sites. UV also provides a second line of defence for disinfection. UV also provides a lower totex solution than microfiltration.

At doses typically applied in water treatment, UV is most effective at sterilising Cryptosporidium, followed by Bacteria, and is least effective against viruses. If viruses are present and UV is the only treatment stage, larger installations (to deliver higher doses) are required with associated operating costs. In all cases chlorine application is required to provide a residual for supply into the network, and chlorine is the most effective at virus removal of the chemicals and processes used in potable water disinfection. We have therefore chosen chlorine disinfection with contact time in as per the WRc disinfection tool, as our preferred solution where viruses have been shown to be a concern.

3.2. Improved understanding and planning for current and future risks – Options

In order to improve our understanding of the impact of climate change and emerging contaminants on our raw water quality, we considered a number of different approaches. For both these areas there has been considerable work done by various organisations in recent years. We used the expertise within our carbon and Water Quality teams to design studies which would build on the work which has been done outside of Southern Water and make it relevant to our business.

For the Climate change Adaptation needs this means the use of climate data sources and climate change impact, then applying that to our assets and historical asset data. Further details can be seen below in section 3.2.1. For emerging contaminants, we have based our investigations on the methodology employed by a recent industry leading study[3] into emerging contaminants. We will apply the methodology to our sources to determine which contaminants are present, then to determine how much of the contaminants are present at different times of year. Further details can be seen below in section 3.2.2.

3.2.1. Climate change adaptation study

This study comprising two phases which will be broken down as follows:

Phase 1 – Understanding Climate Change – Desk based data review:

- Scope development with Subject Matter Experts (SMEs)
- Literature review – utilising existing information from sources such as [redacted] [redacted], Water UK, Academic papers, SWS resilience studies
- Data collection – use of environmental data (Temp, rainfall, groundwater, river flow, asset performance etc) to assess impacts on
  - Supply sources
  - Treatment works
  - Distribution system
- Analysis – combining data from above to generate trends and potential options
- Options assessment – assessment of options for future investigations and future interventions.

[3] SRN30.2 App C – Emerging Contaminants Monitoring Programme Chemcatcher

- Recommendations – list of costed proposals for PR29

Phase 2 – Further studies:

- Further studies – identified in Phase 1
- Data collection/monitoring – activities as identified in Phase 1 such as chlorine decay sampling and modelling
- Analysis – combining outputs from phase 1 with additional data and modelling results from Phase 2
- Options assessment – identification of options for further work or interventions
- Recommendations – review of potential options from phases 1 and 2 to provide a list of costed proposals for PR29

The above study is the first part of an ongoing climate change adaptation process which will inform future planning and investment decisions through the PR29 process. Further details of the methodology can be seen in Appendix B "Climate Change Adaptation Proposal"

3.2.2. Emerging contaminants study

We propose an industry leading three phase process to identify and quantify emerging contaminants within our sources and to determine what treatment or interventions might be appropriate to control them. The process is as follows:

- Phase 1 – Implementation of passive sampling regime using 15,708 Chemcatcher samples over 88 sites. Continual monitoring for 12 months at 2 locations per site.
- Phase 2 – Targeted spot sampling to determine concentrations of identified contaminants using 1,056 samples over 88 sites
- Phase 3 – Interpretation of data from phases 1 and 2 to identify a list of costed proposals for PR29

Further details of the methodology can be seen in Appendix C "Emerging Contaminants Proposal". This proposal was originally envisaged as a 4 year programme however so that results can be used to inform our PR29 investment planning process, we have compressed the programme into 3 years.

4. Cost Efficiency

4.1. Counteracting Raw Water Deterioration – Cost efficiency

To ensure cost efficiency for these programmes of work we adopted our standard Risk and Value engineering approach. Further detail on our general approach to cost efficiency can be found in our technical annex.

4.1.1. Nitrate – Cost efficiency

The scopes for the nitrate schemes have been developed by our engineering teams, who have had extensive experience of designing these types of schemes, having delivered nitrate schemes in both AMP6 and AMP7.

These scopes have then been costed by our Cost Intelligence Team (CIT) using cost curves which have been validated using recent market data. Further detail on our costing approach can be found in our costing technical annex.

The table below shows the scope and costs for the nitrate schemes at each site.

Table 12: Scope and costs to meet nitrate needs by site

			Preferred option		
Group	**Site**	**PWPC** (Ml/d)	**Scope**	**Capex Costs** (£m)	
B	Madehurst	4.16	Install NRP	6.8	15.685
	Stanhope Lodge	6.2	Blend with flows to Highdown Hill WSR	2.1	
	Patching	4.57	Install NRP	6.9	
C	Mossy Bottom	3.38	Install NRP	6.7	14.290
	Patcham	17.5	Install NRP	7.6	
D1	Hazells	7.62	Blend with Northfleet, with enhance monitoring	1.2	1.240
	Fawkham	5.2	Enhance monitoring		
D2	Keycol	1.8	Blend in Sheppey main	1.4	1.377
E	Martin Mill	1.8	Install NRP at Martin Gorse and blend with Martin Mill's treated flows		15.719
	Martin Gorse	4.7		9.1	
	Ringwould	4.36	Install NRP	6.7	
		61.29		**48.3**	**48.311**

To understand the efficiency of our nitrate removal costs, we commissioned [redacted] to undertake a benchmarking exercise. The benchmarking showed that our cost curves for nitrate removal are closely aligned with their "benchmark" counterparts, with similar costs exhibited across all ranges.

These types of schemes have been successfully delivered by Southern Water in the past, so delivery risks are minimal in this area.

4.1.2. Disinfection – Cost efficiency

As with the nitrate schemes these UV and contact tank solutions have been designed and scoped by our engineering teams and costed by our CIT using cost curves.

Table 13: Schemes in the AMP8 Disinfection Future Resilience Programme (DFRP)

					Preferred Option	
Ref	**Site**	**Site capacity** [PWPC] (Ml/d)	**Site criticality Tier**	**Parameter**	**Intervention**	**Cost** (£m)
1	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV installation for crypto treatment	3.704
2	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV installation for crypto treatment	3.695
3	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV installation for crypto treatment	2.284
4	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV installation for crypto treatment	2.285
5	[redacted]	[redacted]	[redacted]	Viruses	Chlorine contact provision for virus treatment	3.486
6	[redacted]	[redacted]	[redacted]	Viruses	Chlorine contact provision for virus treatment	3.621
7	[redacted]	[redacted]	[redacted]	Viruses	Chlorine contact provision for virus treatment	4.692
8	[redacted]	[redacted]	[redacted]	Viruses	Chlorine contact provision for virus treatment	5.380
9	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV installation for crypto treatment	2.744
10	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV to replace temporary Amazon installation	3.314
11	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV to replace temporary Amazon installation	2.755
12	[redacted]	[redacted]	[redacted]	Protozoa/Crypto	UV to replace temporary Amazon installation	3.129
13	[redacted]	[redacted]	[redacted]	Viruses	Chlorine contact provision for virus treatment	4.618
		165.8				**45.708**

These types of schemes have been successfully delivered by Southern Water in the past, so delivery risks are minimal in this area.

4.2. Improved understanding and planning for current and future risks – Cost efficiency

We have used subject matter experts to design and cost the work associated with the two studies outlined in section 3.2 above and as detailed in Appendix b and Appendix C. The costs identified in the Appendices are the pre-efficiency costs. They have had an efficiency applied to them when shown below in table 14.

The estimated costs for this work are as shown in Table 14 below. These numbers have had the delivery efficiency applied to them.

Table 14: Climate change adaptation and Emerging contaminants study costs

Phase	Details	Costs (£m)
Climate change adaptation		
Phase 1 – Understanding Climate Change	Desk based data review	0.259
Phase 2 – Further studies	Data collection, monitoring, analysis and options assessment	1.002
	Sub-total	**1.261**
Emerging Contaminants		
Phase 1 – Identification – Passive sampling	12 month sampling programme 15,708 chemcatcher samples over 88 sites	1.601
Phase 2 – Quantification – Targeted spot sampling	Targeted spot samples	0.841
Phase 3 – Interpretation and recommendations	Interpretation of results and recommendations for future	0.184
	Sub-total	**2.626**
	Total	**3.887**

The majority of the costs comes from the sampling within the emerging contaminants study. The sampling costs used for phase 1 (including sampling, handling and analysis) is approximately £[redacted] per sample. For phase 2 we have used an average cost per sample of [redacted], as per the costs in Table 15 below. In addition, an allowance of £[redacted] has been made to account for two hours of labour per sample.

Table 15: Phase 2 spot sampling costs

Substance	**Cost per sample incl analysis** (pre-efficiency) (£)
op-DDT, op-TDE, Chlorpyrifos, PCBs (non polars pest suite)	[redacted]
Atrazine, (combined pest suite)	[redacted]
2-4D (Acid herbs suite)	[redacted]
Glyphosate	[redacted]
Lead	[redacted]
Cadmium	[redacted]
Bisphenol A	[redacted]

Phenols	[redacted]
PPCP's	[redacted]
PFAS	[redacted]
PAH's	[redacted]
Total per sample	[redacted]
Total for 88 sites over 12 months (1,056 samples)	[redacted]

5. Customer Protection

In this section we set out the customer protection for the two elements of this enhancement case.

5.1. Counteracting Raw Water Deterioration – Protection

Interventions at these sites are to pre-emptively protect public health from water quality failures which will otherwise happen in the future. Consequently, these interventions will not improve current performance but rather protect against future deterioration in performance. It is therefore most appropriate to protect customers from non-delivery in this area using Price Control Deliverables (PCDs) linked to the delivery of DWI notices.

Table 16: Addressing raw water deterioration data table reference

Area of investment	Table	Row/s	Line description	Capex	Opex	Totex
Nitrate	CW3	97/98/99	Raw Water Deterioration	48.311	1.019	49.330
Disinfection	CW3	118/119/120	Resilience	45.708	1.485	47.193
Studies	CW3	132*	Additional Line	3.887	0	3.887

*CW3.132 also contains Reservoir Safety costs

Table 17: Parameters for Raw Water Deterioration PCD

Component	Output based on delivery of DWI notices
Output	Delivery of 5 schemes to reduce nitrate concentrations. Delivery of 13 schemes to enhance disinfection at sites across our region
Total Cost	Total £94.019m Nitrate £48.311m Disinfection £45.708m
Unit cost	Nitrate average scheme value £9.662m Disinfection average scheme value £3.516m
Penalty rate	Nitrate £9.662m per scheme Disinfection £3.516m per scheme
Scheme delivery date	March 2030
Gated dates (if required)	Assurance of the scheme will be delivered on time 31st of March 2026
Late penalty (if required)	No late penalty will be applied
Late penalty unit	N/A - Penalties will be applied by DWI for late delivery
Measurement	Scheme delivery to be verified by agreement with DWI of delivery of the work on site.
Conditions (if required)	If delivery dates or requirements are changed in conjunction with the DWI, the penalties will not be applied to the relevant schemes. Delivery relates to on site work and excludes completion of notice approval paperwork
Assurance	Third party assurer will assure conditions have been met

5.2. Improved understanding and planning for current and future risks – Protection

The benefit of delivering this work is a better understanding of risks to supply and improved future planning capabilities. Investment in this area does not meet the threshold for using a Price Control Deliverable (PCD) we therefore do not propose to apply one here.

Table 18: Improved understanding and planning for current and future risks data table reference

Area of investment	Table	Row/s	Data Table Line Description	Capex (£m)	Opex (£m)
Climate change adaptation study	CW3	132/133	Additional line	1.261	0
Emerging Contaminants Study	CW3	134/135	Additional line	2.626	0
				3.887	**0**

6. Conclusion

Section	Key Commentary	Page
Introduction & Background	This enhancement investment is required to address raw water quality deterioration in AMP8. This investment is supported by the DWI who issued decision letters to confirm their support for the need and solutions on 31st August 2023. This investment breaks down into two broad areas as follows: 1. Counteracting raw water deterioration 2. Improved understanding and planning for current and future risks	7
Need for Enhancement Investment	We are proposing interventions in two areas to counteract raw water deterioration, they are as follows: 1. Nitrate interventions 2. Disinfection improvements – Disinfection Future Resilience Programme (DFRP) In both these areas we have data which shows that the raw water quality is deteriorating. We predict that without interventions at these sites during AMP8, the treatment challenge will exceed the current capabilities of the existing treatment processes leading to potential CRI failures and/or the loss of output from the sites, resulting in interruptions to customer supplies. We are proposing studies in two areas to improve our understanding and planning for current and future risks to raw water quality. The studies are: 1. Climate change adaptation 2. Emerging contaminants In both these areas we require further information to enhance our ability to identify and quantify the risks to raw water quality and to plan for mitigation where required. The need for both these studies is supported by the DWI	9
Best Option for Customers	We have considered a range of options, including a do nothing, delay and source management. The DWI issued decision letters supporting the need to intervene during AMP8. As a result, we have selected the lowest cost option which is the best value option for customers.	29
Cost Efficiency	These scopes of the interventions have then been costed by our Cost Intelligence Team (CIT) using cost curves which have been validated using recent market data. Further detail on our costing approach can be found in our costing technical annex. We commissioned [redacted] to undertake a benchmarking exercise on our nitrate removal costs. The benchmarking showed that our cost curves for nitrate removal are closely aligned with their “benchmark” counterparts, with similar costs exhibited across all ranges.	35

Section	Key Commentary	Page
Customer Protection	We proposed a PCD linked to the delivery of DWI notices and the studies.	

Appendix

Appendix A – Decision letters

Area	Group/Ref	DWI Decision letter reference	DWI Completion date
Nitrate	Group A – Isle of Wight	SRN11 not supported	-
	Group B – West Sussex	SRN12	Mar-27
	Group C – East Sussex	SRN13	Mar-27
	Group D1 – Kent Medway 1	SRN14-1	Mar-30
	Group D2 – Kent Medway 2	SRN14-2	Mar-30
	Group E – Kent Thanet	SRN15	Mar-30
Disinfection Future Resilience Programme	Cryptosporidium	SRN08	Mar-30
	Viruses		
Studies	Climate Change Adaptation Study	SRN16	Mar-30
	Emerging Contaminants Study		

Appendix B – Climate change adaptation study methodology

Document SRN30.1 App B – Climate Change Study Scope

Appendix C – Emerging contaminants study methodology

Document SRN30.2 App C – Emerging Contaminants Monitoring Programme Chemcatcher