SRN44 Growth at Wastewater Treatment Works

Enhancement Business Case

2nd October 2023

Version 1.0

from Southern Water

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Glossary

Acronym	Term
ALP	Asset Lifecycle Process
AMP	Asset Management Period
DWF	Dry Weather Flow
DWMP	Drainage and Wastewater Management Plan
EA	Environment Agency
EPA	Environmental Performance Assessment
FD	Ofwat Final Determination
LA	Local Authority
LDS	Council Local Development Strategy
LP	Council Local Plan
LPA	Local Planning Authority
LTDS	Long Term Delivery Strategy
MDF	Mean Daily Flow
ODI	Outcome Delivery Incentive
ONS	Office for National Statistics
OSM	Operator Self Monitoring
PC	Performance Commitment
PCD	Price Control Deliverable
PE	Population Equivalent
PR24	2024 Price Review
Q90	10th percentile of a year's flow
R&V	Risk and Value process
SW	Southern Water
TAL	Technically Achievable Limits
TSM	Technical Standards Manual
WIMES	Water Industry Mechanical and Electrical Standards
WINEP	Water industry National Environment Program
WLC	Whole Life Cost
WRSE	Water Resources South East
WTW	Wastewater Treatment Works

Executive Summary

Southern Water have a statutory duty to accommodate forecast growth, without harm to the environment whilst improving resilience.

We are forecasting significant population growth across the whole of the region by 2040. Assessment of forecast population growth using the commercial tool Edge v1.3 (19/01/2023) forecasts and cross referencing with council Local Plans have identified 38 Wastewater Treatment Works (WTWs) requiring an increase in capacity by 2033.

We operate a region where housing stock is predicted to grow at a fast pace in the coming five years. Over the 5 years of AMP8, (2025-30) housing in the Southern Water region is projected to grow at 0.85% per annum, which is the highest in the industry and over and above the average forecasted for the sector at 0.63% per annum[1] (see Table 6 Section 2.3). Ofwat's econometric models do not take account of the variation in growth across the country and only fund the average historical growth rate for the industry at 0.71% per annum[1] (see Table 16, Appendix 1). Historically, we have been able to accommodate growth through incremental investment at our WTWs, generally by removing process bottlenecks or increasing treatment capacity. While a similar approach applies to several sites in this business case, significant and atypical investment solutions are required at certain key sites that are not reflected in historical data that Ofwat may use to estimate a standalone model to assess costs for growth at WTWs.

This enhancement case is necessary to provide the required investment in AMP8 and beyond to prevent significant harm to the environment, significantly impacting Southern Water's Environmental Performance Assessment rating from 2027 onwards and resulting in discharge permit compliance performance commitment penalties amounting to over £40m over the course of AMP8 (see Section 5.2).

This enhancement case is based on the assumption that growth at WTWs is funded entirely outside of Botex. It is therefore presented as a standalone case and as such makes no account of implicit allowance. Should growth be funded within the Botex plus model, this claim would be redundant and superseded by the associated Cost Adjustment Claim 'SRN22 Network and WTW Growth'[2] which sets out the rationale for costs above the implicit allowance in the econometric models.

One site is being considered for construction under an alternative delivery model, which is detailed in Technical Annex 'SRN17 Direct Procurement for Customers and Alternative Delivery Model'[3]. This enhancement case includes the costs to deliver the project.

Table 1 Summary of Enhancement Case

Summary of Enhancement Case	
Name of Enhancement Case	**Growth at WTWs**
Summary of Case	• Increase treatment capacity at 38 Wastewater Treatment Works to accommodate population growth, consisting of: ○ Increase in permitted Dry Weather Flow and discharge permit parameters to maintain load standstill at 30 sites to accommodate an increase

	in volume of foul and combined flows from new development ○ Increase in wastewater treatment process capacity at 8 sites to ensure current environmental permit parameters can be met, given the additional load presented because of new development • 4 of the identified sites were funded in AMP7 and therefore are not requesting funding in PR24 • Requested funding is £293.2m in AMP8 and £114.3m in AMP9 across the 34 sites. This includes one site being considered for construction under an alternative delivery model.
Expected Benefits	• Ensure statutory duty to provide capacity for growth can be met, without harm to the environment whilst improving resilience • Facilitating housing growth within region by enabling critical infrastructure for development • Ensure 38 identified WTWs can meet the Dry Weather Flow and final effluent quality parameters of their environmental discharge permits • No negative impact on Environmental Performance Assessment rating due to increase in connected population • Prevention of over £40m of discharge permit compliance performance commitment penalty in AMP8
Associated Price Control	Network plus wastewater
Enhancement TOTEX	£293.2m
Enhancement OPEX	£0
Enhancement CAPEX	£293.2m Capex is split across two Data Tables to account for Whitfield Urban Expansion being considered under alternative delivery, as follows: CWW3.153 - £238.17m SUP12.8 - £2.98m SUP12.9 - £52.03m
Is this enhancement proposed for a direct procurement for customer (DPC)?	No – One site (Whitfield Urban Expansion) is being considered for construction under an alternative delivery model, which is detailed in the Alternative Delivery Technical Annex[3].

1. Introduction and Background

1.1. Introduction

Southern Water (SW) have a statutory duty to accommodate forecast growth, without harm to the environment whilst improving resilience.

We operate a region where housing stock is predicted to grow at a fast pace in the coming five years. Over the 5 years of AMP8, (2025-30) housing in the Southern Water region is projected to grow at 0.85% per annum, which is the highest in the industry and over and above the average forecasted for the sector at 0.63% per annum[1] (see Table 6 Section 2.3). Ofwat's econometric models do not take account of the variation in growth across the country and only fund the average historical growth rate for the industry at 0.71% per annum[1] (see Table 16, Appendix 1). Historically, we have been able to accommodate growth through incremental investment at our Wastewater Treatment Works (WTWs), generally by removing process bottlenecks or increasing treatment capacity. While a similar approach applies to several sites in this business case, significant and atypical investment solutions are required at certain key sites that are not reflected in historical data that Ofwat may use to estimate a standalone model to assess costs for growth at WTWs.

This enhancement case is necessary to provide the required investment in AMP8 and beyond to prevent significant harm to the environment, significantly impacting SW's Environmental Performance Assessment (EPA) rating from 2027 onwards, and to meet our targets for Performance Commitments (PCs), as estimated in Section 5.

Customers tell us two of their top concerns are ageing infrastructure and the impact of growing population, both addressed by the proposal in this enhancement case. They want us to ensure infrastructure is developed to not just 'keep up' with growth but protect for future generations and provide robust long-term solutions for these issues and not quick fixes (using the term 'sticking plaster') for important infrastructure[4].

Both costs derived from bottom-up engineering solutions at individual site level, and top-down modelled costs are considered and compared. Costs from bottom-up solutions using cost curves have been adjusted to include a reduction in project related costs (such as project management). This demonstrates our commitment to drive an increase in efficiency compared to historical costs.

Customers are protected against non-delivery through two measures already in place; environmental performance measures and regulation from the Environment Agency (EA) against legal obligations, and financial penalties from PCs.

This enhancement case is based on the assumption that growth at WTWs is funded entirely outside of Botex. It is therefore presented as a standalone case and as such makes no account of implicit allowance. Should growth be funded within the Botex plus model, this claim would be redundant and superseded by the associated Cost Adjustment Claim 'SRN22 Network and WTW Growth'[2] which sets out the rationale for costs above the implicit allowance in the econometric models.

1.2. Background Information

We are forecasting significant population growth across the whole of the Southern Water region by 2040. Assessment of forecast population growth using the commercial tool Edge v1.3 (19/01/2023) forecasts and cross referencing with council Local Plans (LP) have identified 38 Wastewater Treatment Works (WTWs) requiring an increase in capacity by 2033.

The EA have confirmed their intention to include exceedance of Dry Weather Flow (DWF) as an EPA performance metric in AMP8[5]. Exceeding DWF at a site for 3 years out of a 5-year rolling period would result in that WTW being classed as failing. This is a new metric and historically DWF exceedance was controlled, and performance measured outside of the EPA methodology.

We operate a region where housing stock is predicted to grow at a fast pace in the coming five years. Over the 5 years of AMP8, (2025-30) housing in the Southern Water region is projected to grow at 0.85% per annum, which is the highest in the industry and over and above the average forecasted for the sector at 0.63% per annum[1]. We take this data from Office for National Statistics (ONS) household projections, as used by Ofwat at FD PR19[6].

Table 2 details links to PR24 Data Table lines, common performance commitments, and price control deliverables.

Table 2 Links to Data Table Lines

Links to data table lines		
Enhancement	Table	Line
Growth at sewage treatment works (excluding sludge treatment); enhancement capex Growth at sewage treatment works (excluding sludge treatment); enhancement opex Growth at sewage treatment works (excluding sludge treatment); enhancement totex	CWW3	CWW3.153 CWW3.154 CWW3.155
Whitfield WwTW	SUP12	SUP12.8 SUP12.9 SUP12.14

Links to common/bespoke performance commitments		
Performance commitment name	Unit of measurement of benefit from this investment	Observations
Discharge Permit Compliance	% of sites with discharges within permit limits	Discharge Permit Compliance PC will be impacted by process capacity shortfall. It is to be confirmed by the EA how DWF exceedance will be incorporated into the EPA, we have assumed in this case it will be included in

		Discharge Permit Compliance, or another measure equal to it.
Links to price control deliverables		
Benefit description	Unit of measurement of benefit	Observations
None	N/A	N/A

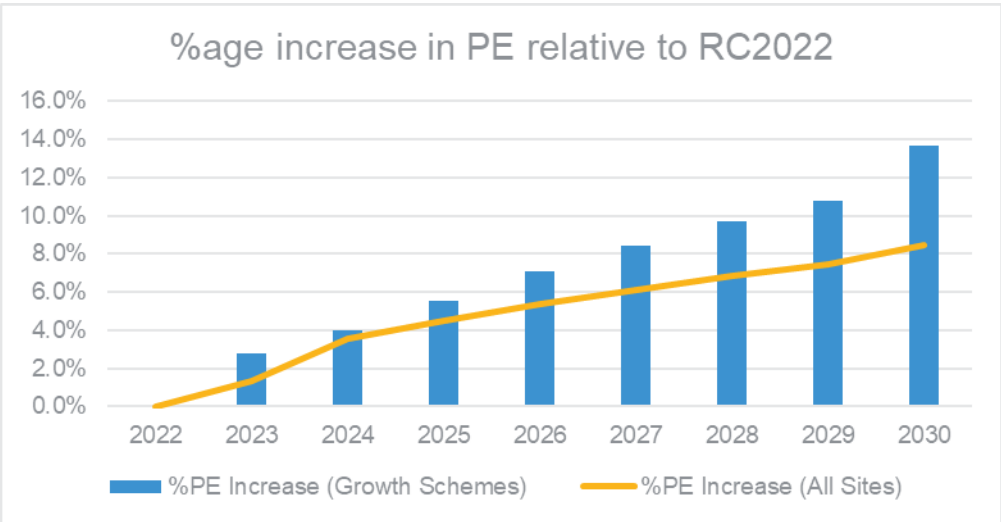
2. Needs Case for Enhancement

SW have a statutory duty to accommodate forecast growth, without harm to the environment whilst improving resilience. SW also have a statutory duty to provide service to new customers without deterioration in the level and quality of service provided to existing customers[7].

We are forecasting significant population growth across the whole of the region by 2040. Assessment of forecast population growth using the commercial tool Edge v1.3 (19/01/2023) forecasts and cross referencing with council LPs have identified 38 WTWs requiring an increase in capacity by 2033.

Figure 1 shows a comparison of Population Equivalent (PE) increase at the 38 sites included in this enhancement case (discussed in later sections) against the PE increase across all SW sites, according to this forecast. It shows that the percentage increase in PE in the 38 sites that will require investment is above the overall percentage increase in PE across all our sites by 1 to 5 percentage points.

Figure 1 Comparison of increase in PE at 38 sites vs all WTWs



Source: SW analysis of internal data.

Note: PE data used for Figure 1 does not include holiday population, as reported in PR24 data tables line CWW20.1.

2.1. How do we determine capacity need?

There are two broad categories of capacity shortfall at a WTW with respect to population growth: process capacity exceedance and permitted DWF exceedance. The investment need set out in this enhancement seeks to increase capacity to address these two sources of capacity shortfall.

Process capacity exceedance is when the flow or load increase at the receiving WTW increases to an extent the existing wastewater treatment process is overloaded, either hydraulically, biologically, or chemically, such that the existing environmental permit limits can no longer be achieved. An increase in process treatment capacity would therefore be required to ensure compliance can be met.

DWF is the average daily flow to a WTW during a period without rain. **DWF exceedance** is when this volume exceeds the maximum that is permitted to be discharged to a specific receiving watercourse. This limit is necessary so that the quality and quantity of treated effluent from WTW do not cause an unacceptable impact on the environment. DWF is measured as annualised 10th percentile daily volume according to the EA guidelines[8]. When the remaining DWF headroom of the existing DWF permit is insufficient to support the growth, an increase in permitted DWF must be applied for with the EA. To maintain load standstill on the receiving watercourse, increases in permitted DWF will result in the tightening of the final effluent quality parameters, to ensure no additional pollutant load is placed on the watercourse because of the additional volume of final effluent being discharged to it. This in turn results in a need to upgrade the existing wastewater treatment process to achieve a higher quality final effluent. Exceedance of the permitted DWF permit for three out of five years on a rolling basis will result in non-compliance with permit conditions for that site, impacting the EPA rating for each following year exceedance occurs.

To determine the available capacity of a wastewater system, the PE of the forecast connected load by 2030 is determined using two methods, Edge v1.3 and council LP data. Edge is SW's long-term population forecast produced by an independent company, renewed on average every 5 years. The last forecast, Edge v1.3 was issued in 2021. SW has a process to monitor and respond to Local Authority (LA) consultations on development plans for the area we serve. Housing allocation data in the local plans with a high degree of certainty are incorporated in the investment planning purposes. This is a continuous process to respond to different councils' Local Development Scheme (LDS) timetables. New LP data used in our investment planning is updated annually.

Where the Edge v1.3 forecast future populations, in any 5-year future planning periods is no less than 92.5% of the latest reported population plus the local plan forecasted growth, the Edge v1.3 figure is retained. Otherwise, the future population will be the latest reported population plus the local plan forecasted growth. This is only related to the residential PE forecasts. For non-residential PE, trade effluent PE, and domestic tankered PE, the actual figure from 2021 plus SW's long-term forecasts are used. This methodology was designed to ensure our planning process caters for large new developments in our region whilst maintaining a high level of consistency.

This forecast PE is compared to the current capacity of the WTW and an assessment of available capacity carried out to determine any capacity shortfall, both process capacity and DWF exceedance.

2.2. What is the extent of the capacity need?

2.2.1. Capacity Need Identification

All 363 WTWs operated and owned by SW have been assessed for process capacity and DWF and headroom by 2030, according to the PE forecast methodology detailed in Section 2.1. Of these, 38 have been identified as requiring investment in AMP8 to prevent a future breach of statutory obligations.

The following methodology was used to determine the capacity that we need to create at the 38 WTWs:

- Predict the 2030 DWF (based on 2020-22 average Q90[i]) and PE growth.
- Evaluate compliance risks using 2020-22 Operator Self Monitoring (OSM) sample data and data from online monitoring.
- Calculate (modelling) of process capacity shortfall by 2030 using Southern Water capacity assessment tool (AM410).
- Rank the 363 WTWs for compliance risk and capacity shortfall by 2030.
- Make reasonable assumption on the AMP7 investment program outcome based on available information.
- Review Southern Water capacity assessment tool (AM410.2) documents for pertinent site-specific factors not covered by the above.
- Use process of elimination. i.e., eliminate sites that do not need a growth scheme because they are predicted to meet compliance requirements by 2030.
- Carry out a due diligent analyses and risk assessment to evaluate sites where marginal exceedance is predicted, e.g. where there is lower confidence in the data.
- Consult Area Plan Managers and the WTW Sponsor for local knowledge of needs in the catchment not identified through the data.

Dry Weather Flow

Expected DWF by 2030 for each site was calculated using the predicted PE growth (including holiday population) and measured historic DWF Q90 values, and compared with the current permitted DWF for each WTW.

From this assessment 50 WTWs are predicted to exceed permitted DWF by 2030.

Risk assessment of the 50 sites identified in the shortlist was carried out, which resulted in 15 WTWs being excluded, and a further 5 removed following due diligence checks to evaluate and reduce uncertainties for sites predicting marginal exceedance by 2030 (98% to 102% of the current permit).

Reasons for (a) excluding sites from the original 50 identified through the calculation of DWF in 2030, or (b) including sites expected to have marginal headroom by 2030 were as follows:

- Capacity being provided prior to 2025 through capital investment in AMP7.
- Infiltration reduction work in the catchment before 2025 expected to increase DWF headroom.
- Lower confidence in Q90 measured values as seasonal variations skewed the data.
- Discrepancies between Edge and Local Plan forecast PE data.
- Efficiency in delivery where investment is required to meet other drivers on the site in AMP8, and there is marginal headroom for DWF by 2030.
- Inclusion of strategic catchments (i.e. serving over 50,000 PE) expected to exceed DWF in early AMP9.

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[i] Q90, also known as the 10th percentile, is the total daily flow value that is exceeded by 90% of the measured total daily flows in any period of 12 months.

A final check was undertaken by using local knowledge of the wastewater catchments by SW Planning teams to assess whether, for example, housing development not identified through either Edge or the Local Plans was being undertaken.

This analysis identified 30 WTWs requiring investment by 2030 to prevent DWF exceedance. Table 3 shows the list of sites; predicted PE by 2030; the measured Q90 (10th percentile) of Mean Daily Flow (MDF) averaged over a three-year period between 2020 and 2022; the predicted annual average Q90 of MDF by 2030, also shown as a percentage of the current DWF permit limit. Also shown for information is the current DWF permit limit and the source of the 2030 PE estimate (Edge or Local Plan).

The full list of sites and their reason for inclusion /exclusion can be seen in Section 3.

Table 3 Sites requiring investment by 2030 to prevent DWF exceedance.

WTW	Driver	2030 PE source	2030 PE[ii]	DWF permit	Measured 3 yr Q90 (2020-2022)	2030 Predicted Q90	2030 Q90 (%) of permit
Alfriston WTW	DWF	Edge	815	307	326	347	113%
Billingshurst WTW	DWF	Local Plan	9,765	1,445	1,568	1,746	121%
Bishops Waltham WTW	DWF	Local Plan	20,051	3,100	2,543	3,272	106%
Chale WTW	DWF	Edge	593	117	111	115	99%
Charing WTW	DWF	Local Plan	3,336	605	562	726	120%
Faversham WTW	DWF	Edge	32,722	7,000	5,995	7,030	100%
Fullerton WTW	DWF	Local Plan	75,043	19,291	19,347	20,578	107%
Goddards Green WTW	DWF	Local Plan	69,873	9,917	8,622	9,808	99%
Gravesend WTW	DWF	Edge	67,347	10,886	9,852	10,940	100%
Ham Hill WTW	DWF	Local Plan	80,092	12,200	12,452	14,292	117%
Hawkhurst North WTW	DWF	Local Plan	3,551	624	450	751	120%
Leeds WTW	DWF	Edge	4,742	1,020	901	1,016	100%
Lenham WTW	DWF	Local Plan	4,415	688	481	694	101%

[ii] PE figures include holiday population forecast as they will impact DWF performance.

WTW	Driver	2030 PE source	2030 PE[ii]	DWF permit	Measured 3 yr Q90 (2020-2022)	2030 Predicted Q90	2030 Q90 (%) of permit
Loxwood WTW	DWF	Edge	3,197	767	742	853	111%
Lydd WTW	DWF	Edge	3,980	611	514	614	101%
Milford Road Pennington WTW	DWF	Local Plan	60,161	17,200	17,566	18,399	107%
Motney Hill WTW	DWF	Local Plan	314,589	44,582	40,268	47,623	107%
Newnham Valley Preston WTW	DWF	Edge	7,059	2,371	2,491	2,646	112%
Northfleet WTW	DWF	Local Plan	99,518	9,300	9,588	16,425	177%
Paddock Wood WTW	DWF	Local Plan	17,509	2,219	1,492	2,700	122%
Park Road Handcross WTW	DWF	Edge	1,246	186	173	212	114%
Sandhurst WTW	DWF	Edge	1,139	206	196	226	110%
Sellindge WTW	DWF	Local Plan	13,663	1,594	792	1,982	124%
Sidlesham WTW	DWF	Edge	25,985	5,800	6,670	8,196	141%
Stockbridge WTW	DWF	Edge	863	231	550	556	241%
Stoke WTW	DWF	Local Plan	4,745	790	804	1,066	135%
Wateringbury WTW	DWF	Edge	10,476	2,215	2,012	2,417	109%
Whitewall Creek WTW	DWF	Local Plan	53,279	6,850	5,488	7,927	116%
Willow Wood St Lawrence WTW	DWF	Edge	304	28	33	48	171%
Wivelsfield WTW	DWF	Edge	1,658	275	271	322	117%

Two sites are included where forecast DWF is 99% of the permit in 2030. Chale WTW has had a history of fluctuating DWF and therefore there is some uncertainty over the forecast. Furthermore, the solution to increase permitted DWF is straightforward and low cost, therefore it is included. Goddards Green WTW is a large works with a complex solution required to enable an increase in permitted DWF, with delivery taking 4-5 years. The inclusion in the table is predicated on the need to begin work early to prevent exceedance.

Alignment with Drainage and Wastewater Management Plan

Our Drainage and Wastewater Management Plan (DWMP) developed over three years from 2020 and published in March 2023[9] collated population data for all Southern Water wastewater catchments using a 2020 baseline and a 2050 planning horizon. The forecast data used for the DWMP was Experian 7.1, adjusted for council Local Plan data in the same way identified in Section 2.1.

The estimated impact of development in each of the wastewater catchments was then assessed against permitted DWF, taking infiltration into account. To do this, measured flows from 2017 to 2019 were used. This analysis identified 8 wastewater catchments as having insufficient DWF headroom in 2020, and 46 by 2050.

Of the 46 sites identified as having insufficient DWF headroom by 2050, 24 are included the PR24 need identification with 9 being addressed either in AMP7 or early AMP8 but funded in AMP7. 15 sites are included in our PR24 submission.

There are an additional 12 schemes included in our PR24 submission which were not identified as having insufficient headroom by 2050 in the DWMP. There are three principal reasons why the PR24 submission and DWMP assessment are not congruent:

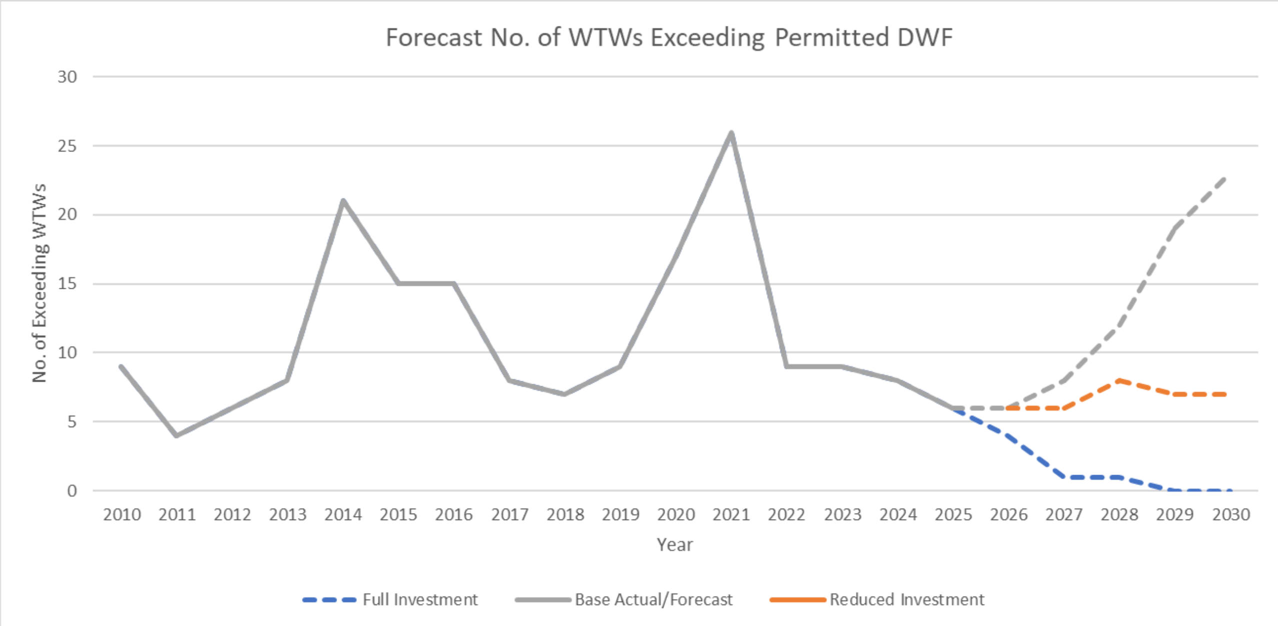
- DWMP uses a 2020 baseline and 2050 planning horizon, whereas the PR24 submission uses a 2022 baseline and 2030 planning horizon.
- A change in source data from Experian for the DWMP to Edge in PR24.
- The DWMP uses flow data from 2017 to 2019, whereas the PR24 assessment uses more recent flow data between 2020 and 2022.

The DWMP did not assess treatment process capacity by wastewater catchment, therefore the above comparison was undertaken for DWF capacity only.

A table showing the comparison by site can be seen in Appendix 4.

Figure 2 shows the number of sites that have exceeded their permitted DWF, annually, and the number of sites forecast to exceed between 2026 and 2030 both with and without the identified investment.

Figure 2 Actual and Forecast DWF performance for Different Investment Scenarios



Source: SW analysis of internal data

To date, investment in growth has maintained a baseline performance of around 5-10 sites exceeding DWF annually when abnormal peaks are removed. Historically this has been considered acceptable performance and managed through the existing action plan process in liaison with the EA[10]. The inclusion of new exceedance clauses in updated environmental permits will drive improvement of DWF performance through tighter regulation, as detailed in Section 5.

We have carried out an assessment of the minimum investment required to maintain existing baseline performance levels in AMP8, against the investment required to drive the increase in performance in this enhancement case. This was done by removing the highest cost schemes needed to prevent DWF exceedance, limited to 8 exceedances.

Reprioritising sites to maintain a maximum of 8 WTWs exceeding permitted DWF by the end of AMP8 would reduce the investment required by up to £74.6m, by removing 7 sites from the plan. However, doing so would result in ongoing DWF exceedance with associated environmental and performance impact, conflicting with the need to improve DWF performance driven by the change in regulation as discussed in Section 5. Therefore, it is correct and proper to fund the full plan to ensure DWF compliance at all sites.

Table 4 DWF Performance Forecast

	No. of sites exceeding DWF		
Year	**Base Actual/Forecast**	**Reduced Investment (£219.2m, 23 sites)**	**Full Investment (£293.2m, 30 sites)**
2026	6	6	4
2027	8	6	1
2028	12	8	1
2029	19	7	0
2030	23	7	0
Total	68	34	6

Process Capacity

Compliance risks at WTWs were evaluated based on 2020-22 OSM sample results and final effluent online monitoring data and compared with future assessed process treatment capacity shortfalls. The compliance risk of a WTW is measured by a R (Risk) score. The capacity shortfall of a WTW is measured by a C (Capacity) score. A combined score RC measures compliance risk due to capacity shortfall of WTW. The higher the score, the higher the compliance risk, or capacity shortfall that may cause an equivalent compliance risk. A score above 0.79 represents a high risk one or more of the final effluent quality permitted limits will be exceeded, resulting in a failure of the permit.

The above assessment determined 49 WTWs will have a compliance risk in 2030 which may be due to process treatment capacity shortfalls, based on current operating performance and future capacity.

Individual assessments were carried out for these 49 sites using a compendium of information for each WTW pertinent to their ability to provide a satisfactory service and achieve compliance. These include:

- Type of wastewater treatment processes
- Scale of growth, built programmes and reliability of population forecast
- Catchment constraints (e.g., agreement of local council to apply special conditions in planning)
- Measured loads and flows
- Implemented AMP7 solutions
- Temporary and semi-permanent plants
- Permit parameters
- Asset conditions

This assessment identified 42 of the 49 sites would not require capital investment in AMP8 to maintain compliance to 2030.

A final check was undertaken by using local knowledge of the wastewater catchments by SW Planning teams to assess whether, for example, housing development not identified through either Edge or the Local Plans was being undertaken. This added another one site.

The analysis identified 8 WTWs requiring investment by 2030 to prevent compliance failure due to process capacity shortfalls. Table 5 shows the list of sites; predicted PE by 2030; and the process risk (RC) score. Also shown for information is the source of the 2030 PE estimate (Edge or Local Plan).

Table 5 Sites requiring investment by 2030 to prevent compliance failure due to process capacity shortfall.

WTW	Driver	2030 Pe source	2030 Pe	RC Score
Broomfield Bank WTW	Capacity	Edge	118,564	0.00[iii]
Dymchurch WTW	Capacity	Edge	7,484	0.51[iii]
Ford WTW	Capacity	Local Plan	161,803	0.39[iii]
Horsmonden WTW	Capacity	Edge	8,564	1.95
Ludgershall WTW	Capacity	Local Plan	5,401	9.41
Staplehurst WTW	Capacity	Local Plan	7,033	3.81
Thornham WTW	Capacity	Local Plan	26,336	13.74
Tonbridge WTW	Capacity	Local Plan	57,695	10.31

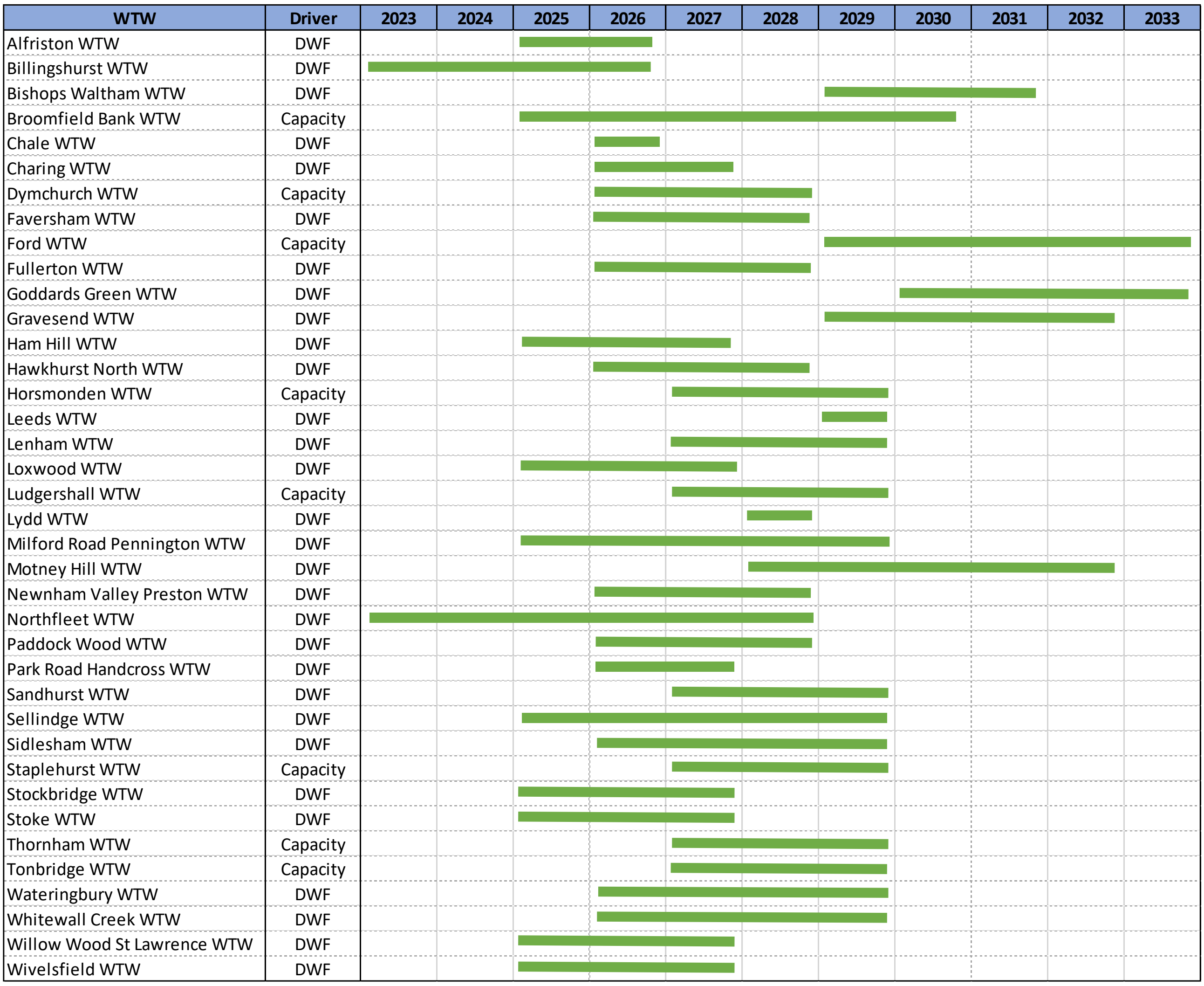
2.2.2. Building the Plan

Figure 3 shows the phasing of investment at each of the 38 sites listed in Table 3 and Table 5 over 10 years between 2023 and 2033, based on the assessment of need above. The investment period of each site is dependent on:

- When the expected capacity of the site will be exceeded; and
- whether there is crossover of scope between implementing a solution to accommodate growth and other drivers such as WINEP (further information on cost efficiency in this case can be seen in Section 4).

[iii] The predicted growth at Broomfield Bank WTW, Dymchurch WTW, and Ford WTW present shortfalls in hydraulic capacity rather than treatment process. The consequence of this is hydraulic overload resulting in flooding and pollution events rather than final effluent discharge compliance, hence inclusion despite an RC score below 0.79.

Figure 3 Phasing of investment over 10 years at 38 WTWs.



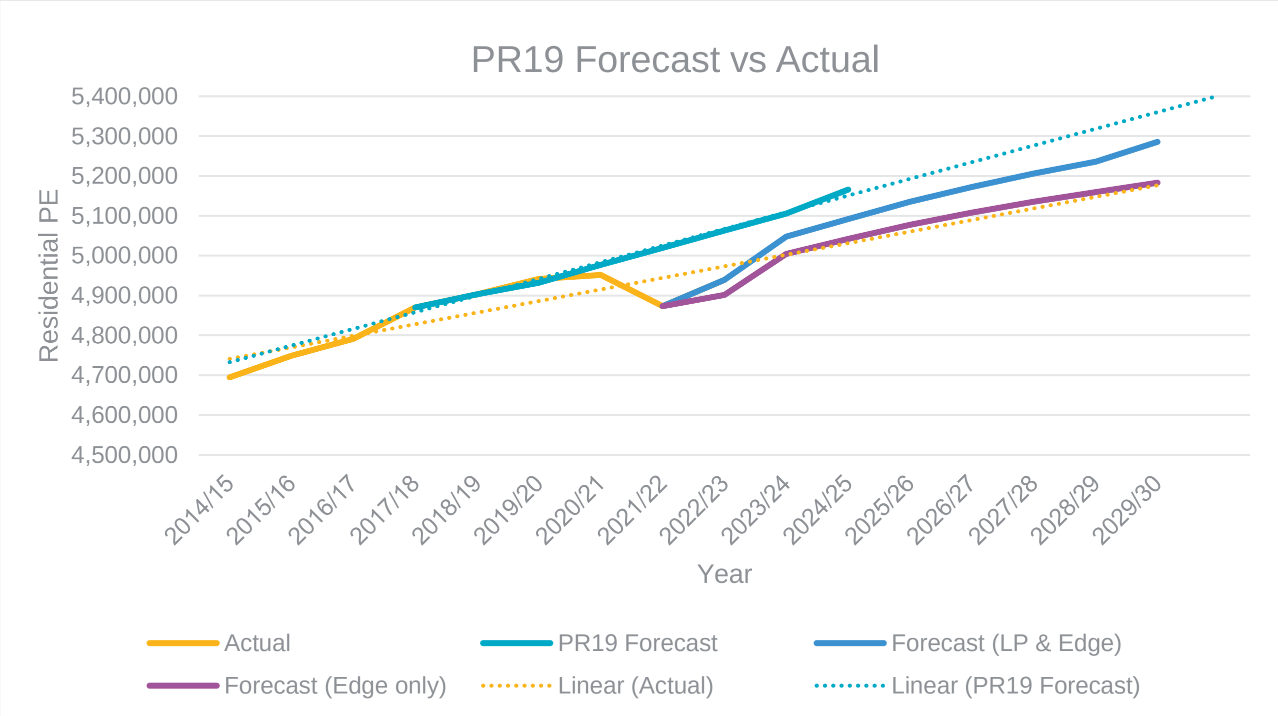
Source: SW analysis of internal data

The green lines on the chart represent the optimal construction time for interventions at each site to align with other capital works on site that would lead to the most efficient outcomes.

Accuracy of growth forecasting reduces the further into the future you go. For example, council local plans are reviewed and updated every 5 years. Therefore, assessing growth needs much beyond 2030 (tactical large-scale developments aside) would come with an increased risk of inaccuracy, and post 2030 the investment plan for growth will be assessed at PR29.

Furthermore, while we are confident in our assessment of the need to invest and when with the best information available currently, we do recognise there is potential for actual development to change from this forecast over time. Therefore, we undertook an assessment of historical forecast from PR19 vs actual growth.

Figure 4 Forecast PE growth at PR19 vs Actual.



Source: PR19 data tables and APR (RC) figures to 2022. Southern Water Forecast residential population equivalent forecast for 2023 to 2025.

Figure 4 shows the population growth forecast at PR19 for 2025 was estimated to be around 2% higher than population figures now being forecast for 2025 and included in this enhancement case. A change in forecast tool from [redacted] at PR19 to [redacted] for PR24[iv] may account for some of the change ([redacted] tends to provide a more conservative estimate than [redacted]). It can be seen from the graph that the [redacted] forecast for AMP8 aligns with the linear projection from actual 2014/15 to 2021/22 values.

Population equivalent forecasts are based on council local plan data for 13 of the 38 sites, which tend to be optimistic. We consult local plan for forecasts as well as [redacted] as they can be more recent and include developments not accounted for in [redacted] (local plans are consulted annually, the latest [redacted] forecast is from 2021).

To account for this, two scenarios were considered.

1. Deliver the full plan as identified above based on assessment of latest forecast growth data. This would require investment of £311.1m in AMP8.

[iv] The change from [redacted] to [redacted] was as part of a tendering process by the Water Resources South East (WRSE) group. Intended to improve the forecasting of new water connections, Southern Water also requested wastewater forecasting to ensure a consistent methodology and data sources across both water and wastewater.

2. Spread the investment required at the 38 sites across 6 years instead of 5, to allow for a factor of uncertainty in the forecast. In this case 6% of the overall AMP8 cost was rephased from years 3, 4 and 5 of the AMP into the first year of AMP9. This would require a total investment of £293.2m in AMP8.

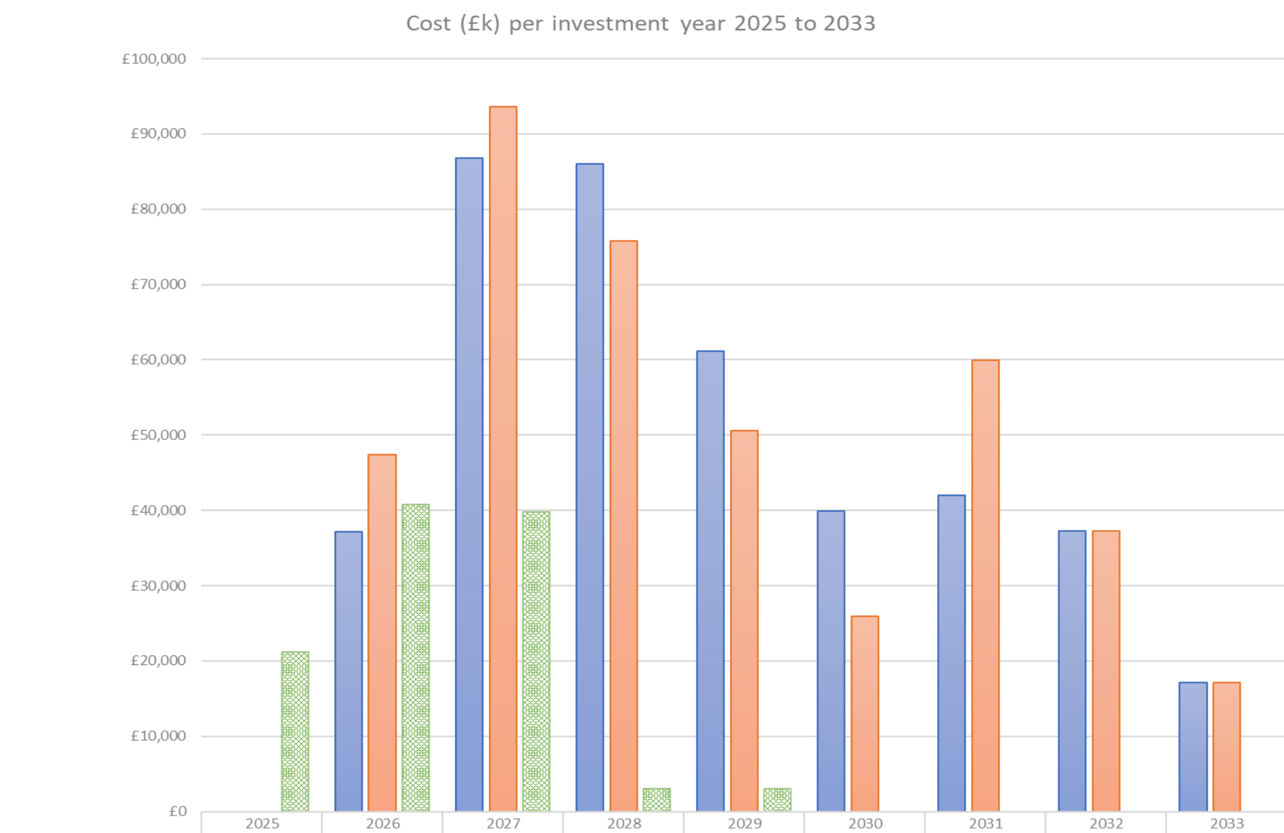
Figure 5 shows the total cost to deliver the investment at all 38 WTWs by investment year, for the scenarios identified above.

4 sites identified in the need assessment as requiring investment by 2030 were funded in AMP7, the costs are shown in green and labelled 'AMP7 Funded' in Figure 5. For clarity, we are not requesting funding for these 4 sites as part of this enhancement case.

Values shown after 2029/30 are costs to deliver the sites identified in Section 2.2.1 only, and as such do not include additional sites which may be identified for investment at PR29. Specifically, this enhancement case requests only the costs between 2025/26 and 2029/30 (AMP8).

We explain the method used to estimate the AMP8 investment costs in Section 4.

Figure 5 Total cost per year for the 38 sites



	2025	2026	2027	2028	2029	2030	2031	2032	2033
Total Un-phased Plan		£37,151	£86,831	£86,017	£61,163	£39,951	£42,010	£37,308	£17,110
Total Phased Plan		£47,376	£93,567	£75,835	£50,534	£25,884	£59,927	£37,308	£17,110
AMP7 Funded	£21,171	£40,807	£39,793	£3,004	£3,004	£0	£0	£0	£0

Total Un-phased Plan · Total Phased Plan · AMP7 Funded

The costs included in this case are based on the second scenario above (£293.2m in AMP8). A breakdown of cost by site can be found in Appendix 3.

2.3. Why is it considered Enhancement?

We operate a region where housing stock is predicted to grow at a fast pace in the coming five years. As Table 6 shows, over the 5 years of AMP8, (2025-30) housing in the Southern Water region is projected to grow at 0.85% per annum, which is the highest in the industry and over and above the average forecasted for the sector at 0.63% per annum[1]. We take this data from ONS household projections, as used by Ofwat at FD PR19[6].

Table 6 ONS annual growth rate forecast by company.

Company	ONS Forecast annual growth rate (2025-30)	Actual historical annual growth rate based on Ofwat data (2011-22)
Anglian Water	0.79%	0.87%
Dwr Cymru	0.54%	0.61%
Hafren Dyfrdwy		
Northumbrian Water	0.32%	0.51%
Severn Trent Water	0.63%	0.73%
South West Water	0.71%	0.99%
Southern Water	**0.85%**	**0.65%**
Thames Water	0.84%	0.84%
United Utilities	0.41%	0.66%
Wessex Water	0.76%	0.74%
Yorkshire Water	0.47%	0.54%
Industry	**0.63%**	**0.71%**

Source: Ofwat base cost models consultation dataset April 2023[1], and ONS household projections[6]

Historically, we have been able to accommodate growth through incremental investment at WTWs generally by removing process bottlenecks or increasing treatment capacity. In part this was driven by an acceptance of increased risk of DWF exceedance, as discussed in Section 2.2 above. While similar approach applies to several of our sites in AMP8, significant and atypical investment solutions are required at 23 of our sites, discussed in Section 4.3.

Southern Water have a statutory duty to accommodate forecast growth without harm to the environment and to provide service to new customers without deterioration in the level and quality of service provided to existing customers. Complying with such statutory duties requires enhancing the level and or quality of service provided to customers and the environment from, which is by definition what enhancement expenditure are designed to fund. Indeed, Ofwat defines enhancement expenditure as

> *"Enhancement expenditure is generally where there is a permanent increase or step change in the current level of service to a new "base" level and/or the provision to new customers of the current service level".*[11]

This enhancement case is based on the assumption that growth at WWTWs is funded entirely outside of Botex. It is therefore presented as a standalone case and as such makes no account of implicit allowance. Should growth be funded within the Botex plus model, this claim would be redundant and superseded by the associated Cost Adjustment Claim 'SRN22 Network and WTW Growth'[2] which sets out the rationale for costs above the implicit allowance in the econometric models.

2.4. Alignment with Long Term Delivery Strategy

We have assessed this programme against the criteria for low regret investment identified in the LTDS guidance[12] and Appendix 9 of the Final Methodology[13]. 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 have developed this programme alongside the Drainage and Wastewater Management Plan (DWMP) which estimates the impact of housing development on each wastewater system, and specifically DWF compliance under Planning Objective (PO) 8. The DWMP assessed current and future risk of breaching DWF compliance by estimating the growth in population to 2050 and calculating when headroom against current permits would be exceeded. Section 2.2 contains a comparison of the needs identified in the DWMP against the need identified in this enhancement case. See Appendix 4 for site-by-site comparison.

Given above, we consider that the investment proposed in this enhancement case is a low regret investment for the following reasons:

- Over 50% of the sites identified in the DWMP as running out of DWF headroom by 2050 are included.
- 7[v] of the 8 sites identified as currently (as of 2020) having insufficient headroom are being addressed in this programme of work, with 5 being delivered under AMP7 funding.
- Section 2.2 details how the programme plan has been developed, and the need to align enhancement due to growth with other programmes of enhancement such as WINEP.
- In developing options to address individual risks, consideration was given to long term future of assets. For example, where possible consolidation of sites was considered and there are several examples where transferring of flows from smaller to larger catchments is proposed.
- Aligning with WINEP and the DWMP demonstrates the imminent need is not forecast to be obsolete in future plans.

For further detail see the DWMP[9].

2.5. Customer Support

Our customers recognise that population growth in the South East is high. They want us to ensure infrastructure is developed to not just 'keep up' with growth but protect for future generations. For our stakeholders, development and new housing remains a top issue in our engagement and Southern Water is seen as central to the planning process.

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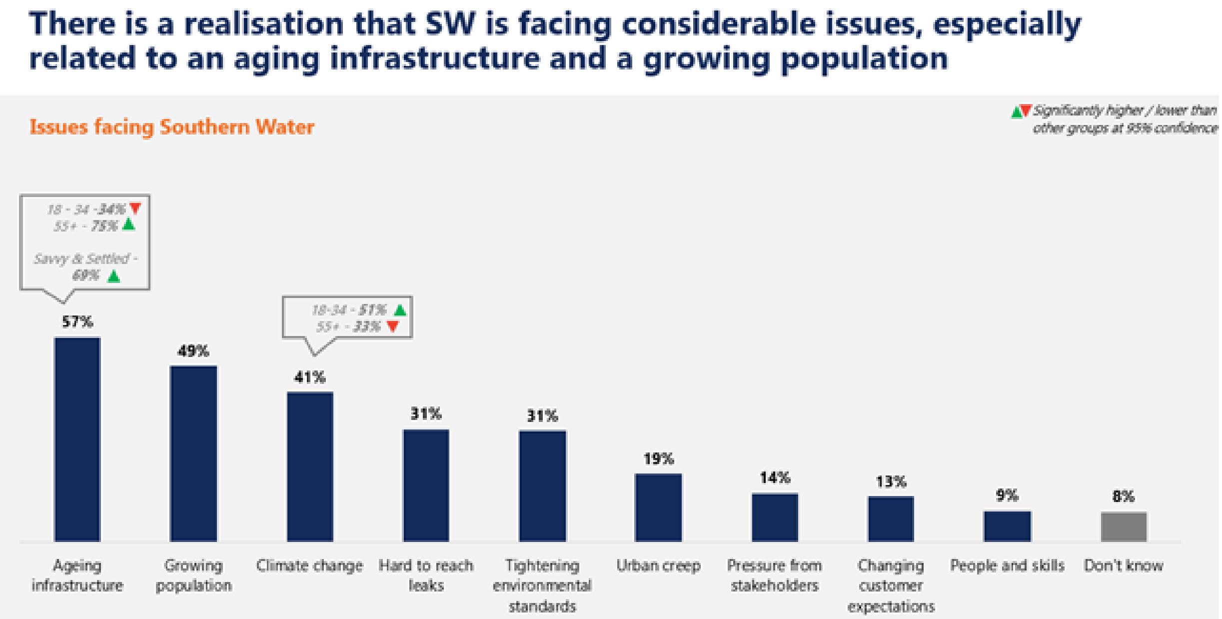
[v] One site, Chale WTW had operational fixes applied in 2020 which resulted in DWF headroom being restored, before growth used the remaining headroom and therefore requires a new permit in AMP8.

Customers want to see solutions that feel logical and are more focused on the right option for the long term. They want solutions that can cope with increases in population and demand, and climate change for the years ahead. Customers, in general, do not support a quick fix (using the term 'sticking plaster') for important infrastructure. The Covid pandemic has further helped to highlight to customers the need to plan ahead. There is an underlying belief that the UK in general has been poor at forward thinking and investment planning.

In detailed review of our DWMP, our customers cited addressing ageing infrastructure combined with the impact of population growth and climate change as the most important issue for our plans. We see the same feedback when engaging less informed customers, with the top 2 issues for Southern Water being the ageing infrastructure and population growth.

Figure 6 Customer support for solutions to a growing population



Source: WF2030 Quant Wave 3, 1,010 customers across the region, March '23

When engaging with our local communities, of 15 major population areas of our region – 60% have concerns about population growth, lack of funding and the ageing infrastructure. For example, customers in central Kent are concerned at the over development and loss of green space. However, customers in Deal (close to the Whitfield site where a new WTW is needed for a garden village) feel there are too many houses being built without the proper infrastructure in place.

To support the best option, customers want reassurances that the right solutions have been explored. They want to see nature based and partnership options prioritised, but also understand a twin track of natural and traditional solutions are often needed. Customers want to see the infrastructure delivered in a sustainable way, that balances the need for the long term, innovation and technology with keeping bills affordable.

2.6. Management Control

The level of housing growth is beyond management control. National Government set housing targets and local councils share the collective responsibility to plan and enable housing development. Local plans are made by the Local Planning Authority (LPA) and provide a framework for addressing housing needs and other economic, social, and environmental priorities. We have a statutory duty to provide additional capacity to enable housing development and serve new customers without detriment of service to existing customers and without harm to the environment.

3. Best Option for Customers

Two sites are currently underway as existing projects, and as such are progressing through the AMP7 Asset Lifecycle Process (ALP) to determine preferred solution and develop target costs, for delivery in AMP8.

For the remaining 36 sites a 'bottom up' optioneering and costing exercise was undertaken to develop notional solutions on a site-by-site basis. Where other work is planned at a WTW for AMP8 outside of growth (for example to meet a WINEP driver) only the incremental costs of solutions are included where work on the same assets is required, to avoid duplication of costs. For example, if new chemical dosing equipment is required under both a WINEP and a Growth driver, only the incremental cost of increasing the size of the dosing equipment to accommodate growth is included.

These costs are then compared to a top-down enhancement model as outlined in Section 4.

3.1. Bottom up optioneering

A Totex hierarchy approach was used to determine any sites where it is feasible to make optimisation changes to existing assets to achieve the required outcome from the needs assessment phase identified in Section 2.2. Sites feasible for 'Eliminate' or 'Operate' solutions were excluded at the needs assessment phase, resulting in most solutions requiring fabrication to meet the need.

Figure 7 Totex hierarchy

Solution Category	Example - River Quality (P)	Certainty	
Eliminate	**Remove the root cause** of the Risk through modified customer behaviour or process / system changes.	L/M	Collaborative effort required / Increasing Totex
Operate	**Operational or maintenance solution** require adherence to standards to ensure Outcomes are met and system failures are eliminated.	M/H	
Invigorate	**Leverage asset capabilities or unused headroom** by increasing the capability of existing or redundant assets through the implementation of latest thinking, best practice, proactive principles, advanced data analytics and control systems.	H	
Fabricate	**Construction of new assets** to meet Customer outcomes.	H	

Examples of options considered for each of the solutions categories are:

Eliminate

Root cause consists of two main elements: additional foul flow due to increase in connected population, and additional non-foul flow due to ingress or inundation of for example surface or groundwater. It is usually a combination of both, to varying extents. Removal of root cause due to population growth is beyond SW management control as discussed in Section 2.6. Removal of non-foul flow is possible through infiltration reduction measures, some of which are being undertaken for the sites identified in this case in AMP7. While this tends to provide additional headroom, the impact on need to provide an ‘end of pipe’ solution at the WTW is usually to provide additional resilience or reduce the scope of any construction scheme rather than eliminate the need for one.

Utilising headroom is another example of eliminating the investment need, or at least postponing intervention. While some sites will in theory have insufficient headroom to accommodate population increase in AMP8, due to lower-than-expected flows for the projected population or lower than normal infiltration the need for investment can be delayed.

Operate

Facilitation of a permit change to increase DWF can sometimes be achieved by simply optimising the existing wastewater treatment process, to treat to a higher quality standard without the need to increase the capacity of, or replace, existing assets.

Furthermore, where there is sufficient headroom in the existing wastewater treatment process and a less substantial increase in permitted DWF is required, a simple change to the permit is all that is required.

Invigorate

Utilising existing assets currently forming part of the wastewater treatment process by augmenting their capability (for example increasing the volume and number of discharge points of an existing chemical dosing plant) or reinstating redundant or mothballed assets. This will typically require some construction or fabrication activities, but the aim is to minimise where possible.

Fabricate

The construction of new or replacement of existing assets where the current capacity of the wastewater treatment process is unable to achieve the required new permit parameters. This would fall into two broad categories – typical and atypical investment.

Typical investment is where incremental upgrades to the existing process are required to meet the need, for example extending the capacity of existing tanks or processes. Atypical investment is required where incremental upgrade to the existing wastewater treatment process is not possible to meet the need, for example a change in process type or converting a WTW into a pumping station and transferring all flows to another WTW for treatment. Generally, consolidating WTWs by transferring flows from smaller satellite works to larger treatment hubs is considered preferential to upgrading several smaller sites. This needs to be balanced with the capex, opex, and whole life cost, as well as environmental, carbon and social capital considerations. Several examples can be seen where consolidation of sites is the preferred solution.

3.1.1. Option selection

The increase in permitted DWF required to accommodate the increase in PE for each catchment was calculated, then indicative permit limits likely to be issued by the EA to ensure ‘load standstill’ on the receiving watercourse determined.

When determining the additional capacity to be provided a design horizon of ten years beyond the end of the funding AMP period is chosen. Therefore, when considering design parameters for sites requiring a growth scheme in AMP8, the PE forecast in 2040 is used. This ensures repeat investments in subsequent AMP periods is minimised, while balancing the increasing uncertainty of growth projections as time goes on.

Using Risk and Value (R&V) optioneering tools from the AMP7 ALP delivery process, solutions to meet the calculated increase in DWF and associated reduction in final effluent determinands were developed, using Water Industry Mechanical & Electrical Specifications (WIMES) and SW specific Technical Specifications Manual (TSM). The identified solutions were considered for Capex, Totex, Whole Life Cost (WLC), and carbon impact and a preferred option chosen. Further detail can be found in the Technical Annex – Enhancement Cost Estimation and Optioneering.

Table 7 summarises the options considered and adopted for each of the WTWs identified as at risk of exceeding capacity by 2030.

Table 7 Full list of sites considered with chosen options

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Alfriston WTW	DWF	2026	✓	Medium		Increase existing process capacity	Fabricate	Adopted	Lowest WLC	✓	0 (Funded in AMP7)
Barton Stacey WTW	DWF	2029	✓	Low		Infiltration reduction	Eliminate	Adopted	Addresses root cause, lowest cost		0 (Funded in AMP7)
Billingshurst WTW	DWF	2026		High		Replace existing secondary treatment with new process	Fabricate	Adopted	Lowest WLC and carbon	✓	0 (Funded in AMP7)
	DWF	2026		High		Divert 50% of flow to new advanced secondary treatment process	Fabricate	Considered	Higher WLC and carbon due to reliance on chemicals and power		0 (Funded in AMP7)
Bishops Waltham WTW	DWF	2031		High		Expansion of existing nutrient removal process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	7,768
Boldre WTW	DWF	2026	✓	Low		Infiltration reduction	Eliminate	Adopted	Addresses root cause, lowest cost		0 (Funded in AMP7)
Whitfield Urban Expansion (Broomfield Bank WTW)	Capacity	2030		High		New WTW for strategic development	Fabricate	Adopted	Lowest process, environmental and cost risk. Least disruption to customers	✓	55,024

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
	Capacity	2030		High		Sewer networks upgrades to treat flows at existing WTW (Broomfield Bank WTW)	Fabricate	Considered	High cost and constructability risk		53,410
	Capacity	2031		High		Sewer and WTW networks upgrades to treat flows at existing WTW (Dambridge Wingham WTW)	Fabricate	Considered	High cost and constructability risk		69,555
Chale WTW	DWF	2031		Low		Increase DWF permit	Operate	Adopted	Utilises existing treatment capacity headroom. Lowest cost	✓	10
Charing WTW	DWF	2028		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	1,743
	DWF	2028		Low		Replace existing filter media	Invigorate	Considered	High process compliance risk		N/A
Cooksbridge WTW	DWF	2031		Low		Increase DWF permit	Eliminate	Adopted	Utilises existing headroom. Low confidence in forecast exceedance.		0
Coolham WTW	DWF	2031		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Droxford WTW	DWF	2029		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0
Dymchurch WTW	Capacity	2028		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	10,749
	Capacity	2028		Medium		New sidestream process with wetland	Fabricate	Considered	Would require significant land, likely to be cost prohibitive. Unable to deliver in time.		N/A
	Capacity	2028		Medium		New sidestream process with package plant	Fabricate	Considered	Existing process can be upgraded at lower WLC		N/A
Edenbridge WTW	DWF	2032		Low		Increase DWF permit	Eliminate	Adopted	Utilises existing headroom. Low confidence in forecast exceedance.		0
Faversham WTW	DWF	2030		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	9,931

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Ford WTW	Capacity	2033		High		Increase existing hydraulic capacity. New discharge outfall.	Fabricate	Adopted	Utilises existing process capacity headroom by ensuing increased flow can pass through	✓	43,955
	Capacity	2033		High		Transfer flows to another WTW and provide additional treatment at receiving works	Fabricate	Considered	Not feasible due to volume of flows, insufficient capacity any WTWs within range, abandonment of existing functioning assets		N/A
Fullerton WTW	DWF	2029	✓	Medium		Expansion of existing nutrient removal process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	25,647
	DWF	2029	✓	High		New sidestream process	Fabricate	Considered	High process compliance and cost risk as new technology		18,839
Goddards Green WTW	DWF	2033		High		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	18,208

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
	DWF	2033		High		Transfer flows to another WTW and provide additional treatment at receiving works	Fabricate	Considered	Not feasible due to volume of flows, insufficient capacity any WTWs within range, abandonment of existing functioning assets		N/A
Gravesend WTW	DWF	2032		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	12,979
	DWF	2032		Medium		Increase existing process and sludge capacity	Fabricate	Considered	Acceptable risk without additional sludge capacity		N/A
Grayswood WTW	DWF	2031		Low		Increase DWF permit	Eliminate	Adopted	Utilises existing headroom. Low confidence in forecast exceedance.		0
Ham Hill WTW	DWF	2027		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	6,651
Hawkhurst North WTW	DWF	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	2,075

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Hillbrow Knowles Meadow WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0
Horsmonden WTW	Capacity	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	1,538
Leeds WTW	DWF	2030		Low		Increase DWF permit	Operate	Adopted	Utilises existing treatment capacity headroom. Lowest cost	✓	10
Lenham WTW	DWF	2031		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	1,297
Levetts Lane Bodiham WTW	DWF	2029		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0
Lidsey WTW	DWF	2026		High	✓	New secondary treatment	Fabricate	Adopted	Capacity for growth provided as part of AMP7 scheme		0 (Funded in AMP7)
Liss Hillbrow WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF. Low confidence in forecast.		0

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Loxwood WTW	DWF	2028	✓	Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	3,141
Ludgershall WTW	Capacity	2029		Medium		Expansion of existing nutrient removal process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	3,669
Lydd WTW	DWF	2032		Low		Utilise WINEP solution to provide process capacity, increase in chemical dosing capacity only	Invigorate	Adopted	Lowest cost	✓	134
Milford Road Pennington WTW	DWF	2029	✓	High	✓	Expansion of existing nutrient removal process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	18,697
	DWF	2029		High		Transfer flows to another WTW and provide additional treatment at receiving works	Fabricate	Considered	Not feasible due to volume of flows, insufficient capacity any WTWs within range, abandonment of existing functioning assets		N/A
Motney Hill WTW	DWF	2031		High		Expansion of existing process and provision of tertiary treatment and storm storage.	Fabricate	Adopted	Wastewater treatment process secure solution	✓	62,822

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
	DWF	2031		High		As above without storm storage	Fabricate	Considered	Unacceptable pollution risk		50,342
Newnham Valley Preston WTW	DWF	2028	✓	Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	3,412
Northfleet WTW	DWF	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	24,559
	DWF	2029		High		Build new WTW next to existing site in collaboration with development corporation	Fabricate	Considered	Discounted as part of negotiations with development corporation		>100,000
Oxted WTW	DWF	2026	✓	Medium		Increase existing process capacity	Fabricate	Adopted	Capacity for growth provided as part of AMP7 scheme		0 (Funded in AMP7)
Offham WTW	DWF	2028		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0
Paddock Wood WTW	DWF	2029		High		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	7,624
Park Road Handcross WTW	DWF	2028		Low		Add chemical dosing	Fabricate	Adopted	Lowest cost	✓	1,340

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Plumpton WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Low confidence in data as a high season PE skews the forecast		0
Saddlers Close WTW	DWF	2026		Medium		Transfer all flows to another WTW	Invigorate	Adopted	Neighbouring site being pumped to another WTW, opportunity to include this additional site.		0 (Funded in AMP7)
Sandhurst WTW	DWF	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	2,914
Sandown New WTW	DWF	2026		Low		Increased DWF permit and sludge capacity upgrades	Invigorate	Adopted	Utilises existing treatment capacity headroom. Lowest cost		0 (Funded in AMP7)
Sellindge WTW	DWF	2030		High		Replace existing secondary treatment with new process	Fabricate	Adopted	Lowest risk option. Supported by EA	✓	20,467
	DWF	2030		High		Transfer flows to another WTW (West Hythe WTW), upgrade process and treat there	Fabricate	Considered	Significant network upgrades required, and unlikely to be supported by EA		N/A

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
	DWF	2030		Medium		Temporary solution to provide capacity until 2028	Fabricate	Considered	Only considered as a mitigation if preferred option not supported by EA		N/A
Sidlesham WTW	DWF	2026	✓	High		Expansion of existing nutrient removal process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	0 (Funded in AMP7)
	DWF	2026		High		Transfer flows to another WTW and provide additional treatment at receiving works	Fabricate	Considered	Not feasible due to volume of flows, insufficient capacity any WTWs within range, abandonment of existing functioning assets		N/A
Sittingbourne WTW	DWF	2026		High		New secondary treatment	Fabricate	Adopted	Capacity growth provided as part of AMP7 scheme		0 (Funded in AMP7)
Slinfold WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Lower confidence in forecast PE		0
Smarden WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Lower confidence in forecast PE		0
St Helens WTW	DWF	2026	✓	Low		Infiltration reduction	Eliminate	Adopted	Addresses root cause, lowest cost		0 (Funded in AMP7)

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
Staplehurst WTW	Capacity	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	4,952
	Capacity	2029		Medium		Reduce incoming flows + process capacity increase	Fabricate	Considered	Uncertainty of efficacy of flow reduction may lead to high cost and process compliance risk		N/A
Stockbridge WTW	DWF	2026	✓	High		Replace existing secondary treatment with new process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	0 (Funded in AMP7)
Stoke WTW	DWF	2027		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	3,502
Thornham WTW	Capacity	2029	✓	High	✓	Replace existing secondary treatment with new process	Fabricate	Adopted	Provides solution for growth and also reduces nutrients in designated sensitive area at Chichester Harbour	✓	18,169
	Capacity	2029	✓	High		Increase existing process capacity	Fabricate	Considered	Lower cost but does not address nutrient neutrality requirements in Chichester Harbour		11,000

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
	Capacity	2029	✓	High		Provide additional treatment process to treat a proportion of flows alongside existing treatment	Fabricate	Considered	Lower cost but does not address nutrient neutrality requirements in Chichester Harbour		11,000
Tonbridge WTW	Capacity	2029		High		Replace existing secondary treatment with new process	Fabricate	Adopted	Wastewater treatment process secure solution	✓	10,911
	Capacity	2029		High		Transfer flows to another WTW and provide additional treatment at receiving works	Fabricate	Considered	Not feasible due to volume of flows, insufficient capacity at any WTWs within range, abandonment of existing functioning assets		N/A
Summer Lane Pagham WTW	DWF	2031		Low		Utilise process capacity provided by AMP7 quality drivers	Eliminate	Adopted	Low risk as resilience provided by significant upgrade to WTW as part of AMP7 WINEP		0
Wateringbury WTW	DWF	2029		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	8,370

Scheme	Shortfall	Estimated first year of failure	Infiltration Reduction	Complexity of solution	Beyond TAL?	Option	Totex Hierarchy	Decision	Reason	Included in EC?	Total Capex Cost (AMP8 & AMP9) (£k)
West Marden WTW	DWF	2030		Low		Do nothing and monitor	Eliminate	Adopted	Does not require flow monitoring as low permitted DWF		0
Whitewall Creek WTW	DWF	2030		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	9,073
Willow Wood St Lawrence WTW	DWF	2027	✓	High		Pump all flows to another WTW for treatment (Sandown WTW)	Fabricate	Adopted	Distance and size of receiving WTW make this the lowest WLC solution.	✓	3,979
	DWF	2027		Medium		New sidestream process	Fabricate	Considered	Higher WLC and carbon		1,826
Wivelsfield WTW	DWF	2028		Medium		Increase existing process capacity	Fabricate	Adopted	Wastewater treatment process secure solution	✓	2,220
Wouldham WTW	DWF	2032		Low		Do nothing and monitor	Eliminate	Adopted	Lower confidence in forecast PE		0

4. Cost Efficiency

4.1. Bottom-up costing methodology

The plan contains a mixture of projects beginning in AMP7 but completing in AMP8, beginning and completing in AMP8, and beginning in AMP8 and completing in AMP9. The cost methodology described below relates to enhancement within the AMP8 business plan only. The full cost of the growth programme by AMP period at the identified sites is shown in Table 8.

Table 8 Cost by AMP period

	AMP8 Cost (£m)	AMP9 Cost (£m)	Total Cost (£m)
Whitfield Urban Expansion[vi]	55.0	0	55.0
All other sites[vii]	238.2	114.3	352.5
Total	**293.2**	**114.3**	**407.5**

Breakdown of these costs by site can be found in Figure 9, Appendix 3.

One scheme is currently underway as an active project as there is significant crossover with the design of an AMP7 scheme. The cost for this site has been determined through the current project R&V process and is based on bottom-up outline designs in collaboration with an AMP7 delivery partner.

Net direct cost estimates for the remaining schemes have been derived by SWS' cost estimating team using cost curves for specific items as identified in the high-level design carried out by our design team. Net direct costs are those associated with installing an asset, typically labour and plant materials, and are derived from either process function or asset equipment cost curves, top down or bottom-up estimates from suppliers and other sources such as specialist quotations. Further information on estimating direct costs can be found in Technical Annex 'SRN15 Cost and Option Methodology'[14].

The equipment set cost curves were updated with applicable, up-to-date captured data, and curves were generated that are a mix of AMP7 and AMP6 data. Where sufficient data points were unavailable to create a purely AMP7/6 model, a curve was generated via a mix with historic AMP5 data, uplifted in line with a Water Industry based Basket of Goods. Additionally, historic curves with little to no new data points were uplifted to current price base using the same Basket of Goods to reduce the formation of gaps through the Equipment Set and provide consistency. Throughout the process, outlying data points from the cost capture process were considered and removed to ensure the curves represent the asset comprehensively.

The bulk of costs used for WTW Growth schemes are from these cost curves, with a few adjustments (such as kiosks and valves, which we know are particularly low when compared against supply chain costs). As the bulk of the schemes involve the type of work previously undertaken at other sites, and that the cost curves were originally developed from, they are a good fit and entirely appropriate for this estimating.

[vi] Costs can be found in data table SUP12

[vii] Costs can be found in data table CWW3.153

Taking into account the level of design maturity, complexity, and quality of cost data for each high-level design, a tool was used to apply cost risk, overhead and indirect (e.g. project management, risk) cost uplifts to the net direct work cost to determine an overall project cost estimate.

Our SRN15 Cost and Option Methodology Technical Annex[14] explains the rationale and provides benchmarking evidence for the uplifts and efficiency factors applied to the net direct costs.

4.2. Top down enhancement cost model methodology

At PR19, Ofwat assessed enhancement costs with growth at wastewater treatment works as part of the base cost econometric models (botex plus models), complemented with a growth unit cost adjustment and deep dives of business plan evidence where relevant.[15]

In its April 2023 base cost model consultation, Ofwat indicated that at PR24 it may depart from the approach followed at PR19 and assess growth at sewage treatment works enhancement costs through a standalone model, following the results from a study commissioned to Arup concluded that "(…) a standalone econometric model may be a viable option to assess these costs."[16]

Arup's study to Ofwat in May 2022 concluded that a standalone econometric model with the following features may be a viable option:[17]

- Cumulative model summing costs and cost drivers over the long term, i.e. over the whole sample period to mitigate the lack of a variable for capacity headroom and smooth lumpiness in the data;
- Log-linear model, i.e., costs in the logarithmic scale are regressed on the drivers expressed in their original metrics;
- Use the following two cost drivers:
    - 'change in population equivalent served by wastewater treatment works'; and
    - 'treatment intensity' defined as the proportion of load requiring tertiary treatment.

We replicated Arup's model using the most recent Ofwat Spring 2023 data set covering the period from 2011-12 to 2021-22. Table 9 presents the model results.

Table 9 Top down enhancement cost model

Variable	Parameter
PE change served by wastewater treatment works (000s)	0.0017943***
Load receiving tertiary treatment (%)	0.019261*
Constant	2.228321**
Dependent variable	Totex GWWTWs (ln)
Estimation method	OLS
N	10
R^2	81%
RESET test	0.768 (pass)
VIF score (mean)	1.051

PE = population equivalent; Totex GWWTW (ln) = Growth at wastewater treatment works totex, logarithmic scale

Source: Southern Water analysis
Notes: *** significant at 1%; ** significant at 5%; *significant at 10%

We found that the model shows similar level of robustness as in the Arup report:

- The estimated coefficients remain statistically significant, of a plausible magnitude and have the expected positive signs;
- The predictive power of the model, measured by the R2 is 81%, above the 77% in the Arup report and above Arup's minimum threshold of 75% to 80%;
- The model is statistically valid, as it passes the Reset test of linear specification meaning that its specification is appropriate for explaining costs. The significance of the estimated coefficients is robust against multicollinearity, as the mean VIF statistic is around 1, which is below the acceptable level of 10.

Comparing the actual vs. predicted costs ratios is important because if they showed too large a spread, this would indicate the model, albeit robust, did not capture companies' costs well enough. Arup's proposed model shows a spread of the ratio between actual and predicted costs, ranging between 0.57 and 1.72 (see Figure 8). This is comparable to the range shown in the Arup report (0.42 to 1.70) and comparable to the range shown in other PR19 enhancement models, e.g. Phosphorus removal which ranged from 0.5 and 1.4 at PR19.

Figure 8 Ratio between actual and predicted costs

Welsh Water	1.72
Anglian Water	1.51
Wessex Water	1.48
Severn Trent Water	1.46
Thames Water	0.9
United Utilities	0.89
Northumbrian Water	0.82
South West Water	0.71
Yorkshire Water	0.67
Southern Water	0.57

Source: Southern Water analysis

Although comparable to other models, this is, nevertheless a relatively high spread suggesting that other factors not captured by this model are at play at explaining companies' costs with growth at wastewater treatment works. This is particularly the case for Southern Water, which shows as the most efficient company with a ratio between actual and predicted costs of 0.57. As we explain elsewhere in this business case, this is likely the reflection of Southern Water's approach in the period covered in the model sample being heavily reliant on incremental investment, generally by removing process bottlenecks or incremental increases in treatment capacity.

We are now reaching the point where this incremental investment is no longer viable in many of our WTWs meaning that significant and atypical investment solutions are required at certain key sites. As a result, and as Arup recognises in its report, there is a need to supplement the econometric modelling with adjustments based on more bottom-up costing to reflect the atypical nature of our costs. We turn to this in the next section.

4.3. Comparison between bottom up and top down costs

A comparison of bottom-up costing methodology vs the top-down modelled costs was undertaken, for costs to deliver capacity at the 34 sites requesting funding, up to 2040. This was done for several scenarios, summarised below.

4.3.1. Scenario 1

This scenario is the baseline comparison of all 34 sites included in the investment plan, without any consideration of solution complexity, typicality, PE served or capacity increased.

Table 10 Difference between bottom up and modelled costs for all 34 sites.

No of WTW	Change in PE between 2025 and 2040	Tertiary treatment %	Modelled £k	Bottom up £k	Difference £k	% Difference[viii]
34	206,211	76.5%	£69,211	£407,150	£337,939	142%

This scenario shows a significant difference in top-down vs bottom-up costs. Indeed, the top-down costs would be insufficient to cover the two most costly schemes according to bottom-up assessment. There are two main considerations which account for this discrepancy. The first consideration is that investment plan contains several 'atypical' solutions where replacement of existing treatment or the process is required to achieve lower than Technically Achievable Limits (TAL), meaning that a small increase in PE will drive a disproportionate amount of construction. These are considered in Scenario 2 and Scenario 3.

4.3.2. Scenario 2

This scenario removes from the comparison sites considered to require atypical solutions to meet the need and considers only the remaining 26 'typical' schemes.

Table 11 Difference between bottom up and modelled costs for the 26 sites considered to require 'typical' solutions to meet the growth need.

No of WTW	Change in PE between 2025 and 2040	Tertiary treatment %	Modelled £k	Bottom up £k	Difference £k	% Difference[viii]
25	119,178	76.0%	£58,646	£165,750	£107,104	95%

While this shows a reduction in the difference between top down and bottom-up costs, there is still a significant discrepancy. This is largely because some of the typical solutions also require a disproportionate investment is required to accommodate growth, for example new treatment processes in areas designated sensitive for nutrients and new treatment works.

4.3.3. Scenario 3

This scenario removes sites where a disproportionate investment is required to accommodate growth, including those requiring atypical solutions, and considers the remaining 14 schemes. Examples of investment considered disproportionate and excluded in this scenario include:

[viii] Percentage difference calculated as: $\frac{V_1 - V_2}{\left[\frac{(V_1+V_2)}{2}\right]} \times 100$

Where V_1 = Modelled cost £k
V_2 = Bottom up cost £k

- Where a new secondary treatment tank is required to be constructed to serve an increase of 89 PE.
- A 50% increase in the process treatment capacity to serve a 13% increase in PE.
- Full replacement of all pipework on site to provide sufficient hydraulic capacity for a 10% increase in PE.

Table 12 As Scenario 2 but also removing sites with disproportionate investment

No of WTW	Change in PE between 2025 and 2040	Tertiary treatment %	Modelled £k	Bottom up £k	Difference £k	% Difference
15	103,504	73.3%	£54,130	£80,024	£25,894	39%

This scenario shows much greater alignment between the modelled and bottom-up costs. We consider this to be a closer representation of the costs for typical sites where capacity can be increased incrementally and proportionally with the additional PE served and proportion of load requiring tertiary treatment, for the reasons stated in the scenarios above. However, there is still a 39% difference between the two costs which is a reflection of the fact that in future increasing capacity will be more costly than historical costs underpinning the models due to reliance on headroom capacity, meaning we now need to invest at more sites to accommodate a comparatively similar increase in PE. Additionally, as discussed in Section 2.2 and 2.3 it has historically cost less to accommodate increased DWF due to acceptance of some sites breaching and the depletion of headroom.

A list of each site excluded under each scenario and why can be found in Appendix 2.

5. Customer Protection

To ensure that our customers are protected against non-delivery, two measures are already in place; the environmental performance measure impact, and financial penalties from the discharge permit compliance performance commitment.

Exceeding DWF at a site for 3 years out of a 5-year rolling period would result in that WTW being classed as failing, leading to enforcement from the EA for non-compliance with an Environmental Permit condition – a legal obligation Southern Water is required to meet. Failure to comply with this obligation would result in enforcement, prosecution, and significant detrimental impact to reputation.

In addition to the regulatory obligation enforced by the EA, a performance commitment for underperformance as a result of failing to invest in assets due to population growth is in place to recompense customers if performance expectations are not met. This is the discharge permit compliance performance commitment For details on the performance commitment benefits foregone in case of non-delivery, please see our Technical Annex 'SRN18 Performance Commitment Methodologies'[18].

As discussed in Section 2.2, there is a small risk the growth forecast by 2030 does not materialise within the AMP period. We have minimised the impact of this risk to customers by reducing the funding requested and phasing over six years instead of five, used comparative assessment of forecast between Edge and Local Plan data, and based our investment on Q90 flow assessment rather than Q80 (see Section 2.2). Additionally, there is also a risk that actual population increase may exceed forecasts (for example, changes to legislation on Nutrient Neutrality unlocking further development). Changes in weather conditions during drier months may also impact the number of sites exceeding DWF than forecast.

We consider that these measures provide sufficient protection to our customers and therefore are not proposing any Price Control Deliverable (PCD) for this investment.

5.1. Environmental Performance Assessment Impact

The EA have confirmed their intention to include exceedance of DWF as an EPA performance metric in AMP8[5].

Assuming an EPA metric for DWF exceedance would align with the discharge permit compliance metric for AMP7[5], exceedance of 6 of the identified 30 sites at risk of failing DWF in any given year would result in less than 98% compliance across 293 sites with a defined DWF permit limit, resulting in Red performance for that EPA metric thereby allowing a maximum of 2 star status. DWF exceedance at 3 sites in any given year would prevent Green status under this metric.

For sites with process capacity shortfall risk, the same performance impacts would be realised. Failure of 3 of the 8 sites identified as at risk prevent Green status, and 6 would result in Red.

Table 13 shows the baseline performance of discharge permit compliance EPA metric if the identified investment is not made.

Table 13 EPA performance without investment

Year	Failed DWF Sites	Failed PC Sites*	EPA status
2025	0	0	Green
2026	2	0	Green
2027	6	0	Red
2028	10	1	Red
2029	17	6	Red
2030	21	7	Red

Note: * Due to inadequate process capacity for identified sites

Performance of the identified sites as a result of the investment requested in this business case will be monitored against their impact on associated EPA metric.

5.2. Performance Commitment

On the basis DWF exceedance will impact the discharge permit compliance performance commitment as discussed above, we will incur a penalty if we do not deliver or delay our investment. We have estimated the penalty that we would incur, i.e., the level of protection that our customers would benefit if we failed or delayed our investment, as follows:

- The number of WTWs that would fail in any year without the investment required in the business case was determined as part of the methodology set out in Section 2.2.
- One failed WTW accounts for a 0.27% point reduction in performance.
- Without this investment, by 2030, 29 sites would have failed the PC and our permit compliance performance would be 7.9% points lower. The performance commitment is forecast at 99.1% compliance per year. Without this investment our performance would deteriorate from 99.1% to 91.2%.
- Using the Ofwat's indicative Outcome Delivery Incentive (ODI) rate for AMP8 of £2.28m per % point of failed WTW, by 2030 we would have incurred a total penalty of £40.1m over the AMP8 period without this investment.

The table below shows the detriment in the performance commitment without this investment over time. Please see the 'SRN18 Performance Commitments Methodologies Technical Annex'[18] for details.

Table 14 PC performance without investment

Year	Failed DWF Sites	Failed Process Capacity Sites	Total failed sites	Detriment in discharge compliance PC level	Penalty (£k)*
2025	0	0	0	0	0
2026	2	0	2	0.5%	0
2027	6	0	6	1.6%	2,040
2028	11	1	12	3.3%	6,120
2029	18	6	24	6.6%	14,280
2030	22	7	29	7.9%	17,680
Total	59	14	73	-	40,120

6. Conclusion

We have proposed an enhancement case to meet the need arising from above average growth across the operating region, through a mixture of permitting, optimisation of sites, and investment in new assets and wastewater treatment processes. Options have been considered and proposed costs demonstrated to be efficient, although out of alignment with expected model costs. We have demonstrated why modelled costs are considered are not appropriate in many cases, whether due to atypical investment needs or disproportionate unit costs.

The £293.2m proposed in this case will be used to increase wastewater treatment capacity at 34 WTWs to ensure no detriment to the environment from these discharges until at least 2040, and is supported by customers' highest two priorities of addressing ageing infrastructure and growing population.

The investment need is beyond management control. National Government set housing targets and local councils share the collective responsibility to plan and enable housing development. Local plans are made by the LPA and provide a framework for addressing housing needs and other economic, social, and environmental priorities. We have a statutory duty to provide additional capacity to enable housing development and serve new customers without detriment.

Customers are protected against non-delivery through two measures already in place; environmental performance measures and regulation from the EA against legal obligations, and financial penalties from PCs.

Table 15 Conclusion

Section	*Key Commentary*	Page
Introduction & Background	Southern Water (SW) have a statutory duty to accommodate forecast growth, without harm to the environment whilst improving resilience. We are forecasting significant population growth across the whole of the region by 2040. Assessment of forecast population growth has identified 38 Wastewater Treatment Works requiring an increase in capacity by 2033.	7
Need for Enhancement Investment	Housing in the Southern Water region is projected to grow at 0.85% per annum, which is the highest in the industry and over and above the average forecasted for the sector at 0.63% per annum. Ofwat's econometric models do not take account of the variation in growth across the country and only fund the average historical growth rate for the industry at 0.71% per annum, according to the data set that Ofwat published alongside the April 2023 base cost model consultation. Therefore, cost allowances for companies in regions with high growth and particularly growth concentrated around specific towns are not	9

	reflected in Ofwat's assessment of botex requirements and are underfunded. This is supported with a comparison of bottom-up costing from engineering solutions at site level with a top down modelled costs. Requirements to provide atypical and non-proportional solutions to meet tightened permit conditions are not factored into the model.	
Best Option for Customers	The optioneering and selection of the preferred solutions will ensure best value for customers through consideration of the totex hierarchy. Where possible utilisation of existing process capacity headroom has been used, and options to optimise the current assets considered.	25
Cost Efficiency	Costs have been derived through SW's cost curves and additional efficiencies have been applied (e.g. reduction in allowance for project related costs, and where there are multiple drivers on the site)	39
Customer Protection	Customers are protected against non-delivery through two measures already in place; environmental performance measures and regulation from the Environment Agency (EA) against legal obligations, and financial penalties from PCs.	44

References

[1] Ofwat, PR24 Cost Assessment Master Dataset, Wholesale Wastewater Base Costs v4, April 2023 (link)

[2] Southern Water, Cost Adjustment Claim, SRN22 Network and WTW Growth, October 2023

[3] Southern Water, Alternative Delivery, SRN17 Direct Procurement for Customers and Alternative Delivery Model PR24 submission and business cases for Alternative Delivery: DPC and DPC-lite, October 2023

[4] WF2030 Quant Wave 3, 1,010 customers across the region, March '23

[5] Environment Agency, Water & sewerage company Environmental Performance Assessment (EPA) methodology (version 9), May 2021 (link)

[6] ONS household projections for England, released 29 June 2020 (link)

[7] Water Industry Act 1991, Section 94 (link)

[8] Environment Agency, Calculating dry weather flow (DWF) at waste water treatment works, May 2018 (link)

[9] Southern Water, Drainage & Wastewater Management Plan, March 2023 (link)

[10] Environment Agency, Water Discharge and Groundwater (from point source) Activity Permits (EPR 7.01) (link)

[11] Ofwat, 'RAG 4.10 – Guideline for the table definition in the annual performance report, March 2022, paragraph 15.3. (link)

[12] Ofwat, PR24 and beyond: Final guidance on long-term delivery strategies, April 2022 (link)

[13] Ofwat, Creating tomorrow, together: Our final methodology for PR24, Appendix 9 Setting expenditure allowances, December 2022 (link)

[14] Southern Water, Technical Annex, SRN15 Cost and Option Methodology, October 2023

[15] Ofwat, PR19 final determinations, Securing cost efficiency technical appendix, Chapter 3.1, December 2019 (link)

[16] Ofwat, 'Econometric base cost models for PR24', April 2023, p.13 (link)

[17] Arup, Assessment of growth-related costs at PR24, May 2022, chapter 5 (link)

[18] Southern Water, Technical Annex, SRN18 Performance Commitment Methodologies, October 2023

Appendix

Appendix 1	*New household forecasts*
Appendix 2	*Sites requiring atypical investment*
Appendix 3	*Breakdown of cost by site*
Appendix 4	*Comparison of DWMP and PR24*

Appendix 1 – New household forecasts

The forecasted number of new households, by company, by both historical growth rate and ONS growth rate.

Table 16 New households forecasts

	Step 1a	Step 1b	Step 1c	
Company	Forecasted number of properties connected in 2025 (nr)	Industry average historical annual growth rate	Forecasted number of properties connected in 2030 (nr)	Forecasted new connected properties across AMP8 assuming industry average historical growth rate (nr)
	(1)	(2)	(3) = (1) x [(1+2)^5]	(4) = (3) – (1)
Anglian Water	2,947,788	0.71%	3,053,931	106,143
Dwr Cymru	1,504,572	0.71%	1,558,748	54,176
Hafren Dyfrdwy				
Northumbrian Water	1,309,159	0.71%	1,356,299	47,140
Severn Trent Water	4,312,737	0.71%	4,468,028	155,292
South West Water	793,554	0.71%	822,128	28,574
Southern Water	2,074,223	0.71%	2,148,911	74,688
Thames Water	6,259,977	0.71%	6,485,384	225,407
United Utilities	3,480,771	0.71%	3,606,106	125,335
Wessex Water	1,307,444	0.71%	1,354,522	47,078
Yorkshire Water	2,379,805	0.71%	2,465,496	85,691
Industry average	**-**	**0.71%**		**-**

Source: Ofwat base cost models consultation dataset April 2023[1] and ONS household projections[6].

Appendix 2 – Sites requiring atypical investment

Table 17 Sites requiring atypical investment

Catalogue Name	£k/PE (Incremental 2025 to 2040)	Typical Solution?	Solution complexity rationale
BISHOPS WALTHAM WTW	4.72	No	Complex and unique discharge permit, including TN and TP. Significant additional tertiary treatment required to meet revised TN limits
BROOMFIELD BANK WTW	3.08	No	New WTW required
FORD WTW	2.67	No	Additional outfall pipe required to take c. 40% increase in FFT
MOTNEY HILL WTW	2.25	No	New tertiary process required and all pipework on site will require replacement to take 95% increase in FFT
MILFORD ROAD PENNINGTON WTW	4.80	No	Change of treatment process and UV replacement. Required to go below NTAL.
SELLINDGE WTW	1.49	No	Replacement of existing process to serve very high growth
THORNHAM WTW	2.73	No	Required to go below TAL, therefore non-conventional treatment process
TONBRIDGE WTW	2.03	No	New process stream required
WILLOW WOOD ST LAWRENCE WTW	48.11	No	Pump away as not feasible to upgrade WTW

Table 18 Disproportionate £/PE

Catalogue Name	£/PE (Incremental 2025 to 2040)	Proportionate £/PE?	Disproportionate £/PE commentary
BISHOPS WALTHAM WTW	4.72	No	See solution complexity rationale
BROOMFIELD BANK WTW	3.08	No	New WTW required
DYMCHURCH WTW	8.85	No	Significant hydraulic and UV upgrades required
FORD WTW	2.67	No	See solution complexity rationale
FULLERTON WTW	7.55	No	Significant hydraulic upgrades required due to 60% increase in FFT

GRAVESEND WTW	1.67	No	Significant hydraulic upgrades required due to 40% increase in FFT
PARK ROAD HANDCROSS WTW	8.48	No	PE increase is only 158 but we will need to build new chemical dosing to serve it.
LOXWOOD WTW	3.62	No	Would require provision of new tertiary treatment
MOTNEY HILL WTW	2.25	No	See solution complexity rationale
NEWNHAM VALLEY PRESTON WTW	9.17	No	PE increase is only 335 but we will need to build new biofilter and humus tank to serve it
MILFORD ROAD PENNINGTON WTW	4.80	No	See solution complexity rationale
SELLINDGE WTW	1.49	No	See solution complexity rationale
SANDHURST WTW	30.08	No	PE increase is only 89 but we will need to build a new humus tank and MBSF to serve it.
STAPLEHURST WTW	6.16	No	See solution complexity rationale
THORNHAM WTW	2.73	No	See solution complexity rationale
TONBRIDGE WTW	2.03	No	See solution complexity rationale
WATERINGBURY WTW	5.63	No	Greater than 50% increase in WTW process treatment assets required for only 13% growth
WILLOW WOOD ST LAWRENCE WTW	48.11	No	See solution complexity rationale
WIVELSFIELD WTW	8.31	No	PE increase is only 267 but we will need to build new biofilter and alkalinity dosing to serve it

Appendix 3 – Breakdown of cost by site

Figure 9 Breakdown of cost by site

WTW	Need	2026	2027	2028	2029	2030	2031	2032	2033	AMP8 Total	Grand Tota
Alfriston WTW	DWF	£0								£0	£0
Billingshurst WTW	DWF	£0								£0	£0
Bishops Waltham WTW	DWF				£1,502	£956	£5,310			£2,458	£7,768
Broomfield Bank WTW	Capacity	£13,780	£10,311	£10,311	£10,311	£10,311				£55,024	£55,024
Chale WTW	DWF	£10								£10	£10
Charing WTW	DWF	£174	£1,569							£1,743	£1,743
Dymchurch WTW	Capacity	£537	£4,837	£5,375						£10,749	£10,749
Faversham WTW	DWF	£497	£4,469	£4,965						£9,931	£9,931
Ford WTW	Capacity				£2,169	£8,674	£11,038	£11,038	£11,038	£10,843	£43,955
Fullerton WTW	DWF	£1,282	£11,541	£12,823						£25,647	£25,647
Goddards Green WTW	DWF					£597	£5,466	£6,073	£6,073	£597	£18,208
Gravesend WTW	DWF				£428	£3,848	£4,352	£4,352		£4,275	£12,979
Ham Hill WTW	DWF	£3,151	£3,501							£6,651	£6,651
Hawkhurst North WTW	DWF	£104	£934	£1,037						£2,075	£2,075
Horsmonden WTW	Capacity		£77	£692	£769					£1,538	£1,538
Leeds WTW	DWF				£10					£10	£10
Lenham WTW	DWF		£65	£584	£649					£1,297	£1,297
Loxwood WTW	DWF	£1,488	£1,653							£3,141	£3,141
Ludgershall WTW	Capacity		£183	£1,651	£1,835					£3,669	£3,669
Lydd WTW	DWF			£134						£134	£134
Milford Road Pennington WTW	DWF	£4,315	£4,794	£4,794	£4,794					£18,697	£18,697
Motney Hill WTW	DWF			£1,557	£14,009	£15,566	£15,845	£15,845		£31,131	£62,822
Newnham Valley Preston WTW	DWF	£171	£1,535	£1,706						£3,412	£3,412
Northfleet WTW	DWF	£1,228	£11,052	£12,280						£24,559	£24,559
Paddock Wood WTW	DWF	£381	£3,431	£3,812						£7,624	£7,624
Park Road Handcross WTW	DWF	£134	£1,206							£1,340	£1,340
Sandhurst WTW	DWF		£146	£1,311	£1,457					£2,914	£2,914
Sellindge WTW	DWF	£4,723	£5,248	£5,248	£5,248					£20,467	£20,467
Sidlesham WTW	DWF	£0	£0	£0	£0					£0	£0
Staplehurst WTW	Capacity		£248	£2,228	£2,476					£4,952	£4,952
Stockbridge WTW	DWF	£0	£0							£0	£0
Stoke WTW	DWF	£1,659	£1,843							£3,502	£3,502
Thornham WTW	Capacity		£6,056	£6,056	£6,056					£18,169	£18,169
Tonbridge WTW	Capacity		£3,637	£3,637	£3,637					£10,911	£10,911
Wateringbury WTW	DWF	£279	£2,511	£2,790	£2,790					£8,370	£8,370
Whitewall Creek WTW	DWF	£302	£2,722	£3,024	£3,024					£9,073	£9,073
Willow Wood St Lawrence WTW	DWF	£1,885	£2,094							£3,979	£3,979
Wivelsfield WTW	DWF	£1,052	£1,169							£2,220	£2,220
All Sites including Whitfield		£37,151	£86,831	£86,017	£61,163	£39,951	£42,010	£37,308	£17,110	£311,113	£407,542
All sites except Whitfield		£23,371	£76,520	£75,706	£50,852	£29,640	£42,010	£37,308	£17,110		
6-year Phasing		£10,225	£6,736	-£10,182	-£10,629	-£14,067	£17,917			-£17,917	£0
Grand Total		**£47,376**	**£93,567**	**£75,835**	**£50,534**	**£25,884**	**£59,927**	**£37,308**	**£17,110**	**£293,196**	**£407,541**

Appendix 4 - Comparison of DWMP and PR24

Figure 12 Comparison of DWMP and PR24

Figure 12 Comparison of DWMP and PR24

Site Code	Catchment Name	DWF permit (m3/d)	Forecasted Population Equivalent (PE)		Spare DWF capacity		In PR24 (or AMP7)
			2020	2050	2020	2050	
ALFR	ALFRISTON WTW	307	858	908	3%	-4%	Yes
ASHF	ASHFORD WTW	24,000	111,517	134,369	25%	-3%	No
BILL	BILLINGSHURST WTW	1,445	8,280	9,609	10%	-6%	Yes (AMP7)
BOLD	BOLDRE WTW	200	650	675	-28%	-34%	Yes (AMP7)
CHLE	CHALE WTW	117	588	701	-8%	-26%	Yes
CHAN	CHARING WTW	605	2,738	2,997	19%	-8%	Yes
CRAN	CRANBROOK WTW	1,337	7,630	8,614	28%	-25%	No
DAMB	DAMBRIDGE WINGHAM WTW	3,510	24,710	27,111	38%	-5%	No
EDEN	EDENBRIDGE WTW	2,240	11,618	14,839	24%	-7%	No
FAVE	FAVERSHAM WTW	7,000	35,943	42,175	23%	-12%	Yes
FULL	FULLERTON WTW	19,291	66,107	78,703	15%	-10%	Yes
BURG	GODDARDS GREEN WTW	9,917	56,830	66,191	20%	-3%	Yes
GRAI	GRAIN WTW	402	1,714	2,394	7%	-24%	No
GRAV	GRAVESEND WTW	10,886	65,468	76,523	13%	-2%	Yes
HAIN	HAILSHAM NORTH WTW	3,162	17,812	20,411	35%	-4%	No
HAMH	HAM HILL WTW	12,200	66,117	82,625	4%	-25%	Yes
HAND	PARK ROAD HANDCROSS WTW	186	1,249	1,565	19%	-6%	Yes
HBKM	HILLBROW KNOWLES MEADOW WTW	11	77	89	30%	-9%	No
LIDS	LIDSEY WTW	5,833	28,941	34,390	19%	-17%	Yes (AMP7)
LIHB	LISS HILLBROW WTW	11	352	401	63%	-330%	No
LOXW	LOXWOOD WTW	767	3,860	4,727	8%	-13%	Yes
HERN	MAY STREET HERNE BAY WTW	5,903	44,443	53,396	1%	-22%	No
MINS	MINSTER IOT WTW	1,000	5,158	6,635	19%	-2%	No
MOTN	MOTNEY HILL WTW	44,582	275,006	362,211	16%	-12%	Yes
VICL	NEWTOWN IOW WTW	5	31	35	-15%	-9%	No
NFLE	NORTHFLEET WTW	9,300	60,105	71,017	-1%	-24%	Yes
OFFH	OFFHAM WTW	10	76	86	31%	-1%	No
LIMP	OXTED WTW	4,724	16,671	19,850	-13%	-34%	Yes (AMP7)
PEEL	PEEL COMMON WTW	59,683	268,490	298,170	6%	-5%	No
PENS	PENSHURST WTW	130	480	650	18%	-7%	No
PETE	PETERSFIELD WTW	4,980	22,147	23,609	15%	-8%	No
PLUM	PLUMPTON WTW	55	354	387	29%	-53%	No
QUEE	QUEENBOROUGH WTW	11,225	44,849	53,983	12%	-12%	No
SHST	SANDHURST WTW	206	1,140	1,367	9%	-9%	Yes
SAND	SANDOWN NEW WTW	29,703	147,581	163,762	-8%	-28%	Yes (AMP7)
SIDL	SIDLESHAM WTW	5,800	35,452	38,423	14%	-22%	Yes (AMP7)
SITT	SITTINGBOURNE WTW	11,800	72,707	90,160	5%	-33%	Yes (AMP7)
SMAR	SMARDEN WTW	175	945	1,122	15%	-1%	No
SOAM	SOUTH AMBERSHAM WTW	3,194	14,007	15,748	23%	-5%	No
HELS	ST HELENS WTW	300	1,612	1,677	11%	-1%	Yes (AMP7)
STOC	STOCKBRIDGE WTW	231	850	893	-88%	-97%	Yes (AMP7)
TUWS	TUNBRIDGE WELLS SOUTH WTW	8,850	32,729	41,027	18%	-5%	No
WESM	WEST MARDEN WTW	40	308	379	22%	0%	No
WCRK	WHITEWALL CREEK WTW	5,000	38,842	47,790	1%	-44%	Yes
WILL	WILLOW WOOD ST LAWRENCE WTW	28	372	382	-219%	-308%	Yes
WOOD	WOODCHURCH WTW	293	1,741	1,830	17%	-9%	No