SES Water

PR24 Early Cost Adjustment Claim: Softening

9th June 2023

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1. Introduction

We are making an early claim for the additional efficient costs resulting from our unique statutory obligation to soften the water we provide to over 80% of our customers. This section provides a brief overview of our claim, its rationale and relevant context. It also highlights where in the claim the reader can find information relevant to each of the cost adjustment claim assessment criteria.

A. Overview

1. We are unique amongst appointed companies in England and Wales in having statutory obligations to partially soften water from our groundwater sources. These obligations date from 1862 (the Caterham Spring Water Company Act) and 1903 (Sutton District Waterworks Act as amended in 1983).
2. Since our PR19 submission[1], we have sought further formal agreement to a level of softening of 80mg/l with the London Borough (LB) of Sutton. Whilst higher than the softening level set out in the original legislation, this figure was agreed by both parties as an appropriate level to target.
3. Because we are the only company to have such obligations, we are requesting that Ofwat continues to take account of this company specific requirement when it sets efficient cost allowances for PR24. Our base operating expenditure and capital investment includes additional costs required to soften water. These costs have been excluded from Ofwat's base cost modelling and so we have assessed them in full in this claim.
4. We estimate that SES Water will need an allowance of £31.6 million (equivalent to £6.3 million per annum) in addition to what is implied within Ofwat's proposed base cost models, reflecting all mitigating actions taken by our management to reduce our cost exposure.
5. We propose to continue the approach taken at PR19 for providing customer protection by retaining the existing (penalty-only) bespoke performance commitment and incentive. In light of this we have included in this claim the same broad scope of activities that have been undertaken (and funded) over a number of Price Review periods. Our updates to this claim are primarily to present our latest view of efficient costs.

B. Claim structure

6. This claim is structured in line with Ofwat's assessment criteria:
    - Section 2 sets out the need for an adjustment, including: the unique circumstances leading to the requirement; the degree to which management has controlled the need for an adjustment; and our estimate of the required adjustment and its materiality.
    - Section 3 sets out our work to demonstrate that the costs we incur in this area are efficient.

1 Correspondence from LB Sutton to SES Water – October 2019, attached as an appendix to this CAC.

- Section 4 recaps the need for investment in this area, though we primarily address this issue in Section 2.
- Section 5 summarises the work we have done to consider alternative options.
- Section 6 summarises the arrangements in place to protect customers, including our statutory obligations, associated PC and ODI, and broader considerations.

We have included two appendices to this early Cost Adjustment Claim (CAC):

- Appendix A provides supporting information on the customer benefits and operational details related to the softening process.
- Appendix B attaches a confidential correspondence between the Royal Borough of Kingston and LB Sutton on our softening obligations.

2. Need for adjustment

We have a unique statutory obligation to soften the supply of water to our customers. Most of our local groundwater sources require the treatment of water to achieve target levels as a consequence of natural hardness. Within this unavoidable requirement, we have optimised our softening treatment and associated costs.

The costs associated with our softening operations have been excluded from Ofwat's base cost modelling. This is because there are no comparable obligations, activities, or costs against which to benchmark other companies in England and Wales. We have therefore assessed our full costs as being in scope for a potential adjustment.

A. SES Water's unique circumstances

Our obligations

7. SES Water has long-standing statutory obligations to partially soften the naturally hard groundwater in our supply area. These obligations date from 1862 (the Caterham Spring Water Company Act) and 1903 (Sutton District Waterworks Act as amended in 1983). This requirement extends to the five large groundwater water treatment works (WTWs) operated by the Company – Cheam, Elmer, Godstone, Kenley and Woodmansterne. In an average year these sites provide around 81% of the water supplied to our customers.

8. Over successive AMPs we have incurred additional operating costs and invested in, operated, and maintained additional treatment assets (and associated plant and equipment such as materials storage; handling and mixing equipment; control systems; and by-products management) at these five WTWs in order to meet our statutory obligations. Maintaining this activity requires material additional investment, in both operating and capital expenditure, to reliably and efficiently soften the water treated at these sites.

Blending

9. There is natural variance in the relative hardness of raw water sources that supply each site. In practice, these variances will be comparatively small as most sources are located in areas of similar strata. One key exception to this is Elmer. Its sources are located in both the greensands and chalk strata of the North Downs, and these two sources often require blending to different degrees based on variability in raw water quality.

10. The level of water hardness illustrated in Table 1 below shows that the underlying hardness of water abstracted from these five sources are due to fundamental geological conditions which have not changed over recent time. We would expect this stability to continue into the future.

Table 1: Untreated water hardness

mg/l	Elmer	Kenley	Godstone	Cheam	Woodman-sterne
2023	107.0	120.7	107.3	124.3	128.4
2022	111.0	121.7	104.0	126.7	129.0
2021	110.0	122.9	101.9	127.9	130.0
2020	112.0	119.1	101.0	130.9	129.6
2019	110.0	118.8	105.8	126.2	129.7
2018	111.0	120.0	101.8	127.1	130.8
Average	110.0	120.6	104.1	127.2	129.5

Source: SES Water analysis

11. In all cases, the choice of water sources is dictated by raw water quality and quantity, rather than relative hardness. As different strata respond differently to weather conditions and recharge at different rates, this can dictate which sources we abstract from. Equally, variance in raw water quality will require us to rest sources for periods of time. We have taken the view that to the extent that these differences occur, they will net each other out over an extended period of time, such as the five-year Price Review period.

12. Further, only 20% of the water we abstract is naturally soft. This comes from our surface water site at Bough Beech and the small treatment works at Westwood and Cliftons Lane situated on greensand strata. We do not have a sufficient quantity of surface water to blend with the naturally hard groundwater to achieve the required level of softening.

13. The operation of our softening sites is such that only a proportion of the partially treated water is softened. This parameter is controlled, and optimised, on a daily basis as a key part of the treatment works operation. This is achieved through the site operators varying the blend – or by-pass – of flows into and around the softening process to ensure that the average hardness of the water produced by the site is maintained around the target levels of 80mg/l for all sites.

14. In practice this means that approximately one third of the raw water abstracted is softened and blended with the remaining two thirds of unsoftened water. The cost of this process varies across the different sites. Within the constraints of our current system connectivity, and accounting for the longer-term considerations regarding availability of water resources, we are confident that the optimum mix and blend of soft and hard water is provided to our customers.

Treatment processes

15. Our statutory requirement to soften adds additional stages to the water treatment process at the five water treatment sites outlined above. At the two remaining groundwater sites we do not undertake softening because the raw water is abstracted from boreholes within greensand strata, which gives rise to naturally softer raw water.

16. Three softening processes are employed across these five treatment plants. These are:

    (i) Pellet reactors (Elmer, Kenley & Woodmansterne);

    (ii) Accelators (Godstone); and

    (iii) Ion exchange (Cheam).

17. The additional treatment stages required for softening using pellet reactors comprise:

    (i) Air strippers which remove dissolved carbon dioxide from raw water that would otherwise increase the consumption of lime in a later stage of the softening process.

    (ii) Pellet reactors, where the pH is raised to convert soluble calcium bicarbonate into insoluble calcium carbonate. Here lime slurry is dosed to react with the dissolved hardness salts to encourage crystallisation onto grains of sand to produce chalk pellets.

    (iii) Associated lime and sand storage, preparation and dosing equipment, and pellet handling and storage facilities.

    (iv) Rapid gravity filters downstream of the reactors, including coagulation and flocculation, to reduce the level of turbidity from around 30 NTUs (Nephelometric turbidity units) to less than 1 NTU required by current disinfection standards.

    (v) Associated by-product and waste processing facilities including rotary vacuum filters and the associated handling process.

18. The process at Godstone treatment works is similar to the pellet reactor process. However, instead of growing calcium carbonate on sand, the calcium carbonate is allowed to precipitate out in an accelator using lime and ferric sulphate and polyelectrolyte as a flocculant.

19. The final site is Cheam treatment works, where softening is achieved through the removal of calcium via the use of ion exchange technology. This process was adopted in the 1970s and the additional treatment stages comprise:

    (i) A semi-batch process whereby partially treated water is passed into ion exchange vessels where calcium ions (in the hard water) exchange with hydrogen ions attached to the resin.

    (ii) After a period of time, each ion exchange vessel is taken offline, and hydrochloric acid is added to regenerate the resin by replacing the calcium ions with hydrogen ions. Each ion exchange vessel is returned to service.

    (iii) The acidic waste from the regeneration process is then neutralised before disposal.

    (iv) Aeration towers are then used to remove the naturally occurring carbon dioxide in the water, plus that produced by the ion exchange reaction.

20. Our softening operations are significant in scale and complex:

    - The complexity of our softening operations is significantly greater than the other treatment processes listed as examples within categories GW3 or GW4.
    - The softening process is not a single stage physical or chemical treatment, but instead multi-stage.
    - As a result, the unit cost of our softening operations is significantly in excess of other treatment processes typical to categories GW3 and GW4.

B. Management control

21. The requirement to partially soften a significant proportion of the water we supply is driven by long-standing statutory obligations and is therefore outside of management control.

22. Accounting for the complex inter-relationships and impacts of long-standing statutory obligations, customer expectations, water resources and quality, environmental

considerations, and cost, and formal agreements with our local authorities[2], we believe we are taking all reasonable steps to find an appropriate balance in the level of softening we continue to provide.

Controllability

23. The hardness of treated water being supplied from these five sites is controlled by the relative blend of the softened stream of water to the bypass stream (since only a proportion of the total flow is softened). This will be influenced by the availability and performance of the softening units (pellet reactors, accelators or ion exchange vessels) and the availability of the raw water sources in use at any time.
24. Our operations team will routinely try to minimise the volume of water it needs to soften, subject to the relative health of all raw water sources available, thus reducing softening costs and the environmental impact of softening where possible.
25. As noted in the section above, our choice of water source is dictated by raw water quality and quantity. This means that we are required to abstract hard water sources depending on water availability and quality.

Our existing approach to optimisation

26. We have operated on a 'reasonable endeavours' basis to comply with the agreed level of softening, where stipulated in the statutory obligations. As such, we are proposing to continue to target a level of water softening of 80 mg/l of calcium (reducing the calcium content from an average of around 120 mg/l when it comes out of the ground) in treated water across our five sites where water is softened.
27. Maintaining this target of 80 mg/l of calcium will ensure that we do not unnecessarily soften water beyond what is efficient. For example, the treatment processes used to soften water impact on our total carbon emissions. This includes direct process emissions (scope 1), indirect emissions from the use of electricity (scope 2) and emissions related to the chemicals we employ (scope 3).
28. This target (which was also adopted as a target level of softening for PR19) reflects an efficient level of softening that considers:
    - the targets we agreed with local authorities for PR19 and customers' views on the hardness of the water they receive;
    - the costs of softening water, which vary in proportion to the target level;
    - the relative health and wider benefits of harder water;
    - the environmental impact of the additional treatment process, primarily related to additional power and chemicals consumption; and
    - customer affordability of the overall cost of softening against the cost that could be faced if in home softening devices are used.
29. As highlighted in the sections above, we also optimise the operation of our softening sites such that only a proportion of the partially treated water is softened. This means that we do not unnecessarily soften more water that required which ensures that we do not generate additional emissions or variable costs beyond what is necessary to meet our target level.

2 See Appendix B for 22 October 2019 correspondence with LB Sutton.

Our performance

30. Summarised below is the quarterly softening performance of our five sites. The (unweighted) average treated water hardness over the period from Q1 2020 to Q4 2022 across the five sites was 79.0 mg/l Ca. This demonstrates our operations and therefore costs are reasonably well calibrated to the target we have adopted, supporting our view that we are claiming for an efficient level of expenditure.

Table 2: Treated water hardness (mg/l)

mg/l	Elmer	Kenley	Godstone	Cheam	Woodman-sterne
Q1 2020	107.0	72.4	72.3	78.8	84.1
Q2 2020	111.7	74.0	74.9	77.2	77.4
Q3 2020	83.6	75.5	73.6	80.6	76.7
Q4 2020	88.0	83.5	69.1	78.4	72.3
Q1 2021	88.6	74.6	72.2	75.7	76.9
Q2 2021	95.7	71.9	74.6	76.4	74.6
Q3 2021	79.7	69.5	75.9	74.8	72.2
Q4 2021	75.2	69.2	72.8	75.6	74.0
Q1 2022	73.7	76.8	76.1	75.5	72.8
Q2 2022	77.0	74.3	79.1	74.9	71.8
Q3 2022	96.5	80.5	102.4	80.5	74.0
Q4 2022	88.4	70.0	94.8	91.3	76.6

Source: SES Water analysis

31. Comparing Table 1 and Table 2 illustrates that we are broadly managing the scale of our softening operations to deliver on our obligations.

32. Quarters where the target of 80 mg/l target has been missed arose due to a range of demand related issues and asset performance. For example, penalties against our softening ODI in 2021/22 arose largely following the commissioning of new equipment at Elmer.

33. SES Water also took steps to suspend our softening activities in Q3 of 2022 in order to reduce supply risks to our consumers due to increased water demand during a heatwave event in that period.

C. Calculation of required adjustment

34. Since we remain the only company that undertakes softening at scale and since Ofwat has excluded softening costs from its base cost modelling, our costs incurred due to our statutory softening activities are not included in our base cost allowance. We therefore

propose (as for previous Price Reviews) that Ofwat continues to base its allowance on the unique totex costs related to the softening process.

35. The additional treatment processes drive capital investment and maintenance costs that would not be required when compared to standard treatment of groundwater due to the periodic replacement of the assets used in the additional treatment stages introduced. In all cases, these additional treatment processes also require additional operating expenditure when compared to standard treatment of groundwater. The additional operating expenditure covers chemicals; power; manpower; maintenance; by-products and waste disposal; other operational expenditure.

36. In total, over the period 2025-30, we forecast that we will incur additional expenditure as a result of our obligation to soften water of £17.67 million in operating expenditure (opex) and £13.96 million in capital expenditure (capex) (2022/23 prices).

Table 3: Summary of AMP8 costs (£m 2022/23 prices)[3]

Cost	2025/26	2026/27	2027/28	2028/29	2029/30	AMP8 total
Opex	3.6	3.6	3.5	3.5	3.5	17.7
Capex	6.2	6.2	0.3	0.3	0.9	14.0
Totex	9.8	9.8	3.9	3.8	4.3	31.6

Source: SES Water analysis

37. We have not, for this early submission, adjusted the amounts in Table 3 for catch-up efficiency. There are two reasons. First, softening costs are outside the scope of base cost modelling and benchmarking, and it would not necessarily be appropriate to apply the overall wholesale challenge out of context. Second, we are submitting a significant CAC in relation to treatment of pumping costs, which would affect our modelled efficiency. In the subset of models in which the relevant cost driver – average pumping head (APH) – is included in a form corresponding to the level of model aggregation, SES' efficiency score is very close to the efficient benchmark. We will, however, keep this position under review.

38. The costs outlined in Table 3 exceed our request for £9.22 million in opex and £3.18 million in capex (2017/18 prices) for the AMP7 period. The increase in costs between AMP7 and AMP8 arises largely due to input price pressures on energy and chemical inputs that are critical to our water softening processes as well as the need to undertake critical investments at Kenley. It is also impacted by an updating of our assessment of the labour-related costs driven by our softening operations, which have been underestimated in previous submissions. We discuss these factors in detail in Section 3.

39. Our softening activities are specific to SES and as such the associated costs have been excluded from Ofwat's benchmarking. We therefore take the view that:

    - there is no implicit allowance in Ofwat's base cost allowance for softening; and
    - the claim is non-symmetrical in nature and will not result in any consequential adjustments to other companies' allowances.

3 Totals may not reconcile exactly to annual figures based on the figures in Table 3 being shown to 1 decimal place only.

D. Materiality

40. We expect our total claim of £31.6 million to be significantly above the relevant materiality thresholds. The implied average annual expenditure of £6.33 million is around 11% of our most recent water network plus annual totex, against a materiality threshold of 1%.

3. Cost efficiency

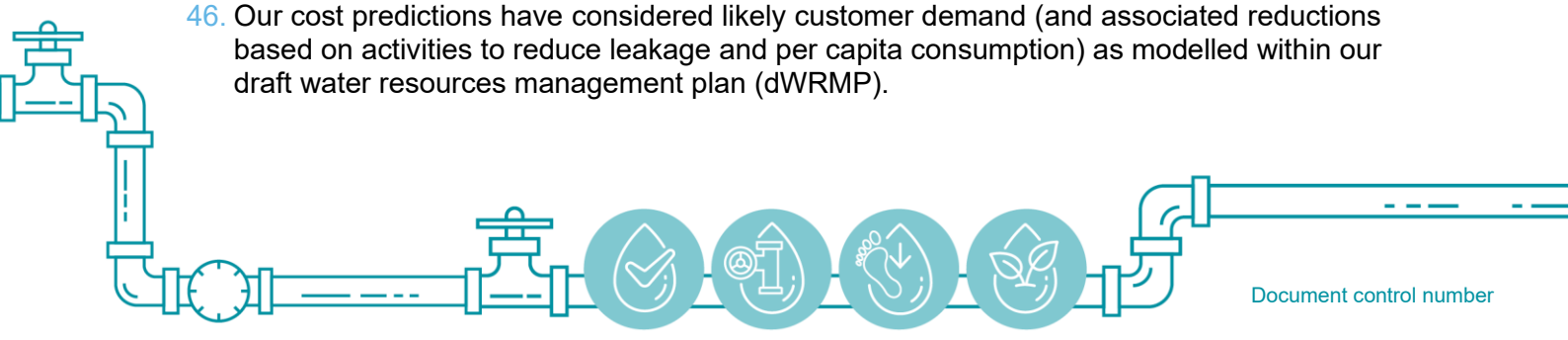
We have undertaken a detailed bottom-up assessment of the additional expenditure (opex and capex) that we will incur in AMP8 arising from our unique statutory softening obligations.

Consistent with the approach that we adopted in our PR19 claim for softening costs, our estimate of the additional opex we will incur is primarily based on the most recent year's data of our incurred costs. For this early submission, we also take into account the impact of the evolution of customer demand and the expected reduction in leakage in AMP8 on our softening related opex.

Our estimate of the additional capex we will incur in AMP8 is based on capital maintenance modelling and asset replacement cycles across the sites. We are confident our costs are efficient. We routinely benchmark our unit costs internally, proactively manage variation in specific cost categories and benchmark our input cost assumptions to well-regarded market benchmarks (e.g., cost of power).

A. Opex cost calculation and supporting evidence

42. The additional opex covers a range of inputs required to deliver on our softening requirements including chemicals; power; manpower; maintenance (labour and materials); by-products and waste disposal; and other opex (plant and sundry equipment).
43. The basis of our forecast costs for the next AMP is the actual costs that we have incurred over recent years and consistent with the approach that we adopted for our PR19 cost claim for softening, our estimate of the additional opex that we expect to incur is based on the most recent year's data of our actual costs.
44. The opex associated with softening is driven by elements which are both fixed and variable in the short term. The requirement to soften drives the fixed costs of management and operational labour along with maintenance labour and materials, all of which are associated with the presence of an asset (and the ongoing statutory obligation to soften) and are generally unaffected by how much water each asset is required to process. Our power costs are effectively fixed too as the configuration of the sites is set up to soften as a rule, even when processes are not running/softening.
45. However, the extent of softening that takes place will dictate the variable cost elements of chemicals and waste disposal (and to some extent power). Variable costs are driven by works throughput (itself driven by demand), and the hardness of the raw water source (in relation to the target level of softening). Although, in practice, the variability of works throughput has been small, this has still been considered in assessing future costs.
46. Our cost predictions have considered likely customer demand (and associated reductions based on activities to reduce leakage and per capita consumption) as modelled within our draft water resources management plan (dWRMP).



47. No adjustment has been made, however, for changes in raw water hardness associated with altering the sources used by each site. Any variance in raw water hardness from different sources is considered to net off over the duration of a price control period.

48. A breakdown of the opex contained in this cost adjustment claim for AMP8 is illustrated in the table below alongside our equivalent claim for AMP7. As shown below, the largest increases in cost are in chemicals and electricity. We discuss the drivers behind all changes in the sections below.

Table 4: Summary of opex costs in AMP7 and AMP8 (£m)

Cost (£m)	AMP7 (2017/18 prices)	AMP7 (2022/23 prices)[4]	AMP8 (2022/23 prices)
Chemicals	3.86	4.56	5.81
Electricity	2.92	3.45	6.37
Labour	1.20	1.42	2.46
Plant Maintenance (Including Labour)	0.61	0.72	1.70
Waste Disposal	0.30	0.35	0.34
Other	0.33	0.39	0.98
Total	9.22	10.89	17.66

Source: SES Water analysis

Chemicals

49. Seven different chemicals are used by SES Water solely in our softening processes: hydrochloric acid; lime; caustic soda; Calgon; silver sand; polyelectrolyte; and ferric acid.

50. The global price of these chemicals has increased materially since the start of AMP7. For example, the cost of hydrochloric acid incurred by SES Water has increased from £95/tonne in 2020/21 to £170/tonne in 2022/23. Over the same period, the unit-cost of lime increased by £135/tonne (128%), the unit-cost of silver sand increased by £20/tonne (22%), and the unit-cost of ferric acid has increased by £60/tonne (36%).

51. These price increases are driven by global supply and demand and sit outside of the direct control of SES Water. The rise in global energy costs (which are the key input in the production of chemicals such as hydrochloric acid) since late 2020 has placed a particular pressure on chemical supply chains.

52. Despite these global price pressures, we have continuously focused on efficiency measures to reduce our cost burden through AMP7. For example, we have reduced our use of hydrochloric acid at Cheam through the optimisation of the soften process by around 13%, resulting in us controlling the softening at the site closer to the 80 mg/l target.

53. Faced with escalating costs, chemical costs for AMP8 have been forecast on the basis that the price of chemicals used in the 2022/23 period remain constant in real terms. We consider this a reasonable assumption in the context of high levels of uncertainty around future price trends in global chemical supply chains. Indeed, over recent years, we have

4 AMP7 opex spend has been adjusted to 2022/23 prices using an index of CPI inflation. This conversion is shown for illustration purposes only.

witnessed significant volatility in chemical costs. All of the chemicals (of feedstock materials) arise at least in part from European or global supply chains and are therefore influenced by fluctuating exchange rates and the potential impact of Brexit. In the context of this uncertainty, we currently assume no further change in the unit cost of chemicals used for softening in AMP8 but will keep the position under review for our final Business Plan submission. Our chemical cost forecast does assume a reduction in the quantity of chemicals consumed due to an expected reduction in water consumption over time from the 2022/23 year.

54. Table 5 below provides a summary of our forecast chemical costs for AMP8.

Table 5: Summary of chemical costs forecast for AMP8 (£m 2022/23 prices)

Cost	Cheam	Woodmansterne	Kenley	Elmer	Godstone	Total
Hydrochloric Acid	2.3	-	-	-	-	2.3
Lime	-	1.4	0.6	0.6	0.2	2.7
Caustic Soda	0.1	-	-	-	-	0.1
Calgon	-	0.0	0.0	0.0	0.0	0.0
Silver Sand	-	0.2	0.1	0.0	-	0.3
Polyelectrolyte	-	0.0	0.0	0.0	0.0	0.0
Ferric Acid	-	0.0	0.0	0.2	0.1	0.4
Total	**2.4**	**1.6**	**0.7**	**0.9**	**0.3**	**5.8**

Source: SES Water analysis

55. Table 5 provides our best current view estimate of our forecast chemical costs for AMP8 related to softening. Ahead of submission of our final Business Plan, and the finalisation of our CAC, we are considering options, for Ofwat's consideration, for the regulatory treatment of chemical related softening costs in AMP8, including a fixed CAC allowance,[5] or a form of uncertainty mechanism (UM) to protect SES Water and our customers if actual softening chemical prices for the AMP differ substantially from the assumptions made ex ante in our final CAC and Ofwat's Final Determination. For example, this UM could be a simple indexation mechanism with a dead band around ex ante chemical price assumption, to retain incentives on SES Water to manage our input costs.

Power

56. Power comprises the cost of electricity purchased for use on site, as consumed by the key assets used in the softening process. The consumption of electricity by each of the key assets used in the softening process have been calculated based on their daily utilisation and their respective electrical ratings.

57. Only assets with high load factors (daily utilisation) are used in the calculation of power costs. This conservative assumption means that power associated with filtration and sludge handling has not been included in the calculations as their load factors are low and therefore the associated power costs are low.

5 Consistent with the cost estimates provided in Table 5.

58. The forecast electricity consumption is then multiplied by the forecast unit cost of electricity as it is currently forecast for the forthcoming years of AMP8 to arrive at our total costs. On this basis, we use a price of £0.1944 / kWh which is the average of the delivered (i.e. full cost as supplied) electricity forward curve developed by Cornwall Energy for the AMP8 period. To calculate power costs over AMP8, we also assume that electricity consumption falls in proportion to the expected decline in water consumption from 2022/23 levels. The table below provides a detailed breakdown of how we have constructed a forecast of electricity costs over AMP8 associated with softening for each WTW.

Table 6: Summary of electricity costs (£m 2022/23 prices)

Appliance	Number of units (#)	kW	Hours/day	Costs in 2022/23 (£m)	Cost for AMP8 (£m)
Cheam					
Hard water pumps	4	75	24	0.511	2.224
Regen pumps	2	45	10	0.064	0.278
no4 borehole pump	1	11	10	0.008	0.034
Effluent pumps	3	11	7.5	0.018	0.076
Cheam total				**0.600**	**2.612**
Elmer					
relift pumps	2	90	24	0.307	1.334
stock tank mixers	2	1.1	24	0.004	0.016
air stripper fans	1	11	24	0.019	0.082
lime dosing pumps	1	7.5	24	0.013	0.056
RGF Dirty backwash pumps	1	18.5	12	0.016	0.069
recirc pump	1	5.5	24	0.009	0.041
Elmer total				**0.372**	**1.597**
Godstone					
Stock Tank Mixers	1	0.75	24	0.001	0.006
Accelator Drives	2	2.2	24	0.007	0.033
Dosing Pumps	2	1.1	24	0.004	0.016
Dirty Water Mixer	1	2.2	24	0.004	0.016
Dirty Water Pumps	1	7.5	8	0.004	0.019
Godstone total				**0.021**	**0.089**
Kenley					
raw water boosters	2	22	24	0.075	0.326
air stripper fans	1	5	24	0.009	0.037
stock tank mixers	3	1.1	24	0.006	0.024
recirc pumps	1	5.5	24	0.009	0.041
lime dosing pumps	2	1.1	24	0.004	0.016

sludge mixer	1	2.2	24	0.004	0.016
Kenley total				**0.106**	**0.461**
Woodmansterne					
relift 3 x 75	2	75	24	0.255	1.112
stock tank mixers	4	7.5	24	0.051	0.222
Air stripper fans	1	11	24	0.019	0.082
RGF backwash tank mixers	12	4	12	0.041	0.178
Lime dosing pumps	2	1.1	24	0.004	0.016
Woodmansterne total				**0.376**	**1.610**
Total				**1.474**	**6.370**

Source: SES Water analysis

Labour, maintenance and other

59. The presence of additional softening assets requires a level of regular intervention and maintenance that, were they not to exist, would significantly reduce the total levels of manpower and materials deployed on the sites. As such, labour and materials are categorised as a fixed cost associated with the requirement to soften.

60. We estimate that four operational staff are allocated to softening activities across the five WTW sites. Cheam, Woodmansterne, and Elemer each have dedicated operations staff for softening. The final operational staff unit that is allocated to softening is shared between Godstone and Kenley. In addition to these operational staff requirements, we estimate one additional M&E technician at both Cheam and Kenley and one additional system technician at Elmer. Additional management costs and payroll costs (e.g., national insurance, trainings, pension contributions etc) associated with each staff involved with softening are also included. This proposal is an increase in the proportion of our labour costs that are attributable to our unique softening activities compared to our PR19 submission.

61. For this cost adjustment claim, we also include an estimate of overtime costs that will be incurred for staff involved in softening related activities. Overtime costs were not included in our cost adjustment claim for softening in AMP7. The inclusion of these costs adds an additional £0.5 million in costs over the AMP8 period to our claim.

62. In terms of maintenance costs and related costs, we have retained our approach of basing costs on the output from granular modelling that uses actual data on plant breakdown rates, maintenance activity and frequency of asset replacement. For AMP8 we assume that 50% of all plant maintenance costs are related to our softening activities.

63. To forecast costs over AMP8, for this early CAC we conservatively assume that estimated labour and maintenance costs associated with softening in 2022/23 are projected to remain constant in real terms across AMP8. This is an assumption that we plan to review ahead of finalising our CAC to be consistent with our broader final Business Plan submission on real price effects we expect to face in the forthcoming AMP.

By-products & waste disposal

64. These costs, again based on actual costs incurred and extrapolated forward, are driven by the requirement to treat the by-products and waste of the softening process – primarily pellets and sludge.

65. In the case of pellets, these are used as an input to a manufacturing process. As such, our only cost is the collection and haulage costs of removing these pellets from our sites and taking them to the manufacturer's facility.

66. Ahead of AMP7, we benchmarked our collection and haulage costs with a competitor manufacturer and secured a reduction of around 35%. There are few outlets for this by-product in the UK and we are comfortable that this benchmarking exercise ensures we continue to have an efficient operation in place, which avoids the alternative of having to dispose of pellets as a waste, at significant additional cost.

67. All sludge produced via the softening process is disposed of to landfill at the prevailing rate, primarily dictated by the level of environmental taxation in operation.

Other costs

68. These costs relate to a range of other fixed activities at each WTW which are nonetheless related to our need to soften. The requirement to soften increases the general level of consumption and activity at each WTW facility. For example, SES Water incurs material costs related to mats and consumables, instrument maintenance, bought-out services, sundry plant, and general apparatus.

69. Our cost estimates for AMP8 are developed based on actual costs incurred in 2022/23 which is extrapolated forward in real terms over the AMP8 period. We assume that 50% of these costs are related to our softening obligations.

B. Capex cost calculation and supporting evidence

70. The capex on softening falls into two categories for AMP8: the replacement of softening assets at Kenley WTW and the ongoing capital maintenance of softening assets. A comparison of incurred and forecast capex spend between AMP7 and AMP8 is shown in the table below.

Table 7: Summary of capex costs in AMP7 and AMP8 (£m)

Cost (£/m)	AMP7 (2017/18 prices)	AMP7 (2022/23 prices)[6]	AMP8 (2022/23 prices)
Capex	3.18	3.75	13.96

Source: SES Water analysis

71. While Table 7 shows a significant increase in capex between AMP7 and AMP8 we note that historic capital works on our softening assets has alternated significantly across previous AMPs. For example, capex equalled £10.9 million in AMP4, £2.6 million in AMP5, £20.2 million in AMP6, and £3.2 million in AMP7.

72. The cyclicality and lumpiness of this expenditure is driven by the small number of WTW sites engaged in softening across SES Water's portfolio and when the major softening refurbishment programmes occur between AMPs. SES Water follows a strategy of spreading out major capital investment schemes in order to avoid investment in multiple

6 AMP7 opex spend has been adjusted to 2022/23 prices using an index of CPI inflation. This conversion is shown for illustration purposes only.

sites falling within the same price control period. As a result, capex associated with softening can vary significantly between AMPs.

73. We provide a summary of the breakdown of the proposed capital spend in the subsections which follow below.

Capital works at Kenley WTW

74. The softening equipment at the Kenley WTW plant has been identified for significant investment within the AMP8 period. The softening equipment at this WTW has been last upgraded in 1985 and is becoming increasingly unreliable and expensive to maintain.

75. The scope of this work is to replace the water filters at this site which has been modelled at a cost of £11.79 million related to softening. This assumes a total investment spend of £13.1m at the site on filters and a 90% dependency on filters is due to softening (we have assumed up to 100% previously). We assume that this capex will be incurred in the first two years of the AMP8 period.

Ongoing capital maintenance and replacement expenditure

76. The remainder of the capital expenditure assigned to this cost claim ongoing capital maintenance of softening assets. We have identified £1.024 million in planned maintenance upgrades which relate to our softening assets across the five WTW plants. Of this total, £0.8 million relates to updates at the Elmer WTW.[7]

77. Our capex estimate for the AMP also includes the replacement of resin at Cheam, at an estimated price of £520k which we assume will be incurred in 2029/30. We also include an estimate of our reactive capital maintenance programme for our softening assets of £630k which we assume will be incurred pro rata across AMP8.

78. Our estimate of the requirement for reactive capital maintenance of our production assets has been informed by PIONEER modelling. PIONEER is an established system used by SES Water for assessing capital maintenance in previous AMPs. The PIONEER modelling system selects interventions (asset replacements or refurbishments) as required in order to maintain a stable level of serviceability at minimum cost, or to achieve a step-change in serviceability (where justified by customer research or regulatory requirements).

C. Benchmarking and efficiency assessment

79. Our unique obligation in this area makes benchmarking challenging. Other examples we are aware of softening at scale are less comparable: for example, softening at scale is more common in the Netherlands but the different operating environment makes direct comparison uninformative.

80. We do, however, review our own costs to support ongoing efficiency in our spend. We benchmark unit costs internally and proactively manage particular sensitivities to specific cost categories. As noted above, we have recently benchmarked our collection and haulage costs with a competitor manufacturer and base our business planning estimates of ongoing costs on market benchmarks.

7 The total allocation for capital maintenance of individual sites related to softening is: £0.8m at Elmer, £93k at Cheam, £45k at Kenley and Godstone and £86k at Woody.

Internal benchmarking

81. We are satisfied that our submission reflects efficient operation and costs. Our submission at PR19, after the application of catch-up efficiency, included £9.2m of opex. This would equate to £11.2m in real terms for AMP8 when adjusted for CPIH inflation. Adjusting for CPIH alone however ignores the real input price pressures faced on both electricity and chemical costs which both increased in price beyond what is implied by CPIH.

82. In the face of such rising input prices, which are outside the direct control of SES Water, we are confident that we have efficiently managed operations to deliver on our unique statutory obligations to soften. As with other areas of our PR24 programme, our optimal softening costs have been derived using software tools widely used in the industry. The PIONEER and 'CopperLeaf' tools that we are employing to develop our business plan helps us to optimise our spend both across areas and over time. We are confident that this supports cost efficiency in relation to softening.

Managing key cost categories

Cheam chemical costs

83. Cheam is the only softening site not to currently employ pellet reactors (or accelators) to undertake softening. Instead, the site uses ion-exchange technology. This is a higher unit cost methodology of softening than pellet reactors and was the preferred technology of the Sutton District Water company in the 1970's when the Cheam site was built.

84. Ion exchange requires the use of hydrochloric acid in the batched regeneration of resin in order to soften reliably and efficiently. This acid presents the single most expensive element of Cheam's variable softening operating costs – around 37% of the total.

85. We consider that the investment costs required to change technology at the Cheam site would be prohibitive relative to the higher unit cost entailed from utilising existing assets. Our focus therefore continues to be on continually optimising chemical usage rates.

86. Improvements in performance have been achieved over the last AMP, with a greater than 20% reduction in acid usage per megalitre of water treated. This has enabled us to mitigate the impact on our cost base of recent trends in chemical costs.

Power costs calculation

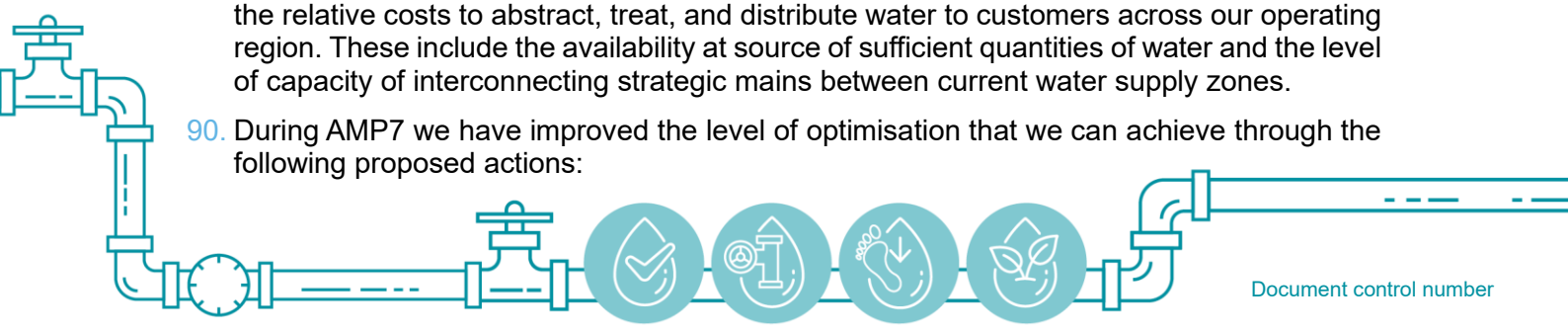
87. We have ensured that our power cost calculations only reflect process equipment with a high daily utilisation (indicating significant regular use), which were dedicated to the process of softening. This means that, although the primary use of the Rapid Gravity Filters (RGF) is to remove the turbidity caused by the softening process, none of the energy costs associated with these units, or those related to it (such as flocculant or coagulant dosing), have been included in the calculation.

88. We do not currently have individual process units sub-metered, so we have used the process equipment rating plates (i.e., the power rating for each unit at its given duty) to calculate power consumption.

Future efficiencies and optimum operation

89. A number of systems constraints exist that prevent full optimisation of our sites based on the relative costs to abstract, treat, and distribute water to customers across our operating region. These include the availability at source of sufficient quantities of water and the level of capacity of interconnecting strategic mains between current water supply zones.

90. During AMP7 we have improved the level of optimisation that we can achieve through the following proposed actions:



- Completion of the work to build a water grid covering our operational area and in doing so, ensure all customers can be supplied by two treatment works.
- Implementation of models developed by consultants operating in the sector that optimise the choice of sources and treatment based on availability of raw water resources and the unit cost of abstracting, treating, and distributing water.

91. Together, these activities will help facilitate the delivery of ongoing efficiencies of our softening operations by choosing lower cost operational regimes.

92. In addition to this, efficiencies will also be delivered within our softening operations through ongoing optimisation of chemical use via the introduction of new control technologies, improving maintenance techniques via the shift from predominantly time-base planned preventative maintenance to more condition-based maintenance, and the gradual replacement of older equipment with more energy-efficient kit.

93. We are currently reviewing the contribution these improvements can make to our softening operations and will quantify the potential efficiency in our final Business Plan submission and associated updated CAC.

4. Need for investment

There is a requirement for ongoing investment in our assets and systems to deliver on our softening obligation. As discussed above, the cyclicality and lumpiness of this expenditure is driven by the small number of WTW sites engaged in softening across SES Water's portfolio and when the major softening refurbishment programmes occur between AMPs, together with the softening-related reactive capital maintenance we need to undertake.

94. As highlighted in Section 2, the capex on softening that is included in this cost adjustment claim falls into two categories for AMP8: the replacement of softening assets at Kenley WTW and the ongoing reactive capital maintenance of softening assets.

Need for capital investment

95. The need for periodic investment derives from our unique statutory obligations in relation to softening, which are explained in Section 2. This results in a profile of capex expenditure that fluctuates across price control periods as refurbishment and replacement is needed to the softening related facilities at the five WTW plants.

96. As discussed above, the softening equipment at the Kenley WTW plant has been identified as requiring significant investment within the AMP8 period. The softening equipment at this WTW has been last upgraded in 1985 and is becoming increasingly unreliable and expensive to maintain. The scope of this work is primarily to replace the water filters at this site which has been modelled at a cost of £11.79 million.

97. The remainder of the capital expenditure assigned to this cost claim relates to reactive capital maintenance of softening assets as explained in detail in Section 3.

Customer Support for Investment

98. We carefully consider the preferences of our customers around the hardness of water. While the majority of customers will have limited knowledge of the softening process that their water goes through, we know from our ongoing conversations that, in general, customers prefer softer water.

99. We also track attitudes to the hardness of the water customers receive. In 2022 58% of customers are satisfied with the hardness/softness of the water they receive. We therefore consider that customers support our current approach to optimising the extent of softening.[8]

100. We have previously found evidence of a net financial benefit from SES Water's softening activities to customers as the cost per customer of the softening process followed by SES Water is lower than the potential cost of the increased use of detergents and salts; increased replacement rate of household goods; and the installation and maintenance of in-home softening devices. We estimate that softening processes carried out by SES Water generates cost savings of up to £46 per household per annum. We outline this evidence in Appendix A of this early CAC.

8 See CC Water (2023): 'Water matters: Household customers' views on their water & sewerage services 2022', Table 40.

5. Options analysis

We have an ongoing statutory obligation to soften. We optimise our refurbishment and reactive capital maintenance spend (as set out above) but the business strategy for softening remains appropriate for the forthcoming AMP.

101. Owing to the statutory obligations we have to partially soften water; we have not tested binary options: ceasing the process is not an option available to us at present. However, as outlined in Section 2 and Section 3 above, we continue to consider our options in optimising our softening operations and capital investment programme.

102. As outlined above, we use three different treatment processes across our five softening sites. This arrangement has remained broadly similar since the mid 1980's, however a number of changes have been made over time.

103. Two examples of this serve to highlight our proactive and continuous process of optimisation and optioneering of the softening obligation:

- Woodmansterne treatment works was converted to the current pellet reactors in the late nineties after the merger between the East Surrey Water and Sutton District Water companies to align with the processes used at Kenley and Elmer treatment works and so the footprint of the entire treatment process could be located within the curtilage of the operational site boundary.
- Cheam treatment works uses ion exchange. During the optioneering work conducted ahead the Cheam refurbishment project in 2006, the option of converting the site to pellet reactors was assessed. However, due to the extent of additional building work that would have been required, this cost – at £21.57m – was at the time considered prohibitive in comparison to refurbishing the existing process – at £4.83m. Over a 25-year design life, ion exchange continues to be the lowest overall cost process for Cheam, despite the variable unit costs of the ion exchange process being materially higher than the pellet reactor process, and its higher throughput.

6. Customer protection

Customers are ultimately protected by our statutory obligations to provide partially softened water. We further protect our customers through our proposed PC and ODI, as well as broader provisions in PR24 that will apply particularly to our softening operations given their importance to our overall cost base.

Performance commitment and ODI

104. During the AMP6 period of 2015-2020, a bespoke Performance Commitment (PC) and associated Outcome Delivery Incentive (ODI) was introduced related to the delivery of our water softening programme. At PR19, a bespoke PC was introduced by Ofwat given SES requested a cost adjustment claim to continue to provide softened water for the 2020-2025 period. This bespoke PC was to incentivise SES Water to provide partially softened water to its customers on a consistent basis across its five named treatment works.

105. As the statutory obligation to partially soften water remains in place, we consequently expect to be subject to a bespoke PC, as defined at PR19. We have proposed to maintain the PC level arrangements already in place at PR19.

106. Under these arrangements, we will sample each treatment works that softens the water (currently five works) three times a week at the works outlet. The hardness tests will represent a uniform regime over time. Any extra tests will not be included.

107. The target for each works will be 80.00 mg Cal/l. We will face a penalty only ODI based on the number of milligrams of calcium per litre by which we fail to meet the fortnightly target. This ensures that customers are protected, since we are strongly incentivised to meet the agreed PC even over relatively short periods of time.

Broad customer protection

108. Due to the scale of impact softening has on our operating costs, it follows that they are, and will remain, a key focus for any ongoing efficiency improvements. We commit that this will be the case over the life of this plan.

109. We have made clear to our stakeholders that water wholesomeness takes priority over softening operations. This is aligned with the intent behind the Water Industry Act 1991. In practice, this means that we will temporarily cease softening operations if they pose a threat to the safety of the drinking water supplied.

110. We expect our suite of PR24 PCs and ODIs to fully support this – with four specific ODIs included for maintaining water quality compliance and low levels of customer concerns about their water; along with reducing unplanned outages and the risk of supply failures.

Appendix A: Supporting material

Customer benefits from softening

111. We estimate that softening activities carried out by SES Water generates material cost savings of £46 per household per annum.

112. This level of cost savings is derived from a range of assumptions surrounding the reduced need for households to consume detergents and salts to deal with hard water alongside a reduced need to replace and maintain household appliances.

Cost savings related to household detergent

113. We estimate average household detergent costs per litre based on a review of the common supermarket brands that are outlined in the table below.

Table 9: Review of typical supermarket brands and prices today

Brand	Size	£ per litre
Ariel Washing Liquid	1225ml	5.70
Ariel Colour Washing Gel	1785ml	5.04
Bold 2in1 Washing Gel	840ml	5.95
Bold 2in1 Washing Liquid	1680ml	4.76
Ecover Bioconcentrate	1500ml	6.67
Fairy Non-Bio Gel	840ml	7.14
Fairy Non-Bio Liquid	1225ml	5.71
Persil Non-Bio Liquid	1026ml	6.82
Persil Colour Liquid	1431ml	5.94
Persil Colour Gel	1225ml	6.12
Own Brand Gel Non-Bio	720ml	3.96
Own Brand Super Concentrated Liquid	1800ml	1.90
Average	**1275ml**	**5.48**

Source: SES Water analysis

114. Based on a further review of information published by common household detergent brands, we estimate that 14ml or 43% more detergent is needed in the presence of hard water. This increase is based on the average increase advised by common supermarket detergent brands:

- Ariel**:** Average load (4-5kg) requires 37ml, but 46ml is required in hard water areas.
- Persil**:** Average load (4-5kg) requires 27ml, but 40ml is required in hard water areas.
- Ecover: Average load (4-5kg) requires 35ml, but 53ml is required in hard water areas.

- Own Brand: Average load (4-5kg) requires 30ml, but 45ml is required in hard water areas.

115. Using the above information, we estimate that the removal of hard water generates a saving of £20.71 per household per annum based on an assumption of 270 machine washes per year.

Cost savings related to other cleaning products

116. We estimate total household savings of £25.29 for other cleaning products as a result of being supplied with water that has been softened by SES water.

117. We estimate that water softening generates shower gel savings of £8.76 per household per annum. This is based on an assumption that the use of shower gel per shower increases by 50% in areas with hard water as follows:

- Soft water area: 4ml of shower gel used at an average cost of 48p per litre. This gives a cost of £7.01 per person per annum and a cost of £17.52 per household per annum under an assumption of 2.5 persons per annum.
- Hard water area: 6ml of shower gel used at an average cost of 48p per litre. This gives a cost of £10.51 per person per annum and a cost of £26.28 per household per annum under an assumption of 2.5 persons per annum.

118. We estimate that water softening generates shampoo savings of £11.83 per household per annum. This is based on an assumption that the use of shampoo per shower increases by 50% in areas with hard water as follows:

- Soft water area: 4ml of shampoo used at an average cost of 91p per litre. This gives a cost of £9.46 per person per annum and a cost of £23.66 per household per annum under an assumption of 2.5 persons per annum and 5 hair washes per person per week..
- Hard water area: 6ml of shampoo used at an average cost of 91p per litre. This gives a cost of £14.20 per person per annum and a cost of £35.49 per household per annum under an assumption of 2.5 persons per annum and 5 hair washes per person per week.

119. We estimate that water softening generates washing up liquid savings of £1.70 per household per annum. This is based on an assumption that the use of washing up liquid per wash increases by 50% in areas with hard water as follows:

- Soft water area: 3ml of washing up liquid used at an average cost of 31p per 100ml. This gives a cost of £3.39 per household per annum under an assumption of one wash per household per day.
- Hard water area: 4.5ml of washing up liquid used at an average cost of 31p per 100ml. This gives a cost of £5.09 per household per annum under an assumption of one wash per household per day.

120. We also estimate annual savings per household of £3 for salt required to clean a domestic dishwasher in the presence of hard water.

Further operational details

121. On each site, a bypass, or blend capability exists around the main softening process units. This is because we are not required to soften the entire flow of partially treated water in order to meet target softening levels. These bypasses feed-back into the main process immediately downstream of the main softening process unit.

122. At each of the five softening sites, rapid gravity filters (RGFs) exist. The primary purpose of these RGFs and the associated plant (collectively highlighted by asterisks in the above table) is to remove the turbidity in the partially treated water that is caused by the softening process.

123. The turbid water created as a result of the softening process is around 20 NTU (nephelometric turbidity units). This a 200-fold increase in turbidity compared with the raw water before softening, which averages around 0.1 NTU across all five sites.

124. The RGFs along with nominal flocculant and coagulant dosing capability would be required as part of our groundwater treatment process, even if we weren't required to soften the water. However, the RGFs and associated process units at our softening sites have a significantly greater treatment capacity than if we weren't required to soften.

125. On the basis of the logic set out above, we consider the complexity of our softening treatment sites is of complexity GW3 or above (excluding the softening operations that we undertake), that the scale of our treatment process is increased as a result of softening and that the costs directly associated with statutory softening processes are not included in Ofwat's cost modelling.

Appendix B: RB Kingston & LB Sutton correspondence

See attachment – ‘RB Kingston and LB Sutton correspondence: Sutton District Waterworks Act 1903, 22 October 2019’.