Wessex Water Services Ltd Response to Ofwat's PR19 Draft Determination – August 2019

Representation reference: **Cost Assessment C1**
Representation title: **Cost adjustment claim for Bristol STW**

Summary of issue

We remain concerned that Ofwat's cost assessment enhancement model for flow to full treatment (FFT) is not properly representative of the true scope and costs of this project for Wessex Water. Ofwat's modelled totex allowance of £54.173m contrasts with our business plan estimated cost of £81.706m (capex + opex in 2020-25 period). We consider that this is due to the exceptional impact of the costs of the extension works required at our largest treatment works at Bristol (Avonmouth) which the model does not accommodate.

Bristol (Avonmouth) treatment works is one of the top ten largest STWs in England and Wales, serving a population equivalent of 800,000. We note that the flow capacity increase at Bristol STW alone is significantly greater than that for the whole flow capacity increase in the WINEP programme for eight other WaSCs (ANH, NES, NWT, SVE, SWB, WSH, YKY and HDD) which is indicative of the considerable impact that this scheme has on the modelled data set.

A proportion of the costs for the planned extensions at Bristol STW have been allocated to the STW growth driver. We have similar concerns that the level of Ofwat's funding for STW growth, which is now considered under base plus cost modelling, is not sufficient.

Change requested

We now submit a new special cost adjustment claim to reflect the scale and complexity of the Bristol (Avonmouth) STW project. The claim is for the difference in cost between our PR19 business plan cost estimate of £44.149m for the planned works at Bristol STW and Ofwat's implicit allowances in their cost assessment feeder model for FFT and base plus cost allowance for STW growth.

We don't have visibility of Ofwat's base costs implicit allowance calculation, but estimate the combined implicit allocation for flow to full treatment and STW growth to be approximately £23.6m.

Therefore, the value of the cost adjustment claim is £20.549m.

Rationale (including any new evidence)

We include below the following documents to explain the need for this new cost adjustment claim:

- Claim WSX07 Bristol (Avonmouth) STW – flow to full treatment and STW growth
- Annex A. Cost adjustment claim summary form.

Why the change is in customers' interests

The increase in permit FFT will increase the amount of flow being fully treated and will avoid flows spilling to storm tanks and the environment on dry days. This is an environmental enhancement required by the EA to ensure compliance with the UWWTD, and is listed in the WINEP.

The proposed solution at Bristol (Avonmouth) STW is provides both increased hydraulic capacity and increased biological treatment capacity for future development growth, as a cost-effective synergy scheme. It will enable us to continue to target 100% compliance with environmental standards for sewage effluent. This level of performance is valued by customers and our other stakeholders.

Further reasons why the requested change is needed

We have set out this claim following the methodology and format of a cost adjustment claim, with the associated gates. We note however that the project remains a statutory obligation for us. The scale of difference between our required, and Ofwat's proposed, allowed levels of financing for the efficient cost for this scheme is such that we consider that Ofwat would be in danger of breaching its duty to finance our necessary obligations if it does not accept this claim.

Links to relevant evidence already provided or elsewhere in the representation document

Additional information is contained within the following business plan supporting documents:

- PR19 business plan submission (September 2018)
    - Supporting document 5.1 Protecting and enhancing the environment
        - Section 3.5
        - Annex B

- Response to Initial Assessment of Plans (April 2019)
    - Appendix 4 - Protecting and enhancing the environment: Response to IAP
        - Section 2.9

        - Annex B

- Response to Draft Determination (August 2019)
    - Representation Appendix C1.1: Third party report - Stantec
    - Representation C2: STW Capacity
    - Representation C5: WINEP: Flow to full treatment (FFT) increase

Claim WSX07 Bristol (Avonmouth) STW – flow to full treatment and STW growth

Wessex Water

August 2019

Contents

1. Summary

This cost adjustment claim relates to the cost of the work required at our Bristol (Avonmouth) STW to increase the flow to full treatment capacity and provide treatment capacity for growth there. The table below provides a summary of the claim and the following sections provide more detail for each of the headings.

Heading	Summary
Brief description	Scheme to increase the flow to full treatment at Bristol (Avonmouth) STW by 35.4% as required by the WINEP.
Total value of claim for AMP7	£44.149m less Ofwat's modelled implicit allowances for FFT and STW growth.
Total opex of claim for AMP7	£0.127m
Total capex of claim for AMP7	£44.022m less Ofwat's modelled implicit allowances for FFT and STW growth.
Price control	Wastewater network plus
Need for cost adjustment	We consider that the Ofwat cost assessment enhancement feeder model for flow to full treatment (FFT) does not adequately cover the true scope and costs of the works required at Bristol (Avonmouth) STW. We have a similar concern about the modelled level of funding for STW growth. On the basis of Ofwat's draft determination models, we estimate Ofwat's implicit modelled totex allowance for those works to be approximately £23.6m. This contrasts with our business plan estimated cost of £44.149m[1] for the planned enhancement works at Bristol STW. We consider that this is primarily due to the combination of (a) the simplicity and crudeness of Ofwat's benchmarking analysis for FFT; and (b) the exceptional impact of the costs of the extension works required at our largest treatment works at Bristol Avonmouth, which the FFT model does not accommodate. Bristol (Avonmouth) treatment works is one of the top ten largest STWs in England and Wales, serving a population equivalent of 800,000. The project at Bristol represents 84% of the total FFT shortfall across the whole of Wessex Water. This FFT shortfall alone is significantly greater than that for the whole FFT shortfall at eight other WaSCs (ANH, NES, NWT, SVE, SWB, WSH, YKY and HDD).
Management control	The underlying need for the investment is to protect and enhance the environment in the receiving water of the discharge from Bristol STW, and to comply with the obligations of the EU Urban Waste Water Treatment Directive. Both factors are outside of management control. We have minimised the costs to customers through a range of different options for meeting the need including:

[1] i.e. £44.149 represents a reduction of £2.0m (capex) from our original business plan estimate, in response to a challenge from independent technical reviewer, Stantec.

<table>
<tr><th>Heading</th><th>Summary</th></tr>
<tr><td></td><td>investment in the lowest whole-life-cost additional treatment option.
taking advantage of synergies with other drivers</td></tr>
<tr><td>Need for investment</td><td>The investment is required to provide increased flow to treatment as required by the WINEP, and hence to maintain compliance and prevent a deterioration of the quality of the receiving waters.

In December 2017 we were advised that the WINEP for PR19 would require an increase in flow to full treatment (FFT) at Bristol STW by 35.4%. This was confirmed by the EA in the WINEP3 in March 2019, with an agreed increase in FFT as described below:
<table>
<tr><th>Driver Code</th><th>Driver code Information</th><th>Completion Date</th><th>Level of certainty?</th><th>Old Permit</th><th>New Permit</th></tr>
<tr><td>U_IMP5</td><td>FFT</td><td>31/03/2025</td><td>Green</td><td>3,472 l/s</td><td>4,700 l/s</td></tr>
</table>
As explained in our final business plan the existing treatment streams at Bristol STW are at the limit of their hydraulic capacity and thus for the site to pass the required FFT to meet WINEP requirements, an additional process stream is required.</td></tr>
<tr><td>Best option for customers</td><td>Customer research shows that protecting the environment is a priority for customers. The funding of this proposed STW enhancement will enable us to continue to target 100% compliance with environmental discharge standards for sewage effluent. This level of performance is valued by customers and our other stakeholders.

The two most feasible alternative options and been appraised and costed. These include either i) an additional treatment stream using the sequencing batch reactor (SBR) process (as already used at this STW), or ii) an additional treatment stream using the conventional activated sludge (ASP) process. The lower whole life cost (and capex) solution using the SBR process has been selected.

Cost benefit analysis shows that the investment will deliver benefits greater than the costs, and that it is best value solution for customers.</td></tr>
<tr><td>Robust and efficient costs</td><td>We have benchmarked the cost estimates using independent external cost consultants and this shows that the cost estimates are robust and efficient.

Subsequent to the challenges from Ofwat to our plans in their IAP, we appointed an independent consultant, Stantec, to review and challenge the proposed option and its technical scope. Stantec confirmed the option selection and its main scope but also have advised that 3 only, rather than the 4 planned, new primary settlement tanks are required. We have therefore reduced our planned investment accordingly, removing £2.0m from our plan.</td></tr>
<tr><td>Customer protection</td><td>Customers will be protected if the investment is cancelled, delayed or reduced in scope through the following performance commitment and ODIs:
E1: Treatment works compliance – one of the common asset health performance commitments.</td></tr>
</table>

Heading	Summary
	• E10: Length of river with improved water quality through WINEP delivery. However given the scale of this project, we propose a new and additional individual PC to include underperformance payments for any delay in delivering the scheme and for non-delivery.
Affordability	The planned work outlined in this new Cost Adjustment Claim was included in our draft business plan that was tested with customers between January and June 2018. The acceptability testing was designed to test customers' acceptance of our overall package of service improvements and bill impacts. Testing has shown that 97% of our customers find our business plan acceptable. Acceptability is above 90% across all demographic subgroups.
Board assurance	The proposals have been subject to our board assurance process, which is described in detail in section 12 of the main business plan narrative and supporting documents 12.1 to 12.8.

2. Background

Wessex Water has 401 sewage treatment works (STWs) across Somerset, Wiltshire, Bristol, Gloucestershire and Dorset. Our STWs are categorised into six groups, as specified by the following Ofwat definitions:-

Table 2-1: Wessex Water sewage treatment works

Size band	Kg BOD/d	Population equivalent (p.e.)	Number of STWs
1	< 15	0 - 250	162
2	15 -30	250 - 500	30
3	30 - 120	500 – 2,000	97
4	120 - 600	2,000 – 10,000	62
5	600 - 1500	10,000 – 25,000	27
6 (Large Works)	> 1500	>25,000	23
			401

In developing the WINEP for PR19 the EA reviewed all STWs within the Wessex Water area and identified 91 STWs with potential U_IMP5 driver improvements for permit FFT. Each of these works has a permit FFT to permit DWF ratio of less than 3.0. We subsequently assessed all of the 91 STWs identified by the EA as having potential issues with existing permit FFTs and identified 13 STWs as needing an increase in permit FFT in PR19. These STWs require an increased hydraulic capacity. All of these were agreed with the EA and included in the WINEP3. Table 2-2 lists these STWs and the agreed change in FFT.

Table 2-2: WINEP3 FFT flow increase schemes

Site	Driver Code	Existing Permit FFT L/s	Required Permit FFT L/s
Bristol (Avonmouth) STW	U_IMP5	3,472.0	4,700.0
Bath (Saltford) STW	U_IMP5	580.0	734.0
Bourton STW	U_IMP5	6.8	11.3
Castle Cary STW	U_IMP5	25.5	31.1
Cheddar STW	U_IMP5	83.5	90.0
Compton Bassett STW	U_IMP5	17.5	45.8
Ditcheat STW	U_IMP5	4.8	6.5
Halstock STW	U_IMP5	2.3	3.0
Lacock STW	U_IMP5	4.6	8.0
Marnhull Common STW	U_IMP5	40.0	60.0
Rode STW	U_IMP5	6.1	8.0
Shillingstone STW	U_IMP5	19.5	22.5
Shoscombe STW	U_IMP5	10.0	13.0

We note that the scale of the STW at Bristol (Avonmouth) STW and its related increase in FFT is orders of magnitude greater than that at the other 12 STWs.

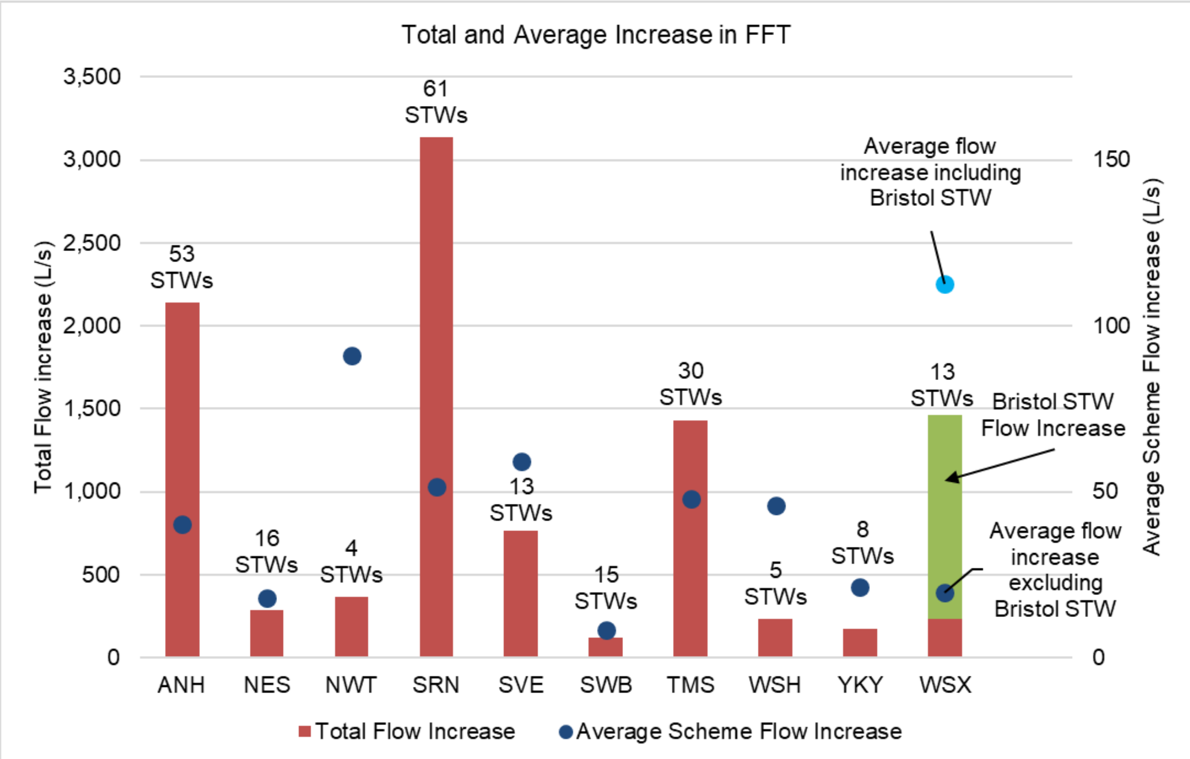
3. Need for cost adjustment

Ofwat's cost assessment is based on the results from their flow to full treatment enhancement feeder model (FFT). We consider that this cost assessment enhancement feeder model for FFT does not adequately cover the true scope and costs of the works required at Bristol (Avonmouth) STW.

We consider that this is primarily due to the combination of (a) the simplicity and crudeness of Ofwat's benchmarking analysis for FFT; and (b) the exceptional impact of the costs of the extension works required at our largest treatment works at Bristol, which, due to its size and particular characteristics, the model does not accommodate. Bristol (Avonmouth) treatment works is one of the top ten largest STWs in England and Wales, serving a population equivalent of 800,000.

Ofwat's feeder model uses "Number of schemes in business plan" and "Shortfall in FFT (l/s)" as the two parameters driving the model. The project at Bristol represents 84% of the total FFT shortfall across the whole of Wessex Water. As shown in Figure 3.1 below, this FFT shortfall alone is significantly greater than that for the whole shortfall at six other WaSCs (NES, NWT, SVE, SWB, WSH, and YKY).

Figure 3-1: Total and average increase in FFT for different WaSCs



We consider that the econometric model for flow to full treatment (FFT) implies an implausibly high economies of scale at the scheme level and that this results in an unreasonably high negative impact on WSX, given this large scheme described above. We note that a simple unit cost metric (based on the driver of FFT shortage in l/s) would give an average unit cost across the industry of about £97,000. However, Ofwat's econometric modelling implies that the cost per unit for Wessex Water, which has a higher than average number of units (l/s), should be around £37,000 per unit. The extent of economies of scale implied here is not plausible and is indicative of a flaw in Ofwat's modelling approach. This flaw has large financial consequences for Wessex Water, given the number of units over which the implausibly low unit cost allowance implied by Ofwat's modelling applies.

This is borne out further by applying the WRc's TR61 cost model for capital cost estimating to a size of typical STWs reducing from 112.4l/s FFT (WSX average shortfall) to 37.6l/s (average shortfall of the other ten WaSCs). The TR61 model indicates an economies of scale factor in the range 65-70%. This contrasts with the 38% economy of scale factor implied by Ofwat's econometric modelling referred to above.

As stated in our IAP response and confirmed by independent technical assessment, the existing Avonmouth STW is at the limit of its hydraulic capacity and the obligatory increase of 1,228 l/s in the WINEP requires the construction of an additional treatment stream. We note, as a comparison, that the size of the increase in permit FFT at Bristol STW is equivalent to the total flow to full treatment of our third largest STW at Poole (1,220 l/s,) which has a population equivalent of 170,000. We consider that the construction of a new treatment stream at this scale, comprising primary and secondary treatment, cannot be accommodated by costs derived from a model so much weighted by data from a sample of STWs using much smaller increases in FFT.

The required improvements at Bristol STW for the increase in permit FFT from 3,472 l/s to 4,700 l/s cannot be delivered for the implied cost model allowance of £22.4m which we have calculated to be the implicit allowance for those FFT improvements within Ofwat's allowances at draft determinations. We therefore request that a special cost adjustment is made for Bristol STW such that the full totex cost of £44.15m (capex + opex for 2020-25 period) is allowed for the major improvement works required at this STW.

Our claim is for £44.150m, which is the totex estimate for the Bristol STW FFT improvement and STW growth works, less the implicit allowances in Ofwat's FFT feeder model and that allowed in the modelled base costs for STW growth. We don't have visibility of Ofwat's base costs calculation, but estimate the combined allocation for FFT and STW growth to be approximately £23.6m. (i.e. £22.4m in respect of FFT improvements, and £1.2m in respect of STW growth)

4. Management control

In this section we demonstrate that the cost is driven by factors beyond management control; and, that we have taken all reasonable steps to control the cost.

The underlying need for the investment is to protect and enhance the environment in the receiving water, and to comply with the obligations of the EU Urban Waste Water Treatment Directive. Both factors are outside of management control.

We have minimised the costs to customers through a range of different options for meeting the need including:

- investment in the lowest whole-life-cost additional treatment option.
- taking advantage of synergies between the quality enhancement and STW growth drivers.

Additionally we have:-

- investigated impacts to ensure that there is a sound scientific basis for a mitigation measure
- had extensive discussions with the Environment Agency over need and timing
- participated in Task and Finish Groups to define the scope and extent of the flow driver schemes.

4.1 Options appraisal

Our STW at Avonmouth is by far the largest STW in our region, and one of the ten largest in England & Wales. It serves a population equivalent of approximately 800,000. Due to the size of the STW and the scale of the planned works required to increase the FFT by over 35%, a detailed appraisal was carried out and associated cost estimates prepared, to confirm the most cost-efficient solution for this scheme.

Further details of the background and appraisal of this scheme are provided in Annex A.

Our Bristol STW has historically treated a relatively low flow to full treatment (FFT), albeit in accordance with its permit requirements. The existing permit FFT being only a factor of 1.7 times the permit DWF figure. The U_IMP5 driver requires that the FFT must be increased to ‘3 x DWF’ by the end of AMP7. Opportunities for a phased approach to investment have been considered but the existing STW is at the limit of its hydraulic capacity and the obligatory increase of 1,228l/s requires the construction of an additional treatment stream. As we explained in our response to IAP (Appendix 4 – Protecting and enhancing the environment, Section 2.7.2), several treatment options were considered at a high level and two options were appraised and costed in more detail. Activated sludge is the “go to” treatment process for large treatment works in urban areas, and, to the best of our knowledge, is the treatment process utilised at all STWs of this size in the UK. Our appraisal compared two types of activated sludge (ASP) treatment processes, conventional ASP and Sequencing Batch Reactors (SBR). A comparison of the costs is given below, with further detail included in Annex B.

Table 4-1: Treatment options at Bristol (Avonmouth) STW for the increased FFT WINEP driver

Option	Option 1 4no. SBRs	Option 2 ASP
Provides hydraulic capacity to meet new FFT	✓	✓
Provides treatment capacity to 2025	✓	✓
Permits future expansion on site for future growth	✓	×
Scheme Capex (£m)	46.02	80.84
Opex (£k/yr)	778	850
Lowest whole-life cost	✓	×

A more detailed explanation and build-up of the scope and cost estimates is included in Section 7 and shown in Table 7.1.

4.2 Synergies

Where possible, for sites where there are multiple needs and drivers (i.e. quality enhancement and growth or capital maintenance) options have been developed for single projects which meet all the required outcomes. This provides efficiencies over meeting these needs with separate projects.

In addition to the need to provide an increase in hydraulic capacity the historical and future planned growth in both residential and trade flows and loads requires additional biological treatment capacity at Bristol STW to ensure the site continues to maintain environmental permit compliance. Some increase in biological treatment capacity will be required during 2020-24, with further treatment capacity likely to be required during 2025-30 based on population growth projections. In providing additional hydraulic capacity for the required 35% increase in FFT we are able to also provide the additional biological capacity with a very small impact on costs.

5. Need for investment

The main driver for the investment is to maintain compliance with the requirements of the UWWTD and prevent a deterioration of the quality of the receiving waters.

To ensure compliance with the UWWTD the EA have identified quality flow drivers for inclusion in the WINEP. In December 2017 we were advised that the WINEP for PR19 would require an increase in flow to full treatment (FFT) at Bristol (Avonmouth) STW by 35.4%. This was confirmed by the EA in the WINEP3 in March 2019, with the agreed increase in FFT described below:

Table 5-1: WINEP requirements for FFT increase at Bristol (Avonmouth) STW

Driver Code	Driver code Information	Completion Date	Level of certainty?	Old Permit	New Permit
U_IMP5	FFT	31/03/2025	Green	3,472 l/s	4,700 l/s

As stated in our final business plan and IAP response and confirmed by independent technical assessment, the existing treatment streams at Bristol STW are at the limit of their hydraulic capacity and the obligatory increase of 1,228L/s in the WINEP requires the construction of an additional treatment stream.

In section 4 above we have explained that a range of options has been evaluated to ensure that our proposed solution represents an appropriate and lowest whole life cost solution to providing the enhanced flow capacity; representing the best value for customers.

As stated above, we have also been able to take advantage of construction synergies to cost efficiently provide additional biological treatment capacity to provide capacity for development growth in the catchment.

6. Best option for customers

6.1 Customer priorities

The increase in permit FFT will increase the amount of flow being fully treated rather than receiving storm settlement only. This will avoid the potential for flows to spill to storm tanks and the environment on dry days, this being an EA requirement listed in the WINEP.

Specifically, this change will enable us to complete the FFT scheme at Bristol (Avonmouth) STW listed in the WINEP, and to continue to target 100% compliance with environmental standards for sewage effluent. This level of performance is valued by customers and our other stakeholders.

Should funding not be provided to enable us to complete this scheme in full, then Wessex Water would find itself in a position where a significant WINEP output is missed, and where our largest and prestigious major sewage treatment works is failing its permit and with a high risk of causing a pollution. Our customer research has shown that our customers place a high value in avoiding any such deterioration in service.

6.2 Independent benchmarking

As explained in Section 4 we have appraised several options to identify the lowest whole-life cost solution. Additionally, we have employed independent specialist cost consultants to produce estimates for the investment proposals.

The cost consultants we employed (ChandlerKBS), have extensive experience in the water sector and have worked with Welsh Water, Thames Water, South West Water and other water companies.

We supplied the cost consultants with project briefs, appraisal reports, scopes of works, M&E schedules and civil quantities where available. In all cases the cost consultants were asked to provide independent estimates without sight of our cost values.

The project costs were estimated by the cost consultants using cost modelling, based on their extensive data bases of historic water industry cost models that include construction costs, design costs, project on-costs and risk.
Further detail of the benchmarking undertaken and comparisons are provided in supporting document 8.11 of our Business Plan.

7. Robust and Efficient Costs

Section 8 of our main business plan narrative submitted in September 2018 describes how we ensured our proposals were efficient across all the price controls, as well as explaining how we had estimated efficient costs for new projects. Supporting document 8.11 provides more detail. Through external benchmarking we have demonstrated that our cost estimates are efficient and competitive compared with the marketplace.

A build-up of the scope and cost estimates for the options considered for Bristol STW FFT increase is shown in Table 7.1 below.

Table 7-1: Cost estimate breakdown and external benchmarking for Bristol (Avonmouth) STW

	Wessex Water Internal Estimate Option 1 – SBRs (£k)	External Cost Consultant Option 1 – SBRs (£k)	Wessex Water Internal Estimate Option 2 – ASP (£k)
Construction Value			
Civil work items Labour, Plant, Material & Subcontract packages	16,652	17,107	36,524
Mechanical and Electrical work items Labour, Plant, Material & Subcontract packages	9,598	9,246	12,718
Supervision and Prelims	5,287	5,630	6,530
Contractor Fees	1,907	2,434	2,788
Total Construction Value:	33,699	34,417	58,561
Design	4,451		8,363
Project management	1,851		3,234
Third party	477		557
Risk (15%)	5,796		10,123
Total Scheme Cost:	46,020	46,353*	80,840

* With pro-rata addition of design, project management, third party and risk.

We have a higher than average level of confidence in the estimated costs for the Bristol FFT scheme, as we have delivered several projects at this site in recent years (including the construction of SBRs, storm tanks and sludge treatment plant) and have gained a good understanding of the engineering construction risks and challenges. This means that our internal benchmarks and cost models are particularly well-suited to costing the proposed Bristol STW work, given they are quite up-to-date and reflective of circumstances at Bristol STW.

Subsequent to the challenges from Ofwat to our plans in their IAP in January 2019 and our response in April 2019, we appointed Stantec to undertake a high-level independent review of a number of proposed STW schemes to confirm and/or challenge our selected business plan option and its technical scope. Stantec is an international engineering consultancy company.

The schemes were chosen for external review based on site-specific complexities and where we had particular concerns that their costs had not been adequately represented through Ofwat's IAP modelling approach. The schemes reviewed by Stantec are shown in the below table. They also covered those schemes where, in our response to the IAP, we had invited Ofwat to review or take a deep dive into those programmes or schemes.

Table 7-2: Schemes reviewed by Stantec

Main driver	Schemes/Sites	BP capex (£m)
Sanitary	Yeovil & Shepton Mallet	39.6
FFT Increase	Bristol (Avonmouth) & Bath (Saltford)	68.2
Growth	Burton, Compton Bassett, Great Wishford, Hurdcott & Salisbury	29.1
MCERTS	Poole, Dorchester, Milborne St Andrew, Palmersford & Weymouth	3.6

We selected Bristol (Avonmouth) and Bath (Saltford) from the set of FFT schemes, as these are the two largest schemes, together representing over 80% of the combined totex value in this area. We have included Stantec's full reports in Appendix C1.1. Stantec were asked to identify any immediate scope challenges as well as any opportunities for consideration in outline and detailed design. Their main conclusions are included below.

The finding of the report is that overall for all 14 sites reviewed, the solution described in the Business Plan is appropriate and a good fit to both Wessex Water design standards and wider industry benchmarks. For example, application of the "Pearce" model demonstrated that the process design approach applied for trickling filters is equal to or more aggressive than that of other UK water companies.

The challenge process applied by Stantec has developed many potential challenges some of which are recommended to be applied in delivery, these comprise optimisation opportunities as outputs of the Pearce model and drive reduced process risk, but not capital efficiency.

In no case was there any radical challenge as alternative unit processes or process trains promoted as a preferred solution after the risk analysis step.

The default approach by Wessex Water was to remain compliant with their in-house asset standards for wastewater process design. No significant positive deviations were identified through the gap analysis process i.e. examples of significant over provision of asset were not found. Conversely there were multiple examples of negative deviations i.e. examples of risk or potential under provision being proposed. These were driven by factors such as footprint constraint and the modular nature of process assets.

Wessex Water design standard sets out design horizons for new projects, dependant on the size of the STW as shown below: -

- *Population >10000 10 year horizon*

- *Population < 10000 20 year horizon*

In our view, this is a common and efficient approach with the longer design horizon for smaller STWs based on the very small marginal cost increase involved in constructing slightly larger process units for the longer term at these STWs.

There was evidence that Wessex Water were willing to take risks regarding the reuse of ageing assets either in their current or enhanced functionality or repurposed.

Where existing process assets are not embraced, modified or repurposed, a clear argument is given as to why an alternative is adopted. The theme in this case was the replacement or augmentation of trickling filter sites with the Activated Sludge process.

For many of the sites, the improvements required are manifold, for example at Hurdcott STW, Compton Bassett STW and Great Wishford STW. At these sites, simultaneous application of the load standstill principle regards sanitary determinants, and updating FTT for historic, and future growth to the design horizon is applied. This span of requirements across quality and flow mostly precludes the classical solution of solely adding tertiary or quaternary unit processes. Typically for the nine sites the whole process train from inlet to outfall requires quality and hydraulic upgrades and/or asset replacement.

Stantec's conclusion, specifically with regards to Bristol (Avonmouth) STW was:-

The results of the gap analysis identified that the capacity of the existing biological treatment would not be suitable to treat the future flows and loads, and that provision of additional Sequencing Batch Reactors (SBR) would be the lowest whole life cost solution. If land availability was an issue, then IFAS should be considered, but as there is available Wessex owned land it is not appropriate, based on the higher WLC costs.

The gap analysis conducted on Avonmouth assets concluded that from a process loading perspective (surface loading and retention) 4No. additional PSTs are not strictly speaking required as the existing PSTs are only marginally hydraulically overloaded. However, the capacity of the existing units to pass a 35% increase in flowrate is uncertain. For process robustness and site arrangement reasons and based on surface loading, at least 2 No. additional new PSTs dedicated to the new SBRs would be necessary. However, the process criticality of 2 new PSTs serving 4 new SBRs would be unacceptably high. A PST outage in this scenario would cause a process pinch point disabling full use of the new SBR assets. For this reason the minimum delivery in the initial phase would need to be three PSTs.

The 4No. new proposed SBRs however are process-critical to accommodate the increase in FFT. Based on the existing SBR design parameters, the proposed new SBRs are slightly undersized, however this should be able to be accommodated by optimising the MLSS levels, bottom water level within the cells and cycle times.

We have considered the comments from Stantec regarding the SBRs and PSTs. Whereas we consider the risk they have identified concerning the slight under-sizing of the SBRs can be managed and accommodated, we accept that the provision of 4No. PSTs is potentially over conservative. They have confirmed the need for at least 3 No. PSTs and we have accepted that the provision of 3No. rather than 4No. PSTs, represents a more cost efficient solution, with a reduction in costs of £2.0m. This reduction is reflected in our requested cost adjustment figure.

Direct procurement for customers

The Bristol (Avonmouth) STW project was considered as possible candidate for DPC in our business plan submission in September 2018 - refer to section 6 (page 192) of main business narrative.

We concluded that this project was not operationally discrete from the existing works and therefore it was not suitable for procurement via DPC; this assessment remains unchanged.

8. Customer protection

The obligation to increase the flow to full treatment at Bristol (Avonmouth) STW is a green (definite) requirement in the WINEP, with an associated high degree of certainty of progressing.

Our environmental performance history, as shown in the EA's annual Environmental Performance Assessment (EPA) reports, shows that we always deliver our statutory programme.

The performance commitments (PCs) and ODIs in our final business plan which relate to this large scheme include:

- E1: Treatment works compliance – one of the common asset health performance commitments.
- E10 : Length of river with improved water quality through WINEP delivery.

We recognise however, that the payments associated with under-performance of either or both of these PC's are not reflective of the costs that would be involved should this major scheme be delayed. As explained in IAP Appendix 3: Updated Performance Commitment detail document[2] these penalties amount to a combined total of £0.481m/year; i.e.:

- E1 : £170,000 per year per failing works
- E10 : £17,000/km x 18.32km.

Additional performance commitment

We understand the need to provide greater assurance of customer protection should a large scheme, such as Bristol STW be delayed, and thus fail to deliver the environmental benefits on time.

Therefore we would be content to accept an individual performance commitment for the delivery of this major scheme. We propose this would be similar to the PC associated with the delivery of another of our major schemes, the Trym tunnel in north Bristol. Our PC for that scheme (F4 North Bristol Sewer Scheme – Trym catchment), includes underperformance payments for delay in delivering the scheme and for non-delivery. We would be pleased to discuss the details of such an additional PC prior to final determination. We suggest its main elements would include:

> Definition: Delivery of additional full flow to treatment capacity of 1228 l/s at Bristol (Avonmouth) STW by 31 March 2025 as required by the WINEP.
>
> Customer friendly definition: Delivering one of our major projects – a 35% increase in treatment capacity at Bristol (Avonmouth) STW.

[2] Appendix 3 Updated Performance Commitment detail document (update from business plan) – April 2019. See sections 8.1 and 8.10

Incentive type: Underperformance payment only.

P10: Delivering the scheme one year late.
P90: Delivering the scheme one year early.

Incentive rates:
Based on the assumption that the full costs of this scheme are accepted, then the following incentive rates would be proposed (to be confirmed):

Incentive type	Incentive Rate (£)
Underperformance (delay)	1,680,000 / year delay (to be based on half the value of the annualised benefits)
Underperformance (non-delivery)	8,500,000 (to be based on the revenue received from customers for this scheme during the period)

9. Affordability

The programme of work described in this supporting document was included in our draft business plan that was tested with customers between January and June 2018.

The customer research is designed to test whether customers find the plan acceptable and affordable. The stimulus material covered our overall package of service improvements, statutory enhancements and bill impacts. We tested our plan with household customers, business customers, retailers, those in vulnerable circumstances and industry stakeholders. Results were triangulated across a variety of qualitative and quantitative methodologies to maximise the robustness of both the sample and conclusions.

Testing has shown that 96% of our customers find our business plan acceptable. Acceptability is above 80% across all demographic subgroups. Those in vulnerable circumstances were slightly less accepting of the plan than other groups, but still at a very high level.

A large majority of household customers (92%) consider our plans are affordable for them. Affordability amongst business customers was also very high at 96%. Vulnerable customers also found the plan acceptable and affordable, and were positive about the assistance that we provide to this group.

Full details of our acceptability testing can be found in our September 2018 business plan supporting document 1.1 and details of how we address affordability and vulnerability are in included in supporting document 2.1.

10. Board assurance

The proposals have been subject to our board assurance process, which is described in detail in section 12 of the main business plan narrative and supporting documents 12.1 to 12.8 (September 2018).

Section 12 of the main business plan narrative includes the following statements that are relevant to this supporting document:

> The full Board confirms that, in our view, the proposals within the Business Plan are consistent with and should allow the company to deliver against its statutory obligations, now and up to 2025.
>
> We, the Board of Wessex Water, understand our accountability for this Business Plan. We are unequivocal in our assurance that the Plan is both high-quality and deliverable. We also confirm that it is consistent with our long-term vision for the company and our strategy.
>
> The Board assures that this plan is informed by customer engagement and the views of the Wessex Water Partnership (WWP), and that the performance commitments contained within it reflect customer priorities, are stretching and reporting is robust.
>
> The Board confirms that the expenditure projections contained within this Business Plan are robust and efficient, and that large investments are deliverable and best for customers.

11. References to relevant evidence already provided or elsewhere in the representation documents

- PR19 business plan submission (September 2018)
  - Supporting document 5.1 – Protecting and enhancing the environment
    - Section 3.5
    - Annex B

- Response to Initial Assessment of Plans (April 2019)
  - Appendix 4 – Protecting and enhancing the environment: Response to IAP.
    - Section 2.7
    - Annexes B and D

- Response to Draft Determination (August 2019)
  - Representation Appendix C1.1 – Third party report – Stantec
  - Representation C2: STW Capacity
  - Representation C5: WINEP: Flow to full treatment (FFT) increase

Annex A. Cost adjustment claim summary form

Cost adjustment claim summary form

Name of claim	Bristol (Avonmouth) STW – flow to full treatment
Name and identifier of related claim submitted in May 2018	This is a new claim WSX07
Business plan table lines where the totex value of this claim is reported.	£44.149m in WWn8 line E19
Total value of claim for AMP7	£44.149m (totex)
Total opex of claim for AMP7	£0.127m
Total capex of claim for AMP7	£44.022m - less Ofwat's modelled implicit allowances for FFT and STW growth.
Depreciation on capex in AMP7 (retail controls only)	n/a
Remaining capex required after AMP7 to complete construction	£0m
Whole life totex of claim	£75.677m
Do you consider that part of the claim should be covered by our cost baselines? If yes, please provide an estimate	Yes, we recognise that a small part of the claim would be covered by your allowance for STW growth in base costs. A larger part of the claim will be covered by the funding allowance calculated by your cost assessment feeder model for flow to full treatment. We have explained how this feeder model is not able to accommodate the true costs for a scheme of the scale of that required at our Bristol (Avonmouth) STW. This claim is for the difference between the implicit allowances for Bristol STW in your feeder and STW growth (base costs) model and our final business plan estimated true costs[3] for the scheme.

[3] Reduced by £2.0m to take account of a more recent independent review and challenge of the technical scope by Stantec of the planned works for Bristol (Avonmouth) STW.

	We don't have visibility of Ofwat's base costs calculation, but estimate the combined allocation for FFT and STW growth cost models to be approximately £23.6m.	
Materiality of claim for AMP7 as percentage of business plan (5 year) totex for the relevant controls.	Materiality of the Bristol (Avonmouth) STW claim = 2.9% of Wastewater Network+ totex	
Does the claim feature as a Direct Procurement for Customers (DPC) scheme? (please tick)	Yes	No
		✓

Company: Wessex Water
Name of claim: Bristol (Avonmouth) STW – flow to full treatment
Claim identifier: WSX07

<table>
<tr><th></th><th>Brief summary of evidence to support claim against relevant test</th><th>List of accompanying evidence, including document references, page or section numbers.</th></tr>
<tr><td>Need for investment/ expenditure</td><td>The investment is required to provide increased flow to treatment as required by the WINEP, and hence to maintain compliance and prevent a deterioration of the quality of the receiving waters.
In December 2017 we were advised that the WINEP for PR19 would require an increase in flow to full treatment (FFT) at Bristol STW by 35.4%. This was confirmed by the EA in the WINEP3 in March 2019, with an agreed increase in FFT as described below:
<table>
<tr><th>Driver Code</th><th>Driver code Information</th><th>Completion Date</th><th>Level of certainty?</th><th>Old Permit</th><th>New Permit</th></tr>
<tr><td>U_IMP5</td><td>FFT</td><td>31/03/2025</td><td>Green</td><td>3,472 l/s</td><td>4,700 l/s</td></tr>
</table>
As explained in our final business plan the existing treatment streams at Bristol STW are at the limit of their hydraulic capacity and thus for the site to pass the required FFT to meet WINEP requirements an additional process stream is required.</td><td>Refer to Representation C1, Section 5</td></tr>
<tr><td>Need for cost adjustment</td><td>We consider that the Ofwat cost assessment enhancement feeder model for flow to full treatment (FFT) does not adequately cover the true scope and costs of the works required at Bristol (Avonmouth) STW. We have a similar concern about the modelled level of funding for STW growth. Ofwat's implicit modelled totex allowance of approximately £23.6m contrasts with our business plan estimated cost of £44.149m for the planned enhancement works at Bristol STW.
We consider that this is primarily due to the exceptional impact of the costs of the extension works required at our largest treatment works at Bristol Avonmouth, which the FFT model does not accommodate. Bristol (Avonmouth) treatment works is one of the top ten largest STWs in England and Wales, serving a population equivalent of 800,000. The project at Bristol represents 84% of the total FFT shortfall across the whole of Wessex Water. This FFT shortfall alone is significantly greater than that for the whole shortfall at eight other WaSCs (ANH, NES, NWT, SVE, SWB, WSH,YKY and HDD).</td><td>Refer to Representation C1, Section 3</td></tr>
<tr><td>Outside management control</td><td>The underlying need for the investment is to protect and enhance the environment in the receiving water of the discharge from Bristol STW, and to comply with the obligations of the EU Urban Waste Water Treatment Directive. Both factors are outside of management control.
We have minimised the costs to customers through a range of different options for meeting the need including:
• investment in the lowest whole-life-cost additional treatment option.
• taking advantage of synergies with other drivers</td><td>Refer to Representation C1, Section 4</td></tr>
<tr><td>Best option for customers</td><td>Customer research shows that protecting the environment is a priority for customers. A range of options has been evaluated.
Cost benefit analysis shows that the investment will deliver benefits greater than the costs, and that it is best value solution for customers.</td><td>Refer to Representation C1, Section 6</td></tr>
<tr><td>Robustness and efficiency of claim's costs</td><td>We have benchmarked the cost estimates using independent external cost consultants and this shows that the cost estimates are robust and efficient.
Subsequent to the challenges from Ofwat to our plans in their IAP, we appointed an independent consultant (Stantec) to review and challenge the proposed option and its technical scope. They confirmed the option selection and its main scope but also have advised that 3 only, rather than the 4 planned, new primary settlement tanks are required. We have therefore reduced our planned investment accordingly, removing £2.0m from our plan.</td><td>Refer to Representation C1, Section 7</td></tr>
<tr><td>Customer protection</td><td>Customers will be protected if the investment is cancelled, delayed or reduced in scope through the following performance commitment and ODIs:
• E1: Treatment works compliance – one of the common asset health performance commitments.
• E10: Length of river with improved water quality through WINEP delivery.
• We propose a new individual PC to include underperformance payments for any delay in delivering the scheme and for non-delivery</td><td>Refer to Representation C1, Section 8</td></tr>
<tr><td>Affordability</td><td>The planned work outlined in this new Cost Adjustment Claim was included in our draft business plan that was tested with customers between January and June 2018. The acceptability testing was designed to test customers' acceptance of our overall package of service improvements and bill impacts. Testing has shown that 97% of our customers find our business plan acceptable. Acceptability is above 90% across all demographic subgroups.</td><td>Refer to Representation C1, Section 9</td></tr>
<tr><td>Board assurance</td><td>The proposals have been subject to our board assurance process, which is described in detail in section 12 of the main business plan narrative and supporting documents 12.1 to 12.8.</td><td>Refer to Representation C1, Section 10</td></tr>
</table>

Annex B. Bristol (Avonmouth) STW – Further Information

This annex is a copy of Annex B from
Appendix 4 – Protecting and enhancing the environment: Response to IAP
from our Response to Initial Assessment of Plans (April 2019)

1. Need

Quality Enhancement

The following lines are included in the WINEP for Avonmouth STW:

Table B-1: Quality enhancement drivers identified in the WINEP for Avonmouth STW

Driver Code	Driver code Information	Relevant section within Supporting document 5.1
Investigations / Monitoring		
U_INV	Frequently spilling overflow investigation	4.1
U_MON3	Storm tank EDM	3.5
U_MON4	Flow measurement	3.5
WFD_MON_CHEM	Chemical Investigations	3.4
WFD_INV_CHEM2		3.4
WFD_INV_CHEM14		3.4
Improvements		
U_IMP5	FFT increase	3.5

This annex relates to works associated with the improvement quality driver.

In December 2017 we were advised that the WINEP for PR19 would require an increase in flow to full treatment (FFT) at Avonmouth STW by 35.4%. This was confirmed in the WINEP3 in March 2018, which included the increase in FFT described below:

Table B-2: PR19 permit identified in the WINEP for Avonmouth STW

Driver Code	Driver code Information	Completion Date	Level of certainty?	Old Permit	New Permit
U_IMP5	FFT	31/03/2025	Green	3,472 l/s	4,700 l/s

The 4,700l/s figure represents the "3PG+I_{max}+ 3E" at year 2025.

The EA have stated, in relation to the U_IMP5 projects that "Future risk due to growth should be picked up by the Water Companies under growth or maintenance in their Capital Programme, not WINEP" and also that **"**U_IMP5 *(and U_IMP6*) drivers only apply to increases required to FFT *(and storm tank capacity)* over and above those required and funded under growth." [4]

[4] Environment Agency (November 2017). PR19 further guidance for completing WINEP3 for flow drivers U_MON3, U_MON4, U_IMP5 and U_IMP6 DRAFT v0.10.
Environment Agency (December 2017). PR19 Driver Guidance: Increasing Flow to Full Treatment (FFT)- FINAL v3.

This means that investment to meet the new FFT at year 2025 will be costed under the quality enhancement driver, while the provision of capacity to a reasonable design horizon (i.e. 2040) will be allocated to capacity enhancement.

Growth Enhancement

Historical and future planned growth in both residential and trade flows and loads requires additional treatment capacity to ensure that the site continues to maintain environmental permit compliance. Some increase in biological treatment capacity will be required during 2020-2024, with further treatment capacity likely to be required during 2025-2030 based on population growth projections.

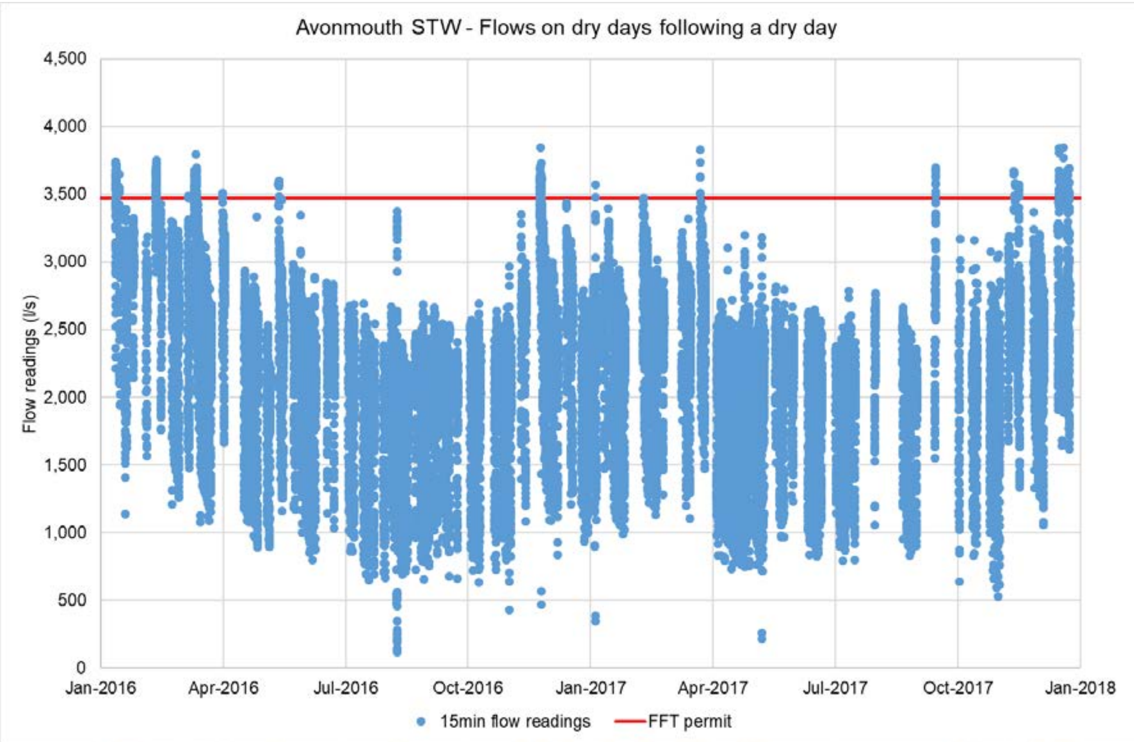
2. Background

Avonmouth STW is our largest STW, serving a population equivalent of 799,129. It treats sewage from most of the Bristol city area and also receives a high trade load, particularly from nearby industries in the Severn Estuary. The site is co-located with a Sludge Treatment Centre, which also receives sludge imports from other STWs. Additional loads are also received from the onsite Organic Waste facility and the Food Waste facility.

There are two treatment streams at Avonmouth STW, the largest treating approximately 91% of the inflow comprises 11 Sequencing Batch Reactor (SBR) basins. The last investment in capacity occurred in 2003, with the addition of three SBR basins.

The existing permit FFT is a low multiplier of DWF (<3). As can be seen in the figure below, the site routinely treats flows in excess of the permit FFT on dry days.

Figure B-1: Flows through Avonmouth STW on dry days (and following a dry day)



3. Options

The existing treatment streams are at the limit of their hydraulic capacity, and thus for the site to pass the required FFT to meet the WINEP requirements, an additional process stream is required. This has been sized as follows:

Table B-3: Design flow parameters for increased FFT at Avonmouth STW

	Current	By 2025
DWF	179,867 m^3/d = 2,082 l/s	2,082 l/s
FFT	3,472 l/s	4,700 l/s
FFT:DWF Multiplier	1.67	2.26
Flow splits to process streams		
Existing SBRs (11no. tanks as twin stream)	90% = DWF: 1,874 l/s FFT: 3,125 l/s	66% = DWF: 1,384 l/s FFT: 3,125 l/s
Existing ASP (twin lane)	10% = DWF: 208 l/s FFT: 347 l/s	7% = DWF: 154 l/s FFT: 347 l/s
New Process Stream	-	26% = DWF: 544 l/s FFT: 1,228 l/s

Two options were considered to provide the required hydraulic capacity enhancement. In brief, these two options included the following:

- Option 1 – 4 additional SBRs
  - Four new PSTs
  - Four new SBR basins and associated ancillaries, as per design of existing
- Option 2 – Additional ASP stream
  - Four new PSTs
  - New aeration lanes
  - Eight new final settlement tanks FSTs

Both of these options would be located on our land to the south of existing site operational boundary.

Table B-4: Treatment options at Avonmouth STW for the increased FFT WINEP3 driver

Option	Option 1 4no. SBRs	Option 2 ASP
Provides hydraulic capacity to meet new FFT	✓	✓
Provides treatment capacity to 2025	✓	✓
Permits future expansion on site for future growth	✓	×
Scheme Capex (£m)	46.02	80.84
Opex (£k/yr)	778	850

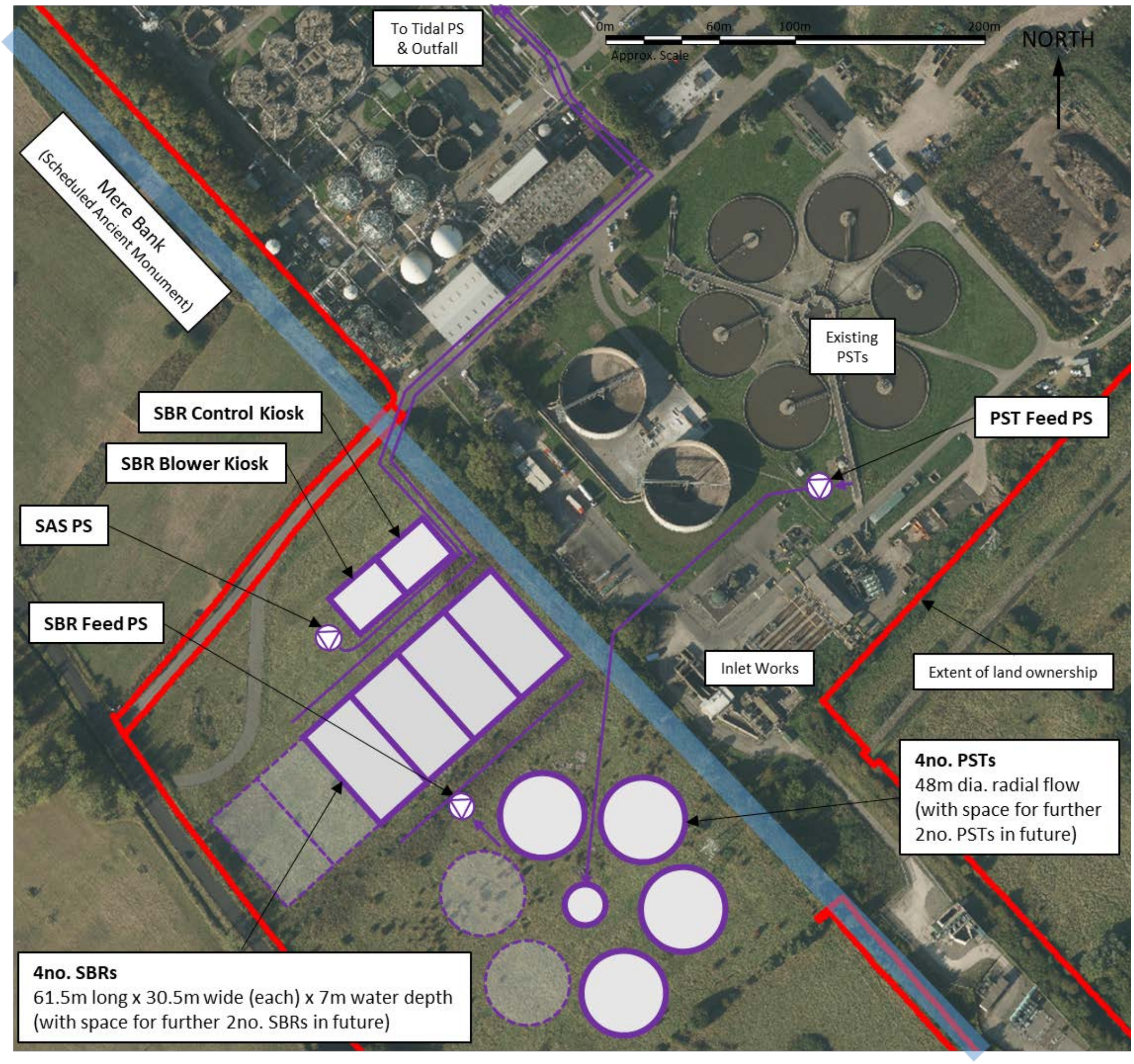
Option	Option 1 4no. SBRs	Option 2 ASP
Lowest whole-life cost	✓	×

4. Proposed solution

As can be seen above, Option 1 (4no. SBRs) has the lowest whole life cost. This option also provides synergies with future treatment capacity and is thus included in our PR19 proposal.

An indicative layout for this proposed option is show below.

Figure B-2: Proposed site plan of Avonmouth STW to pass an increased FFT



Due to the requirement under the WINEP, a significant increase in hydraulic capacity is required at the works. The hydraulic capacity enhancement will additionally provide treatment capacity enhancement up until 2025. Following this it is expected the permitted

DWF will be exceeded around 2030, triggering a permit change. We are thus anticipating the need for further investment in treatment capacity enhancement in PR24, as shown in the following figure.

Figure B-3: Recent historical and mid/long-term plan for Avonmouth STW

2015-19 (PR14)
- Monitoring of SBR performance
- Management of trade waste imports where possible

2020-24 (PR19)
- Increase in FFT permit
- Investment in hydraulic capacity in synergy with treatment capacity

2025-35 (PR24/29)
- Possible DWF exceedance and subsequent increase in DWF permit – may require additional treatment capacity to meet revised permit