Annex A5: Scheme Cost and Carbon Reports

Standard Gate two submission for London Water Recycling SRO

Notice – Position Statement

This document has been produced as the part of the process set out by RAPID for the development of the Strategic Resource Options (SROs). This is a regulatory gated process allowing there to be control and appropriate scrutiny on the activities that are undertaken by the water companies to investigate and develop efficient solutions on behalf of customers to meet future drought resilience challenges.

This report forms part of suite of documents that make up the 'Gate 2 submission.' That submission details all the work undertaken by Thames Water in the ongoing development of the proposed SRO. The intention at this stage is to provide RAPID with an update on the concept design, feasibility, cost estimates and programme for the schemes, allowing decisions to be made on their progress.

Should a scheme be selected and confirmed in the Thames Water final Water Resources Management Plan (WRMP), in most cases it would need to enter a separate process to gain permission to build and run the final solution. That could be through either the Town and Country Planning Act 1990 or the Planning Act 2008 development consent order process. Both options require the designs to be fully appraised and, in most cases, an environmental statement to be produced. Where required that statement sets out the likely environmental impacts and what mitigation is required.

Community and stakeholder engagement is crucial to the development of the SROs. Some high-level activity has been undertaken to date. Much more detailed community engagement and formal consultation is required on all the schemes at the appropriate point. Before applying for permission Thames Water will need to demonstrate that they have presented information about the proposals to the community, gathered feedback and considered the views of stakeholders. We will have regard to that feedback and, where possible, make changes to the designs as a result.

The SROs are at a very early stage of development, despite some options having been considered for several years. The details set out in the Gate 2 documents are still at a formative stage.

Disclaimer

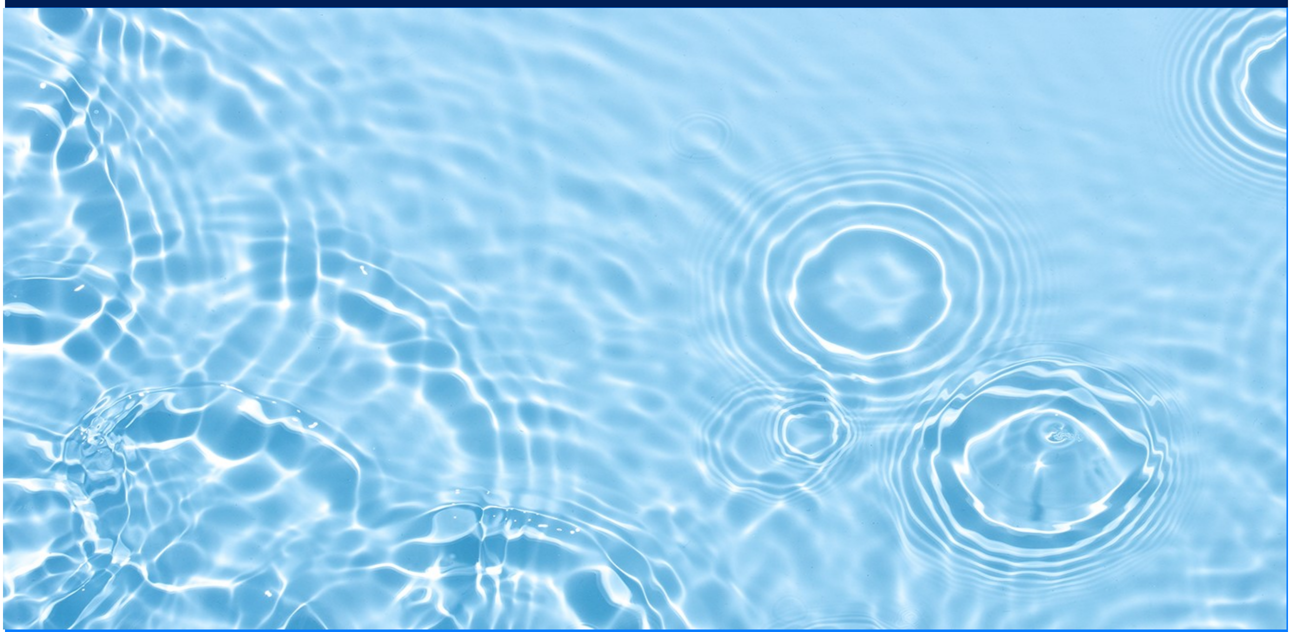
This document has been written in line with the requirements of the RAPID Gate 2 Guidance and to comply with the regulatory process pursuant to Thames Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solutions presented in this document be taken forward, Thames Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

Annex 5A: Beckton Cost and Carbon Report

Document no: J698-LR-DOC-240015-0B
Revision no: 0B

Thames Water Utilities Ltd
J698

London Recycling Schemes
25 October 2022



Annex 5A: Beckton Cost and Carbon Report

Client name:	Thames Water Utilities Ltd		
Project name:	London Recycling Schemes		
Client reference:	J698	Project no:	B22849AP
Document no:	J698-LR-DOC-240015-0B		
Date:	25 October 2022		

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Contents

Appendices

Table of tables

Table of figures

Executive Summary

This report demonstrates the basis, methodologies and results of cost and carbon estimates for the Beckton Effluent Reuse scheme. The Beckton Effluent Reuse scheme is one of the four schemes in the London Effluent Reuse Strategic Regional Water Resource Option (London Effluent Reuse SRO). The scheme will treat a portion of final effluent from the Beckton STW in a new Advanced Water Recycling Plant (AWRP) and will transfer the Recycled Water to the River Lee Diversion, upstream of the inlet to the King George V Reservoir (KGV) to supplement the raw water supply to the Lee Valley reservoirs.

Base Capital Expenditures (Base Capex) and Operating Expenditures (Opex) for the scheme were estimated using Thames Water's Asset Planning System (APS). Cost curves in Thames Water's Engineering Estimating System (EES) were used to populate Base Capex data entries in F909 worksheets, which are Thames Water's costing spreadsheets to calculate input information for APS. As for the items where appropriate EES cost curves were not available, the estimated costs were verified with supplier quotations and unit-rate cost benchmarking.

Quantitative Costed Risk Assessment (QCRA) was performed, identifying risk events, cost impacts and likelihood of risk events. The likelihood of the risk events and the cost ranges estimated to be incurred by the risk events were combined using Monte Carlo simulations to return a costed risk value. Optimism Bias (OB) was derived in the methodology outlined in the "Cost Consistency Methodology – Technical Note and Methodology Revision E" (Mott MacDonald, Feb 2022). The estimated OB values were reviewed with the QCRA outputs and scaled back where required to avoid double-counting in the Costed Risk and OB. Carbon estimates were formulated through the Thames Water EES and APS in the cost estimating exercise, with a whole-life carbon mitigation assessment carried out based on the PAS 2080 principles.

The Capex, Opex, Costed Risk, OB and Carbon values were calculated and reported in the requirements set out by the Water Resources South East (WRSE). A summary of the costs and carbon estimates is listed in Table S -1 below. All costs and carbon estimates discussed in this report are consistent with the WRSE Input Template version 5 ("J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO") issued in May 2022.

Table S-1. Summary of Estimated Costs – Beckton Effluent Reuse

Scheme	Component	Total Capex (£m)	Fixed Opex (£m/year)	Variable Opex (£/Ml)	Embodied Carbon (tCO2e)	Fixed Operational Carbon (tCO2e/y)	Variable Operational Carbon (tCO2e/y)
Beckton Effluent Reuse scheme	50 Ml/d AWRP	£186	£2.00	£496	32,713	46.85	2,624
	100 Ml/d AWRP	£301	£2.76	£477	55,176	29.05	5,159
	150 Ml/d AWRP	£429	£3.61	£533	70,361	0.00	8,267
	Beckton to Lockwood Recycled Water Transfer Tunnel	£351	£0.47	£13	62,230	6.55	113
	Lockwood to KGV Recycled Water Transfer Tunnel	£261	£0.43	£19	46,090	32.14	90

1. "Total Capex" is a sum of Base Capex (including overheads), Costed Risk and Optimism Bias.
2. "Beckton to Lockwood Recycled Water Transfer Tunnel" is sized for 300 Ml/d at this stage. "Lockwood to KGV Recycled Water Transfer Tunnel" is sized for 300 Ml/d at this stage but has the potential to be increased simply to 800 Ml/d in order to include for flows from the Thames Lee Tunnel (TLT) plus Beckton Effluent Reuse flows.
3. Costs estimates are from WRSE Input Template (J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO). Costs are based on September 2022 base rate.

Construction Capex and Opex costs have been used to generate the Net Present Values (NPV) and Average Incremental Costs (AIC) for the components to allow comparison ensuring for lifetime cost. A summary of the AIC values is shown below for four configurations of this scheme at a minimum and maximum utilisation level over an 80-year period. The values are adjusted to a 2020/21 Cost base for consistency with WRMP19 estimates.

Table S-2. Summary of Average Incremental Costs (AIC) at Minimum and maximum Utilisation Level - Beckton Effluent Reuse

Configuration name	Units	Beckton Effluent Reuse (50Ml/d yield)	Beckton Effluent Reuse (100Ml/d yield)	Beckton Effluent Reuse (150Ml/d yield)	Beckton Effluent Reuse (300Ml/d yield)
Option benefit	Ml/d	46	89	130	252
Minimum Flow – based on 25% utilisation in Hot Standby mode for 12 months of the year					
Average Incremental Cost (AIC)	p/m^3	226	144	121	118
Maximum Flow – full capacity (100% utilisation) for 12 months of the year					
Average Incremental Cost (AIC)	p/m^3	266	183	164	195

1. Beckton Effluent Reuse (50 Ml/d yield): a combination of the 50Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 50 Ml/d.
2. Beckton Effluent Reuse (100 Ml/d yield): a combination of the 100Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 100 Ml/d.
3. Beckton Effluent Reuse (150 Ml/d yield): a combination of the 150Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 150 Ml/d.
4. Beckton Effluent Reuse (300 Ml/d yield): a combination of 2 phases of the 150Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 300 Ml/d.

1. Introduction

1.1 Background and Purpose of Report

Beckton Effluent Reuse was identified as one of the four schemes which compose the London Effluent Reuse SRO by the Regulators' Alliance for Progressing Infrastructure Development (RAPID). Thames Water Utilities Limited (Thames Water) have developed a conceptual design for this scheme and estimated costs and carbon associated with the scheme. The results of cost and carbon estimating has been reported to the Water Resources South East (WRSE) to update the WRSE Database for its investment modelling.

The purposes of this report are to present the basis, methodologies and results of cost and carbon estimating for the Beckton Effluent Reuse scheme in the London Effluent Reuse SRO.

1.2 Scheme Overview

Beckton Sewage Treatment Works (STW) is located on the North side of the Thames Tideway at Barking and East of London City Airport. A new Advanced Water Recycling Plant (AWRP) will be constructed within the Beckton STW boundary to the North of the existing operational area. This new works will abstract a portion of final effluent flow from the Beckton STW and treat it for indirect reuse with advanced treatment technologies to allow the Recycled Water to be discharged as a source water for abstraction at existing Water Treatment Works (WTW). Waste flows from the AWRP will be discharged to the existing Beckton STW outfall. The recycled water will then be pumped to a proposed discharge location on the River Lee Diversion to the North of the King George V Reservoir (KGV), upstream of the inlet to KGV, to supplement the raw water supply to the Lee Valley reservoirs. Figure 1-1 shows the overview of the Beckton Effluent Reuse, and Table 1-1 lists a summary of design elements costed for the scheme.

In the cost estimate and conceptual design, the AWRP was sized in three phased components which will be capable to yield 50, 100 and 150 Ml/d of Recycled Water. Up to 3 phases can be employed modularly over time to enable the maximum total yield of 300 Ml/d for the Beckton Effluent scheme, via a combination of the 50, 100 and / or 150 Ml/d components.

The proposed conveyance element from Beckton AWRP to the River Lee Diversion consists of two parts: a tunnel from the AWRP on the Beckton STW site to Lockwood Reservoir Pumping Station and an extension of the existing Thames Lee Tunnel (TLT) from Lockwood Shaft to the River Lee Diversion.

The first part of the conveyance route will pass close to Coppermills Water Treatment Works (WTW), and end at a shaft next to the existing Lockwood Reservoir Pumping Station (of the Thames Lee Tunnel - TLT). This proposed tunnel was sized for transfer of 300 Ml/d recycled water, with the pumping operation to be restricted to the maximum treatment capacity at the AWRP.

The second part of the conveyance route, which is considered an extension of the existing TLT, will transfer the flow from Lockwood to the discharge location on the River Lee Diversion upstream of the KGV inlet. The TLT extension follows an alignment along the Western side of the Chingford Reservoirs (William Girling and KGV). This tunnel was sized hydraulically for 800 Ml/d at this stage; however the assets for the final pumping station are currently costed for 300 Ml/d maximum as any flows greater than this would be part of a separate project for the TLT extension, not for conveying recycled water flows in the Beckton Effluent Reuse scheme.

The Beckton Effluent Reuse scheme will supply the London Water Resource Zone (WRZ).

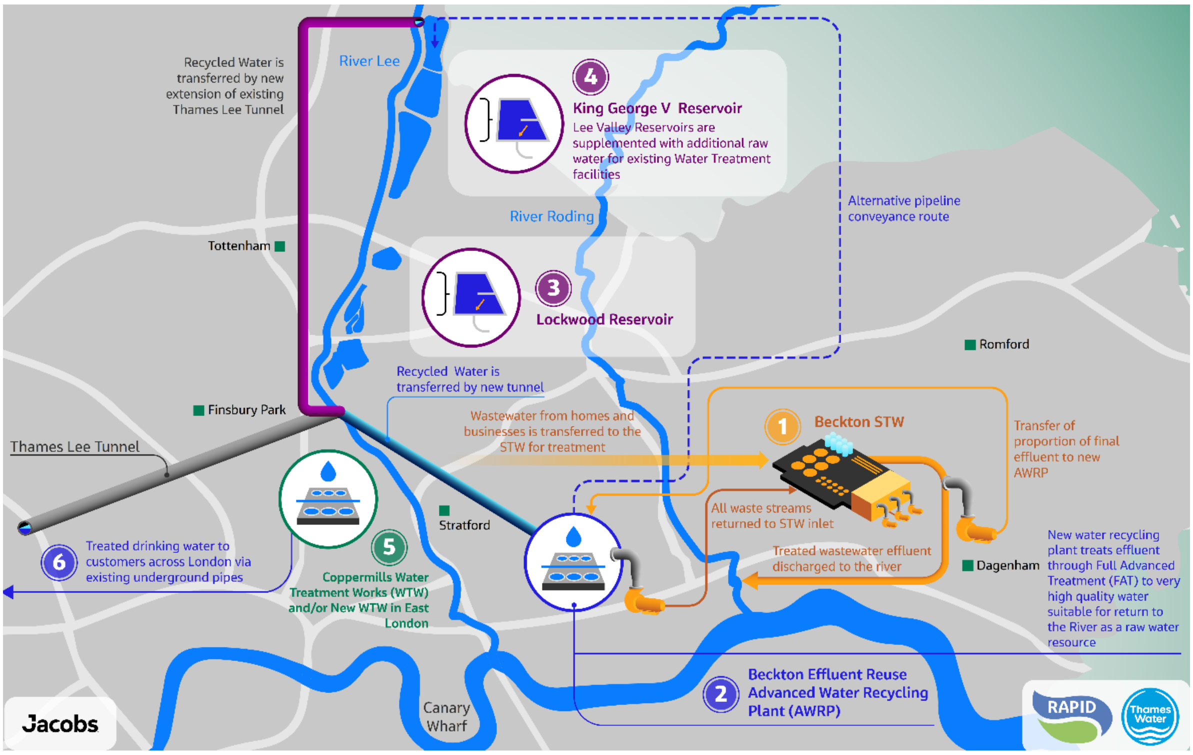


Figure 1-1. Beckton Effluent Reuse Scheme Overview

Table 1-1. Beckton Effluent Reuse Components for Cost Estimate

Components	Gate-2/ WRSE Reference	Scope Summary
50 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 50	Treatment Plant to yield 50 Ml/d Recycled Water Final Effluent Transfer Pumping Station Recycled Water Pumping Station Wastewater Return Pumping Station Waste stream & Effluent abstraction conveyance elements
100 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 100	Treatment Plant to yield 100 Ml/d Recycled Water Final Effluent Transfer Pumping Station Recycled Water Pumping Station Wastewater Return Pumping Station Waste stream & Effluent abstraction conveyance elements
150 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 150	Treatment Plant to yield 150 Ml/d Recycled Water Final Effluent Transfer Pumping Station Recycled Water Pumping Station Wastewater Return Pumping Station Waste stream & Effluent abstraction conveyance elements
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	3.5m ID tunnel from Beckton AWRP to Lockwood Pumping Station for Recycled Water transfer. (sized for 300 ML/d for maximum flows)
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	3.5m ID tunnel from Lockwood Pumping Station to KGV for Recycled Water transfer flows. (sized for 300 Ml/d for maximum scheme flows, but could be simply increased to account for 800 Ml/d to include TLT flows) New assets at existing TLT Lockwood Pumping Station to allow transfer of flows from TLT.

1.3 Removal of Beckton to KGV Alternative 100 Ml/d Pipeline Component

The conveyance at Gate 2 is designed as a single size for 300 Ml/d capacity to transfer the maximum AWRP Recycled Water flows, with a reduced utilisation depending on the installed treatment plant capacity. This is due to the inability to feasibly construct modular conveyance elements (e.g. not feasible to increase the size of a tunnel at a later stage). Alternative conveyance options for smaller sizes of Beckton Effluent Reuse schemes were investigated (such as a pressurised pipeline alternative for 100 Ml/d capacity and smaller tunnel options) which were screened out on viability grounds for a multitude of engineering, environmental and planning reasons, as discussed in the Conceptual Design Report. These alternative options were unsatisfactory compared to the 3.5m-diameter tunnel option due to number of shafts, construction impact and the density of the urban topography the route crosses.

During Gate 2, engineering and environmental refinements have been carried out to further understand and develop the alternative pipeline 100 Ml/d component (WRSE Option ID: TWU_KGV_HI-TFR_KGV_ALL_bectontokgv100). Material changes have been identified that when assessed through the WRMP19 feasibility screening criteria assessment results in the component being screened out and deemed not viable or cost-effective. RAPID have formally agreed to the removal of this component from the London Effluent Reuse SRO as of 20th May 2022. It is therefore not discussed in this report.

2. Cost and Carbon Estimate Methodology

Total Capital Expenditure (Total Capex), Operating Expenditure (Opex) and Embodied Carbon, and Operational Carbon (Fixed and Variable) values were estimated for the Beckon Effluent Reuse scheme. Total Capex consists of Base Capital Expenditure (Base Capex), Costed Risk and Optimism Bias (OB). This section demonstrates methodologies to estimate these components for the Beckton Effluent Reuse scheme. Estimate developed using Thames Water internal estimating process and system EES and APS. In instances where model data wasn't available supply quotes and bottom-up estimates were used.

2.1 Base Capex Costing

Base Capex cost estimates for Beckton Effluent Reuse scheme were carried out with Thames Water's Engineering Estimating System (EES) and Asset Planning System (APS), using F909 worksheets. F909 worksheets are Thames Water's costing spreadsheets used to calculate input information for APS by using EES cost curves and through manual/ override inputs where required. Descriptions of EES and APS are provided in the following sections.

For the RAPID Gate 2 cost estimates, the Base Capex entries in the F909s prepared in Gate 1 were reviewed and updated as per the latest conceptual design of the scheme, and an F909 worksheet was prepared for each of the five components in Beckton Effluent Reuse scheme in Table 1-1. A new F909 worksheet was developed bottom-up for the "100Ml/d Alternative Recycled Water Transfer Pipeline, but as of 20th May 2022, this component has now been removed from the London Effluent Reuse SRO scope in agreement with RAPID.

Once F909s had been prepared, they were processed through APS. Outputs from APS were populated in the WRSE Input Template as per the reporting requirements for WRSE to update the WRSE Database and for input to their investment modelling. The WRSE costing methodology aligns with the guidance prepared for the All Company Working Group (ACWG) to improve costing consistency between SROs.

2.1.1 Engineering Estimating System (EES) Cost Curves

Base Capex entries in F909s were derived mostly from the Thames Water costing system using Engineering Estimating System (EES).

EES is a database containing capital project costs and carbon information against asset structures commonly used in Thames Water's facilities. The system was introduced to Thames Water in 2000 and holds the cost for the construction against EES coding structure for all capital expenditure within infrastructure and non-infrastructure assets. A Carbon estimate system was also introduced to EES later around 2008 and mirrors the cost model structure for infrastructure and non-infrastructure assets. In EES, users select the appropriate cost curve from the library of available items and populate the appropriate yardstick value.

Data in the EES libraries has been collected from Thames Water projects against two key milestones; Target Cost and Final Actual Cost. Thames Water's EES database currently has data from over 6,500 projects totalling £12billion in value. Projects range from small £100k modifications to £620M large-scale construction works. The data has been checked against final drawings to ensure accuracy with all financials validated using the Thames Water corporate financial system.

The data enables EES to produce robust process model(s) from these projects and helps Thames Water to support the three key areas within the business in a repeatable and auditable way:

- High level Estimating for investment purposes
- Benchmarking 'Value for Money' statements
- Regulatory 5 yearly pricing – from Price Review (PR)04/Asset management Plan (AMP)3 to PR19/AMP7

Projects hold a unique index date/figure when imported into the EES system, and when modelled as a group, the projects are inflated to a common inflation index date/figure to ensure the model reflects current day prices. These models are periodically updated with new data and older data removed.

For WRMP19, F909s were developed using the EES version 9.2 cost curve library. For Gate-2 costing, all F909s were updated in terms of scope and yardsticks, using the latest EES.

In the F909s worksheet, appropriate cost models were selected from EES costing library as per individual design items identified in conceptual design. Cost curves of Civil, M&E and ICA expenditures were available for each design item/ cost model. Relevant yardsticks/ quantities required were also entered, and the F909s generated Capex costs for Civil, M&E and ICA elements as a sum of base costs and overheads.

2.1.2 Manual Override Entries

The F909 worksheet allows manual override entries for items not covered by the EES database. For some items, such as the “3.5m-ID tunnels”, “reverse osmosis (RO) plant”, “ultraviolet advanced oxidation process system (UVAOP)” and “remineralisation system” the EES cost curves were not used and manual override costs were entered. This was either due to the variables of the costed element being outside the allowable yardstick range (*e.g.* tunnel maximum diameter of 2.5m within EES and costs not expected as a linear increase to 3.5m diameter) or because the complexity/specificity of an element meant that quotes/bottom-up estimates were viewed as more accurate (*e.g.* RO, UVAOP and Remineralisation). Cost rates of these items were entered with manual override, reviewing the WRMP19 manual entries and quotation information provided by suppliers.

Where the yardstick value required in F909s was outside the upper range of the EES cost curve, such as “site clearance” and “fine screens” in the AWRP, a manual cost rate was entered based on the pro rata cost rate at the upper limit of the EES cost curve, and the cost was calculated through a linear extrapolation, as agreed with Thames Water.

2.1.3 Overhead Costs

Overhead costs are added by APS process to the EES costs onto the base costs to account for additional costs associated with design, construction supervision and project management. Overheads percentages from Thames Water EES system were used for this costing exercise. The same overheads are applied to WRMP24 and PR24 cost assessment.

2.1.4 Thames Water Asset Planning System (APS)

The Base Capex items entered in the F909s were processed through APS. APS is a database used within Thames Water to hold candidate investments for the Periodic Review business plan submission to Ofwat.

APS calculates the base cost for each element using the quantities and parent process code entered in the F909. Any costs generated using EES rates are inflated with respect to the Retail Prices Index (RPI). The Inflation Index Date entered in the F909X-Solution sheet in the respective F909 as “The date manual cost inputs are current for” is used by APS to apply inflation to manual override costs.

The F909 worksheet is limited to a single Inflation Index Date for override figures. Inflation Index Dates in the F909s for all elements were set as 4th of February, 2022 as the date of the submission of the WRSE Input Templates. The actual date used on the F909 costing sheet was the date that the Capital cost scoping were entered based on when Supplier quotations were received (e.g. October 2021 for the Reverse Osmosis plant).

2.1.5 Base Date

All costs generated are presented at 20/21 prices. Costs generated using the various water company costing systems can be at different base dates but all costs have been presented at 20/21 for consistency. The deflation factors used for Capex and Opex have been agreed with the ACWG and are based on the figures used by the WRSE modelling team. Figures used are summarised below in Table 2-1. Inflation will require updating for Gate 3 as current inflation is well above the figures predicted.

Table 2-1. Inflation/ Deflation factors

F/Yr.	Capex indices	Capex Factors	Opex indices	Opex Factors
2017/18	275.5	1.1002	104.3	1.0662
2018/19	284.8	1.0645	106.7	1.0417
2019/20	293.7	1.0323	109.0	1.0197
2020/21	303.1	1.0000	111.2	1.0000
2021/22	312.9	0.9688	113.3	0.9811
2022/23	322.3	0.9405	115.6	0.9619

2.1.6 Assumptions

- Costs presented include standardised overheads in line with Thames Water EES cost model across WRMP24 and PR24.
- It is assumed the project can engage and consult on the scheme and proceed without delay.
- Costs based upon procurement being design and built (D&B) self-delivered by Thames Water.
- Land is rented for contractor compounds and agricultural rates apply.
- All permanent structures are located on land that is purchased at agricultural rates and are connected to the network with roads and protected with site fencing and gates.
- 40m easement is adequate and compensation payments included. Land purchase for pipeline route is excluded.
- Average pipe depths with battered excavation unless ground conditions suggest sheet piling will be required.
- Major crossings are tunnelled with launch and reception shafts. Single pipeline average lengths.
- Spend profiles are indicative only to facilitate multi-solution decision making and will be refined at Gate 3.

2.2 Quantitative Costed Risk Assessment

Risk registers for the five components listed in Table 1-1 were prepared, using ACWG template, and Monte Carlo analyses were carried out for Quantitative Cost Risk Assessment (QCRA).

2.2.1 Risk Identification and Scoring

Risk registers in Gate 1 were reviewed and updated for consistency with the other London Effluent Reuse SRO schemes and as per the latest conceptual designs.

Gate 2 risk registers for the 50, 100 and 150 Ml/d AWRP were compared with the ones for treatment plants proposed in the other schemes in the London Effluent Reuse SRO (i.e. Mogden Effluent Reuse, Mogden South Sewer and Teddington DRA), whereas the Gate 2 risk registers for the tunnels were compared with the risk registers of the conveyance tunnels in the Teddington DRA and Mogden Effluent Reuse schemes for consistency for consistency. Where applicable, risk entries were added or combined to ensure consistency throughout schemes and components within the SRO.

Once the draft risk registers had been prepared with the adjustment for consistency among schemes/ components, they were reviewed by the project design team in the process, conveyance, civil, MEICA, planning and environmental design aspects. Then, the risk entries and scores were updated based on the latest conceptual designs and the analysis of regulatory requirements.

The ACWG QCRA worksheet requires entries of "Cost Score" scaled from 1 to 5 depending on the costs expected to be incurred by the individual risk events. The scales are defined as percentages of estimated Base Capex as shown in Table 2-2. "Probability Percentage" of the risk events is also required to be entered in the spreadsheets, and these two parameters are used in the ACWG QCRA with Monte Carlo Simulation to produce the Costed Risk. Specific cost impact ranges expected to be incurred by individual risk events had been allocated to some of the risk entries in WRMP19 without using the percentages of estimated Base Capex in Table 2-2, and these cost ranges were also used for Gate 2 estimates, where applicable.

The Costed Risk is produced for each risk entry based on these three factors: "Cost Score", "Probability Percentage" and "Time Score" as shown in the risk score matrix in Figure 2-1. However, the "Time Score" is not considered in the Monte Carlo QCRA, and the WRMP19 Time Scores were generally used at this time.

Table 2-2. Thames Water ACWG QCRA Risk Assessment - Cost Scoring

Cost Scoring Scale	Cost Incurred by Individual Risk Event
1. Very Low	Less than 1% of estimated Base Capex
2. Low	1 – 2 % of estimated Base Capex
3. Medium	2 – 5 % of estimated Base Capex
4. High	5 – 15 % of estimated Base Capex
5. Very High	15 – 30 % of estimated Base Capex

Risk Criteria					Probability Score				
				Description	Remote	Unlikely	Possible	Likely	Very likely
				Guidance	Event may occur in exceptional circumstances	Event could occur at some time	Event should occur at some time	Event will probably occur in most circumstances	Event is expected to occur in most circumstances
				Probability	1% - 10%	11% - 30%	31% – 50%	51- 70%	71% - 99%
	Description	Cost £	Time months	Scale	1	2	3	4	5
Impacts	Very High	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	5	10	15	20	25
	High	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4	4	8	12	16	20
	Medium	Moderate (2.1-5%) increase in project cost	Moderate (2.1 - 5%) delay to project delivery	3	3	6	9	12	15
	Low	Small (1-2%) effect on project cost	Small (1-2%) effect on project delivery	2	2	4	6	8	10
	Very Low	Minimal (<1%) effect on project cost	Minimal (<1%) effect on project delivery	1	1	2	3	4	5

Figure 2-1. Thames Water ACWG QCRA Risk Scoring Matrix

2.2.2 Risk Mitigation

Risks were assessed in the current, pre-mitigated position as of February 2022 at the time of the risk identification and scoring exercise. Risks should be assessed again in their residual, post-mitigated position as the programme progresses with estimate of any costs associated with the mitigation.

2.2.3 Monte Carlo Analysis

The likelihood of the risk events and the cost ranges estimated to be incurred by the risk events are combined using Monte Carlo simulation.

A uniform distribution using the range shown in Table 2-2 was allocated as a probability distribution of costs incurred by each risk event (e.g. for the Cost Scoring Scale "3 – Medium", a uniform distribution with equal likelihood of an impact between 2 % and 5% of Base Capex costs was assumed). A Bernoulli distribution was used for the likelihood of the risk event, which were entered as "Probability Percentage" in the risk registers. Each of the identified risks were treated as discrete events, and no dependencies between risk events were considered. Each simulation was run with 50,000 iterations with Latin Hypercube sampling, and 50th percentile (P50) of the output distribution was used as the Costed Risk of the component.

2.3 Optimism Bias

Optimism Bias (OB) was derived using ACWG methodology which sets out recommendations for SROs on the common approach to OB assessment.

The Cost Consistency Methodology recommends that the approach to OB should use an associated excel template "Optimism Bias Template" provided for all SROs. The OB Template was developed by Mott MacDonald based on the HM Treasury Green Book and supplementary guidance by the HM Treasury. The OB Template was used to calculate OB percentage rates.

2.3.1 Upper Bound Optimism Bias

The OB Template is designed to determine the Upper Bound Optimism Bias based on the proportion of the Base Capex cost that is considered to be standard civil engineering and the proportion that is considered to be non-standard civil engineering. This step is stipulated as "First Stage" in Section 6.2.1 in the "Cost Consistency Methodology" report. ACWG methodology has been followed in assessing standard vs non-standard civil engineering proportions of the scheme.

At the initial stage of the assessment, the proportions of non-standard and standard civil engineering Base Capex had been determined, examining natures of individual Base Capex items. However, it was requested from ACWG that consistent proportions be used to eliminate subjective judgements and to maintain consistency among the schemes. As per discussion with ACWG, it was assumed that 100% of Base Capex would be "non-standard civil engineering" for all treatment plants and tunnels, whereas in the case of pipelines 75% would be "non-standard civil engineering" and 25% would be "standard civil engineering". The Upper Bound Optimism Bias Percentages shown in Table 2-3 were obtained based on these assumptions, using the Optimism Bias Template.

Table 2-3. Assumed Proportion of Non-Standard and Standard Civil Engineering Capex and Upper Bound Optimism Bias Percentage in Beckton Effluent Reuse

Components	Gate-2/ WRSE Reference	Component type	Proportion of Non-Standard Civil Engineering Capex	Proportion of Standard Civil Engineering Capex	Upper Bound Optimism Bias %
50 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 50	Treatment Plant	100%	0%	66.00%

Components	Gate-2/ WRSE Reference	Component type	Proportion of Non-Standard Civil Engineering Capex	Proportion of Standard Civil Engineering Capex	Upper Bound Optimism Bias %
100 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 100	Treatment Plant	100%	0%	66.00%
150 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 150	Treatment Plant	100%	0%	66.00%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	Tunnel	100%	0%	66.00%
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	Tunnel	100%	0%	66.00%

2.3.2 Confidence Grade Assessment

Subsequently, “Contributory Factors” defined by the HM Treasury Green Book were allocated to “High”, “Medium” and “Low” confidence bands according to the OB Template. This step is stipulated as “Second Stage” in Section 6.2.2 in the “Cost Consistency Methodology” report.

The OB template calculates mitigation factors to lower the Upper Bound OB according to the allocated confidence grades. Weighting of each contributory factor, which is based on the HM Treasury Green Book guidance, is used in the OB Template calculation. The OB Template, then, returns “Adjusted Optimism Bias” as a percentage of Base Capex.

At Gate 1, previous assessment of confidence factors in Thames Water WRMP19 F909s Worksheet (Sheets F910J and F910K) were fully reviewed when allocating the Contributory Factors to the “High”, “Medium” and “Low” confidence bands. Allocation is to be entered from 0 to 1, and a sum of the allocations to “High”, “Medium” and “Low” is to be 1.

As “Third Stage”, it is required to review the confidence grade allocation after Quantitative Costed Risk Assessment (QRCA). The OB confidence grade set out in the second stage should be reassessed against the risk entries in the QRCA, and further scaling-back of the OB should be considered to avoid double-counting, where applicable. In “Cost Consistency Methodology – Technical Note and Methodology Revision 3”, it is also required to record the level of OB at the conclusion of the first, second and third stages.

In February 2021, ACWG carried out a survey of Risk Assessment methodologies and OB template confidence grade assessment by the SROs and issued comments and guidance (9th February 2021 update) to maintain consistency throughout the SROs. The third stage OB percentages were further revised according to the instructions provided by ACWG. Table 2-4 includes the OB percentages adjusted as per ACWG’s guidance as the Final OB%.

For the Gate 2 stage, it was agreed with the ACWG that Optimism Bias final values would be scaled-back to account for design development between Gate 1 and Gate 2 submission, where some OB values would be reduced due to greater certainty in the scope. The “Confidence Grade Criteria” were re-scored by the Project Team to determine the new Adjusted Optimism Bias value at Gate 2.

Table 2-4. Level of Optimism Bias at First, Second and Third Stages[1)] and the Final OB%

Components	Gate-2/ WRSE Reference	Component type	First Stage (Upper Bound OB%)	Second Stage (Adjusted OB% based on WRMP19 Assessment)	Third Stage Gate 1 OB (Adjusted OB% updated after Gate1 QCRA)	Final OB% at Gate 2 (Adjusted as per design development)	Summary of Changes from Second Stage to Third Stage
50 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 50	Treatment Plant	66.00%	50.12%	49.83%	45.28%	Confidence level of “Large Number of Stakeholders”, “Contract Structure”, “Contractor Involvement”, “Design Complexity” and “Political influences” were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
100 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 100	Treatment Plant	66.00%	50.12%	49.83%	45.28%	As above.
150 Ml/d Advanced Water Recycling Plant	TWU_KGV_HI-REU_reuse beckton 150	Treatment Plant	66.00%	50.12%	49.83%	45.28%	As above.
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	Tunnel	66.00%	40.52%	40.72%	36.58%	Confidence level of “Large Number of Stakeholders”, “Contract Structure”, “Contractor Involvement”, “Design Complexity” and “Political influences” were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	Tunnel	66.00%	41.54%	40.10%	35.96%	Confidence level of “Large Number of Stakeholders”, “Contract Structure”, “Contractor Involvement”, “Design Complexity” and “Political influences” were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.

First, Second and Third Stages in Optimism Bias assessment were defined in section 6.2 “Cost Consistency Methodology – Technical Note and Methodology Revision E” (Mott MacDonald, 2022).

2.4 Opex Costing

Operating Expenditures (Opex) were estimated using Thames Water's Asset Planning System (APS). Items required for scheme operation, such as electricity, chemical and employee headcount, had been identified and quantified in conceptual design, and the data was entered in the F909 worksheets.

The Opex items, including types of chemicals and maintenance work, were selected from the Opex cost codes built into the F909 worksheet, and quantity of each item was entered based on requirements in the conceptual design. Then, Opex costs were derived by multiplying the quantity by the default unit rate in APS processing.

These unit rate costs have a price base, so once calculated, the costs were rebased by APS to the price base of September 2022. APS uses Consumer Price Index (CPI) for the majority of the Opex costs, although different indices are used for electricity and employee headcount.

As per the requirements for WRSE, APS outputs for Opex were categorised into fixed and variable expenses for reporting.

2.5 Carbon Estimate Methodology

Carbon estimates were performed through the Thames Water's EES and APS tools in the cost estimating exercise. The EES holds over 6 million embodied carbon values, and each value is held against Thames Water common asset structure. For operational carbon values, specific carbon factors are allocated to individual Opex cost codes per quantity unit rates. As cost data is collected and imported into the system, the carbon is automatically calculated based upon code, volume, size and/or attributes unique to the project.

As per the requirements for WRSE, APS outputs for carbon were categorised into Embodied Carbon and Operational Carbon (variable) for reporting.

Thames Water re-assessed the way operational carbon is reported for the SROs, and operational carbon valued were estimated as Variable Operational Carbon (tCo2e/Ml) in Gate 2 rather than Fixed Operational Carbon (tCo2e/yr) as in Gate 1. The estimated values for Variable Operational Carbon (tCo2e/Ml) are outputs of APS run.

All Operation carbon values estimates were for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times).

The operational carbon values estimates are for the first year of operation, using Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions, which was adopted in the ACWG Cost Consistency Methodology Report. Carbon from electricity was calculated using the year 2031 as the first year of operation, including the carbon reduction at year 2050 and afterwards. The electricity demand is calculated for the scheme using the operation regime of 10 months minimum 25% capacity and 2 months full 100% capacity. The electricity demand is multiplied by electricity emissions factors taken from the Treasury Green Book.

3. Cost and Carbon Estimate Results

3.1 Capex Estimates

The Base Capex, Costed Risk, Optimism Bias and Total Capex (that is, a sum of Base Capex, Costed Risk and Optimism Bias) estimated for the components associated with Beckton Effluent Reuse scheme are as shown in Table 3-1. These estimates were reported to WRSE for its database and financial modelling updates. Detailed breakdowns of the Base Capex are also found in Appendix A to this report.

Table 3-1. London Effluent Reuse SRO, Beckton Effluent Reuse – Capex Estimates

Components	Gate-2/ WRSE Reference	Base Capex (£)	Costed Risk (£)	Optimism Bias (£)	Total Capex (£)
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£101,399,541	£38,246,451	£45,917,008	£185,562,999
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£160,912,451	£67,312,269	£72,866,387	£301,091,107
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£227,846,952	£97,524,771	£103,176,505	£428,548,227
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£227,297,309	£40,496,631	£83,136,832	£350,930,771
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£165,289,136	£36,446,840	£59,431,775	£261,167,751

3.2 Opex Estimates

The fixed and variable Opex estimated for the components associated with Beckton Effluent Reuse scheme are as shown in Table 3-2. These estimates were reported to WRSE for its database and financial modelling updates.

It should be noted that the fixed Opex costs do not include any flow proportional costs. If a minimum flow (i.e. a sweetening flow) is agreed, then the minimum annual Opex cost would be the fixed Opex plus the variable Opex taken at the minimum flow.

All Opex shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). For an assessment of the costs in the minimum and maximum, refer to Section 5.

Table 3-2. London Effluent Reuse SRO, Beckton Effluent Reuse – Opex Estimates

Components	Gate-2/ WRSE Reference	Max Fixed Opex (£/year)	Max Variable Opex (£/Ml)
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£1,998,401	£496
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£2,755,346	£477
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£3,614,510	£533
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£467,535	£13
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£433,603	£19

3.3 Carbon Estimates

The Embodied Carbon, Fixed Operational Carbon and Variable Operational Carbon estimated for the components associated with the Beckton Effluent Reuse scheme are as shown in Table 3-3.

These estimates were reported to WRSE for its database and financial modelling updates. All Operation carbon values shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). The Operational Carbon values include carbon from electricity estimates. The carbon from electricity is calculated as 10 months at min flow 25% and 2 months at max flow 100% to be comparable with other SROs presentation of Cost & Carbon. The carbon from electricity is used in the WRSE investment modelling (IVM) in the following way which ensures carbon is used as an integral part of option selection decision making.

Table 3-3. London Effluent Reuse SRO, Beckton Effluent Reuse – Carbon Estimates

Components	Gate-2/ WRSE Reference	Embodied Carbon (tCO2e)	Operational Carbon – Fixed *including electricity* (tCO2e/year)	Operational Carbon – Variable *excluding electricity* (tCO2e/Ml)	Operational Carbon – Variable *from electricity* (tCO2e/Ml)
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	32713	0.239	0.239	0.14
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	55177	0.247	0.247	0.13
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	70361	0.254	0.254	0.15
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	62230	0	0	0.005
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	46090	0	0	0.003

1. Thames Water aspiration is that by the year 2030 all electricity purchased is to be zero carbon via either a Renewable Energy Guarantee of Origin (REGO) contract or Power Purchase Agreement (PPA).

3.4 Greenhouse Gases Mitigation and Recommendations

A high-level life cycle carbon assessment of greenhouse gas (GHG) emissions for all the London Effluent Reuse SRO schemes has been carried out by a Carbon and Energy Consulting team. The summary below recommends approaches to mitigate embodied and operational GHG emissions, with emissions in tonnes of carbon dioxide equivalent (tCO2e) reported and evaluated. Whilst the carbon from electricity has been included in the carbon values reported above to be consistent with other SROs, Thames Water are committed to achieving carbon net zero by 2030, which is before the water into supply date of this SRO. Therefore this assessment assumed grid emissions to be zero carbon and sought to identify a strategy for reduction of emissions from non-electricity generation sources.

The mass in tonnes of carbon dioxide equivalent (tCO2e) emissions were analysed for the following schemes 1) Beckton Effluent Reuse 2) Mogden Effluent Reuse 3) Mogden South Sewer Reuse 4) Teddington Direct River Abstraction (DRA).

Operational emissions have been identified as the largest single source of emissions across the four schemes. Sources of these emissions include supply chain emissions from chemicals used in dosing, and process emissions from nitrifying filters (in the case of the Teddington DRA TTP). Grid emissions from electricity use are considered in this assessment as zero due to Thames Water's corporate policy to procure 100% of its electricity from renewable sources. The Advanced Water Recycling Plants (AWRPs) contribute the largest proportion of embodied emissions for the Beckton and Mogden Effluent Reuse schemes, while Sewage Treatment Works are the main contributor for the Mogden South Sewer Effluent Reuse scheme.

To maximise alignment with PAS 2080 and the Water UK Net Zero 2030 Routemap, it is recommended for to follow the emissions hierarchy when deciding which approach to prioritise to mitigate emissions. This prioritises in order demand reduction, efficiency gains and renewable energy integration before pursuing offsets to remove residual carbon emissions. Due to the complexity and long lifetime of these schemes, it is important to take a holistic approach to carbon mitigation, which uses a combination of approaches.

A more robust assessment of carbon emissions is advised, firstly to provide a more complete assessment of the emissions associated with each scheme and to include those sources not captured in this report. Secondly a detailed opportunity cost analysis should be conducted to identify which interventions would allow the greatest reduction in emissions for the lowest cost. This report provides a high-level inclusion of the possible range of interventions, but further analysis is required to select those most appropriate for the chosen scheme.

At this design stage, some scope requirements are largely fixed. This will limit the opportunity to completely 'design out' embodied carbon for the schemes. However, there is still sufficient optioneering time to 'design out' some embodied carbon. Embodied emissions represent the majority share of total GHG emissions in the short term - as such, focusing on reducing embodied emissions will likely yield significant reductions across the early stage of a site's operational life. This can be achieved through close engagement with carbon subject matter experts (SMEs) at the design and procurement stages. A focus on 'designing out' carbon can reduce both embodied and operational emissions, in particular for building heating and plant efficiency.

While annual operational emissions are less than those released due to material sources. Over time, across the lifetime of a site operational emissions will contribute more than embodied emissions, therefore reducing operational emissions will achieve the greatest reduction of GHG emissions in the long term. This approach is also line with the Water UK and Thames Water targets of net zero operational carbon by 2030.

Table 3-4 summarises the recommended carbon mitigation approaches, providing a high-level ranking of their potential impact on emissions reduction and alignment with the emissions hierarchy.

Table 3-4. Summary and Ranking of Carbon Emissions Reduction Approaches

Approach to mitigate carbon emissions	Emissions Hierarchy Category	Potential for emissions reduction	Ability for Thames Water to Influence	List of options
Energy management & efficiency (highest priority)	Emissions reduction	High	High	▪ Improved pump efficiency ▪ Metering ▪ Smart control systems ▪ Catchment level analytics
Renewable energy on site	Renewable energy	High	High	▪ Solar ▪ Wind ▪ Storage
Procured Renewable Energy	Renewable energy	High	High	▪ Sleeved PPA ▪ Synthetic PPA ▪ Private Wire PPA ▪ REGO-backed Green Tariffs
Resource Efficiency and Chemical Supply	Emissions reduction	High	Low	▪ Supply chain contracts ▪ Reduced resource use
Embodied emissions reduction	Emissions reduction	Moderate	High	▪ Low carbon concrete ▪ Low carbon steel ▪ Recycled materials ▪ Locally sourced materials
Engineering design	Emissions reduction	Moderate	Moderate	▪ Conveyance routes ▪ Land use ▪ Building size ▪ Building heating
Construction emissions	Emissions reduction	Low	Moderate	▪ Reduced transport ▪ Vehicle energy use ▪ Renewable onsite power ▪ Temporary buildings
Insets	Offset	Low	Moderate	▪ Peatland restoration ▪ Grassland restoration ▪ Tree planting
Offsets (lowest priority)	Offset	Low	High	▪ UK ETS ▪ Voluntary Offset Market

3.5 Key Costed Risks

See below Table 3-5 showing a list of delivery focused key risks with description.

Table 3-5. Delivery focus Key Risks with description

Risk Name	Description
Ecology Risk	There is a risk that additional ecological works are required or cannot be undertaken/finalised within the target season. Additional capex cost and time delay to overall project programme.
Protected Species	1. Protected Species may be found during surveys. Additional protection and/or mitigation measures may need to be carried out prior to works. 2. Protected Species may create habitat during works. Causing programme delays. Noted that badger setts and bat roosts are almost certain.
Material Price Increase	There is a risk that materials incorporating metal / oil / plastics could increase by the time this project goes ahead. Leading to additional CAPEX cost.
Mogden STW Discharge Consent	There is a risk that that the discharge consent for the Mogden STW will need to be amended due to the decrease in FE flow. Additional cost and delay to the programme.
Onsite Energy Generation	There is a risk of the need for 20% onsite renewable energy generation at the reuse plant (as part of the planning requirement due to high energy use RO), when it is used during extreme drought periods. Assume 30% of time per year. Additional capex cost. As this would be known at the planning stage it is assumed that it can be absorbed within the current project / construction programme.
Planning Approval	Planning approvals may require longer than time allowed for in the programme.
Power Distribution	Current power supply capacity may not be sufficient to support the new Reuse Plant (UF, RO, AOP, BAFF). Risk that reinforcement of power supply will be required by DNO. Additional power supply required.
River Thames New Discharge License	There is a risk that there will be a delay with obtaining the treated FE discharge licence for the River Thames. Additional cost and delay to the programme.
Discharge of concentrate from RO	Whilst backwash and microfiltration concentrate can be returned to Beckton WWTW for treatment, RO concentrate produced by the advanced water recycling facility should not be returned to WwTW inlet and will require disposal to discharge. There is a risk that EA licence to discharge concentrate will not be granted for permeate disposal. Alternatives to RO would require consideration at considerable cost and programme impact.
Discharge of wastewaters from WRTW	Wastewaters from microfiltation and chemical cleaning systems from the Reuse plant require disposal at Beckton WwTW. There is a risk that there is insufficient hydraulic and/or process capacity to treat these waste streams. Additional cost to address through further capital upgrade works.
Land Purchase for BNG Offset	Additional land purchase required to meet BNG offset requirements. Insufficient space on existing TW-owned land for this. Requirement for improvements to footpaths around proposed development areas, as part of the construction work. Requirement for improvements to footpaths around proposed development areas, as part of the construction work. Purchase additional land and small delays to programme due to increased negotiations etc.

4. Cost Benchmarking

Unit rate benchmarking has been carried out for this SRO to create bottom-up estimates of the base capital costs of the schemes, with unit rates compared against industry standards and budget quotations from UK Suppliers. Additionally, benchmarking of some elements of the scheme against other water reuse and desalination projects globally has been undertaken at the Gate 2 stage. It is recommended that further, more detailed scheme benchmarking is undertaken at Gate 3 stage following the completion of the WRSE modelling to understand the base case(s) and likely in-combination schemes.

Base Capex for the majority of capex items were estimated using Thames Water's Engineering Estimating System (EES) cost curves. The EES cost curves were derived from over 6,500 projects totalling £12billion in value, which had been implemented within Thames Water's operational regions. The costs derived are benchmarked and validated through Thames Water's Performance Review 2019 (PR19) process with updates since then, which has been agreed as suitable benchmarking for the EES cost curves.

4.1 Unit Rate Benchmarking

The unit cost rate of the four items listed below had been estimated with a "bottom-up" approach at Gate 2, identifying and summing up possible cost items to arrive at the total unit cost rate. The three items below in the Beckton Effluent Reuse scheme were the cost estimates which were not derived from EES cost curves due to either unsuitable cost curves for the non-standard item or more accurate Supplier quotations available. The cost estimates which were not derived from EES cost curves, such as the 3.5m-ID tunnels and some of the process equipment in the Advanced Water Recycling Plant (AWRP), WRMP19 unit rates were used for estimated costs, with verification of costs using the following methods:

1. Benchmarking of tunnel unit-cost rate completed using industry costing data for £ / km unit rate (see Section 4.2).
2. Unit-rate benchmarking for process equipment using current budget quotations from suppliers (see Section 4.3).
3. Unit-rate benchmarking for process equipment where quotations were not available, sensitivity analyses undertaken to assess total cost estimate sensitivity to unit rate changes (see Section 4.2).

Impacts of price differences in these items on Total Capex or Base Capex for 50Ml/d, 100Ml/d and 150Ml/d AWRP (Gate-2 / WRSE References: TWU_KGV_HI-REU_reuse beckton 50, TWU_KGV_HI-REU_reuse beckton 100, and TWU_KGV_HI-REU_reuse beckton 150), Beckton to Lockwood Recycled Water Transfer Tunnel (Gate-2/ WRSE Reference: TWU_KGV_HI-TFR_beckton to lockwood) and Lockwood to KGV Recycled Water Transfer Tunnel (Gate-2/ WRSE Reference: TWU_KGV_HI-TFR_lockwood ps-kgv res) were analysed.

OPEX benchmarking is traditionally a difficult task to undertake due to the differences that can occur in working practices, staffing levels, approach to risk for maintenance activities and regional power costs. At this early stage it is not viewed as practical to carry out detailed Opex benchmarking until the WRSE RPv2 Investment Modelling is carried out and a greater understanding of the configuration of schemes and expected utilisation values is confirmed.

4.2 Tunnels Unit Cost

The unit cost rate (£/kilometre) for the 3.5m-ID tunnels had been estimated with a "bottom-up" approach in WRMP19, identifying and summing up possible cost items to arrive at the total unit cost rate.

The WRMP19 tunnel unit cost rate was used in the Gate 2 cost estimate with inflation adjustments, and the unit cost rate was verified with a "top-down" estimating approach, using data of outturn costs of similar tunnel projects.

In the top-down verification, tunnel cost data in "Infrastructure UK (IUK) Cost Study Tunnels", which was published in October 2010 by the British Tunnelling Society (BTS) and further reported in the "HM Treasury Infrastructure Cost UK – Infrastructure Cost Review: Technical Report (Dec 2010)", was used. This cost study is widely accepted as a basis for estimates of tunnel cost for UK projects. In addition, the data set was augmented by cost data on the same basis from the recently completed Shieldhall Tunnel in Glasgow and tunnel cost from the main Thames Tideway Contracts which are nearing completion of the tunnel works.

The 3.5m-ID tunnel unit costs used in the Gate 2 cost estimate ("bottom-up" cost) was £23.37 million/km, while the benchmark cost ("top-down" cost) was £24.19 million/km. Because it is reasonable to consider that the top-down outturn cost, by definition, includes a large element of Optimism Bias (OB), comparison was made in Total Capex which is a sum of Base Capex, Costed Risk and Optimism Bias.

4.3 Advanced Water Recycling Plant Process Equipment

EES cost curves were either not available or not viewed to be sufficiently accurate for some of the process equipment in the AWRP, as discussed in Section 2.1.2. For these items, estimates made in WRMP19 were used for the Gate 2 cost estimates with adjustments for inflation and revised TWUL overhead costs. The estimated costs for these process assets were verified with quotes from suppliers during WRMP19 stage.

New quotations during the Gate 2 stage were obtained for the Ultraviolet Advanced Oxidation Process (UVAOP) and Reverse Osmosis (RO) systems from suppliers, and benchmarked prices for each item were established with adjustments for overhead costs, civil costs, installation costs and inflation rates. Thames Water's Internal Business Plan (IBP) inflationary factors were used for inflation rate adjustment to maintain consistency, based upon a combination of the relevant RPI, CPIH and CPI (forecast) annual average index. Refer to **Error! Reference source not found.** for further detail.

Supplier's quotes for the Remineralisation System were not available. Therefore, a sensitivity analysis based on the WRMP19 supplier quote was completed to provide some benchmarking for the Remineralisation System. The sensitivity analyses scenarios were assumed to be -50%, -25%, ±0%, +25%, +50% or +100% of the estimated price of the WRMP19 Remineralisation System quote price.

All costs shown for Process equipment are in Base Capex, and they include overhead costs. Costed risk and Optimism Bias are not included in the benchmark figures as they are applicable to both the derived numbers and the benchmark numbers.

Details of benchmark analysis for the AWRP process equipment are found in Figure 4-1.

4.4 Comparison of Estimated Capex Costs and Benchmark Costs

Table 4-1 shows comparison of the Estimated Costs in Gate 2 and Benchmark Costs for the components in the Beckton Effluent Reuse scheme. Cost comparison for the 50Ml/d, 100Ml/d and 150Ml/d AWRP were made in Base Capex, whereas costs for tunnel components were discussed in Total Capex because the tunnel Benchmark Costs were established in a top-down approach, which includes a large element of Optimism Bias.

The percentage difference between the Estimated Costs and Benchmark Costs for the components was up to 16%. These costs will be investigated further in Gate 3.

Table 4-1. Comparison of Estimated Costs and Benchmark Costs

Components	Gate-2/ WRSE Reference	Gate 2 Costs	Benchmark Costs	Percentage Difference	
50Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£101,399,541 (Base Capex)	£96,977,145 - £103,132,641 (Base Capex)	4.46%	-1.69%
100Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£160,912,451 (Base Capex)	£164,847,491 - £177,158,482 (Base Capex)	-2.42%	-9.61%
150Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£227,846,952 (Base Capex)	£250,116,354 - £268,582,841 (Base Capex)	-9.32%	-16.41%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£350,930,771 (Total Capex)	£347,438,975 (Total Capex)	1.00%	
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£261,167,751 (Total Capex)	£249,999,333 (Total Capex)	4.37%	

1. "Estimated Costs" are prices used in Gate 2 cost estimates, typically based on WRMP19 quotations.
2. Prices shown for 50Ml/d, 100Ml/d and 150Ml/d AWRP are Base Capex including overhead costs (not including Costed Risk and Optimum Bias).
3. Prices shown for "Beckton to Lockwood Recycled Water Transfer Tunnel" and "Lockwood to KGV Recycled Water Transfer Tunnel" are Total Capex which is a sum of Base Capex, Costed Risk and Optimism Bias.
4. Supplier's quotes for Remineralisation System were not available. Therefore, benchmark cost for Remineralisation System was assumed to be -50%, -25%, ±0%, +25%, +50% or +100% of the Estimated Price of Remineralisation System.
5. Percentage Difference (%) = $\frac{|\text{Estimated Cost} - \text{Benchmark Cost}|}{(\textit{avarage of } \text{Estimated Cost } \textit{and } \text{Benchmark Cost})} \times 100$
6. Where supplier's quotes were in US$, exchange rate of US$1 = GBP 0.72139 was used.
7. All costs are given in September 2022 Base Cost rates.

4.5 Scheme Benchmarking for AWRP

To provide some additional confidence in the project estimates at this stage, some top-down benchmarking of the treatment Options that make-up the Beckton Effluent Reuse scheme has been completed. While the elements of a raw water bulk transfer (the tunnels) are relatively standard assets for Thames Water (and therefore suitable cost curves are largely accounted for), the top-down benchmarking provides further evidence of accurate cost estimates for the non-standard Advanced Water Recycling Plants by comparing against real-world project data for global treatment plants.

For the benchmarking analysis, seven different advanced water recycling plants that have been constructed in the USA were compared for capital expenditure costs. For confidentiality reasons, the specific site locations and capex values are not included in this report; but the information had been shared with Thames Water for the benchmarking assessment. Seven facilities for water recycling purposes that used the same treatment processes (microfiltration, reverse osmosis membranes and UVAOP) were assessed against the bottom-up cost estimates for the Mogden Effluent Reuse AWRP components. The Capital costs reported for the plants in the USA were compared with the base capex costs from the Gate 2 costing assessment, with a cost per Ml/d taken based on the appropriate plant capacity. An average benchmark unit cost was taken for the seven real-world applications to compare.

The Beckton Effluent Reuse 150 scheme cost appeared to be 5% higher when compared with the average unit cost of real-world plants, while when its capacity decreased to 50 Ml/d then the difference increased to 29% as shown in Table 4-2. Figure 4-1 demonstrates the comparison between the London Effluent Reuse AWRP costs and the real-world applications in the USA. Overall, the cost for London Reuse schemes tends to be at the higher end of the cost scale, which is somewhat expected considering that AWRP's are a non-standard engineering process in the UK. The greater the capacity of the Mogden Effluent Reuse scheme the more cost-effective in comparison to real-world plants.

Table 4-2. Beckton Effluent Reuse Scheme Benchmark Results

	Capacity Ml/d	Benchmark cost (£)	Gate 2 Base Capex (£)	Unit Cost (£ / Ml/d)	Benchmark unit cost - average of all plants (£ / Ml/d)	Percentage Difference
Beckton 50 Ml/d AWRP	50	£71,846,145	£101,399,541	2,027,991	1,436,923	29%
Beckton 100 Ml/d AWRP	100	£143,692,290	£160,912,451	1,609,125	1,436,923	11%
Beckton 150 Ml/d AWRP	150	£215,538,436	£227,846,952	1,518,980	1,436,923	5%

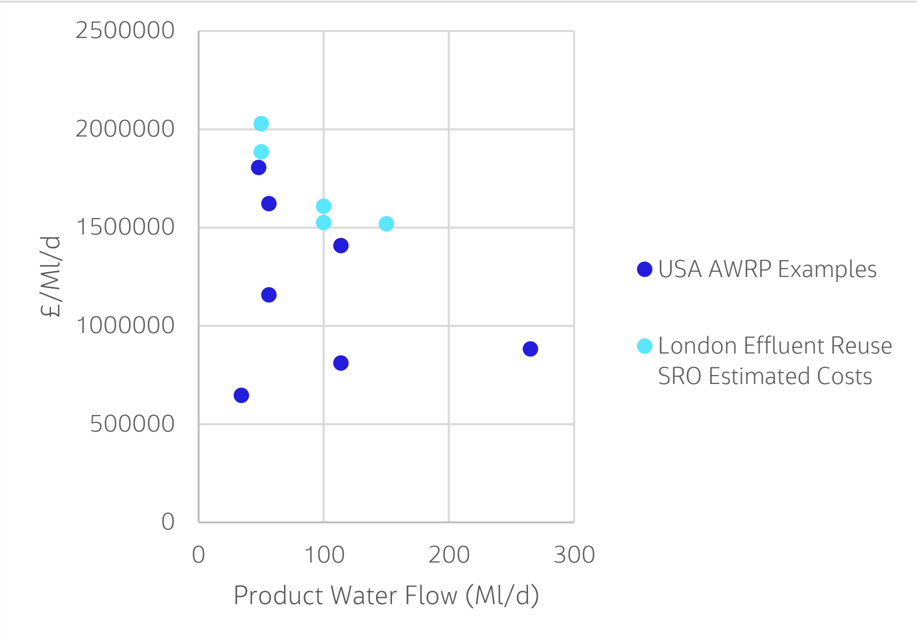


Figure 4-1. Cost Comparison of Capex for AWRP Schemes constructed in USA vs London Effluent Reuse AWRP Estimates

5. Net Present Value (NPV) and Average Incremental Cost (AIC)

Construction Capex and Opex costs have been used to generate the NPV and AIC values for the elements using the Treasury Green book with a declining schedule of discount rates and an 80-year period. The All Company Working Group (ACWG) had agreed with RAPID that for consistency across all SRO's, NPV and AIC costings would be completed via the same methodology for inclusion in the Gate 2 Report for direct comparison with the other schemes and SRO's.

The NPV and AIC values were analysed for the following four configurations (i.e. combinations of components) in the Beckton Effluent Reuse scheme:

- **Beckton Effluent Reuse (50 Ml/d yield):** a combination of the 50Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 50 Ml/d.
- **Beckton Effluent Reuse (100 Ml/d yield):** a combination of the 100Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 100 Ml/d.
- **Beckton Effluent Reuse (150 Ml/d yield):** a combination of the 150Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they conveys up to 150 Ml/d.
- **Beckton Effluent Reuse (300 Ml/d yield):** a combination of 2 phases of the 150Ml/d AWRP component, the Beckton to Lockwood Recycled Water Transfer Tunnel component, and the Lockwood to KGV Recycled Water Transfer Tunnel components. Costs for operations of the tunnel components were calculated, assuming they convey up to 300 Ml/d.

NPV and AIC for each component were calculated for the estimated utilisation level, using "One Scheme AIC RevB Template" prepared by Mott MacDonald in April 2021 as per ACWG review and agreement. Data from the WRSE Input Template "J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO", which holds all costing data for the London Effluent Reuse SRO at Gate 2 and is to be used to populate the WRSE Database with information required for option appraisal, environmental analysis and the investment modeller, was entered into this calculation sheet. The "Profiles" tab of the WRSE Input Template holds all the metrics which build up the various components, including Capex, Opex, Electricity and Carbon. The data in the "Profiles" tab was filtered for elements relevant to a specific component by the WRSE Option ID, and then the full profiles data was copied and pasted directly into the "Input" tab in the One Scheme AIC RevB Template.

The costs for all stages (i.e. Planning, Development and 'Construction & Operation') were included for pasting into the "Input" tab. If modelling a real option, the stages will get reprofiled on the 'AIC calc' tab to ensure the Planning, Development and 'Construction & Operation' are done consecutively.

The inputs required for the calculation were:

- Option reference ID: The WRSE Option ID
- WACC: Weighted Average Cost of Capital used. In the 2019 Final Determination20, Ofwat allowed a real return on capital of 2.92%. The All Company Working Group (ACWG) agreed to applying a WACC of 2.92%, which has therefore been used on all NPV and AIC calculations in this report.
- Operational Year: The year in which Recycled Water is to be first produced following the end of construction stage. This was taken from the WRSE Input Template in the tab "Summary" from column N "Opex Start Year".
- Optimism Bias: As per Final OB% in Table 2-4.

- Deployable Output: A minimum and maximum utilisation was calculated for each configuration. The maximum utilisation was based on the Deployable Output (DO) of the maximum capacity of the configuration continuously for 365 days, 24 hours per day (e.g. Beckton 100Ml/d AWRP component has a DO of 89 Ml/d for the 1 in 500 year average). This value was taken from the WRSE Input Template in the tab "Summary" from column U "DO: 1 in 500 average".
- Minimum Flow: The minimum utilisation was based on the proposed operating mode for each scheme (refer to CDR Section 4.1.1 for detail For the treatment components, the assumption for minimum flow is the plant being used only in "Hot Standby" mode for 12 months of the year at 25% utilisation rate (e.g. in the "Continuous Sweetening Flow Model". Therefore, it was assumed to be 25% of the maximum capacity. For conveyance components, the minimum flow is assumed as 25% of the total treatment plant capacity (even if it is likely that a smaller proportion would be passed fully through the conveyance – e.g. some would be run-to-waste to the source STW).

Then, a profile of the costs of the component over 80 years was computed. The costs were split into capital (including maintenance and replacement costs), operating (both fixed and variable costs) and financing costs. The NPV of all costs was then calculated using the Treasury Test Discount Rate as set out in the HM Treasury "Green Book" (Appraisal and Evaluation in Central Government, HM Treasury 2003). This is 3.5% for years 0-30 of the appraisal period, 3.0% for years 31-75, and 2.5% for years 76-125. The outputs of this analysis are NPV Finance (Capex), NPV Opex, NPV WAFU (Water Available for Use, in m3 for the resource benefit over the 80-year period) and AIC (in p/m3). The outputs were given for both the minimum utilisation scenario and maximum utilisation scenario. Note that the Opex values are input as costs at maximum utilisation taken from the WRSE input template and adjusted by the percentage for minimum utilisation.

To calculate the NPV and AIC for each configuration, which is a combination of treatment component and conveyance component, these values were then summed to provide the results in Table 5-1.

Table 5-1. NPV and AIC for Beckton Effluent Reuse scheme at various configuration sizes (all costs adjusted for 2021/20 Cost Base)

Configuration name	Units	Beckton Effluent Reuse (50Ml/d)	Beckton Effluent Reuse (100Ml/d)	Beckton Effluent Reuse (150Ml/d)	Beckton Effluent Reuse (300Ml/d)
Option benefit	Ml/d	46	89	130	252
Total planning period option benefit (NPV)	Ml	360,157	696,826	1,017,835	1,973,034
Total planning period indicative capital cost of option (CAPEX NPV)	£m	794	942	1,112	1,674
Minimum Flow – based on Hot Standby mode for 12 months of the year					
Total planning period indicative operating cost of option (OPEX NPV)	£m	110	167	241	819
Total planning period indicative option cost (NPV)	£m	815	1,007	1,234	2,323
Average Incremental Cost (AIC)	p/m³	226	144	121	118
Maximum Flow – full capacity for 12 months of the year					
Total planning period indicative operating cost of option (OPEX NPV)	£m	252	433	672	2,341
Total planning period indicative option cost (NPV)	£m	957	1,272	1,665	3,844
Average Incremental Cost (AIC)	p/m³	266	183	164	195
Total Carbon over 80-year period and no discount rate					
Embodied Carbon	tCO2e	32,712	55,176	70,360	249,041

Configuration name	Units	Beckton Effluent Reuse (50Ml/d)	Beckton Effluent Reuse (100Ml/d)	Beckton Effluent Reuse (150Ml/d)	Beckton Effluent Reuse (300Ml/d)
Operational Carbon – Minimum Flow	tCO2e	87,290	180,465	277,986	555,974
Operational Carbon – Max Flow	tCO2e	349,160	721,862	1,111,948	2,223,895

The solution costs detailed have been developed in line with relevant HM Treasury Green Book guidance. All values in Table 5-1 have been adjusted for deflation to 2020/21 cost base for accurate comparison with the Final Determination allowance, using Thames Water's Internal Business Plan (IBP) deflationary factors, based upon a combination of the relevant RPI, CPIH and CPI (forecast) annual average index values. A lifecycle carbon assessment has been carried out here without discount factors, and no adjustment for inflation as per the NPV costs. Carbon values are calculated in Section **Error! Reference source not found.** for maximum utilisation presented at first year of operation using T reasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. In Table 5-1 above, Operational carbon values are assessed over the 80-year period from first year of operation at the minimum and maximum utilisation levels for the specific scheme. Note that Table 5-1 does not include carbon emissions from electricity. Refer to Section **Error! Reference source not found.** for full carbon values.

6. The Journey from Gate 1 to Gate 2

Section 6 lists the changes that took place between Gate 1 to Gate 2, these changes have direct implications on the costs, some changes increase, and some decrease the costs. Section 6 covers CAPEX, OPEX, Optimism Bias, and Costed Risk.

6.1 CAPEX

6.1.1 Reuse treatment plant

Increases in CAPEX:

- Number and kW ratings of all pumps have changed following Gate 2 Hydraulic assessment.
- Land clearance, temp/permanent land, etc have been updated to match Design development.
- Added new buildings to reflect all buildings proposed for the AWRP.
- New sodium bisulphite dosing plant.

Decreases in CAPEX:

- Treated water pumps resized (much smaller) to discharge only to tunnel first shaft. Main recycled water pumps are included in the conveyance F909s.

6.1.2 Thames Lee Tunnel extension conveyance - Lockwood to KGV

Increases in CAPEX:

- Recycled water pumping station moved from Treatment F909 to this conveyance F909 as is no longer needed for other conveyance option (tunnels). Pumps to discharge from final shaft to outfall structures.
- Drainage pumps & valving arrangement added at KGV discharge point to return flows to Lockwood (then Beckton) for WQ failure / drain-down sequence.
- New discharge structure to River Lee Diversion consisting of a concrete tank/chamber for breaking pressure form pumps, a stilling basin with pipes feeding recycled water into the River Lee Diversion and river erosion protection.
- Shaft depths updated for Operational philosophy and drain down direction.
- New pumps installed within the existing Lockwood PS to connect TLT to new extension.

6.1.3 Conveyance from Beckton reuse to Lockwood Res (Tunnel)

Increases in CAPEX:

- Shaft depths updated for Operational philosophy and drain down direction.
- Submersible pumps added to pump out and into Lockwood Secondary Shaft for connection to the TLT extension.
- Pipework and valves added to connect the Lockwood Primary Shaft with the Lockwood Secondary Shaft.
- Drainage pumps added at Beckton STW shaft for draining down the tunnel at shutdown or on WQ failure.
- Added access roads for the shaft locations.

6.2 OPEX

6.2.1 Reuse treatment plant

- Electricity and chemical usage set to a "Percentage at Minimum Output" of 25% of Phased output of 150Ml/d.
- On Solution tab, Minimum flow changed from 0 Ml/d to 37.5 Ml/d (25% for sweetening flow operation). This causes a major increase in Opex.
- Added chemical costs for sodium bisulphite dosing.

- Separated the fixed electricity costs for the AWRP (lighting, building services etc).
- Removed cost for labour for de-commissioning and re-commissioning plant on restart/shutdown. Not relevant for "sweetening flow" operational method.

6.2.2 Thames Lee Tunnel extension conveyance - Lockwood to KGV

- Power costs added for the treated water discharge pumps at KGV shaft.
- Power requirement for Drainage pumps at KGV discharge point added.
- Pumping station kiosk fixed electrical costs added - lighting, building services, etc.
- Electricity set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d.
- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a significant increase in Opex.

6.2.3 Conveyance from Beckton reuse to Lockwood Res (Tunnel)

- Power costs added for the treated water discharge pumps at Lockwood Primary shaft into Lockwood Secondary Shaft (TLT Extension).
- Power requirement for Drainage pumps at Beckton STW shaft added.
- Pumping station kiosk fixed electrical costs added - lighting, building services, etc.
- Electricity set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d.
- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a significant increase in Opex.

6.3 Optimism Bias

6.3.1 Reuse treatment plant

- Poor contractor capabilities: Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Design Complexities: Although design mitigation was not yet in place, risks of Design of UV/AOP, Discharge of concentrate from RO, Discharge of wastewaters from WRTW, Discharge of permeate from Water Reuse Treatment Works, Design of UV/AOP, Biofouling management in treated water pipeline, were added in costed risk. Therefore, increased confidence.
- Environmental impact: Risks of EA license regarding "Discharge of concentrate from RO", "Discharge of wastewater from WRTW" and "Discharge of permeate from Water Reuse Treatment Works" were added to Costed Risk, therefore rated "Medium".
- Large number of stakeholders: Views of stakeholders such as authorities of abstraction and discharge consents and landowners are not obtained.
- Poor project intelligence: Process design to date has relied on preliminary calculation and RO projections with available dataset from 2015 - 2019. Lack of data and accuracy of data, combined with lack of information about acceptability of permeate and concentrate disposal routes give rise to uncertainties that alternative treatment stages/operational costs may be incurred as design progresses.
- Site characteristics: Reduced because site studies (such as archaeology and heritage assets) were carried out.

6.3.2 Thames Lee Tunnel extension conveyance - Lockwood to KGV

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Government guidelines: At this stage a contract structure has not been defined and may involve DPC. However, as TW has extensive experience of tunnel construction in London, rated at Medium: Low = 0.5:0.5. Amended to Low from OB Consistency Guidelines 19th Feb 2021.
- Design Complexities: Design is inherently complex as a nature of large diameter tunnel projects. Design mitigations are not yet in place. A risk due to condition of existing tunnel at the tie-in location was added to costed risk.

6.3.3 Conveyance from Beckton reuse to Lockwood Res (Tunnel)

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Government guidelines: At this stage a contract structure has not been defined and may involve DPC. However, as TW has extensive experience of tunnel construction in London, rated at Medium: Low = 0.5:0.5. Amended to Low from OB Consistency Guidelines 19th Feb 2021.
- Design complexity: Design is inherently complex as a nature of large diameter tunnel projects. Design mitigations are not yet in place.
- Environmental impact: No significant environmental issues when completed. Environmental impacts during construction, including waste disposal, will need to be addressed. Costed risks have been identified for "noise and vibration", "Disposal of Spoil", "Ecology Risk", "Protected Species" and "Contaminated Land". However, there has been no consultation at this stage with local authorities or local communities and confidence around the extent of environmental challenge and associated mitigation cannot be assessed as "High". Because of length of tunnel and the number of shafts, 0.8: 0.2.

6.4 Costed Risk

6.4.1 Reuse treatment plant

- Minor decrease due to reduction in scoring of certain assets following further design development.
- Lower risk cost for insufficient land due to smaller phased size. Noted that a risk of multiple phases in combination could increase this risk (e.g., 4No. 50 Ml/d plants would require significantly more land than 2No. 100 Ml/d plants).

6.4.2 Thames Lee Tunnel extension conveyance - Lockwood to KGV

- Increased risk items added due to the site constraints at the Lockwood area and King George V reservoirs - limited space with multiple below ground assets and overhead pylons / cables.
- Increased risk probabilities for environmental / ecological issues following site assessments and walkovers - e.g., migratory birds, historic landfill / contaminated land, etc.

6.4.3 Conveyance from Beckton reuse to Lockwood Res (Tunnel)

- Insurance costs for tunnelling next to HS1 Tunnel and BT Comms Tunnel (East London).
- Increased risk items added due to the site constraints at the Lockwood area and King George V reservoirs - limited space with multiple below ground assets and overhead pylons / cables.
- Increased risk probabilities for environmental / ecological issues following site assessments and walkovers - e.g., migratory birds, historic landfill / contaminated land, etc.

6.5 Changes from WRSE draft regional plan submission

No changes in cost values have been made since the WRSE submission in February 2022. Deployable Output, Project scope, QRCA & Optimism Bias, Opex & Capes are all the same.

Carbon from electricity was not included in WRSE template, but it was finally included in WRSE modelling.

7. Glossary

Acronym	Definition
ACWG	All Company Working Group
AIC	Average Incremental Cost
AMP	Asse Management Plan
AOP	Advanced Oxidation Process
APS	Asset Planning System
AWRP	Advanced Water Recycling Plant
Base Capex	Base Capital Expenditure
Capex	Capital Expenditure
CDR	Conceptual Design Report
CPES	Conceptual & Parametric Engineering System
CPI	Consumer Price Index
CPIH	Consumer Price Index Including Owner Occupiers' Housing Costs
DO	Deployable Output
DRA	Direct River Abstraction
EES	Engineering Estimating System
ID	Internal Diameter
KGV	King George V Reservoir
Ml/d	Mega litres per day
NPV	Net Present Value
OB	Optimism Bias
Opex	Operating Expenditure
PR	Price Review
QCRA	Quantitative Costed Risk Assessment
RAPID	Regulators' Alliance for Progressing Infrastructure Development
RO	Reverse Osmosis
RPI	Retail Prices Index
SRO	Strategic Regional Water Resource Option
STW	Sewage Treatment Works
Thames Water	Thames Water Utilities Limited
TLT	Thames Lee Tunnel
Total Capex	Total Capital Expenditure
UF	Ultrafiltration
WAFU	Water Available for Use
WRMP	Water Resource Management Plan
WRSE	Water Resources South East
WTW	Water Treatment Works
WACC	Weighted Average Cost of Capital

Appendix A. Cost and Carbon Estimates

Gate 1 & 2 Capex Costs Summary - from WRSE Input Templates (Gate 1 - 20210322; Gate 2 - 20220104)

Noted the Gate 2 values are in Cost Base 2020/21 as per APS Outputs. Percentage changes use deflationary factor

Cost Price Base: 2020/21

Components	Gate-2/ WRSE Reference	Gate 1 Base Capex (£)	Gate 2 Base Capex (£)	% Difference	Gate 1 Costed Risk (£)	Gate 2 Costed Risk (£)	% Difference
Beckton Effluent Reuse							
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£98,432,883	£101,399,541	3%	£46,978,341	£38,246,451	-19%
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£168,589,133	£160,912,451	-5%	£75,294,275	£67,312,269	-11%
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£244,323,339	£227,846,952	-7%	£113,830,440	£97,524,771	-14%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£220,873,390	£227,297,309	3%	£26,006,940	£40,496,631	56%
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£155,926,049	£165,289,136	6%	£23,920,938	£36,446,840	52%

Components	Gate-2/ WRSE Reference	Gate 1 Optimism Bias (£)	Gate 2 Optimism Bias (£)	% Difference	Gate 1 Total Capex (£)	Gate 2 Total Capex (£)	% Difference
Beckton Effluent Reuse							
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£49,046,153	£45,917,008	-6%	£194,457,377	£185,562,999	-5%
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£84,002,907	£72,866,387	-13%	£327,886,314	£301,091,107	-8%
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£121,738,990	£103,176,505	-15%	£479,892,769	£428,548,227	-11%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£89,939,644	£83,136,832	-8%	£336,819,975	£350,930,771	4%
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£62,526,346	£59,431,775	-5%	£242,373,333	£261,167,751	8%

Components	Gate-2/ WRSE Reference	Gate 1 Max Fixed Opex (£)	Gate 2 Max Fixed Opex (£ /yr)	% Difference	Gate 1 Max Variable Opex (£/ML)	Gate 2 Max Variable Opex (£/ML)	% Difference
Beckton Effluent Reuse							
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	£1,560,709	£1,998,401	28%	£341	£496	45%
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	£2,542,832	£2,755,346	8%	£353	£477	35%
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	£3,260,688	£3,614,510	11%	£362	£533	47%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	£380,797	£467,535	23%	£0	£13	n/a
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	£580,823	£433,603	-25%	£16	£19	17%

Components	Gate-2/ WRSE Reference	Gate 1 Total Embodied Carbon (tCO2e)	Gate 2 Total Embodied Carbon (tCO2e)	% Difference	Gate 1 Max Fixed Operational Carbon (tCO2e/yr.)	Gate 2 Max Fixed Operational Carbon *Including Electricity* (tCO2e/yr.)	% Difference
Beckton Effluent Reuse							
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	27461.88	32712.82	19%	159.9704	46.85	-71%
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	47615.21	55176.47	16%	319.9416	29.05	-91%
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	59183.57	70360.84	19%	479.9132	0.00	-100%
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	97326.71	62229.82	-36%	0	6.55	n/a
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	68600.25	46089.87	-33%	0	32.14	n/a

Components	Gate-2/ WRSE Reference	Gate 2 Variable Operational Carbon *Excluding Electricity* (tCO2e/Ml)	Gate 2 Variable Operational Carbon *From Electricity* (tCO2e/Ml)	Gate 2 Variable Operational Carbon *Total* (tCO2e/yr.)
Beckton Effluent Reuse				
50 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 50	0.239151281	0.14	5,315
100 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 100	0.247213175	0.13	6,271
150 Ml/d AWRP	TWU_KGV_HI-REU_reuse beckton 150	0.253869336	0.15	16,836
Beckton to Lockwood Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_beckton to lockwood	0	0.005	114
Lockwood to KGV Recycled Water Transfer Tunnel	TWU_KGV_HI-TFR_lockwood ps-kgv res	0	0.003	90
100Ml/d Alternative Recycled Water Transfer Pipeline	TWU_KGV_HI-TFR_KGV_ALL_bectontokgv100	0	0	

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

Table 9a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Capex			Total							76.3637	76.3637	76.3637	76.3637	76.3637	56.0838	56.0838	0	0	0	0	0	0	0	0	0	8.71722	0	0	0	0	0	0	0	0	0	72.54	0	0	0	0	0	0	0	0	0	9.23314	0	0	0	0	0	0	0	0	0	72.54	0	0	0	0	0	0	0	0	0	10.9328	0	0	0	0	0	0	0	0	0	98.2345	0	0	0	0	0	0	0	0	0	8.71722	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	11.7394	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496	11.7496
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Financing Cost			Total							1.813	5.439	9.06501	12.691	16.317	19.4221	22.0064	34.3052	33.9791	33.6529	33.3268	33.0006	32.6745	32.3483	32.0221	31.696	31.5457	31.3954	31.0693	30.7431	30.417	30.0908	29.7646	29.4385	29.1123	28.7862	29.9237	31.0612	30.7351	30.4089	30.0828	29.7566	29.4304	29.1043	28.7781	28.452	28.3121	28.1722	27.8461	27.5199	27.1938	26.8676	26.5414	26.2153	25.8891	25.563	26.7005	27.838	27.5119	27.1857	26.8596	26.5334	26.2072	25.8811	25.5549	25.2288	25.1232	25.0176	24.6915	24.3653	24.0392	23.713	23.3868	23.0607	22.7345	22.4084	24.0643	25.7203	25.3942	25.068	24.7419	24.4157	24.0895	23.7634	23.4372	23.1111	22.9608	22.8105	22.4844	22.1582
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Capex	Costed Risk		Total							18.6412	18.6412	18.6412	18.6412	18.6412	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Capex	Optimism Bias		Total							29.1733	29.1733	29.1733	29.1733	29.1733	21.4257	21.4257	0	0	0	0	0	0	0	0	0	3.33025	0	0	0	0	0	0	0	0	0	27.7125	0	0	0	0	0	0	0	0	0	3.52735	0	0	0	0	0	0	0	0	0	27.7125	0	0	0	0	0	0	0	0	0	4.17667	0	0	0	0	0	0	0	0	0	37.5286	0	0	0	0	0	0	0	0	0	3.33025	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Net Present Cost (NPC)			Total							1.75169	5.07737	8.17612	11.0595	13.7385	15.7999	17.2968	34.9668	33.5525	32.1867	30.8749	29.6149	28.4049	27.2429	26.1269	25.0553	24.1243	23.2276	22.2725	21.3554	20.4749	19.6294	18.8178	18.0386	17.2906	16.5725	16.4615	16.3389	15.6661	15.0202	14.4699	13.9389	13.4265	12.9322	12.4553	11.9952	11.6053	11.228	10.8119	10.4105	10.0234	9.64992	9.28972	8.94232	8.60728	8.28417	8.28808	8.28474	7.97717	7.68048	7.39431	7.1183	6.85209	6.59535	6.34776	6.10899	5.91412	5.72543	5.50936	5.30102	5.10014	4.90647	4.71975	4.53974	4.36622	4.19896	4.27429	4.34168	4.17853	4.0212	3.8695	3.72321	3.58217	3.44618	3.31508	3.20425	3.11262	3.02356	2.92197	2.82354
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Total NPC			Total	957.05311																																																																																					

Table 9b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options >£100m (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	2.88936	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954	2.89954
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005	8.85005
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Land (Non depreciating)			Fixed							9.01777	9.01777	9.01777	9.01777	9.01777	4.90185	4.90185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Planning and Development (Non-depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Computers and Data Loggers (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Fencing (10)		10	Fixed							0.14234	0.14234	0.14234	0.14234	0.14234	0.0279	0.0279	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0	0	0	0	0	0	0	0.76751	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							2.04108	2.04108	2.04108	2.04108	2.04108	0.53727	0.53727	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0	0	0	0	0	0	0	11.28	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							16.8479	16.8479	16.8479	16.8479	16.8479	1.98271	1.98271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88.2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88.2051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88.2051	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0.14261	0.14261	0.14261	0.14261	0.14261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71303	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							0.61241	0.61241	0.61241	0.61241	0.61241	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.06203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							6.23368	6.23368	6.23368	6.23368	6.23368	1.34156	1.34156	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33.8515	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0.17358	0.17358	0.17358	0.17358	0.17358	0.03909	0.03909	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.94609	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Headworks/Valves (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Underwater Assets (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Pipelines (100)		100	Fixed							6.55258	6.55258	6.55258	6.55258	6.55258	4.90614	4.90614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Tunnels (100)		100	Fixed							63.773	63.773	63.773	63.773	63.773	63.773	63.773	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 50 p2	Beckton scheme (50Ml/d yield)	Costed Risk			Fixed							18.6412	18.6412	18.6412	18.6412	18.6412	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

1

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Capex			Total							88.2663	88.2663	88.2663	88.2663	88.2663	56.0838	56.0838	0	0	0	0	0	0	0	0	0	10.7542	0	0	0	0	0	0	0	0	0	111.256	0	0	0	0	0	0	0	0	0	11.2702	0	0	0	0	0	0	0	0	0	111.256	0	0	0	0	0	0	0	0	0	13.248	0	0	0	0	0	0	0	0	0	146.401	0	0	0	0	0	0	0	0	0	10.7542	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	20.1637	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739	20.1739
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Financing Cost			Total							2.14785	6.44355	10.7393	15.035	19.3307	22.7769	25.3736	40.7899	40.3715	39.9532	39.5348	39.1165	38.6981	38.2798	37.8614	37.443	37.2429	37.0427	36.6244	36.206	35.7877	35.3693	34.951	34.5326	34.1143	33.6959	35.5348	37.3737	36.9553	36.537	36.1186	35.7003	35.2819	34.8636	34.4452	34.0269	33.8372	33.6475	33.2291	32.8108	32.3924	31.9741	31.5557	31.1374	30.719	30.3007	32.1396	33.9785	33.5601	33.1418	32.7234	32.3051	31.8867	31.4684	31.05	30.6317	30.4821	30.3325	29.9142	29.4958	29.0775	28.6591	28.2408	27.8224	27.4041	26.9857	29.5376	32.0896	31.6712	31.2529	30.8345	30.4162	29.9978	29.5795	29.1611	28.7428	28.5426	28.3424	27.9241	27.5057
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Capex	Costed Risk		Total							24.4544	24.4544	24.4544	24.4544	24.4544	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Capex	Optimism Bias		Total							34.3924	34.3924	34.3924	34.3924	34.3924	21.8527	21.8527	0	0	0	0	0	0	0	0	0	4.19031	0	0	0	0	0	0	0	0	0	43.3501	0	0	0	0	0	0	0	0	0	4.39134	0	0	0	0	0	0	0	0	0	43.3501	0	0	0	0	0	0	0	0	0	5.16199	0	0	0	0	0	0	0	0	0	57.0441	0	0	0	0	0	0	0	0	0	4.19031	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Net Present Cost (NPC)			Total							2.07522	6.01512	9.68619	13.1021	16.2759	18.529	19.9434	46.2889	44.4241	42.6252	40.8972	39.2374	37.643	36.1116	34.6407	33.228	31.9929	30.8032	29.544	28.3346	27.1733	26.0581	24.9873	23.9591	22.9719	22.024	22.0056	21.9633	21.0663	20.2049	19.4717	18.764	18.0811	17.4221	16.786	16.1723	15.6463	15.1372	14.5821	14.0465	13.5297	13.0311	12.55	12.086	11.6383	11.2064	11.2764	11.3328	10.9177	10.5172	10.1307	9.75789	9.39816	9.0511	8.71629	8.39331	8.12485	7.86491	7.57259	7.29062	7.01866	6.75635	6.50337	6.25939	6.02411	5.79722	5.93294	6.05583	5.83238	5.61681	5.40886	5.20825	5.01474	4.82808	4.64804	4.49622	4.36861	4.24454	4.10531	3.97035
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Total NPC			Total	1272.3972																																																																																						

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options >£100m (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	3.64631	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648	3.65648
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174	16.5174
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Land (Non depreciating)			Fixed							11.3924	11.3924	11.3924	11.3924	11.3924	4.92885	4.92885	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Planning and Development (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Process-Related Carbon Media Including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Computers and Data Logging (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Fencing (10)		10	Fixed							0.16839	0.16839	0.16839	0.16839	0.16839	0.02805	0.02805	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0	0	0	0	0	0	0	0.89806	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							2.59321	2.59321	2.59321	2.59321	2.59321	0.54023	0.54023	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0	0	0	0	0	0	0	14.0465	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							27.1348	27.1348	27.1348	27.1348	27.1348	1.99363	1.99363	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139.661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139.661	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139.661	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0.14339	0.14339	0.14339	0.14339	0.14339	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71696	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.71696	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							0.69308	0.69308	0.69308	0.69308	0.69308	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.46542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							8.89453	8.89453	8.89453	8.89453	8.89453	1.34895	1.34895	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47.1706	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0.17454	0.17454	0.17454	0.17454	0.17454	0.03931	0.03931	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.9513	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Headworks/Valves (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Underwater Assets (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Pipelines (100)		100	Fixed							7.33997	7.33997	7.33997	7.33997	7.33997	4.93317	4.93317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Tunnels (100)		100	Fixed							64.1243	64.1243	64.1243	64.1243	64.1243	64.1243	64.1243	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 100 p2	Beckton scheme (100Ml/d yield)	Costed Risk			Fixed							24.4544	24.4544	24.4544	24.4544	24.4544	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

1

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48
Complete for all options (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Capex			Total							101.653	101.653	101.653	101.653	101.653	56.0838	56.0838	0	0	0	0	0	0	0	0	0	13.0441	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Opex			Total							0	0	0	0	0	0	0	31.301	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Financing Cost			Total							2.51779	7.55338	12.589	17.6245	22.6601	26.4819	29.0897	48.2549	47.7257	47.1964	46.6671	46.1378	45.6085	45.0793	44.55	44.0207	43.7574	43.4941	42.9648	42.4355	41.9062	41.377	40.8477
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Capex	Costed Risk		Total							30.4969	30.4969	30.4969	30.4969	30.4969	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Capex	Optimism Bias		Total							40.3015	40.3015	40.3015	40.3015	40.3015	22.235	22.235	0	0	0	0	0	0	0	0	0	5.17149	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Net Present Cost (NPC)			Total							2.43265	7.05116	11.3545	15.3588	19.0792	21.543	22.8643	60.4157	57.9918	55.6555	53.4109	51.2545	49.1828	47.1926	45.2808	43.4444	41.8285	40.2722	38.6351	37.0626	35.5523	34.1017	32.7086
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Total NPC			Total	1665.3683																												

Cost Metric (£m)	Cost Sub-metric (£m)	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77
Capex		0	0	0	158.82	0	0	0	0	0	0	0	0	0	13.5601	0	0	0	0	0	0	0	0	0	158.82	0	0	0	0	0
Opex		31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112
Financing Cost		40.3184	39.7891	39.2599	41.9687	44.6775	44.1482	43.6189	43.0896	42.5604	42.0311	41.5018	40.9725	40.4433	40.1904	39.9376	39.4084	38.8791	38.3498	37.8205	37.2913	36.762	36.2327	35.7034	38.4122	41.121	40.5918	40.0625	39.5332	39.0039
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor		0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	62.966	0	0	0	0	0	0	0	0	0	5.37603	0	0	0	0	0	0	0	0	0	62.966	0	0	0	0	0
Net Present Cost (NPC)		31.3707	30.0859	28.8521	28.9464	29.0014	27.8255	26.696	25.7354	24.808	23.9129	23.0489	22.2149	21.4099	20.7131	20.0387	19.3105	18.6078	17.9296	17.2751	16.6435	16.0341	15.446	14.8787	15.0292	15.1583	14.6093	14.0794	13.5679	13.0743
Total NPC																														

Cost Metric (£m)	Cost Sub-metric (£m)	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		0	0	0	0	15.8201	0	0	0	0	0	0	0	0	0	202.969	0	0	0	0	0	0	0	0	0	13.0441	0	0	0
Opex		31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112	31.3112
Financing Cost		38.4747	37.9454	37.4161	36.8868	36.6801	36.4734	35.9441	35.4148	34.8855	34.3563	33.827	33.2977	32.7684	32.2392	35.8481	39.457	38.9277	38.3984	37.8692	37.3399	36.8106	36.2813	35.7521	35.2228	34.9595	34.6961	34.1669	33.6376
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor		0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	6.27204	0	0	0	0	0	0	0	0	0	80.4691	0	0	0	0	0	0	0	0	0	5.17149	0	0	0
Net Present Cost (NPC)		12.598	12.1383	11.6947	11.2666	10.9053	10.5555	10.168	9.79418	9.43349	9.08549	8.74977	8.4259	8.11347	7.81209	8.01527	8.19999	7.90161	7.61366	7.33578	7.06763	6.80887	6.55919	6.31828	6.11553	5.94276	5.77477	5.58875	5.40837
Total NPC																													

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48
Complete for all options >£100m (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Land (Non depreciating)			Fixed							13.8634	13.8634	13.8634	13.8634	13.8634	4.95303	4.95303	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Planning and Development (Non-depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Process-Related Carbon Media including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Computers and Data Loggers (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Fencing (10)		10	Fixed							0.1946	0.1946	0.1946	0.1946	0.1946	0.02616	0.02616	0	0	0	0	0	0	0	0	0	1.0294	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							3.22009	3.22009	3.22009	3.22009	3.22009	0.04286	0.04286	0	0	0	0	0	0	0	0	0	17.1862	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							39.9126	39.9126	39.9126	39.9126	39.9126	2.00341	2.00341	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0.14409	0.14409	0.14409	0.14409	0.14409	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Brick/Concrete Office Structures (50)		50	Fixed							0.7753	0.7753	0.7753	0.7753	0.7753	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							11.4526	11.4526	11.4526	11.4526	11.4526	1.35557	1.35557	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Roads and Car Parks (60)		60	Fixed							0.17539	0.17539	0.17539	0.17539	0.17539	0.0586	0.0586	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Headworks/Valves (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Underwater Assets (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Pipelines (100)		100	Fixed							7.97726	7.97726	7.97726	7.97726	7.97726	4.95731	4.95731	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Tunnels (100)		100	Fixed							64.4366	64.4366	64.4366	64.4366	64.4366	64.4366	64.4366	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 150 p2	Beckton scheme (150Mld yield)	Costed Risk			Fixed							30.4969	30.4969	30.4969	30.4969	30.4969	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Cost Sub-metric (£m)	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77
Opex	Cost	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565
Opex	Cost	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956
Land (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non-depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Loggers (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)		0	0	0	1.0294	0	0	0	0	0	0	0	0	0	1.0294	0	0	0	0	0	0	0	0	0	1.0294	0	0	0	0	0
Domestic Meters (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)		0	0	0	17.1862	0	0	0	0	0	0	0	0	0	17.1862	0	0	0	0	0	0	0	0	0	17.1862	0	0	0	0	0
Plant and Machinery (15)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		0	0	0	203.571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	203.571	0	0	0	0	0
Raw Water and District Meters (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0.72047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Cost Sub-metric (£m)	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Cost	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565	4.51565
Opex	Cost	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956	26.7956
Land (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non-depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Loggers (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)		0	0	0	0	1.0294	0	0	0	0	0	0	0	0	0	1.0294	0	0	0	0	0	0	0	0	0	1.0294	0	0	0
Domestic Meters (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)		0	0	0	0	17.1862	0	0	0	0	0	0	0	0	0	17.1862	0	0	0	0	0	0	0	0	0	17.1862	0	0	0
Plant and Machinery (15)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	203.571	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.72047	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)		0	0	0	0	3.87651	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	59.975	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.95596	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company		Version			Back to title page

1

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Table 5a: WC Level - Option Level Cost Profile Table																																																																																														
Complete for all options (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Capex			Total							147.223	147.223	147.223	147.223	147.223	56.0838	56.0838	0	0	0	0	0	0	0	0	0	23.2257	0	0	0	0	0	0	0	0	0	304.736	0	0	0	0	0	0	0	0	0	24.2575	0	0	0	0	0	0	0	0	0	304.736	0	0	0	0	0	0	0	0	0	28.7776	0	0	0	0	0	0	0	0	0	386.04	0	0	0	0	0	0	0	0	0	23.2257	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	109.101	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112	109.112
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Financing Cost			Total							3.76419	11.2926	18.821	26.3494	33.8777	38.9583	41.5909	72.9197	72.0303	71.141	70.2516	69.3623	68.4729	67.5836	66.6942	65.8049	65.3942	64.9835	64.0942	63.2048	62.3155	61.4262	60.5368	59.6475	58.7581	57.8688	63.2598	68.6509	67.7616	66.8722	65.9829	65.0935	64.2042	63.3148	62.4255	61.5361	61.1467	60.7573	59.868	58.9786	58.0893	57.1999	56.3106	55.4212	54.5319	53.6426	59.0336	64.4247	63.5354	62.646	61.7567	60.8673	59.978	59.0886	58.1993	57.3099	57.0137	56.7174	55.8281	54.9387	54.0494	53.16	52.2707	51.3813	50.492	49.6026	56.6693	63.736	62.8467	61.9573	61.068	60.1787	59.2893	58.4	57.5106	56.6213	56.2106	55.7999	54.9106	54.0212
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Capex	Costed Risk		Total							50.0018	50.0018	50.0018	50.0018	50.0018	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Capex	Optimism Bias		Total							60.5971	60.5971	60.5971	60.5971	60.5971	23.0842	23.0842	0	0	0	0	0	0	0	0	0	9.55974	0	0	0	0	0	0	0	0	0	125.43	0	0	0	0	0	0	0	0	0	9.98446	0	0	0	0	0	0	0	0	0	125.43	0	0	0	0	0	0	0	0	0	11.8449	0	0	0	0	0	0	0	0	0	158.895	0	0	0	0	0	0	0	0	0	9.55974	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Net Present Cost (NPC)			Total							3.6369	10.5417	16.9754	22.9619	28.5242	31.6926	32.6901	138.229	132.909	127.784	122.854	118.111	113.548	109.159	104.937	100.875	97.2353	93.726	90.094	86.6004	83.24	80.0079	76.8992	73.9092	71.0336	68.2679	68.0888	67.8438	65.2216	62.6992	60.5654	58.5027	56.5088	54.5814	52.7183	50.9175	49.3216	47.7755	46.1412	44.5615	43.0347	41.559	40.1328	38.7544	37.4222	36.1348	36.2444	36.317	35.0785	33.8814	32.7242	31.6057	30.5246	29.4797	28.4697	27.4936	26.6453	25.8231	24.9365	24.0796	23.2515	22.4513	21.6779	20.9305	20.2083	19.5104	19.7855	20.028	19.3446	18.6841	18.0456	17.4284	16.8319	16.2554	15.6981	15.2335	14.8251	14.4276	13.9998	13.5843
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Total NPC			Total	3844.4336																																																																																						

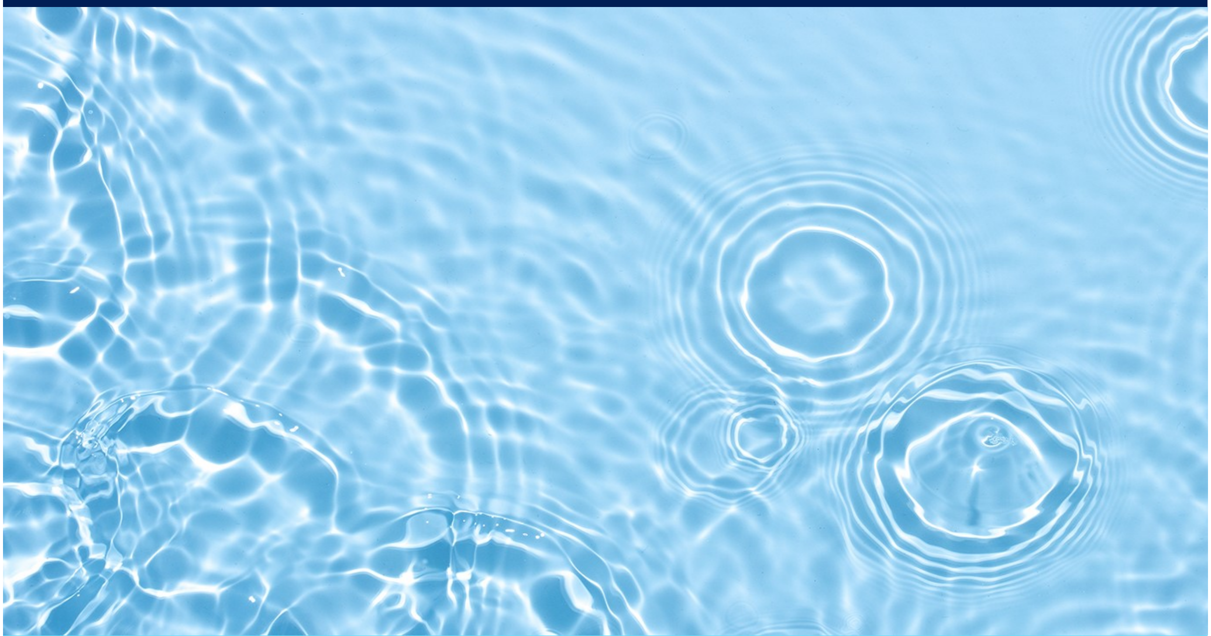
Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Table 5b: WC Level - Option Level Unit Cost Profile Table																																																																																														
Complete for all options >£100m (Feasible and preferred)	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	8.11998	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016	8.13016
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981	100.981
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Land (Non depreciating)			Fixed							22.6164	22.6164	22.6164	22.6164	22.6164	5.00673	5.00673	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Planning and Development (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Process-Related Carbon Media Including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Computers and Data Logging (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Fencing (10)		10	Fixed							0.36493	0.36493	0.36493	0.36493	0.36493	0.0285	0.0285	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0	0	0	0	0	0	0	1.88165	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							5.96125	5.96125	5.96125	5.96125	5.96125	0.54876	0.54876	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0	0	0	0	0	0	0	30.9038	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							78.666	78.666	78.666	78.666	78.666	2.02513	2.02513	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	397.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	397.38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	397.38	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0.29131	0.29131	0.29131	0.29131	0.29131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.45657	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.45657	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							1.56742	1.56742	1.56742	1.56742	1.56742	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.83708	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							21.7836	21.7836	21.7836	21.7836	21.7836	1.37026	1.37026	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111.659	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0.31466	0.31466	0.31466	0.31466	0.31466	0.03993	0.03993	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.65316	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Headworks/Valves (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Underwater Assets (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Pipelines (100)		100	Fixed							11.1165	11.1165	11.1165	11.1165	11.1165	5.01112	5.01112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Tunnels (100)		100	Fixed							65.1375	65.1375	65.1375	65.1375	65.1375	65.1375	65.1375	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_KGV_HI-REU_RE2_ALL_reuse beckton 300 p2	Beckton scheme (300Ml/d yield)	Costed Risk			Fixed							50.0018	50.0018	50.0018	50.0018	50.0018	10.9919	10.9919	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Annex A5: Mogden Cost and Carbon Report

Document no: J698-MR-DOC-220009-0B
Revision no: 0B

Thames Water Utilities Ltd
J698

London Recycling Schemes
25 October 2022



Annex A5: Mogden Cost and Carbon Report

Client name:	Thames Water Utilities Ltd		
Project name:	London Recycling Schemes		
Client reference:	J698	**Project no:**	B22849AP
Document no:	J698-MR-DOC-220009-0B		
Date:	25 October 2022		

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Contents

Appendices

Table of Tables

Table of Figures

Executive Summary

This report demonstrates the basis, methodologies and results of cost and carbon estimates for the Mogden Effluent Reuse scheme. This scheme is one of the four schemes in the London Effluent Reuse Strategic Regional Water Resource Option (London Effluent Reuse SRO). The scheme will treat final effluent from Mogden STW in a new Advanced Water Recycling Plant (AWRP) to be constructed on a site close to Kempton Water Treatment Works (WTW) and will transfer the Recycled Water to the River Thames, approximately 2km upstream of the existing Thames Water Walton WTW intake.

Base Capital Expenditures (Base Capex) and Operating Expenditures (Opex) for the scheme were estimated using Thames Water's Asset Planning System (APS). Cost curves in Thames Water's Engineering Estimating System (EES) were used to populate Base Capex data entries in F909 worksheets, which are Thames Water's costing spreadsheets to calculate input information for APS. As for the items where appropriate EES cost curves were not available, the estimated costs were verified with supplier quotations and unit-rate cost benchmarking.

Quantitative Costed Risk Assessment (QCRA) was performed, identifying risk events, cost impacts and likelihood of risk events. The likelihood of the risk events and the cost ranges estimated to be incurred by the risk events were combined using Monte Carlo simulations to return a costed risk value. Optimism Bias (OB) was derived in the methodology outlined in the "Cost Consistency Methodology – Technical Note and Methodology Revision E" (Mott MacDonald, Feb 2022). The estimated OB values were reviewed with the QCRA outputs and scaled back where required to avoid double-counting in the Costed Risk and OB. Carbon estimates were formulated through the Thames Water EES and APS in the cost estimating exercise, with a whole-life carbon mitigation assessment carried out based on the PAS 2080 principles.

The Capex, Opex, Costed Risk, OB and Carbon values were calculated and reported in the requirements set out by the Water Resources South East (WRSE). A summary of the costs and carbon estimates is listed in Table S-1 below. All costs and carbon estimates discussed in this report are consistent with the WRSE Input Template version 5 ("J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO") issued in May 2022.

Table S-1. Summary of Estimated Costs – Mogden Effluent Reuse

Scheme	Component	Total Capex (£m)	Fixed Opex (£m/year)	Variable Opex (£/Ml)	Embodied Carbon (tCO2e)	Fixed Operational Carbon (tCO2e/y)	Variable Operational Carbon (tCO2e/y)
Mogden Effluent Reuse scheme	50 Ml/d AWRP	£180	£2.00	£534	37,006	52.05	2736.257
	100 Ml/d AWRP	£294	£3.21	£486	49,475	216.57	5414.726
	Conveyance (All Streams)	£329	£0.60	£45	57,795	68.42	320.370

1. "Total Capex" is a sum of Base Capex (including overheads), Costed Risk and Optimism Bias.
2. All conveyance streams (e.g., wastewater and RO concentrate discharge from Hydes Field to Mogden STW, final effluent transfer from Mogden STW to Hydes Field and recycled water transfer from Hydes Field to River Thames) are included in one component for costing purposes. Conveyance elements were sized for 200 Ml/d maximum yield from the AWRP; however pumping costs are included within the AWRP phase cost estimates.
3. Costs estimates are from WRSE Input Template (J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO). Costs are based on September 2022 base rate.

Construction Capex and Opex costs have been used to generate the Net Present Values (NPV) and Average Incremental Cost (AIC) for the components to allow comparison ensuring for lifetime cost. A summary of the AIC values is shown below for three configurations of this scheme at a minimum and maximum utilisation level over an 80-year period. The values are adjusted to a 2020/21 Cost base using agreed deflationary factors for consistency with WRMP19 estimates.

Table S-2. Summary of Average Incremental Costs (AIC) at Minimum and Maximum Utilisation Level – Mogden Effluent Reuse

Configuration name	Units	Mogden Effluent Reuse (50Ml/d yield)	Mogden Effluent Reuse (100Ml/d yield)	Mogden Effluent Reuse (200Ml/d yield)
Option benefit	Ml/d	46	88	169
Minimum Flow – based on 25% utilisation in Hot Standby mode for 12 months of the year				
Average Incremental Cost (AIC)	p/m³	133	97	97
Maximum Flow – full capacity for 12 months of the year				
Average Incremental Cost (AIC)	p/m³	172	132	165

1. Mogden Effluent Reuse (50 Ml/d yield): a combination of the 50Ml/d AWRP component and the Conveyance (All Streams) component. Costs for operations of the conveyance component were calculated, assuming it conveys up to 50 Ml/d.
2. Mogden Effluent Reuse (100 Ml/d yield): a combination of the 100Ml/d AWRP component and the Conveyance (All Streams) component. Costs for operations of the conveyance component were calculated, assuming it conveys up to 100 Ml/d.
3. Mogden Effluent Reuse (200 Ml/d yield): a combination of 2 phases of the 100Ml/d AWRP component and the conveyancing (all streams) component. Costs for operations of the conveyance component were calculated, assuming it conveys up to 200 Ml/d.

1. Introduction

1.1 Background and Purpose of Report

Mogden Effluent Reuse was identified as one of the four schemes which compose the London Effluent Reuse SRO by the Regulators' Alliance for Progressing Infrastructure Development (RAPID). Thames Water Utilities Limited (Thames Water) have developed a conceptual design for this scheme and estimated costs and carbon associated with the scheme. The results of cost and carbon estimating has been reported to the Water Resources South East (WRSE) to update the WRSE Database for its investment modelling.

The purposes of this report are to present the basis, methodologies and results of cost and carbon estimating for the Mogden Effluent Reuse scheme in the London Effluent Reuse SRO.

1.2 Scheme Overview

Mogden Sewage Treatment Works (STW) is located in Isleworth, West London. For this scheme, a new Advanced Water Recycling Plant (AWRP) will be constructed to abstract final effluent flow from Mogden STW and treat it for indirect reuse with advanced treatment technologies. At Gate 2, these technologies are proposed to be reverse osmosis and advanced oxidation. Due to the lack of currently available land at Mogden STW and the risk of being able to obtain planning permission for major additional and potentially high-rise treatment facilities, the scheme includes locating the AWRP on an area of land owned by Thames Water near Kempton WTW, approximately 6.5 km to the Southwest of Mogden STW. Final effluent from Mogden STW will be transferred to the new AWRP site and treated to sufficient standard for indirect reuse to allow its discharge to the River Thames as a source water for drinking use. Waste flows from the AWRP will be discharged to the existing Mogden STW outfall and inlet works. The Recycled Water will be discharged into the River Thames, 2km upstream of the existing Thames Water Walton WTW Intake. Figure 1-1 shows the overview of the Mogden Effluent Reuse scheme, and Table 1-1 lists a summary of design elements costed for the scheme.

In the cost estimate and conceptual design, the AWRP was sized in two components which will be capable to yield 50 and 100 Ml/d of Recycled Water. The maximum total yield from the AWRP in the Mogden Effluent Reuse scheme was agreed to be 200 Ml/d, where a combination of 50 and/ or 100Ml/d components will be constructed as a phased development.

There are multiple proposed conveyance elements for the Mogden Effluent Reuse scheme which are grouped together as one component "Conveyance – All Streams" for the purposes of this costing assessment. The sizes of the pipelines in this report are for the scenario in which the AWRP yields a 200 Ml/d of recycled water. The conveyance required for this scheme consists of:

- Final Effluent Transfer Pipeline from Mogden STW to Hydes Field
- Recycled Water Transfer Pipeline from Hydes Field to River Thames
- RO Concentrate Pipeline from Hydes Field to Mogden STW
- Wastewater Pipeline from Hydes Field to Mogden STW

The conveyance system outlined in this report is sized for the full 200Ml/d treatment capacity scenario. Pipelines in smaller diameters could be considered if the ultimate capacity of Mogden Effluent Reuse scheme is agreed to be less than 200Ml/d with no future intention to increase the treatment capacity. Conveyances will not be constructed in phases as no cost or social benefits will be expected and a modular construction of conveyance assets is not feasible. Therefore, the design sizing is for a conveyance suitable for 200 Ml/d capacity.

The Mogden Effluent Reuse scheme will supply the London Water Resource Zone (WRZ).

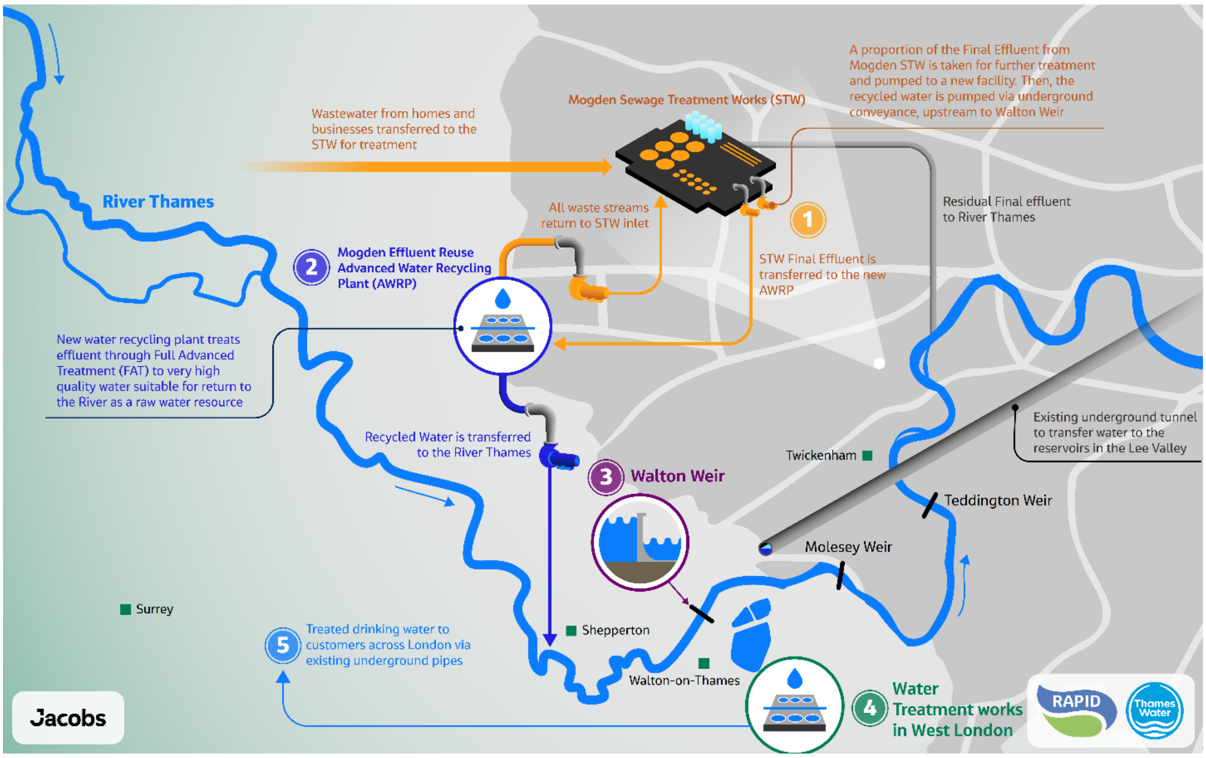

Figure 1-1. Mogden Effluent Reuse Scheme Overview

Table 1-1. Mogden Effluent Reuse Components for Cost Estimate

Components	Gate-2/ WRSE Reference	Scope Summary
50 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 50	▪ Treatment Plant to yield 50 Ml/d Recycled Water ▪ Final Effluent Transfer Pumping Station ▪ Recycled Water Pumping Station ▪ Wastewater Return & RO Concentrate Pumping Stations
100 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 100	▪ Treatment Plant to yield 100 Ml/d Recycled Water ▪ Final Effluent Transfer Pumping Station ▪ Recycled Water Pumping Station ▪ Wastewater Return & RO Concentrate Pumping Stations
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	▪ Final Effluent Transfer Pipeline and ancillaries from Mogden STW to AWRP site (sized for 200Ml/d Recycled Water yield) ▪ Wastewater Return Pipeline and ancillaries from AWRP site to Mogden STW (sized for maximum waste stream at 200 Ml/d AWRP capacity) ▪ RO Concentrate Return Pipeline and ancillaries from AWRP site to Mogden STW (sized for maximum RO concentrate flow for 200Ml/d Recycled Water yield) ▪ Recycled Water Transfer Pipeline and ancillaries from AWRP site to River Thames (sized for 200Ml/d Recycled Water yield)

2. Cost and Carbon Estimate Methodology

Total Capital Expenditure (Total Capex), Operating Expenditure (Opex) and Embodied Carbon, and Operational Carbon (Fixed and Variable) values were estimated for the Mogden Effluent Reuse scheme. Total Capex consists of Base Capital Expenditure (Base Capex), Costed Risk and Optimism Bias (OB). This section demonstrates methodologies to estimate these components for the Mogden Effluent Reuse scheme. Estimate developed using Thames Water internal estimating process and system EES and APS. In instances where model data wasn't available supply quotes and bottom-up estimates were used.

2.1 Base Capex Costing

Base Capex cost estimates for Mogden Effluent Reuse scheme were carried out with Thames Water's Engineering Estimating System (EES) and Asset Planning System (APS), using F909 worksheets. F909 worksheets are Thames Water's costing spreadsheets used to calculate input information for APS by using EES cost curves and through manual/ override inputs where required. Descriptions of EES and APS are provided in the following sections.

For the RAPID Gate 2 cost estimates, the Base Capex entries in the F909s prepared in Gate1 were reviewed and updated as per the latest conceptual design of the scheme, and an F909 worksheet was prepared for each of the three components of the Mogden Effluent Reuse scheme in Table 1-1. Each F909 worksheet the components had changes and additions from the previous Gate 1 version which are summarised in Appendix A.

Once F909s had been prepared, they were processed through APS. Outputs from APS were populated in the WRSE Input Template as per the reporting requirements for WRSE to update the WRSE Database and for input to their investment modelling. The WRSE costing methodology aligns with the guidance prepared for the All Company Working Group (ACWG) to improve costing consistency between SROs.

2.1.1 Engineering Estimating System (EES) Cost Curves

Base Capex entries in F909s were derived mostly from the Thames Water costing system using Engineering Estimating System (EES).

EES is a database containing capital project costs and carbon information against asset structures commonly used in Thames Water's facilities. The system was introduced to Thames Water in 2000 and holds the cost for the construction against EES coding structure for all capital expenditure within infrastructure and non-infrastructure assets. A Carbon estimate system was also introduced to EES later around 2008 and mirrors the cost model structure for infrastructure and non-infrastructure assets. In EES, users select the appropriate cost curve from the library of available items and populate the appropriate yardstick value.

Data in the EES libraries has been collected from Thames Water projects against two key milestones; Target Cost and Final Actual Cost. Thames Water's EES database currently has data from over 6,500 projects totalling £12billion in value. Projects range from small £100k modifications to £620M large-scale construction works. The data has been checked against final drawings to ensure accuracy with all financials validated using the Thames Water corporate financial system.

The data enables EES to produce robust process model(s) from these projects and helps Thames Water to support the three key areas within the business in a repeatable and auditable way:

- High level Estimating for investment purposes
- Benchmarking 'Value for Money' statements
- Regulatory 5 yearly pricing – from Price Review (PR)04/Asset management Plan (AMP)3 to PR19/AMP7

Projects hold a unique index date/figure when imported into the EES system, and when modelled as a group, the projects are inflated to a common inflation index date/figure to ensure the model reflects current day prices. These models are periodically updated with new data and older data removed.

For WRMP19, F909s were developed using the EES version 9.2 cost curve library. For Gate-2 costing, all F909s were updated to use the latest EES.

In the F909s worksheet, appropriate cost models were selected from EES costing library as per individual design items identified in conceptual design. Cost curves of Civil, M&E and ICA expenditures were available for each design item/ cost model. Relevant yardsticks/ quantities required were also entered, and the F909s generated Capex costs for Civil, M&E and ICA elements as a sum of base costs and overheads.

2.1.2 Manual Override Entries

The F909 worksheet allows manual override entries for items not covered by the EES database. For some items, such as the "reverse osmosis (RO) plant", "ultraviolet advanced oxidation process system (UVAOP)" and "remineralisation system" the EES cost curves were not used and manual override costs were entered. This was because the complexity/specificity of an element meant that quotes/bottom-up estimates were viewed as more accurate. Cost rates of these items were entered with manual override, reviewing the WRMP19 manual entries and quotation information provided by suppliers.

Where the yardstick value required in F909s was outside the upper range of the EES cost curve, such as "site clearance" and "fine screens" in the AWRP, a manual cost rate was entered based on the pro rata cost rate at the upper limit of the EES cost curve, and the cost was calculated through a linear extrapolation, as agreed with Thames Water.

2.1.3 Overhead Costs

Overhead costs are added by APS process to the EES costs onto the base costs to account for additional costs associated with design, construction supervision and project management. Overheads percentages from Thames Water EES system were used for this costing exercise. The same overheads are applied to WRMP24 and PR24 cost assessment.

2.1.4 Thames Water Asset Planning System (APS)

The Base Capex items entered in the F909s were processed through APS. APS is a database used within Thames Water to hold candidate investments for the Periodic Review business plan submission to Ofwat.

APS calculates the base cost for each element using the quantities and parent process code entered in the F909. Any costs generated using EES rates are inflated with respect to the Retail Prices Index (RPI). The Inflation Index Date entered in the F909X-Solution sheet in the respective F909 as "The date manual cost inputs are current for" is used by APS to apply inflation to manual override costs.

The F909 worksheet is limited to a single Inflation Index Date for override figures. Inflation Index Dates in the F909s for all elements were set as 4th of February, 2022 as the date of the submission of the WRSE Input Templates. The actual date used on the F909 costing sheet was the date that the Capital cost scoping were entered based on when Supplier quotations were received (e.g. October 2021 for the Reverse Osmosis plant).

2.1.5 Base Date

All costs generated are presented at 20/21 prices. Costs generated using the various water company costing systems can be at different base dates but all costs have been presented at 20/21 for consistency. The deflation factors used for Capex and Opex have been agreed with the ACWG and are based on the figures used by the WRSE modelling team. Figures used are summarised below in Table 2-1. Inflation will require updating for Gate 3 as current inflation is well above the figures predicted.

Table 2-1. Inflation / Deflation factors

F/Yr.	Capex indices	Capex Factors	Opex indices	Opex Factors
2017/18	275.5	1.1002	104.3	1.0662
2018/19	284.8	1.0645	106.7	1.0417
2019/20	293.7	1.0323	109.0	1.0197
2020/21	303.1	1.0000	111.2	1.0000
2021/22	312.9	0.9688	113.3	0.9811
2022/23	322.3	0.9405	115.6	0.9619

2.1.6 Assumptions

- Costs presented include standardised overheads in line with Thames Water EES cost model across WRMP24 and PR24.
- It is assumed the project can engage and consult on the scheme and proceed without delay.
- Costs based upon procurement being design and built (D&B) self-delivered by Thames Water.
- Land is rented for contractor compounds and agricultural rates apply.
- All permanent structures are located on land that is purchased at agricultural rates and are connected to the network with roads and protected with site fencing and gates.
- 40m easement is adequate and compensation payments included. Land purchase for pipeline route is excluded.
- Average pipe depths with battered excavation unless ground conditions suggest sheet piling will be required.
- Major crossings are tunnelled with launch and reception shafts. Single pipeline average lengths.
- Spend profiles are indicative only to facilitate multi-solution decision making and will be refined at Gate 3.

2.2 Quantitative Costed Risk Assessment

Risk registers for the three components listed in Table 1-1 were prepared using ACWG template, and Monte Carlo analyses were carried out for Quantitative Cost Risk Assessment (QCRA).

2.2.1 Risk Identification and Scoring

Risk registers in Gate 1 were reviewed and updated for consistency with the other London Effluent Reuse SRO schemes and as per the latest conceptual designs.

Gate 2 risk registers for the 50 and 100 Ml/d AWRP were compared with the ones for treatment plants proposed in the other schemes in the London Effluent Reuse SRO (i.e. Beckton Effluent Reuse, Mogden South Sewer and Teddington Direct River Abstraction), whereas the Gate 2 risk registers for the conveyance elements were compared with the risk registers for the other SRO scheme conveyance cost estimates for consistency. Where applicable, risk entries were added or combined to ensure consistency throughout schemes and components within the SRO.

Once the draft risk registers had been prepared with the adjustment for consistency among schemes/ components, they were reviewed by the project design team in the process, conveyance, civil and environmental design aspects. Then, the risk entries and scores were updated based on the latest conceptual designs and the analysis of regulatory requirements.

The ACWG QCRA worksheet requires entries of “Cost Score” scaled from 1 to 5 depending on the costs expected to be incurred by the individual risk events. The scales are defined as percentages of estimated Base Capex as shown in Table 2-2. “Probability Percentage” of the risk events is also required to be entered in the spreadsheets, and these two parameters are used in the ACWG QCRA with Monte Carlo Simulation to produce the Costed Risk. Specific cost impact ranges expected to be incurred by individual risk events had been allocated to some of the risk entries in WRMP19 without using the percentages of estimated Base Capex in Table 2-2, and these cost ranges were also used for Gate 2 estimates, where applicable.

The Costed Risk is produced for each risk entry based on these three factors: “Cost Score”, “Probability Percentage” and “Time Score” as shown in the risk score matrix in Figure 2-1. However, the “Time Score” is not considered in the Monte Carlo QCRA, and the WRMP19 Time Scores were generally used at this time.

Table 2-2. Thames Water ACWG QCRA Risk Assessment - Cost Scoring

Cost Scoring Scale	Cost Incurred by Individual Risk Event
1. Very Low	Less than 1% of estimated Base Capex
2. Low	1 – 2 % of estimated Base Capex
3. Medium	2 – 5 % of estimated Base Capex
4. High	5 – 15 % of estimated Base Capex
5. Very High	15 – 30 % of estimated Base Capex

Risk Criteria					Probability Score				
				Description	Remote	Unlikely	Possible	Likely	Very likely
				Guidance	Event may occur in exceptional circumstances	Event could occur at some time	Event should occur at some time	Event will probably occur in most circumstances	Event is expected to occur in most circumstances
				Probability	1% - 10%	11% - 30%	31% - 50%	51 - 70%	71% - 99%
	Description	Cost £	Time months	Scale	1	2	3	4	5
Impacts	Very High	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	5	10	15	20	25
	High	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4	4	8	12	16	20
	Medium	Moderate (2.1-5%) increase in project cost	Moderate (2.1 - 5%) delay to project delivery	3	3	6	9	12	15
	Low	Small (1-2%) effect on project cost	Small (1-2%) effect on project delivery	2	2	4	6	8	10
	Very Low	Minimal (<1%) effect on project cost	Minimal (<1%) effect on project delivery	1	1	2	3	4	5

Figure 2-1. Thames Water ACWG QCRA Risk Scoring Matrix

2.2.2 Risk Mitigation

Risks were assessed in the current, pre-mitigated position as of February 2022 at the time of the risk identification and scoring exercise. Risks should be assessed again in their residual, post-mitigated position as the programme progresses with estimate of any costs associated with the mitigation.

2.2.3 Monte Carlo Analysis

The likelihood of the risk events and the cost ranges estimated to be incurred by the risk events are combined using Monte Carlo simulation.

A uniform distribution using the range shown in Table 2-2 was allocated as a probability distribution of costs incurred by each risk event (e.g. for the Cost Scoring Scale "3 – Medium", a uniform distribution with equal likelihood of an impact between 2 % and 5% of Base Capex costs was assumed). A Bernoulli distribution was used for the likelihood of the risk event, which were entered as "Probability Percentage" in the risk registers. Each of the identified risks were treated as discrete events, and no dependencies between risk events were considered. Each simulation was run with 50,000 iterations with Latin Hypercube sampling, and 50th percentile (P50) of the output distribution was used as the Costed Risk of the component.

2.3 Optimism Bias

Optimism Bias (OB) was derived using ACWG methodology which sets out recommendations for SROs on the common approach to OB assessment.

The Cost Consistency Methodology recommends that the approach to OB should use an associated excel template "Optimism Bias Template" recommends that the approach to OB should use an associated excel template "Optimism Bias Template" provided for all SROs. The OB Template was developed by Mott MacDonald based on the HM Treasury Green Book and supplementary guidance by the HM Treasury. The OB Template was used to calculate OB percentage rates.

2.3.1 Upper Bound Optimism Bias

The OB Template is designed to determine the Upper Bound Optimism Bias based on the proportion of the Base Capex cost that is considered to be standard civil engineering and the proportion that is considered to be non-standard civil engineering. This step is stipulated as "First Stage" in Section 6.2.1 in the "Cost Consistency Methodology" report. ACWG methodology has been followed in assessing standard vs non-standard civil engineering proportions of the scheme.

At the initial stage of the assessment, the proportions of non-standard and standard civil engineering Base Capex had been determined, examining natures of individual Base Capex items. However, it was requested from ACWG that consistent proportions be used to eliminate subjective judgements and to maintain consistency among the schemes. As per discussion with ACWG, it was assumed that 100% of Base Capex would be "non-standard civil engineering" for all treatment plants and tunnels, whereas in the case of pipelines 75% would be "non-standard civil engineering" and 25% would be "standard civil engineering". The Upper Bound Optimism Bias Percentages shown in Table 2-3 were obtained based on these assumptions, using the Optimism Bias Template.

Table 2-3. Assumed Proportion of Non-Standard and Standard Civil Engineering Capex and Upper Bound Optimism Bias Percentage in Mogden Effluent Reuse

Components	Gate-2/ WRSE Reference	Component type	Proportion of Non-Standard Civil Engineering Capex	Proportion of Standard Civil Engineering Capex	Upper Bound Optimism Bias %
50 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 50	Treatment Plant	100%	0%	66.00%
100 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 100	Treatment Plant	100%	0%	66.00%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	Pipelines	75%	25%	60.50%

2.3.2 Confidence Grade Assessment

Subsequently, "Contributory Factors" defined by the HM Treasury Green Book were allocated to "High", "Medium" and "Low" confidence bands according to the OB Template. This step is stipulated as "Second Stage" in Section 6.2.2 in the "Cost Consistency Methodology" report.

The OB template calculates mitigation factors to lower the Upper Bound OB according to the allocated confidence grades. Weighting of each contributory factor, which is based on the HM Treasury Green Book guidance, is used in the OB Template calculation. The OB Template, then, returns "Adjusted Optimism Bias" as a percentage of Base Capex.

At Gate 1, previous assessment of confidence factors in Thames Water WRMP19 F909s Worksheet (Sheets F910J and F910K) were fully reviewed when allocating the Contributory Factors to the "High", "Medium" and "Low" confidence bands. Allocation is to be entered from 0 to 1, and a sum of the allocations to "High", "Medium" and "Low" is to be 1.

As "Third Stage", it is required to review the confidence grade allocation after Quantitative Costed Risk Assessment (QRCA). The OB confidence grade set out in the second stage should be reassessed against the risk entries in the QRCA, and further scaling-back of the OB should be considered to avoid double-counting, where applicable. In "Cost Consistency Methodology – Technical Note and Methodology Revision 3", it is also required to record the level of OB at the conclusion of the first, second and third stages.

In February 2021, ACWG carried out a survey of Risk Assessment methodologies and OB template confidence grade assessment by the SROs and issued comments and guidance (9th February 2021 update) to maintain consistency throughout the SROs. The third stage OB percentages were further revised according to the instructions provided by ACWG. Table 2-4 includes the OB percentages adjusted as per ACWG's guidance as the Final OB%.

For the Gate 2 stage, it was agreed with the ACWG that Optimism Bias final values would be scaled-back to account for design development between Gate 1 and Gate 2 submission, where some OB values would be reduced due to greater certainty in the scope. The "Confidence Grade Criteria" were re-scored by the Project Team to determine the new Adjusted Optimism Bias value at Gate 2.

Table 2-4. Level of Optimism Bias at First, Second and Third Stages[1)] and the Final OB%

Components	Gate-2/ WRSE Reference	Component type	First Stage (Upper Bound OB%)	Second Stage (Adjusted OB% based on WRMP19 Assessment)	Third Stage Gate 1 OB (Adjusted OB% updated after Gate1 QCRA)	Final OB% at Gate 2 (Adjusted as per design development)	Summary of Changes from Second Stage to Third Stage
50 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 50	Treatment Plant	66.00%	50.16%	52.34%	49.23%	Confidence level of "Large Number of Stakeholders", "Contract Structure", "Contractor Involvement", "Design Complexity" and "Political influences" were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
100 Ml/d Advanced Water Recycling Plant	TWU_WLJ_HI-REU_reuse mogden 100	Treatment Plant	66.00%	50.16%	52.34%	49.23%	As above.
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walto n	Pipelines	60.50%	37.29%	34.74%	33.28%	Confidence level of "Large Number of Stakeholders", "Contract Structure", "Contractor Involvement", "Design Complexity" and "Political influences" were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.

1. First, Second and Third Stages in Optimism Bias assessment were defined in Section 6.2 "Cost Consistency Methodology – Technical Note and Methodology Revision E" (Mott MacDonald, 2022).

2.4 Opex Costing

Operating Expenditures (Opex) were estimated using Thames Water's Asset Planning System (APS). Items required for scheme operation, such as electricity, chemical and employee headcount, had been identified and quantified in conceptual design, and the data was entered in the F909 worksheets.

The Opex items, including types of chemicals and maintenance work, were selected from the Opex cost codes built into the F909 worksheet, and quantity of each item was entered based on requirements in the conceptual design. Then, Opex costs were derived by multiplying the quantity by the default unit rate in APS processing.

These unit rate costs have a price base, so once calculated, the costs were rebased by APS to the price base of September 2022. APS uses Consumer Price Index (CPI) for the majority of the Opex costs, although different indices are used for electricity and employee headcount.

As per the requirements for WRSE, APS outputs for Opex were categorised into fixed and variable expenses for reporting.

2.5 Carbon Estimate Methodology

Carbon estimates were performed through the Thames Water's EES and APS tools in the cost estimating exercise. The EES holds over 6 Million embodied carbon values and each value is held against Thames Water common asset structure. For operational carbon values, specific carbon factors are allocated to individual Opex cost codes per quantity unit rates. As cost data is collected and imported into the system, the carbon is automatically calculated based upon code, volume, size and/or attributes unique to the project.

As per the requirements for WRSE, APS outputs for carbon were categorised into Embodied Carbon and Operational Carbon (variable) for reporting.

Thames Water re-assessed the way operational carbon is reported for the SROs, and operational carbon valued were estimated as Variable Operational Carbon (tCo2e/Ml) in Gate 2 rather than Fixed Operational Carbon (tCo2e/yr) as in Gate 1. The estimated values for Variable Operational Carbon (tCo2e/Ml) are outputs of APS run.

All Operation carbon values estimates were for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times).

The operational carbon values estimates are for the first year of operation, using Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions, which was adopted in the ACWG Cost Consistency Methodology Report. Carbon from electricity was calculated using the year 2031 as the first year of operation, including the carbon reduction at year 2050 and afterwards. The electricity demand is calculated for the scheme using the operation regime of 10 months minimum 25% capacity and 2 months full 100% capacity. The electricity demand is multiplied by electricity emissions factors taken from the Treasury Green Book.

3. Cost and Carbon Estimate Results

3.1 Capex Estimates

The Base Capex, Costed Risk, Optimism Bias and Total Capex (that is, a sum of Base Capex, Costed Risk and Optimism Bias) estimated for the components associated with Mogden Effluent Reuse scheme are as shown Table 3-1.

These estimates were reported to WRSE for its database and financial modelling updates. Detailed breakdowns of the Base Capex are also found in Appendix A to this report.

Table 3-1. London Effluent Reuse SRO, Mogden Effluent Reuse – Capex Estimates

Components	Gate-2/ WRSE Reference	Base Capex (£)	Costed Risk (£)	Optimism Bias (£)	Total Capex (£)
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£94,259,953	£39,776,669	£46,407,238	£180,443,860
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£152,510,143	£66,711,628	£75,085,700	£294,307,471
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	£213,677,168	£44,640,248	£71,109,659	£329,427,075

3.2 Opex Estimates

The fixed and variable Opex estimated for the components associated with Mogden Effluent Reuse scheme are as shown in Table 3-2. These estimates were reported to WRSE for its database and financial modelling updates.

It should be noted that the fixed Opex costs do not include any flow proportional costs. If a minimum flow (i.e. a sweetening flow) is agreed, then the minimum annual Opex cost would be the fixed Opex plus the variable Opex taken at that minimum flow.

All Opex shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). For an assessment of the costs in the minimum and maximum, refer to Section 5.

Table 3-2. London Effluent Reuse SRO, Mogden Effluent Reuse – Opex Estimates

Components	Gate-2/ WRSE Reference	Max Fixed Opex (£/yr.)	Max Variable Opex (£/Ml)
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£1,997,637	£534
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£3,207,501	£486
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	£600,375	£45

3.3 Carbon Estimates

The Embodied Carbon, Fixed Operational Carbon and Variable Operational Carbon estimated for the components associated with the Mogden Effluent Reuse scheme are as shown in Table 3-3.

These estimates were reported to WRSE for its database and financial modelling updates. All Operation carbon values shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). The Operational Carbon values include carbon from electricity estimates. The carbon from electricity is calculated as 10 months at min flow 25% and 2 months at max flow 100% to be comparable with other SROs presentation of Cost & Carbon. The carbon from electricity is used in the WRSE investment modelling (IVM) in the following way which ensures carbon is used as an integral part of option selection decision making.

Table 3-3. London Effluent Reuse SRO, Mogden Effluent Reuse – Carbon Estimates

Components	Gate-2/ WRSE Reference	Embodied Carbon (tCO2e)	Operational Carbon – Fixed *including electricity* (tCO2e/year)	Operational Carbon – Variable *excluding electricity* (tCO2e/Ml)	Operational Carbon – Variable *from electricity* (tCO2e/Ml)
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	37006	52.05	0.24	0.16
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	49475	216.57	0.25	0.13
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	57795	68.42	0	0.02

1. Thames Water aspiration is that by the year 2030 all electricity purchased is to be zero carbon via either a Renewable Energy Guarantee of Origin (REGO) contract or Power Purchase Agreement (PPA).

3.4 Greenhouse Gases Mitigation and Recommendations

A high-level life cycle carbon assessment of greenhouse gas (GHG) emissions for all the London Effluent Reuse SRO schemes has been carried out by a Carbon and Energy Consulting team. The summary below recommends approaches to mitigate embodied and operational GHG emissions, with emissions in tonnes of carbon dioxide equivalent (tCO2e) reported and evaluated. Whilst the carbon from electricity has been included in the carbon values reported above to be consistent with other SROs, Thames Water are committed to achieving carbon net zero by 2030, which is before the water into supply date of this SRO. Therefore, this assessment assumed grid emissions to be zero carbon and sought to identify a strategy for reduction of emissions from non-electricity generation sources.

The mass in tonnes of carbon dioxide equivalent (tCO2e) emissions were analysed for the following schemes 1) Beckton Effluent Reuse 2) Mogden Effluent Reuse 3) Mogden South Sewer Reuse 4) Teddington Direct River Abstraction (DRA).

Operational emissions have been identified as the largest single source of emissions across the four schemes. Sources of these emissions include supply chain emissions from chemicals used in dosing, and process emissions from nitrifying filters (in the case of the Teddington DRA TTP). Grid emissions from electricity use are considered in this assessment as zero due to Thames Water's corporate policy to procure 100% of its electricity from renewable sources. The Advanced Water Recycling Plants (AWRPs) contribute the largest proportion of embodied emissions for the Beckton and Mogden Effluent Reuse schemes, while Sewage Treatment Works are the main contributor for the Mogden South Sewer Effluent Reuse scheme.

To maximise alignment with PAS 2080 and the Water UK Net Zero 2030 Routemap, it is recommended for to follow the emissions hierarchy when deciding which approach to prioritise to mitigate emissions. This prioritises in order demand reduction, efficiency gains and renewable energy integration before pursuing offsets to remove residual carbon emissions. Due to the complexity and long lifetime of these schemes, it is important to take a holistic approach to carbon mitigation, which uses a combination of approaches.

A more robust assessment of carbon emissions is advised, firstly to provide a more complete assessment of the emissions associated with each scheme and to include those sources not captured in this report. Secondly a detailed opportunity cost analysis should be conducted to identify which interventions would allow the greatest reduction in emissions for the lowest cost. This report provides a high-level inclusion of the possible range of interventions, but further analysis is required to select those most appropriate for the chosen scheme.

At this design stage, some scope requirements are largely fixed. This will limit the opportunity to completely 'design out' embodied carbon for the schemes. However, there is still sufficient optioneering time to 'design out' some embodied carbon. Embodied emissions represent the majority share of total GHG emissions in the short term - as such, focusing on reducing embodied emissions will likely yield significant reductions across the early stage of a site's operational life. This can be achieved through close engagement with carbon subject matter experts (SMEs) at the design and procurement stages. A focus on 'designing out' carbon can reduce both embodied and operational emissions, in particular for building heating and plant efficiency.

While annual operational emissions are less than those released due to material sources. Over time, across the lifetime of a site operational emissions will contribute more than embodied emissions, therefore reducing operational emissions will achieve the greatest reduction of GHG emissions in the long term. This approach is also line with the Water UK and Thames Water targets of net zero operational carbon by 2030.

Table 3-4 summarises the recommended carbon mitigation approaches, providing a high-level ranking of their potential impact on emissions reduction and alignment with the emissions hierarchy.

Table 3-4. Summary and Ranking of Carbon Emissions Reduction Approaches

Approach to mitigate carbon emissions	Emissions Hierarchy Category	Potential for emissions reduction	Ability for Thames Water to Influence	List of options
Energy management & efficiency (highest priority)	Emissions reduction	High	High	▪ Improved pump efficiency ▪ Metering ▪ Smart control systems ▪ Catchment level analytics
Renewable energy on site	Renewable energy	High	High	▪ Solar ▪ Wind ▪ Storage
Procured Renewable Energy	Renewable energy	High	High	▪ Sleeved PPA ▪ Synthetic PPA ▪ Private Wire PPA ▪ REGO-backed Green Tariffs
Resource Efficiency and Chemical Supply	Emissions reduction	High	Low	▪ Supply chain contracts ▪ Reduced resource use
Embodied emissions reduction	Emissions reduction	Moderate	High	▪ Low carbon concrete ▪ Low carbon steel ▪ Recycled materials ▪ Locally sourced materials
Engineering design	Emissions reduction	Moderate	Moderate	▪ Conveyance routes ▪ Land use ▪ Building size ▪ Building heating
Construction emissions	Emissions reduction	Low	Moderate	▪ Reduced transport ▪ Vehicle energy use ▪ Renewable onsite power ▪ Temporary buildings
Insets	Offset	Low	Moderate	▪ Peatland restoration ▪ Grassland restoration ▪ Tree planting
Offsets (lowest priority)	Offset	Low	High	▪ UK ETS ▪ Voluntary Offset Market

3.5 Key Costed Risks

See below Table 3-5 showing a list of delivery focused key risks with description.

Table 3-5. Delivery focus Key Risks with description

Risk Name	Description
Protected Species	1. Protected Species may be found during surveys. Additional protection and/or mitigation measures may need to be carried out prior to works. 2. Protected Species may create habitat during works. Causing programme delays. Noted that badger setts and bat roosts are almost certain.
Ecology Risk	There is a risk that additional ecological works are required or cannot be undertaken/finalised within the target season. Additional capex cost and time delay to overall project programme.
Material Price Increase	There is a risk that materials incorporating metal / oil / plastics could increase by the time this project goes ahead. Leading to additional CAPEX cost.
Mogden STW Discharge Consent	There is a risk that that the discharge consent for the Mogden STW will need to be amended due to the decrease in FE flow. Additional cost and delay to the programme.
Onsite Energy Generation	There is a risk of the need for 20% onsite renewable energy generation at the reuse plant (as part of the planning requirement due to high energy use RO), when it is used during extreme drought periods. Assume 30% of time per year. Additional capex cost. As this would be known at the planning stage it is assumed that it can be absorbed within the current project / construction programme.
Planning Approval	Planning approvals may require longer than time allowed for in the programme.
Power Distribution	Current power supply capacity may not be sufficient to support the new Reuse Plant (UF, RO, AOP, BAFF). Risk that reinforcement of power supply will be required by DNO. Additional power supply required.
River Thames New Discharge License	There is a risk that there will be a delay with obtaining the treated FE discharge licence for the River Thames. Additional cost and delay to the programme.
Discharge of concentrate from RO	Whilst backwash and microfiltration concentrate can be returned to Beckton WWTW for treatment, RO concentrate produced by the advanced water recycling facility should not be returned to WwTW inlet and will require disposal to discharge. There is a risk that EA licence to discharge concentrate will not be granted for permeate disposal. Alternatives to RO would require consideration at considerable cost and programme impact.
Discharge of wastewaters from WRTW	Wastewaters from microfiltation and chemical cleaning systems from the Reuse plant require disposal at Beckton WwTW. There is a risk that there is insufficient hydraulic and/or process capacity to treat these waste streams. Additional cost to address through further capital upgrade works.
Land Purchase for BNG Offset	Additional land purchase required to meet BNG offset requirements. Insufficient space on existing TW-owned land for this Requirement for improvements to footpaths around proposed development areas, as part of the construction work. Requirement for improvements to footpaths around proposed development areas, as part of the construction work. Purchase additional land and small delays to programme due to increased negotiations etc.
Existing Infrastructure/ Obstructions Underground	High likelihood of encountering buried structures and services during construction that were not planned for or known. Plant construction delayed.
Change of Pipeline Route	Change of Pipeline route will be required during Planning and Development stage. Pipe jacking or additional length of pipeline will be required.

4. Cost Benchmarking

Unit rate benchmarking has been carried out for this SRO to create bottom-up estimates of the base capital costs of the schemes, with unit rates compared against industry standards and budget quotations from UK Suppliers. Additionally, benchmarking of some elements of the scheme against other water reuse and desalination projects globally has been undertaken at the Gate 2 stage. It is recommended that further, more detailed scheme benchmarking is undertaken at Gate 3 stage following the completion of the WRSE modelling to understand the base case(s) and likely in-combination schemes.

Base Capex for the majority of capex items were estimated using Thames Water's Engineering Estimating System (EES) cost curves. The EES cost curves were derived from over 6,500 projects totalling £12billion in value, which had been implemented within Thames Water's operational regions. The costs derived are benchmarked and validated through Thames Water's Performance Review 2019 (PR19) process with updates since then, which has been agreed as suitable benchmarking for the EES cost curves.

4.1 Unit Rate Benchmarking

The unit cost rate of the four items listed below had been estimated with a "bottom-up" approach at Gate 2, identifying and summing up possible cost items to arrive at the total unit cost rate. The two items below in the Mogden Effluent Reuse scheme were the cost estimates which were not derived from EES cost curves due to either unsuitable cost curves for the non-standard item or more accurate Supplier quotations available. The cost estimates which were not derived from EES cost curves, such as the 3.5m-ID tunnels and some of the process equipment in the Advanced Water Recycling Plant (AWRP), WRMP19 unit rates were used for estimated costs, with verification of costs using the following methods:

1. Unit-rate benchmarking for process equipment using current budget quotations from suppliers (see Section 4.2).
2. Unit-rate benchmarking for process equipment where quotations were not available, sensitivity analyses undertaken to assess total cost estimate sensitivity to unit rate changes (see Section 4.3).

Impacts of price differences in these items on Total Capex or Base Capex for 50Ml/d AWRP (Gate-2/ WRSE Reference: TWU_WLJ_HI-REU_reuse mogden 50), 100Ml/d AWRP (Gate-2/ WRSE Reference: TWU_WLJ_HI-REU_reuse mogden 100), and the "Conveyance (All Streams)" (Gate-2/ WRSE Reference: TWU_WLJ_HI-TFR_reuse mogden/walton) were analysed.

OPEX benchmarking is traditionally a difficult task to undertake due to the differences that can occur in working practices, staffing levels, approach to risk for maintenance activities and regional power costs. At this early stage it is not viewed as practical to carry out detailed Opex benchmarking until the WRSE RPv2 Investment Modelling is carried out and a greater understanding of the configuration of schemes and expected utilisation values is confirmed.

4.2 Advanced Water Recycling Plant Process Equipment

EES cost curves were either not available or not viewed to be sufficiently accurate for some of the process equipment in the AWRP, as discussed in Section 2.1.2. For these items, estimates made in WRMP19 were used for the Gate 2 cost estimates with adjustments for inflation. The estimated costs for these process assets were verified with quotes from suppliers during the WRMP19 stage.

New quotations during the Gate 2 stage were obtained for the Ultraviolet Advanced Oxidation Process (UVAOP) and Reverse Osmosis (RO) systems from suppliers, and benchmark price for each item was established with adjustments for overhead costs, civil costs, installation costs and inflation rates.

Supplier's quotes for the Remineralisation System were not available. Therefore, a sensitivity analysis based on the WRMP19 supplier quote was completed to provide some benchmarking for the Remineralisation System. The sensitivity analyses scenarios were assumed to be -50%, -25%, ±0%, +25%, +50% or +100% of the estimated price of the WRMP19 Remineralisation System quote price.

4.3 Comparison of Estimated Costs and Benchmark Costs

Table 4-1 shows comparison of the Estimated Costs in Gate 2 and Benchmark Costs for the component Base Capex. Percentage difference between the Estimated Costs and Benchmark Costs for the components were up to 19.1%. These costs will be investigated further in Gate 3.

All costs shown are Base Capex, and they include overhead costs. Costed risk and Optimism Bias are not included in the benchmark figures as they are applicable to both the derived numbers and the benchmark numbers.

Table 4-1. Comparison of Estimated Costs and Benchmark Costs (Base Capex)

Components	Gate-2/ WRSE Reference	Gate 2 Base Capex	Benchmark Costs	Percentage Difference	
50Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£94,259,953	£101,095,777 - £107,251,273	-7.00%	-12.89%
100Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£152,510,143	£172,410,719 - £184,721,710	-12.25%	-19.10%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	N/A	N/A	N/A	N/A

1. "Estimated Costs" are prices used in Gate 2 cost estimates.
2. Prices shown are Base Capex including overhead costs (not including Costed Risk and Optimum Bias).
3. All items in "Conveyance (All Streams)" were derived from EES cost curves, which have been benchmarked and validated through the Thames Water's Performance Review 2019 (PR19). Therefore, benchmarking exercise was not carried out in this report for this sub option.
4. Supplier's quotes for Remineralisation System were not available. Therefore, benchmark cost for Remineralisation System was assumed to be -50%, -25%, ±0%, +25%, +50% or +100% of the Estimated Price of Remineralisation System.
5. Percentage Difference (%) = $\frac{|\text{Estimated Cost} - \text{Benchmark Cost}|}{(\mathit{avarage\ of}\ \text{Estimated Cost}\ \mathit{and}\ \text{Benchmark Cost})} \times 100$
6. Where supplier's quotes were in US$, exchange rate of US$1 = GBP 0.72139 was used.
7. All costs are given in September 2020 Base Cost rates.

4.4 Scheme Benchmarking for AWRP

To provide additional confidence in the project estimates at this stage, some top-down benchmarking of the treatment Options that make-up the Mogden Effluent Reuse scheme has been completed. While the elements of a raw water bulk transfer (the tunnels) are relatively standard assets for Thames Water (and therefore suitable cost curves are largely accounted for), the top-down benchmarking provides further evidence of accurate cost estimates for the non-standard Advanced Water Recycling Plants by comparing against real-world project data for global treatment plants.

For the benchmarking analysis, seven different advanced water recycling plants that have been constructed in the USA were compared for capital expenditure costs. For confidentiality reasons, the specific site locations and capex values are not included in this report; but the information had been shared with Thames Water for the benchmarking assessment. Seven facilities for water recycling purposes that used the same treatment processes (microfiltration, reverse osmosis membranes and UVAOP) were assessed against the bottom-up cost estimates for the Mogden Effluent Reuse AWRP components. The Capital costs reported for the plants in the USA were compared with the base capex costs from the Gate 2 costing assessment, with a cost per Ml/d taken based on the appropriate plant capacity. An average benchmark unit cost was taken for the seven real-world applications to compare.

The Mogden Effluent Reuse 100 scheme cost appeared to be 6% higher when compared with the average unit cost of real-world plants, while when its capacity decreased to 50 Ml/d then the difference increased to 24% as shown in Table 4-2. Figure 4-1 demonstrates the comparison between the London Effluent Reuse AWRP costs and the real-world applications in the USA. Overall, the cost for London Reuse schemes tends to be at the higher end of the cost scale, which is somewhat expected considering that AWRP's are a non-standard engineering process in the UK. The greater the capacity of the Mogden Effluent Reuse scheme the more cost-effective in comparison to real world plants.

Table 4-2. Mogden Effluent Reuse Scheme Benchmark Results

	Capacity Ml/d	Benchmark cost (£)	Gate 2 Base Capex (£)	Unit Cost (£ / Ml/d)	Benchmark unit cost - average of all plants (£ / Ml/d)	Percentage Difference
Mogden 50 Ml/d AWRP	50	£71,846,145	£94,259,953	1,885,199	1,436,923	24%
Mogden 100 Ml/d AWRP	100	£143,692,290	£152,510,143	1,525,101	1,436,923	6%

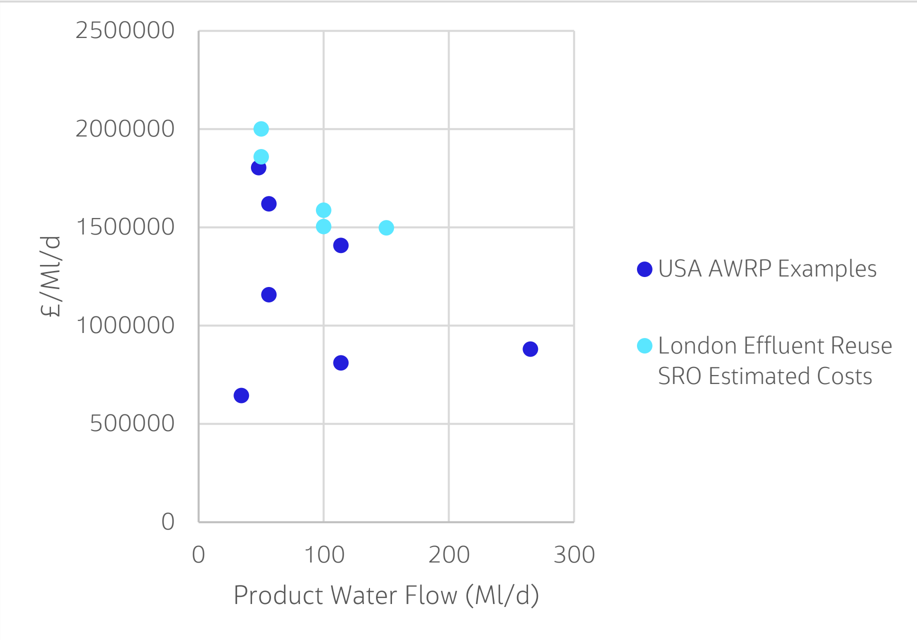

Figure 4-1. Cost Comparison of Capex for AWRP Schemes constructed in USA vs London Effluent Reuse AWRP Estimates

5. Net Present Value (NPV) and Average Incremental Cost (AIC)

Construction Capex and Opex costs have been used to generate the NPV and AIC values for the elements using the Treasury Green book with a declining schedule of discount rates and an 80-year period. The All Company Working Group (ACWG) had agreed with RAPID that for consistency across all SRO's, NPV and AIC costings would be completed via the same methodology for inclusion in the Gate 2 Report for direct comparison with the other schemes and SRO's.

The NPV and AIC values were analysed for the following three configurations (i.e. combinations of components) in the Mogden Effluent Reuse scheme:

1. **Mogden Effluent Reuse (50 Ml/d yield):** 1 phase of 50Ml/d AWRP component and the Conveyance (All Streams) component. Costs for operation of the conveyance component were calculated assuming it conveys up to 50 Ml/d.
2. **Mogden Effluent Reuse (100 Ml/d yield):** 1 phase of 100Ml/d AWRP component and the Conveyance (All Streams) component. Costs for operation of the conveyance component were calculated assuming it conveys up to 100 Ml/d.
3. **Mogden Effluent Reuse (200 Ml/d yield):** 2 phases of 100Ml/d AWRP component and the conveyancing (all streams) component. Costs for operation of the conveyance component were calculated assuming it conveys up to 200 Ml/d. This is the maximum capacity option for the Mogden Effluent Reuse scheme.

NPV and AIC for each component were calculated for the estimated utilisation level, using "One Scheme AIC RevB Template" prepared by Mott MacDonald in April 2021 as per ACWG review and agreement.

The costs for all stages (i.e. Planning, Development and 'Construction & Operation') were included for pasting into the "Input" tab. If modelling a real option, the stages will get reprofiled on the 'AIC calc' tab to ensure the Planning, Development and 'Construction & Operation' are done consecutively.

The inputs required for the NPV and AIC calculation were:

- Option reference ID: The WRSE Option ID.
- WACC: Weighted Average Cost of Capital used. In the 2019 Final Determination20, Ofwat allowed a real return on capital of 2.92%. The All Company Working Group (ACWG) agreed to applying a WACC of 2.92%, which has therefore been used on all NPV and AIC calculations in this report.
- Operational Year: The year in which Recycled Water is to be first produced following the end of construction stage. This was taken from the WRSE Input Template in the tab "Summary" from column N "Opex Start Year".
- Optimism Bias: As per Final OB% in Table 2-4.
- Deployable Output: A minimum and maximum utilisation was calculated for each configuration. The maximum utilisation was based on the Deployable Output (DO) of the maximum capacity of the configuration continuously for 365 days, 24 hours per day (e.g. Mogden Effluent Reuse 100Ml/d AWRP component has a DO of 88 Ml/d for the 1 in 500 year average). This value was taken from the WRSE Input Template in the tab "Summary" from column U "DO: 1 in 500 average".
- Minimum Flow: The minimum utilisation was based on the proposed operating mode for each scheme (refer to CDR Section 4.1.1 for detail). For the treatment components, the assumption for minimum flow is the plant being used only in "Hot Standby" mode for 12 months of the year at 25% utilisation rate (e.g. in the "Continuous Sweetening Flow Model". Therefore, it was assumed to be 25% of the maximum capacity. For conveyance components, the minimum flow is assumed as 25% of the total treatment plant capacity (even if it is likely that a smaller proportion would be passed fully through the conveyance – e.g. some would be run-to-waste to the source STW).

Then, a profile of the costs of the component over 80 years was computed. The costs were split into capital (including maintenance and replacement costs), operating (both fixed and variable costs) and financing costs. The NPV of all costs was then calculated using the Treasury Test Discount Rate as set out in the HM Treasury "Green Book" (Appraisal and Evaluation in Central Government, HM Treasury 2003). This is 3.5% for years 0-30 of the appraisal period, 3.0% for years 31-75, and 2.5% for years 76-125. The outputs of this analysis are NPV Finance (Capex), NPV Opex, NPV WAFU (Water Available for Use, in m3 for the resource benefit over the 80-year period) and AIC (in p/m3). The outputs were given for both the minimum utilisation scenario and maximum utilisation scenario. Note that the Opex values are input as costs at maximum utilisation taken from the WRSE input template and adjusted by the percentage for minimum utilisation.

To calculate the NPV and AIC for each configuration, which is a combination of treatment component and conveyance component, these values were then summed to provide the results in Table 5-1.

Table 5-1. NPV and AIC for Mogden Effluent Reuse scheme at various configuration sizes (all costs adjusted for 2021/20 Cost Base)

Configuration name	Units	Mogden Effluent Reuse (50Ml/d yield)	Mogden Effluent Reuse (100Ml/d yield)	Mogden Effluent Reuse (200Ml/d yield)
Option benefit	Ml/d	46	88	169
Total planning period option benefit (NPV)	Ml	387,012	740,371	1,421,850
Total planning period indicative capital cost of option (CAPEX NPV)	£m	460	611	1,007
Minimum Flow – based on Hot Standby mode for 12 months of the year – (ca. 25%)				
Total planning period indicative operating cost of option (OPEX NPV)	£m	104	167	469
Total planning period indicative option cost (NPV)	£m	514	715	1,380
Average Incremental Cost (AIC)	p/m³	133	97	97
Maximum Flow – full capacity for 12 months of the year				
Total planning period indicative operating cost of option (OPEX NPV)	£m	255	431	1,442
Total planning period indicative option cost (NPV)	£m	665	980	2,352
Average Incremental Cost (AIC)	p/m³	172	132	165
Total Carbon (including electricity) over 80-year period and no discount rate				
Embodied Carbon	tCO2e	94,801	107,269	156,744
Variable Operational Carbon – Max Flow	tCO2e/yr.	3,057	5,735	1,461,116

The solution costs detailed have been developed in line with relevant HM Treasury Green Book guidance. All values in **Error! Reference source not found.** have been adjusted for deflation to 2 020/21 cost base for accurate comparison with the Final Determination allowance, using Thames Water's Internal Business Plan (IBP) deflationary factors, based upon a combination of the relevant RPI, CPIH and CPI (forecast) annual average index values. A lifecycle carbon assessment has been carried out here without discount factors, and no adjustment for inflation as per the NPV costs. Carbon values are calculated in Section **Error! Reference source not found.** for maximum utilisation presented a t first year of operation using Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. In **Error! Reference source not found.** above, O perational carbon values are assessed over the 80-year period from first year of operation at the minimum and maximum utilisation levels for the specific scheme. Note that **Error! Reference source n**

ot found. does not include carbon emissions from electricity. Refer to Section **Error! Reference source not found.** for full carbon values.

6. The Journey from Gate 1 to Gate 2

Section 6 lists the changes that took place between Gate 1 to Gate 2, these changes have direct implications on the costs, some changes increase, and some decrease the costs. Section 6 covers CAPEX, OPEX, Optimism Bias, and Costed Risk.

6.1 CAPEX

6.1.1 Reuse treatment plant

Increases in CAPEX:

- Number and kW ratings of all pumps have changed following Gate 2 Hydraulic assessment.
- Land clearance, temp/permanent land, etc have been updated to match Design development.
- Added new buildings to reflect all buildings proposed for the AWRP.
- New sodium bisulphite dosing plant.

Decreases in CAPEX:

- RO Concentrate Return and Waste stream pumps have been reduced in size based on Process capacity assessment.
- Power supply costs reduced slightly based on Process assessment for power requirements.
- Removed capital costs for UF and RO Membrane replacement and UV lamp replacement - double counted at previous stage as are in Opex costs.
- Building costs reduced for above ground footprint; previous uploaded included very high costs for a basement structure with piled foundations.

6.1.2 All Conveyance Pipelines

Increases in CAPEX:

- New discharge chamber and associated civils works for the outfall (updated detail and scope).
- Additional access roads, hardstanding etc for access to pipejack shafts, pipeline valves/hydrants etc.
- MEICA equipment for backflushing of the recycled water main from outfall location at Walton on River Thames for draining down the pipeline at shutdown or on WQ failure.
- Reinstatement of proportion of tarmacadam roads for the pipeline sections through minor roads. Add new row item for scour valves and hydrants on the rising mains.
- New section of pipeline added for discharge of Waste streams to Mogden STW inlet.
- Shaft costs increased due to design change from one large rectangular shaft for two pipe-jacks, to 2 cylindrical shafts for the 2 pipe jacks.

6.2 OPEX

6.2.1 Reuse treatment plant

- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a major increase in Opex.
- Added chemical costs for sodium bisulphite dosing.
- Separated the fixed electricity costs for the AWRP (lighting, building services etc).
- Electricity and chemical usage set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d.

6.2.2 All Conveyance Pipelines

- Electricity set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d.
- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a significant increase in Opex.

- Added electricity costs for the infrequently used Drainage / backflushing pumps at Walton.
- Added fixed electricity costs for the pump stations (lighting, building services etc).

6.3 Optimism Bias

6.3.1 Reuse treatment plant

- Design complexity: TW has limited experience in delivering this type of technology for water reuse UF+RO+AOP. A small-scale experimental plant has been constructed and operated. Although design mitigation was not yet in place, risks of Design of UV/AOP, Discharge of concentrate from RO, Discharge of wastewaters from WRTW, Discharge of permeate from Water Reuse Treatment Works, Design of UV/AOP, Biofouling management in treated water pipeline, were added in costed risk. Therefore, increased confidence.
- Environmental impact: Risks of EA license regarding "Discharge of concentrate from RO", "Discharge of wastewater from WRTW" and "Discharge of permeate from Water Reuse Treatment Works" were added to Costed Risk. However, the solution requires planning permission for the treatment works. The treatment location could be challenged regarding land use / environmental aspects / odour / noise / visual impacts / traffic. Discharge consents could be challenged regarding environmental effects of new location on the Thames. Therefore, rated as "Low".
- Large number of stakeholders: Views of stakeholders such as authorities of abstraction and discharge consents and landowners are not obtained. Some key stakeholders are identified, but option not developed that far in WRMP19 so all view not clear at this stage.
- Poor project intelligence: Process design to date has relied on preliminary calculation and RO projections with available dataset from 2015 - 2019. Lack of data and accuracy of data, combined with lack of information about acceptability of permeate and concentrate disposal routes give rise to a risk that alternative treatment stages/operational costs may be incurred as design progresses. There is a question as to whether there is sufficient additional power availability within the local grid.

6.3.2 All Conveyance Pipelines

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Government guidelines: At this stage a contract structure has not been defined and may involve DPC. Assume Low confidence at this stage. Amended to Low from OB Consistency Guidelines 19th Feb 2021.
- Design complexity: large diameter pipelines tried and tested construction techniques however early stage of concept design and complexity around the scale of project. "Medium" for both Non-standard and Standard Civil.
- Degree of Innovation: Standard technology used for pipeline / pumping options.
- Environmental impact: The solution requires planning permission for the conveyance works. The route / shaft locations could be challenged but should be reasonably flexible to mitigate regarding environmental effects. Costed risks have been identified for "noise and vibration", "Disposal of Spoil", "Ecology Risk", "Protected Species" and "Contaminated Land".
- Poor project intelligence: Not sufficient data for crossings. Sections of tunnelling/ pipe jack were assumed to be no obstacles. No Geotech study available at this moment. Preliminary environmental data available.
- Permits / consents / approvals: A specific risk has been included as costed risk for planning delays, improving confidence from "Low" to "Medium".

6.4 Costed Risk

6.4.1 All Conveyance Pipelines

- Increases in line with the Capex cost increases. Updated risk costs for new section of pipeline to discharge waste stream into Mogden STW, new discharge chamber, more access roads and updated shaft design. Additional land requirements, programme delays and increased construction costs.

6.5 Changes from WRSE draft regional plan submission

No changes in cost values have been made since the WRSE submission in February 2022. Deployable Output, Project scope, QRCA & Optimism Bias, Opex & Capes are all the same.

Carbon from electricity was not included in WRSE template, but it was finally included in WRSE modelling.

7. Glossary

Acronym	Definition
ACWG	All Company Working Group
AIC	Average Incremental Cost
AMP	Asse Management Plan
AOP	Advanced Oxidation Process
APS	Asset Planning System
AWRP	Advanced Water Recycling Plant
Base Capex	Base Capital Expenditure
Capex	Capital Expenditure
CDR	Conceptual Design Report
CPES	Conceptual & Parametric Engineering System
CPI	Consumer Price Index
CPIH	Consumer Price Index Including Owner Occupiers' Housing Costs
DO	Deployable Output
DRA	Direct River Abstraction
EES	Engineering Estimating System
ID	Internal Diameter
KGV	King George V Reservoir
Ml/d	Mega litres per day
NPV	Net Present Value
OB	Optimism Bias
Opex	Operating Expenditure
PR	Price Review
QCRA	Quantitative Costed Risk Assessment
RAPID	Regulators' Alliance for Progressing Infrastructure Development
RO	Reverse Osmosis
RPI	Retail Prices Index
SRO	Strategic Regional Water Resource Option
STW	Sewage Treatment Works
Thames Water	Thames Water Utilities Limited
TLT	Thames Lee Tunnel
Total Capex	Total Capital Expenditure
UF	Ultrafiltration
WAFU	Water Available for Use
WRMP	Water Resource Management Plan
WRSE	Water Resources South East
WTW	Water Treatment Works
WACC	Weighted Average Cost of Capital

Appendix A. Cost and Carbon Estimates

Gate 1 & 2 Capex Costs Summary - from WRSE Input Templates (Gate 1 - 20210322; Gate 2 - 20220104)

Noted the Gate 2 values are in Cost Base 2020/21 as per APS Outputs. Percentage changes use deflationary factor

Cost Price Base: 2020/21

Components	Gate-2/ WRSE Reference	Gate 1 Base Capex (£)	Gate 2 Base Capex (£)	% Difference	Gate 1 Costed Risk (£)	Gate 2 Costed Risk (£)	% Difference
Mogden Effluent Reuse							
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£102,551,515	£94,259,953	-8%	£49,025,617	£39,776,669	-19%
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£175,536,811	£152,510,143	-13%	£79,588,752	£66,711,628	-16%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	£195,445,556	£213,677,168	9%	£24,283,607	£44,640,248	84%

Components	Gate-2/ WRSE Reference	Gate 1 Optimism Bias (£)	Gate 2 Optimism Bias (£)	% Difference	Gate 1 Total Capex (£)	Gate 2 Total Capex (£)	% Difference
Mogden Effluent Reuse							
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£53,674,950	£46,407,238	-14%	£205,252,082	£180,443,860	-12%
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£91,875,089	£75,085,700	-18%	£347,000,653	£294,307,471	-15%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	£67,888,177	£71,109,659	5%	£287,617,341	£329,427,075	15%

Components	Gate-2/ WRSE Reference	Gate 1 Max Fixed Opex (£/yr.)	Gate 2 Max Fixed Opex (£/yr.)	% Difference	Gate 1 Max Variable Opex (£/ML)	Gate 2 Max Variable Opex (£/ML)	% Difference
Mogden Effluent Reuse							
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	£1,566,717	£1,997,637	28%	£341	£534	56%
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	£2,600,721	£3,207,501	23%	£384	£486	26%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	£496,520	£600,375	21%	£32	£45	39%

Components	Gate-2/ WRSE Reference	Gate 1 - Total Embodied Carbon (tCO2e)	Gate 2 - Total Embodied Carbon (tCO2e)	Difference %	Gate 1 - Max Fixed Operational Carbon (tCO2e/yr.)	Gate 2 - Max Fixed Operational Carbon including electricity (tCO2e/yr.)	% Difference
Mogden Effluent Reuse							
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	35532.1	37,006.02	4%	159.9704	52.05	-67%
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	46488.81	49,474.75	6%	296.5896	216.57	-27%
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	51266.57	57,794.65	13%	0	68.42	n/a

Components	Gate-2/ WRSE Reference	Gate 2 Variable Operational Carbon Excluding Electricity (tCO2e/Ml)	Gate 2 Variable Operational Carbon From Electricity (tCO2e/Ml)	Gate 2 Variable Operational Carbon Total (tCO2e/yr.)
Mogden Effluent Reuse				
50 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 50	0.239151281	0.159	5,427
100 Ml/d AWRP	TWU_WLJ_HI-REU_reuse mogden 100	0.250191158	0.13	11,044
Conveyance (All Streams)	TWU_WLJ_HI-TFR_reuse mogden/walton	0	0.019	320

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53
Complete for all options (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Capex			Total							45.5616	45.5616	45.5616	45.5616	45.5616	26.7096	0	0	0	0	0	0	0	0	5.93132	0	0	0	0	0	0	0	0	0	60.8358	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	0	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099	12.3099
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Financing Cost			Total							1.11667	3.35002	5.58337	7.81672	10.0501	18.6072	19.0253	18.8232	18.6211	18.419	18.2169	18.0148	17.8127	17.6106	17.5282	17.4457	17.2436	17.0415	16.8394	16.6373	16.4352	16.2331	16.031	15.8289	16.854	17.879	17.6769	17.4748
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Capex	Costed Risk		Total							13.5354	13.5354	13.5354	13.5354	13.5354	5.58003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Capex	Optimism Bias		Total							17.3875	17.3875	17.3875	17.3875	17.3875	10.1931	0	0	0	0	0	0	0	0	2.26355	0	0	0	0	0	0	0	0	0	23.2166	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Net Present Cost (NPC)			Total							1.07891	3.12728	5.03588	6.81182	8.46189	15.137	14.9537	14.2946	22.6951	21.7844	20.9093	20.0684	19.2606	18.4844	17.8101	17.1603	16.4674	15.8017	15.1622	14.5479	13.9578	13.391	12.8466	12.3236	12.3406	12.3424	11.8452	11.3675
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Total NPC			Total	664.98117																																	

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53
Complete for all options >£100m (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	0	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801	2.59801
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	0	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194	9.71194
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Land (Non depreciating)			Fixed							4.23176	4.23176	4.23176	4.23176	4.23176	0.97673	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Planning and Development (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Process-Related Carbon Media Including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Computers and Data Logging (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Fencing (10)		10	Fixed							0.15209	0.15209	0.15209	0.15209	0.15209	0	0	0	0	0	0	0	0	0	0.76043	0	0	0	0	0	0	0	0	0	0.76043	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed							1.43839	1.43839	1.43839	1.43839	1.43839	0.08083	0	0	0	0	0	0	0	0	7.43444	0	0	0	0	0	0	0	0	0	7.43444	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							15.0713	15.0713	15.0713	15.0713	15.0713	0.16692	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75.8575	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0.14256	0.14256	0.14256	0.14256	0.14256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							0.61223	0.61223	0.61223	0.61223	0.61223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							5.9318	5.9318	5.9318	5.9318	5.9318	0.41264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0.31271	0.31271	0.31271	0.31271	0.31271	0.20935	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Headworks/Valves (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Underwater Assets (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Pipelines (100)		100	Fixed							35.0563	35.0563	35.0563	35.0563	35.0563	35.0563	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Tunnels (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 50 p2	Modgen Reuse scheme (50Ml/d yield)	Costed Risk			Fixed							13.5354	13.5354	13.5354	13.5354	13.5354	5.58003	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable
Complete for all options (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Capex			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Opex			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Financing Cost			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Discount Rate			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Discount Factor			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Capex	Costed Risk		Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Capex	Optimism Bias		Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Net Present Cost (NPC)			Total
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Total NPC			Total

1

Cost Metric (£m)	Cost Sub-metric (£m)	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40
Capex								57.2117	57.2117	57.2117	57.2117	57.2117	26.7096	0	0	0	0	0	0	0	0	8.02262
Opex								0	0	0	0	0	0	0	0	20.844	20.844	20.844	20.844	20.844	20.844	20.844
Financing Cost								1.44504	4.33511	7.22518	10.1152	13.0053	25.0839	25.4145	25.118	24.8215	24.5249	24.2284	23.9319	23.6354	23.3389	23.2062
Discount Rate								0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Discount Factor								0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689
Capex	Costed Risk							18.9224	18.9224	18.9224	18.9224	18.9224	5.58003	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias							22.841	22.841	22.841	22.841	22.841	10.6635	0	0	0	0	0	0	0	0	3.20292
Net Present Cost (NPC)								1.39617	4.04687	6.5167	8.81485	10.9501	20.4058	19.9756	19.0749	33.5062	32.1629	30.8722	29.632	28.4403	27.2954	26.2932
Total NPC		979.85695																				

Cost Metric (£m)	Cost Sub-metric (£m)	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60
Capex		0	0	0	0	0	0	0	0	0	100.699	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opex		20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844
Financing Cost		23.0736	22.7771	22.4806	22.1841	21.8876	21.591	21.2945	20.998	20.7015	22.4621	24.2228	23.9263	23.6298	23.3332	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Factor		0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	0	40.2028	0	0	0	0	0	0	0	0	0	3.4089
Net Present Cost (NPC)		25.3276	24.3059	23.3243	22.3813	21.4754	20.6052	19.7693	18.9664	18.1952	18.3249	18.425	17.6848	16.9736	16.2903	15.6338	15.0759	14.5372	14.0171	13.515	13.0838
Total NPC																					

Cost Metric (£m)	Cost Sub-metric (£m)	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80
Capex		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opex		20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844
Financing Cost		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Rate		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Factor		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	0	40.2028	0	0	0	0	0	0	0	0	0	4.19852
Net Present Cost (NPC)		12.6663	12.2115	11.7724	11.3486	10.9394	10.5445	10.1632	9.79529	9.44015	9.56782	9.68005	9.33419	9.00027	8.67788	8.36663	8.06615	7.77608	7.49607	7.22577	7.00141
Total NPC																					

Cost Metric (£m)	Cost Sub-metric (£m)	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Opex		20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844	20.844
Financing Cost		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Rate		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Factor		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	0	53.4317	0	0	0	0	0	0	0	0	0	3.20292	0	0	0	0	0
Net Present Cost (NPC)		6.78399	6.53884	6.30221	6.07383	5.85339	5.64065	5.43534	5.2372	5.04599	5.20765	5.35562	5.16424	4.97947	4.80108	4.62885	4.46259	4.30209	4.14715	3.99758	3.86865	3.7621	3.64376	3.52894	3.41756	3.30951
Total NPC																										

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	
Complete for all options >£100m (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Opex	Cost		Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Opex	Cost		Variable
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Land (Non depreciating)			Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Planning and Development (Non depreciating)			Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Process-Related Carbon Media Including GAC (4)		4	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Vehicles (4)		4	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Computers and Data Logging (4)		4	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Fencing (10)		10	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Domestic Meters (10)		10	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Building Services (10)		10	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Membranes (10)		10	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Plant and Machinery (15)		15	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Raw Water and District Meters (20)		20	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Power Supply (25)		25	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Bridges (40)		40	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Roads and Car Parks (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Water Towers (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Borehole Installation (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Headworks/Valves (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Underwater Assets (60)		60	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Weirs (100)		100	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Pipelines (100)		100	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Tunnels (100)		100	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Aqueducts (100)		100	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Embankment Works (250)		250	Fixed
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 100 p2	Modgen Reuse scheme (100Ml/d yield)	Costed Risk			Fixed

Cost Metric (£m)		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40
Opex	Fixed							0	0	0	0	0	0	0	0	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787
Opex	Variable							0	0	0	0	0	0	0	0	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362
Land (Non depreciating)	Fixed							6.92689	6.92689	6.92689	6.92689	6.92689	0.98918	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed							0.16674	0.16674	0.16674	0.16674	0.16674	0	0	0	0	0	0	0	0	0	0.83371
Domestic Meters (10)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed							2.02925	2.02925	2.02925	2.02925	2.02925	0.08186	0	0	0	0	0	0	0	0	10.3918
Plant and Machinery (15)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed							25.8339	25.8339	25.8339	25.8339	25.8339	0.16905	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed							0.14438	0.14438	0.14438	0.14438	0.14438	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed							0.69787	0.69787	0.69787	0.69787	0.69787	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed							8.33619	8.33619	8.33619	8.33619	8.33619	0.4179	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed							0.41439	0.41439	0.41439	0.41439	0.41439	0.21202	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed							35.5031	35.5031	35.5031	35.5031	35.5031	35.5031	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed							18.9224	18.9224	18.9224	18.9224	18.9224	5.58003	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60
Opex	Fixed	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787
Opex	Variable	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	0	0	0	0	0	0.83371	0	0	0	0	0	0	0	0	0	0.83371
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	0	0	0	0	0	10.3918	0	0	0	0	0	0	0	0	0	10.3918
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	0	0	0	0	0	129.676	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.7219
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80
Opex	Fixed	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787
Opex	Variable	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	0	0	0	0	0	0.83371	0	0	0	0	0	0	0	0	0	0.83371
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	0	0	0	0	0	10.3918	0	0	0	0	0	0	0	0	0	10.3918
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	0	0	0	0	0	129.676	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.48935
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Fixed	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787	3.80787
Opex	Variable	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362	17.0362
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	0	0	0	0	0	0.83371	0	0	0	0	0	0	0	0	0	0.83371	0	0	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	0	0	0	0	0	10.3918	0	0	0	0	0	0	0	0	0	10.3918	0	0	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	0	0	0	0	0	129.676	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0.7219	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	42.9347	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	2.70798	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company		Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

1

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Complete for all options (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Capex			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Opex			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Financing Cost			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Discount Rate			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Discount Factor			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Capex	Costed Risk		Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Capex	Optimism Bias		Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Net Present Cost (NPC)			Total						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Total NPC			Total	2352.4162					

Cost Metric (£m)	Cost Sub-metric (£m)	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Capex		87.7137	87.7137	87.7137	87.7137	87.7137	26.7096	0	0	0	0	0	0	0	0	15.5772	0	0	0	0	0
Opex		0	0	0	0	0	0	0	0	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848
Financing Cost		2.29801	6.89403	11.49	16.0861	20.6821	42.1024	42.1925	41.6447	41.097	40.5492	40.0015	39.4538	38.906	38.3583	38.135	37.9117	37.3639	36.8162	36.2684	35.7207
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Discount Factor		0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257
Capex	Costed Risk	32.2647	32.2647	32.2647	32.2647	32.2647	5.58003	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	37.4195	37.4195	37.4195	37.4195	37.4195	11.3946	0	0	0	0	0	0	0	0	6.64537	0	0	0	0	0
Net Present Cost (NPC)		2.2203	6.43565	10.3634	14.0181	17.4138	34.2504	33.1629	31.6255	81.284	78.147	75.1292	72.2261	69.4334	66.747	64.3566	62.0515	59.648	57.336	55.1122	52.9732

Cost Metric (£m)	Cost Sub-metric (£m)	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
Capex		0	0	0	0	199.964	0	0	0	0	0	0	0	0	0	16.6091	0	0	0	0	0
Opex		69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848
Financing Cost		35.1729	34.6252	34.0774	33.5297	37.1469	40.7641	40.2163	39.6686	39.1209	38.5731	38.0254	37.4776	36.9299	36.3821	36.1803	35.9785	35.4308	34.883	34.3353	33.7875
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor		0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	85.3064	0	0	0	0	0	0	0	0	0	7.08557	0	0	0	0	0
Net Present Cost (NPC)		50.9159	48.9371	47.0339	45.2035	45.2055	45.1557	43.4123	41.7352	40.1219	38.57	37.2571	35.988	34.7612	33.5754	32.5354	31.5276	30.4506	29.4096	28.4035	27.431

Cost Metric (£m)	Cost Sub-metric (£m)	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
Capex		0	0	0	0	199.964	0	0	0	0	0	0	0	0	0	20.5647	0	0	0	0	0
Opex		69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848
Financing Cost		33.2398	32.692	32.1443	31.5965	35.2137	38.8309	38.2832	37.7354	37.1877	36.64	36.0922	35.5445	34.9967	34.449	34.3295	34.2101	33.6624	33.1146	32.5669	32.0191
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor		0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	85.3064	0	0	0	0	0	0	0	0	0	8.77309	0	0	0	0	0
Net Present Cost (NPC)		26.4911	25.5826	24.7046	23.856	23.9884	24.0928	23.273	22.4805	21.7144	20.9739	20.2581	19.5662	18.8975	18.251	17.6991	17.1639	16.5761	16.008	15.459	14.9283

Cost Metric (£m)	Cost Sub-metric (£m)	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		0	0	0	0	262.634	0	0	0	0	0	0	0	0	0	15.5772	0	0	0	0	0
Opex		69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848	69.6848
Financing Cost		31.4714	30.9237	30.3759	29.8282	34.7507	39.6732	39.1254	38.5777	38.03	37.4822	36.9345	36.3867	35.839	35.2912	35.0679	34.8446	34.2969	33.7491	33.2014	32.6536
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor		0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	112.042	0	0	0	0	0	0	0	0	0	6.64537	0	0	0	0	0
Net Present Cost (NPC)		14.4154	13.9198	13.4408	12.9779	13.2231	13.4431	12.9862	12.5445	12.1175	11.7047	11.3057	10.9201	10.5472	10.1869	9.86915	9.60792	9.32446	9.04911	8.78165	8.52185

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25
Complete for all options >£100m (Feasible and preferred)	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Opex	Cost		Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Opex	Cost		Variable						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Land (Non depreciating)			Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Planning and Development (Non depreciating)			Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Process-Related Carbon Media Including GAC (4)		4	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Vehicles (4)		4	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Computers and Data Logging (4)		4	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Fencing (10)		10	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Domestic Meters (10)		10	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Building Services (10)		10	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Membranes (10)		10	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Plant and Machinery (15)		15	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Raw Water and District Meters (20)		20	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Power Supply (25)		25	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Bridges (40)		40	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Roads and Car Parks (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Water Towers (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Borehole Installation (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Headworks/Valves (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Underwater Assets (60)		60	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Weirs (100)		100	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Pipelines (100)		100	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Tunnels (100)		100	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Aqueducts (100)		100	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Embankment Works (250)		250	Fixed						
	TWU_WLJ_HI-REU_RE2_ALL_reuse mogden 200 p2	Modgen Reuse scheme (200Ml/d yield)	Costed Risk			Fixed						

Cost Metric (£m)		2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Opex	Fixed	0	0	0	0	0	0	0	0	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537
Opex	Variable	0	0	0	0	0	0	0	0	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694
Land (Non depreciating)	Fixed	13.1163	13.1163	13.1163	13.1163	13.1163	1.00853	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0.34001	0.34001	0.34001	0.34001	0.34001	0	0	0	0	0	0	0	0	0	1.70005	0	0	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	4.05443	4.05443	4.05443	4.05443	4.05443	0.08346	0	0	0	0	0	0	0	0	20.5225	0	0	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	52.5061	52.5061	52.5061	52.5061	52.5061	0.17236	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0.29441	0.29441	0.29441	0.29441	0.29441	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	1.42304	1.42304	1.42304	1.42304	1.42304	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	16.5725	16.5725	16.5725	16.5725	16.5725	0.42607	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0.62882	0.62882	0.62882	0.62882	0.62882	0.21617	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	36.1976	36.1976	36.1976	36.1976	36.1976	36.1976	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	32.2647	32.2647	32.2647	32.2647	32.2647	5.58003	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
Opex	Fixed	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537
Opex	Variable	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	1.70005	0	0	0	0	0	0	0	0	0	1.70005	0	0	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	20.5225	0	0	0	0	0	0	0	0	0	20.5225	0	0	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	263.048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.47205	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
Opex	Fixed	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537
Opex	Variable	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	1.70005	0	0	0	0	0	0	0	0	0	1.70005	0	0	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	20.5225	0	0	0	0	0	0	0	0	0	20.5225	0	0	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	263.048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7.11521	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)		2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Fixed	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537	7.01537
Opex	Variable	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694	62.6694
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media Including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	1.70005	0	0	0	0	0	0	0	0	0	1.70005	0	0	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	Fixed	0	0	0	0	20.5225	0	0	0	0	0	0	0	0	0	20.5225	0	0	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	263.048	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	1.47205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	84.1406	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	3.79258	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company	Jacobs	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Complete for all options (Feasible and preferred)	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Capex			Total		36.0293	36.0293	36.0293	36.0293	36.0293	36.0293	36.0293	0	0	0	0	0	0	0	0	0	8.0455	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Opex			Total		0	0	0	0	0	0	0	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Financing Cost			Total		0.9296	2.78879	4.64798	6.50717	8.36636	10.2255	12.0847	21.9331	21.6688	21.4045	21.1403	20.876	20.6117	20.3474	20.0831	19.8188	19.7264	19.634	19.3697	19.1054
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Discount Rate			Total		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Discount Factor			Total		0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Capex	Costed Risk		Total		10.9517	10.9517	10.9517	10.9517	10.9517	10.9517	10.9517	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Capex	Optimism Bias		Total		16.6899	16.6899	16.6899	16.6899	16.6899	16.6899	16.6899	0	0	0	0	0	0	0	0	0	3.72694	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Net Present Cost (NPC)			Total		0.89816	2.60336	4.19221	5.67062	7.04425	8.31849	9.4985	27.8069	26.6727	25.5833	24.5372	23.5325	22.5677	21.6413	20.7517	19.8976	19.1732	18.4751	17.7128	16.981
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Total NPC			Total	764.87471																				

Cost Metric	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capex	0	0	0	0	0	0	87.3536	0	0	0	0	0	0	0	0	0	8.56143	0	0	0
Opex	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833
Financing Cost	18.8411	18.5769	18.3126	18.0483	17.784	17.5197	19.1216	20.7234	20.4591	20.1949	19.9306	19.6663	19.402	19.1377	18.8734	18.6091	18.5278	18.4464	18.1821	17.9178
Discount Rate	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	40.4651	0	0	0	0	0	0	0	0	0	3.96594	0	0	0
Net Present Cost (NPC)	16.2785	15.604	14.9565	14.335	13.7384	13.1658	13.3533	13.5131	12.9587	12.4263	11.973	11.5355	11.1133	10.706	10.3129	9.93371	9.6208	9.31769	8.97414	8.64269

Cost Metric	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Capex	0	0	0	0	0	0	87.3536	0	0	0	0	0	0	0	0	0	10.2611	0	0	0
Opex	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833
Financing Cost	17.6535	17.3892	17.1249	16.8606	16.5964	16.3321	17.9339	19.5358	19.2715	19.0072	18.7429	18.4787	18.2144	17.9501	17.6858	17.4215	17.3764	17.3314	17.0671	16.8028
Discount Rate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	40.4651	0	0	0	0	0	0	0	0	0	4.75328	0	0	0
Net Present Cost (NPC)	8.32294	8.01448	7.71693	7.42991	7.15307	6.88605	7.03078	7.16123	6.89895	6.64588	6.40169	6.16609	5.93879	5.71949	5.50794	5.30385	5.14214	4.98535	4.80019	4.62158

Cost Metric	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Capex	0	0	0	0	0	0	131.103	0	0	0	0	0	0	0	0	0	8.0455	0	0	0
Opex	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833	14.6833
Financing Cost	16.5385	16.2742	16.0099	15.7456	15.4813	15.2171	17.7535	20.29	20.0257	19.7615	19.4972	19.2329	18.9686	18.7043	18.44	18.1757	18.0833	17.9909	17.7266	17.4623
Discount Rate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	60.731	0	0	0	0	0	0	0	0	0	3.72694	0	0	0
Net Present Cost (NPC)	4.44931	4.28315	4.1229	3.96835	3.8193	3.67557	3.87124	4.05239	3.90463	3.76204	3.62444	3.49166	3.36355	3.23994	3.12067	3.02026	2.93831	2.85856	2.76628	2.6768

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Complete for all options >£100m (Feasible and preferred)	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Opex	Cost		Fixed		0	0	0	0	0	0	0	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Opex	Cost		Variable		0	0	0	0	0	0	0	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Land (Non depreciating)			Fixed		11.608	11.608	11.608	11.608	11.608	11.608	11.608	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Planning and Development (Non depreciating)			Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Vehicles (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Computers and Data Logging (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Fencing (10)		10	Fixed		0.11505	0.11505	0.11505	0.11505	0.11505	0.11505	0.11505	0	0	0	0	0	0	0	0	0	0.80534	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Domestic Meters (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Building Services (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Membranes (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed		1.56673	1.56673	1.56673	1.56673	1.56673	1.56673	1.56673	0	0	0	0	0	0	0	0	0	10.9671	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Plant and Machinery (15)		15	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed		16.578	16.578	16.578	16.578	16.578	16.578	16.578	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Raw Water and District Meters (20)		20	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Power Supply (25)		25	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed		0.10785	0.10785	0.10785	0.10785	0.10785	0.10785	0.10785	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Bridges (40)		40	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed		0.46313	0.46313	0.46313	0.46313	0.46313	0.46313	0.46313	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed		8.51795	8.51795	8.51795	8.51795	8.51795	8.51795	8.51795	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Roads and Car Parks (60)		60	Fixed		0.51919	0.51919	0.51919	0.51919	0.51919	0.51919	0.51919	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Water Towers (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Borehole Installation (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Headworks/Valves (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Underwater Assets (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Weirs (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Pipelines (100)		100	Fixed		13.2433	13.2433	13.2433	13.2433	13.2433	13.2433	13.2433	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Tunnels (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Aqueducts (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Embankment Works (250)		250	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_WRJ_HI-REU_RE1_ALL_reuse mogden s sewer	Mogden South Sewer (50Ml/d yield)	Costed Risk			Fixed		10.9517	10.9517	10.9517	10.9517	10.9517	10.9517	10.9517	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
Opex - Cost (Fixed)	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958
Opex - Cost (Variable)	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0.80534	0	0	0	0	0	0	0	0	0	0.80534	0	0	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	10.9671	0	0	0	0	0	0	0	0	0	10.9671	0	0	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	116.046	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.75492	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
Opex - Cost (Fixed)	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958
Opex - Cost (Variable)	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0.80534	0	0	0	0	0	0	0	0	0	0.80534	0	0	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	10.9671	0	0	0	0	0	0	0	0	0	10.9671	0	0	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	116.046	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.24194	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex - Cost (Fixed)	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958	2.87958
Opex - Cost (Variable)	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037	11.8037
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0.80534	0	0	0	0	0	0	0	0	0	0.80534	0	0	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	10.9671	0	0	0	0	0	0	0	0	0	10.9671	0	0	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	116.046	0	0	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0.75492	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	59.6257	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	3.63431	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Annex A5: Teddington DRA Cost and Carbon Report

Document no: J698-TD-DOC-210013-0B
Revision no: 0B

Thames Water Utilities Ltd
J698

London Recycling Schemes
25 October 2022

Annex A5: Teddington DRA Cost and Carbon Report

Client name:	Thames Water Utilities Ltd		
Project name:	London Recycling Schemes		
Client reference:	J698	**Project no:**	B22849AP
Document no:	J698-TD-DOC-210013-0B		
Date:	25 October 2022		

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This document has been written in line with the requirements of the RAPID Gate 2 Guidance and to comply with the regulatory process pursuant to Thames Water's statutory duties. The information presented relates to material or data which is still in the course of completion. Should the solution presented in this document be taken forward, Thames Water will be subject to the statutory duties pursuant to the necessary consenting process, including environmental assessment and consultation as required. This document should be read with those duties in mind.

Contents

Appendices

Table of tables

Table of figures

Executive Summary

This report demonstrates the basis, methodologies and results of cost and carbon estimates for the Teddington Direct River Abstraction (DRA) scheme. This scheme is one of the four schemes in the London Effluent Reuse Strategic Regional Water Resource Option (London Effluent Reuse SRO). The scheme will treat a portion of final effluent from Mogden Sewage Treatment Works (STW) in a new Tertiary Treatment Plant (TTP) within the Mogden STW boundary and will transfer the Treated Effluent to a new outfall on the River Thames upstream of Teddington Weir. The discharge of treated effluent to the River Thames shall allow flow to be abstracted from the River Thames up to the volume discharged from the TTP. The abstraction intake is to be 150m upstream of the Treated Effluent discharge location, thus compensating the Teddington Target Flows (TTF) at Teddington Weir. The abstracted water would be transferred into the Thames Lee Tunnel and would be conveyed to the Lee Valley Reservoirs in East London.

Base Capital Expenditures (Base Capex) and Operating Expenditures (Opex) for the scheme were estimated using Thames Water's Asset Planning System (APS). Cost curves in Thames Water's Engineering Estimating System (EES) were used to populate Base Capex data entries in F909 worksheets, which are Thames Water's costing spreadsheets to calculate input information for APS. For the items where appropriate EES cost curves were not available, the estimated costs were verified with supplier quotations and unit-rate cost benchmarking.

Quantitative Costed Risk Assessments (QCRA) were performed, identifying risk events, cost impacts and likelihood of risk events. Estimated risk probabilities and cost/schedule scoring for each project risk were evaluated using Monte Carlo simulations to return a costed risk value. Then, Optimism Bias (OB) was derived in the methodology outlined in the "Cost Consistency Methodology – Technical Note and Methodology Revision E" (Mott MacDonald, Feb 2022). The estimated OB values were reviewed with the QCRA outputs and scaled back where required to avoid double-counting in the Costed Risk and OB. Carbon estimates were formulated through the Thames Water EES and APS in the cost estimating exercise, with a whole-life carbon mitigation assessment carried out based on the PAS 2080 principles.

The Capex, Opex, Costed Risk, OB and Carbon values were calculated and reported in the requirements set out by Water Resources South East (WRSE). A summary of the costs and carbon estimates is listed in Table S-1 below. All costs and carbon estimates discussed in this report are consistent with the WRSE Input Template version 5 ("J698-GN-DOC-002015-0E WRSE_InputTemplate_v5_Reuse_20220531 - London Reuse SRO") issued in May 2022.

Table S-1. Summary of Estimated Costs – Teddington DRA

Scheme	Component	Total Capex (£m)	Fixed Opex (£m/year)	Variable Opex (£/Ml)	Embodied Carbon (tCO2e)	Fixed Operational Carbon (tCO2e/y)	Variable Operational Carbon (tCO2e/y)
Teddington DRA scheme	50Ml/d Tertiary Treatment Plant	£117	£0.37	£120	39,320	10.41	657
	75Ml/d Tertiary Treatment Plant	£128	£0.40	£124	44,409	6.62	1008
	River Abstraction & TLT Connection	£31	£0.05	£28	5,432	1.86	16
	Treated Effluent Transfer Tunnel	£78	£0.13	£14	13,723	7.91	66

1. "Total Capex" is a sum of Base Capex (including overheads), Costed Risk and Optimism Bias.
2. Conveyance elements ("River Abstraction and TLT Connection" and "Treated Effluent Transfer Tunnel") were sized for 75Ml/d maximum yield from the TTP, as agreed with the EA during Gate 2 stage (reduction from 150 Ml/d maximum at Gate 1 stage).
3. The capacity of the Mogden to Teddington weir conveyance (tunnel) for reference is 150 Ml/d. With pumps and discharge outfall sized for 75 Ml/d. But the tunnel size could accommodate up to 300 Ml/d hydraulically with a larger pump station. And if 100 Ml/d scheme were selected we would need to upsize the pumps to outfall.

Construction Capex and Opex costs have been used to generate the Net Present Values (NPV) and Average Incremental Costs (AIC) for the components to allow comparison ensuring for lifetime cost. A summary of the AIC values is shown below for two configurations of this scheme at a minimum and maximum utilisation level over an 80-year period. The values are adjusted to a 2020/21 Cost base.

Table S-2. Summary of Average Incremental Costs (AIC) at Minimum and Maximum Utilisation Level - Teddington DRA

Configuration name	Units	Teddington DRA scheme (50Ml/d yield)	Teddington DRA scheme (75Ml/d yield)
Option benefit	Ml/d	46	67
Minimum Flow – based on 25% utilisation for 12 months of the year			
Average Incremental Cost (AIC)	p/m^3	68	51
Maximum Flow – full capacity (100% utilisation) for 12 months of the year			
Average Incremental Cost (AIC)	p/m^3	80	63

1. Teddington DRA scheme (50Ml/d yield): a combination of the 50Ml/d TTP component, the River Abstraction and TLT Connection component and the Treated Effluent Transfer Tunnel component. Costs for operations of the conveyance component were calculated, assuming it conveys up to 50Ml/d.
2. Teddington DRA scheme (75Ml/d yield): a combination of the 75Ml/d TTP component, the River Abstraction and TLT Connection component and the Treated Effluent Transfer Tunnel component. Costs for operations of the conveyance component were calculated, assuming it conveys up to 75Ml/d.

1. Introduction

1.1 Background and Purpose of Report

Teddington DRA was identified as one of the four schemes which compose the London Effluent Reuse SRO by the Regulators' Alliance for Progressing Infrastructure Development (RAPID). Thames Water Utilities Limited (Thames Water) have developed a conceptual design for this scheme and estimated costs and carbon associated with the scheme. The results of cost and carbon estimating has been reported to the Water Resources South-East (WRSE) to update the WRSE Database for its investment modelling.

The objectives of this report are to present the basis, methodologies and results of cost and carbon estimating for the Teddington DRA scheme in the London Effluent Reuse SRO.

1.2 Scheme Overview

Mogden STW is located in Isleworth, West London. The Teddington DRA scheme will abstract a fraction of final effluent from Mogden STW for treatment in a new Tertiary Treatment Plant (TTP) within the Mogden STW boundary. Treated Effluent from the TTP will be conveyed and discharged into the River Thames just above the Teddington Weir which marks the river's tidal limit. Then, the same amount of water will be abstracted from the River Thames approximately 150m upstream of the discharge location, thus compensating the Teddington Target Flows (TTF) at Teddington Weir. The abstracted water will be pumped into a shaft connecting into the Thames Lee Tunnel (TLT) which crosses the abstraction site. The TLT will convey flows to the Lee Valley Reservoirs for treatment at Water Treatment Works (WTW) in East London to supplement raw water resources. Figure 1-1 shows the overview of the Teddington DRA, and Table 1-1 lists a summary of design elements costed for the scheme.

In the cost estimate and conceptual design, the Tertiary Treatment Plant was sized in two components which will be capable to yield 50 and 75 Ml/d of Treated Effluent. The maximum total yield from the TTP in the Teddington DRA scheme has been revised at Gate 2 to 100 Ml/d, due to environmental constraints, at the stage of WRSE modelling the scheme maximum size was constrained to a single phase of either 50 Ml/d or 75Ml/d component. It is noted that ongoing modelling and discussions with the Environment Agency (EA) have identified that an increase to 100 Ml/d is viable without significant detriment to the river, in which case a phased (or simultaneous phasing) development of the 50 Ml/d TTP size would be used in combination. The wastewater from the tertiary treatment plant will be returned to Mogden STW inlet works, and it has been modelled that there is sufficient hydraulic and treatment capacity at Mogden STW to accommodate these flows.

The proposed conveyance elements for Treated Effluent consists of a tunnel from the TTP on the Mogden STW site to the discharge at the river Thames upstream of Teddington Weir. This tunnel is sized for transfer of 75 Ml/d Treated Effluent in the cost estimate. But hydraulically it has capacity to take up to 150 Ml/d and potentially more, subject to increasing pumping station capacity.

The river abstraction intake, upstream of Teddington weir, is a low velocity intake with eel-friendly band screens, with flows gravitating to the abstraction pumping station. Raw water shall then be discharged from the pumping station into the TLT via a new pressurised connection to the tunnel.

The Teddington DRA scheme will supply the London Water Resource Zone (WRZ), with King George V zone being the beneficiary in the WRSE modelling.

Teddington DRA Schematic

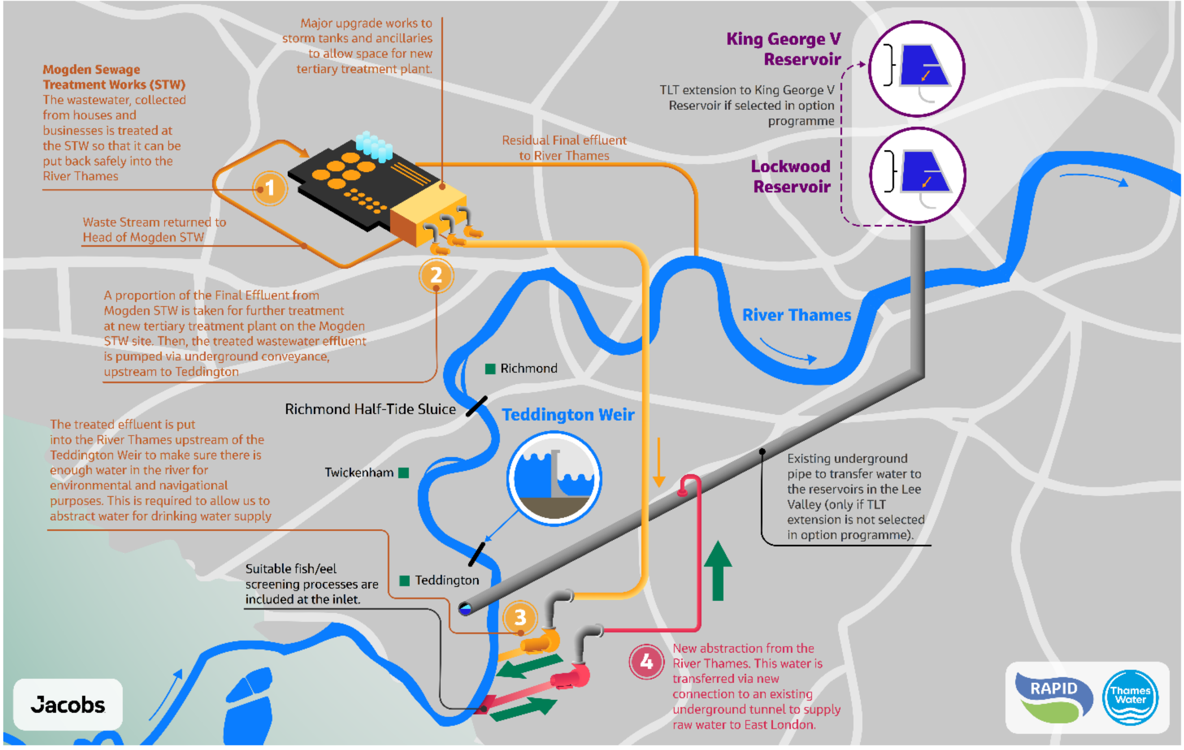

Figure 1-1. Teddington DRA Scheme Overview

Table 1-1. Teddington DRA Components for Cost Estimate

Components	Gate-2/ WRSE Reference	Scope Summary
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	▪ Tertiary Treatment Plant to yield 50 Ml/d Treated Effluent ▪ Final Effluent Transfer Pumping Station ▪ Treated Effluent Pumping Station ▪ Wastewater Return Pumping Station ▪ Waste stream & Effluent abstraction conveyance elements
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	▪ Tertiary Treatment Plant to yield 75 Ml/d Treated Effluent ▪ Final Effluent Transfer Pumping Station ▪ Treated Effluent Pumping Station ▪ Wastewater Return Pumping Station ▪ Waste stream & Effluent abstraction conveyance elements
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_teddingtondrated/tlt	▪ Raw Water Abstraction from River Thames incl. screens & pipeline (sized for 75Ml/d) ▪ Abstraction Pumping Station (sized for 75Ml/d) ▪ Transfer pipeline to TLT and shaft connection / adit (sized for 75Ml/d)
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_teddingtondramog/ted	▪ 1.8m-diameter tunnel from TTP (in Mogden STW) to River Thames at Teddington Weir for Treated Effluent transfer (sized for 75Ml/d), including shafts and discharge pumps

Solutions	Components	Gate-2/ WRSE Reference
Solution 1	50 Ml/d Tertiary Treatment Plant River Abstraction and TLT Connection Treated Effluent Transfer Tunnel	▪ TWU_KGV_HI-RAB_teddington dra 50 ▪ TWU_KGV_HI-TFR_teddingtondrated/tlt ▪ TWU_WLJ_HI-TFR_teddingtondramog/ted
Solution 2	75 Ml/d Tertiary Treatment Plant River Abstraction and TLT Connection Treated Effluent Transfer Tunnel	▪ TWU_KGV_HI-RAB_teddington dra 75 ▪ TWU_KGV_HI-TFR_teddingtondrated/tlt ▪ TWU_WLJ_HI-TFR_teddingtondramog/ted

A further transfer of abstracted water from Lockwood to the King George V Reservoir (KGV) was included in the Raw Water Cross Option Study at WRMP19 and updates to the model for WRMP24. At this stage, it is not clear at what final scheme size of Teddington DRA this transfer will be required to meet the requirements of raw water supply resilience at a programme level. For the Teddington DRA schemes, there remains a potential of the TLT extension being required, and this will be defined and confirmed following the autumn 2022 version of the WRSE draft regional plan during Gate 2 scheme development. The TLT extension is a mutually inclusive option component for the Beckton Effluent Reuse scheme and therefore the costs for the TLT extension are included in the Beckton Effluent Reuse Cost and Carbon Report (the component "Lockwood to KGV Recycled Water Transfer Tunnel", with the Gate 2 / WRSE Reference ID "TWU_KGV_HI-TFR_lockwood ps-kgv res" in Appendix D of Annex A.4) and may need to be added to the Teddington DRA costs if the TLT extension is demonstrated to be required for the scheme to achieve it's DO benefit.

1.3 Potential Increase in Maximum Scheme Size

In compliance with the SRO, Thames Water have established, though environmental constraint modelling, that the maximum capacity for Teddington DRA could be increased from 75Ml/d capacity to 100Ml/d. This is based on temperature plume and river modelling which was updated with the latest conceptual design configurations and additional environmental data. If the maximum capacity of the scheme is increased to 100Ml/d, this would entail two phases of the TTP in combination and an increase in the number and size of pumps and interconnecting pipework for the conveyance assets.

The Gate 2 scope is currently agreed to be a maximum capacity of 75 Ml/d, in line with the scheme size constraint used in the WRSE modelling for dWMRP24, the focus of this report is on a 75 Ml/d maximum scheme size, with limited assessment of the multiple phase selection to achieve 100 Ml/d size.

In Gate 1, conceptual design of Teddington DRA scheme had been progressed assuming that the maximum scheme size could be 150Ml/d. However, during Gate 2, a size constraint of 75 Ml/d was put place on the Teddington DRA scheme within the WRSE regional modelling and design development mainly focused on 75Ml/d scheme as a result of concerns raised by the Environmental Agency over potential impact within the River Thames from the scheme up to 150Ml/d. This constraint has been investigated further through Gate 2, and environmental investigations have concluded that impacts on river temperature would be acceptable up to the scheme size of 100Ml/d. Maximum scheme size of 100Ml/d is now recommended for going forward, and further design details of a 100Ml/d scheme will be developed in the next design stage.

2. Cost and Carbon Estimate Methodology

Total Capital Expenditure (Total Capex), Operating Expenditure (Opex), and Embodied Carbon, and Operational Carbon (Fixed and Variable) values were estimated for the Teddington DRA scheme. Total Capex consists of Base Capital Expenditure (Base Capex), Costed Risk and Optimism Bias (OB). This section demonstrates methodologies to estimate these components for the Teddington DRA scheme. Estimate developed using Thames Water internal estimating process and system EES and APS. In instances where model data wasn't available supply quotes and bottom-up estimates were used.

2.1 Base Capex Costing

Base Capex cost estimates for Teddington DRA scheme were carried out with Thames Water's Engineering Estimating System (EES) and Asset Planning System (APS), using F909 worksheets. F909 worksheets are Thames Water's costing spreadsheets used to calculate input information for APS by using EES cost curves and through manual/ override inputs where required. Descriptions of EES and APS are provided in the following sections.

For the RAPID Gate 2 cost estimates, the Base Capex entries in the F909s prepared in Gate 1 were reviewed and updated as per the latest conceptual design of the scheme, and an F909 worksheet was prepared for each of the four components in the Teddington DRA scheme in Table 1-1.

Once F909s had been prepared, they were processed through APS. Outputs from APS were populated in the WRSE Input Template as per the reporting requirements for WRSE to update the WRSE Database and for input to their investment modelling. The WRSE costing methodology aligns with the guidance prepared for the All Company Working Group (ACWG) to improve costing consistency between SROs.

2.1.1 Engineering Estimating System (EES) Cost Curves

Base Capex entries in F909s were derived mostly from the Thames Water costing system using Engineering Estimating System (EES).

EES is a database containing capital project costs and carbon information against asset structures commonly used in Thames Water's facilities. The system was introduced to Thames Water in 2000 and holds the cost for the construction against EES coding structure for all capital expenditure within infrastructure and non-infrastructure assets. A Carbon estimate system was also introduced to EES later around 2008 and mirrors the cost model structure for infrastructure and non-infrastructure assets. In EES, users select the appropriate cost curve from the library of available items and populate the appropriate yardstick value.

Data in the EES libraries has been collected from Thames Water projects against two key milestones; Target Cost and Final Actual Cost. Thames Water's EES database currently has data from over 6,500 projects totalling £12billion in value. Projects range from small £100k modifications to £620M large-scale construction works. The data has been checked against final drawings to ensure accuracy with all financials validated using the Thames Water corporate financial system.

The data enables EES to produce robust process model(s) from these projects and helps Thames Water to support the three key areas within the business in a repeatable and auditable way:

- High level Estimating for investment purposes
- Benchmarking 'Value for Money' statements
- Regulatory 5 yearly pricing – from Price Review (PR)04/Asset management Plan (AMP)3 to PR19/AMP7

Projects hold a unique index date/figure when imported into the EES system, and when modelled as a group, the projects are inflated to a common inflation index date/figure to ensure the model reflects current day prices. These models are periodically updated with new data and older data removed.

For Gate-2 costing, all F909s were updated in terms of scope and yardsticks, using the latest EES.

In the F909s worksheet, appropriate cost models were selected from EES costing library as per individual design items identified in conceptual design. Cost curves of Civil, M&E and ICA expenditures were available for each design item/ cost model. Relevant yardsticks/ quantities required were also entered, and the F909s generated Capex costs for Civil, M&E and ICA elements as a sum of base costs and overheads.

2.1.2 Manual Override Entries

The F909 worksheet allows manual override entries for items not covered by the EES database. An EES cost curve was not used for the abstraction eel-friendly band screens or the connection works to the existing Thames Lee Tunnel, and therefore manual override costs were entered. This was due to the variables of the costed elements not having a suitable EES cost curve for the non-standard scope item (i.e. eel-friendly bandscreens have different cost rates than standard abstraction screen EES cost curves). Cost rates of these items were entered with manual override, thereby obtaining budget quotations from Suppliers and using industry benchmarked evidence.

Where the yardstick value required in F909s was outside the upper range of the EES cost curve and where linear increase of the price was expected, such as “Mechanical Filters” and “Nitrifying Sand Filters”, a manual cost rate was entered based on the pro rata cost rate at the upper limit of the EES cost curve, and the cost was calculated through a linear extrapolation, as agreed with Thames Water.

2.1.3 Overhead Costs

Overhead costs are added by APS process to the EES costs onto the base costs to account for additional costs associated with design, construction supervision and project management. Overheads percentages from Thames Water EES system were used for this costing exercise. The same overheads are applied to WRMP24 and PR24 cost assessment.

2.1.4 Thames Water Asset Planning System (APS)

The Base Capex items entered in the F909s were processed through APS. APS is a database used within Thames Water to hold candidate investments for the Periodic Review business plan submission to Ofwat.

APS calculates the base cost for each element using the quantities and parent process code entered in the F909. Any costs generated using EES rates are inflated with respect to the Retail Prices Index (RPI). The Inflation Index Date entered in the F909X-Solution sheet in the respective F909 as “The date manual cost inputs are current for” is used by APS to apply inflation to manual override costs.

The F909 worksheet is limited to a single Inflation Index Date for override figures. Inflation Index Dates in the F909s for all elements were set as 4th of February, 2022 as the date of the submission of the WRSE Input Templates. The actual date used on the F909 costing sheet was the date that the Capital cost scoping were entered based on when Supplier quotations were received (e.g. October 2021 for the abstraction eel-friendly bandscreens).

2.1.5 Base Date

All costs generated are presented at 20/21 prices. Costs generated using the various water company costing systems can be at different base dates but all costs have been presented at 20/21 for consistency. The deflation factors used for Capex and Opex have been agreed with the ACWG and are based on the figures used by the WRSE modelling team. Figures used are summarised below in Table 2-1. Inflation will require updating for Gate 3 as current inflation is well above the figures predicted.

Table 2-1. Inflation/ Deflation factors

F/Yr.	Capex indices	Capex Factors	Opex indices	Opex Factors
2017/18	275.5	1.1002	104.3	1.0662
2018/19	284.8	1.0645	106.7	1.0417

F/Yr.	Capex indices	Capex Factors	Opex indices	Opex Factors
2019/20	293.7	1.0323	109.0	1.0197
2020/21	303.1	1.0000	111.2	1.0000
2021/22	312.9	0.9688	113.3	0.9811
2022/23	322.3	0.9405	115.6	0.9619

2.1.6 Assumptions

- Costs presented include standardised overheads in line with Thames Water EES cost model across WRMP24 and PR24,
- It is assumed the project can engage and consult on the scheme and proceed without delay,
- Costs based upon procurement being design and built (D&B) self-delivered by Thames Water,
- Land is rented for contractor compounds and agricultural rates apply,
- All permanent structures are located on land that is purchased at agricultural rates and are connected to the network with roads and protected with site fencing and gates,
- 40m easement is adequate and compensation payments included. Land purchase for pipeline route is excluded,
- Average pipe depths with battered excavation unless ground conditions suggest sheet piling will be required,
- Major crossings are tunnelled with launch and reception shafts. Single pipeline average lengths,
- Spend profiles are indicative only to facilitate multi-solution decision making and will be refined at Gate 3.

2.2 Quantitative Costed Risk Assessment

Risk registers for the four components listed in Table 1-1 were prepared using ACWG template, and Monte Carlo analyses were carried out for Quantitative Cost Risk Assessment (QCRA).

2.2.1 Risk Identification and Scoring

Risk registers in Gate 1 were reviewed and updated for consistency with the other London Effluent Reuse SRO schemes and as per the latest conceptual designs.

Gate 2 risk registers for the 50 and 75 Ml/d TTP were compared with the ones for treatment plants proposed in the other schemes in the London Effluent Reuse SRO (i.e. Mogden Effluent Reuse, Mogden South Sewer and Beckton Effluent Reuse), whereas the Gate 2 risk register for the tunnel was compared with the risk registers for the proposed tunnels in the Beckton Effluent Reuse and Mogden Effluent Reuse schemes for consistency. Where applicable, risk entries were added or combined to ensure consistency throughout schemes and components within the SRO.

Once the draft risk registers had been prepared with the adjustment for consistency among schemes/ components, they were reviewed by the project design team in the process, conveyance, civil and environmental design aspects. Then, the risk entries and scores were updated based on the latest conceptual designs and the analysis of regulatory requirements.

The ACWG QCRA worksheet requires entries of “Cost Score” scaled from 1 to 5 depending on the costs expected to be incurred by the individual risk events. The scales are defined as percentages of estimated Base Capex as shown in Table 2-2. “Probability Percentage” of the risk events is also required to be entered in the spreadsheets, and these two parameters are used in the ACWG QCRA with Monte Carlo Simulation to produce the Costed Risk.

The Costed Risk is produced for each risk entry based on these three factors: “Cost Score”, “Probability Percentage” and “Time Score” as shown in the risk score matrix in Figure 2-1. However, the “Time Score” is not considered in the Monte Carlo QCRA, and the WRMP19 Time Scores were generally used at this time.

Table 2-2. Thames Water ACWG QCRA Risk Assessment – Cost Scoring

Cost Scoring Scale	Cost Incurred by Individual Risk Event
1. Very Low	Less than 1% of estimated Base Capex
2. Low	1 – 2 % of estimated Base Capex
3. Medium	2 – 5 % of estimated Base Capex
4. High	5 – 15 % of estimated Base Capex
5. Very High	15 – 30 % of estimated Base Capex

Risk Criteria					Probability Score				
				Description	Remote	Unlikely	Possible	Likely	Very likely
				Guidance	Event may occur in exceptional circumstances	Event could occur at some time	Event should occur at some time	Event will probably occur in most circumstances	Event is expected to occur in most circumstances
				Probability	1% - 10%	11% - 30%	31% – 50%	51- 70%	71% - 99%
	Description	Cost £	Time months	Scale	1	2	3	4	5
Impacts	Very High	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	5	10	15	20	25
	High	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4	4	8	12	16	20
	Medium	Moderate (2.1-5%) increase in project cost	Moderate (2.1 - 5%) delay to project delivery	3	3	6	9	12	15
	Low	Small (1-2%) effect on project cost	Small (1-2%) effect on project delivery	2	2	4	6	8	10
	Very Low	Minimal (<1%) effect on project cost	Minimal (<1%) effect on project delivery	1	1	2	3	4	5

Figure 2-1. Thames Water ACWG Risk Scoring Matrix

2.2.2 Risk Mitigation

Risks were assessed in the current, pre-mitigated position as of February 2022 at the time of the risk identification and scoring exercise. Risks should be assessed again in their residual, post-mitigated position as the programme progresses with estimate of any costs associated with the mitigation.

2.2.3 Monte Carlo Analysis

The likelihood of the risk events and the cost ranges estimated to be incurred by the risk events are combined using Monte Carlo simulation.

A uniform distribution using the range shown in Table 2-2 was allocated as a probability distribution of costs incurred by each risk event (e.g. for the Cost Scoring Scale "3 – Medium", a uniform distribution with equal likelihood of an impact between 2 % and 5% of Base Capex costs was assumed). A Bernoulli distribution was used for the likelihood of the risk event, which were entered as "Probability Percentage" in the risk registers. Each of the identified risks were treated as discrete events, and no dependencies between risk events were considered. Each simulation was run with 50,000 iterations with Latin Hypercube sampling, and 50th percentile (P50) of the output distribution was used as the Costed Risk of the component.

2.3 Optimism Bias

Optimism Bias (OB) was derived using ACWG methodology which sets out recommendations for SROs on the common approach to OB assessment.

The Cost Consistency Methodology recommends that the approach to OB should use an associated excel template "Optimism Bias Template" provided for all SROs. The OB Template was developed by Mott MacDonald based on the HM Treasury Green Book and supplementary guidance by the HM Treasury. The OB Template was used to calculate OB percentage rates.

2.3.1 Upper Bound Optimism Bias

The OB Template is designed to determine the Upper Bound Optimism Bias based on the proportion of the Base Capex cost that is considered to be standard civil engineering and the proportion that is considered to be non-standard civil engineering. This step is stipulated as "First Stage" in Section 6.2.1 in the Cost Consistency Methodology report. ACWG methodology has been followed in assessing standard vs non-standard civil engineering proportions of the scheme.

At the initial stage of the assessment, the proportions of non-standard and standard civil engineering Base Capex had been determined, examining natures of individual Base Capex items. However, it was requested from ACWG that consistent proportions be used to eliminate subjective judgements and to maintain consistency among the schemes. As per discussion with ACWG, it was assumed that 100% of Base Capex would be "non-standard civil engineering" for all treatment plants and tunnels, whereas in the case of pipelines 75% would be "non-standard civil engineering" and 25% would be "standard civil engineering". The Upper Bound Optimism Bias Percentages shown in Table 2-3 were obtained based on these assumptions, using the Optimism Bias Template.

Table 2-3. Assumed Proportion of Non-Standard and Standard Civil Engineering Capex and Upper Bound Optimism Bias Percentage in Teddington DRA

Components	Gate-2/ WRSE Reference	Component type	Proportion of Non-Standard Civil Engineering Capex	Proportion of Standard Civil Engineering Capex	Upper Bound Optimism Bias %
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	Treatment Plant	100%	0%	66.00%
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	Treatment Plant	100%	0%	66.00%
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_teddingtondrated/tlt	Tunnel	100%	0%	66.00%
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_teddingtondramog/ted	Tunnel	100%	0%	66.00%

2.3.2 Confidence Grade Assessment

Subsequently, "Contributory Factors" defined by the HM Treasury Green Book were allocated to "High", "Medium" and "Low" confidence bands according to the OB Template. This step is stipulated as "Second Stage" in Section 6.2.2 in the "Cost Consistency Methodology – Technical Note and Methodology".

The OB template calculates mitigation factors to lower the Upper Bound OB according to the allocated confidence grades. Weighting of each contributory factor, which is based on the HM Treasury Green Book guidance, is used in the OB Template calculation. The OB Template, then, returns "Adjusted Optimism Bias" as a percentage of Base Capex.

At Gate 1, previous assessment of confidence factors in Thames Water WRMP19 F909s Worksheet (Sheets F910J and F910K) were fully reviewed when allocating the Contributory Factors to the "High", "Medium" and "Low" confidence bands. Allocation is to be entered from 0 to 1, and a sum of the allocations to "High", "Medium" and "Low" is to be 1.

As "Third Stage", it is required to review the confidence grade allocation after Quantitative Costed Risk Assessment (QRCA). The OB confidence grade set out in the second stage should be reassessed against the risk entries in the QRCA, and further scaling-back of the OB should be considered to avoid double-counting, where applicable. It is also required to record the level of OB at the conclusion of the first, second and third stages.

In February 2021, ACWG carried out a survey of Risk Assessment methodologies and OB template confidence grade assessment by the SROs and issued comments and guidance (9th February 2021 update) to maintain consistency throughout the SROs. The third stage OB percentages were further revised according to the instructions provided by ACWG. Table 2-4 includes the OB percentages adjusted as per ACWG's guidance as the Final OB%.

For the Gate 2 stage, it was agreed with the ACWG that Optimism Bias final values would be scaled-back to account for design development between Gate 1 and Gate 2 submission, where some OB values would be reduced due to greater certainty in the scope or identification of specific risks. The "Confidence Grade Criteria" were re-scored by the Project Team to determine the new Adjusted Optimism Bias value at Gate 2.

Table 2-4. Level of Optimism Bias at First, Second and Third Stages1) and the Final OB%

Components	Gate-2/ WRSE Reference	Component type	First Stage (Upper Bound OB%)	Second Stage (Adjusted OB% based on WRMP19 Assessment)	Third Stage Gate 1 OB (Adjusted OB% updated after Gate1 QCRA)	Final OB% at Gate 2 (Adjusted as per design development)	Summary of Changes from Gate 1 to Gate 2
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	Treatment Plant	66.00%	42.34%	45.22%	43.04%	Confidence level of "Large Number of Stakeholders", "Contract Structure", "Late Contractor Involvement in Design" and "Political influences" were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	Treatment Plant	66.00%	42.34%	45.22%	43.04%	Confidence level of "Large Number of Stakeholders", "Contract Structure", "Late Contractor Involvement in Design" and "Political influences" were improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_teddingtondra ted/tlt	Tunnel/ Direct River Abstraction	66.00%	46.47%	44.02%	40.29%	Confidence level of "Design Complexity" was improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2.
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_teddingtondra mog/ted	Tunnel	66.00%	46.30%	44.02%	36.10%	Confidence level of "Design Complexity", "Large Number of Stakeholders", "Contract Structure", "Late Contractor Involvement in Design" and "Political influences" was improved based on further data collection, monitoring and surveys, and stakeholder engagement through the Planning Consultants at Gate 2. Additionally, the change from a large diameter segmental tunnel to a smaller diameter pipe-jacked tunnel improved the confidence levels based on more standard engineering.

First, Second and Third Stages in Optimism Bias assessment were defined in section 6.2 "Cost Consistency Methodology – Technical Note and Methodology Revision E" (Mott MacDonald, 2022).

2.4 Opex Costing

Operating Expenditures (Opex) were estimated using Thames Water's Asset Planning System (APS). Items required for scheme operation, such as electricity, chemical and employee headcount, had been identified and quantified in conceptual design, and the data was entered in the F909 worksheets.

The Opex items, including types of chemicals and maintenance work, were selected from the Opex cost codes built into the F909 worksheet, and quantity of each item was entered based on requirements in the conceptual design. Then, Opex costs were derived by multiplying the quantity by the default unit rate in APS processing.

These unit rate costs have a price base, so once calculated, the costs were rebased by APS to the price base of September 2022. APS uses Consumer Price Index (CPI) for the majority of the Opex costs, although different indices are used for electricity and employee headcount.

As per the requirements for WRSE, APS outputs for Opex were categorised into fixed and variable expenses for reporting.

2.5 Carbon Estimate Methodology

Carbon estimates were performed through the Thames Water's EES and APS tools in the cost estimating exercise. The EES holds over 6 Million embodied carbon values and each value is held against Thames Water common asset structure. For operational carbon values, specific carbon factors are allocated to individual Opex cost codes per quantity unit rates. As cost data is collected and imported into the system, the carbon is automatically calculated based upon code, volume, size and/or attributes unique to the project.

As per the requirements for WRSE, APS outputs for carbon were categorised into Embodied Carbon and Operational Carbon (variable) for reporting.

Thames Water re-assessed the way operational carbon is reported for the SROs, and operational carbon valued were estimated as Variable Operational Carbon (tCo2e/Ml) in Gate 2 rather than Fixed Operational Carbon (tCo2e/yr) as in Gate 1. The estimated values for Variable Operational Carbon (tCo2e/Ml) are outputs of APS run.

All Operational carbon values estimates were for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times).

The operational carbon values estimates are for the first year of operation, using Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions, which was adopted in the ACWG Cost Consistency Methodology Report. Carbon from electricity was calculated using the year 2031 as the first year of operation, including the carbon reduction at year 2050 and afterwards. The electricity demand is calculated for the scheme using the operation regime of 10 months minimum 25% capacity and 2 months full 100% capacity. The electricity demand is multiplied by electricity emissions factors taken from the Treasury Green Book.

3. Cost and Carbon Estimate Results

3.1 Capex Estimates

The Base Capex, Costed Risk, Optimism Bias and Total Capex (that is, a sum of Base Capex, Costed Risk and Optimism Bias) estimated for the components associated with Teddington DRA scheme are as shown in Table 3-1. These estimates were reported to WRSE for its database and financial modelling updates. Detailed breakdowns of the Base Capex are also found in Appendix A to this report.

Table 3-1. London Effluent Reuse SRO, Teddington DRA – Capex Estimates

Components	Gate-2/ WRSE Reference	Base Capex (£)	Costed Risk (£)	Optimism Bias (£)	Total Capex (£)
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	£66,520,991	£21,793,725	£28,631,466	£116,946,183
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	£71,441,180	£25,908,793	£30,749,177	£128,099,150
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_teddingtondrated/tlt	£20,811,062	£1,708,683	£8,385,037	£30,904,782
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_teddingtondramog/ted	£50,293,239	£9,720,161	£18,154,233	£78,167,633

3.2 Opex Estimates

The fixed and variable Opex estimated for the components associated with Teddington DRA scheme are as shown in Table 3-2. These estimates were reported to WRSE for its database and financial modelling updates.

It should be noted that the fixed Opex costs do not include any flow proportional costs. If a minimum flow (i.e. a sweetening flow) is agreed, then the minimum annual Opex cost would be the fixed Opex plus the variable Opex taken at the minimum flow.

All Opex shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). For an assessment of the costs in the minimum and maximum, refer to Section 5.

Table 3-2. London Effluent Reuse SRO, Teddington DRA – Opex Estimates

Components	Gate-2/ WRSE Reference	Opex - Fixed (£/year)	Opex - Variable (£/Ml)
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	£373,649	£120
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	£404,717	£124
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_teddingtondrated/tlt	£45,933	£28
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_teddingtondramog/ted	£134,569	£14

3.3 Carbon Estimates

The Embodied Carbon and Variable Operational Carbon estimated for the components associated with the Teddington DRA scheme are as shown in Table 3-3.

These estimates were reported to WRSE for its database and financial modelling updates. All Operational carbon values shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times). The Operational Carbon values include carbon from electricity estimates. The carbon from electricity is calculated as 10 months at min flow 25% and 2 months at max flow 100% to be comparable with other SROs presentation of Cost & Carbon. The carbon from electricity is used in the WRSE investment modelling (IVM) in the following way which ensures carbon is used as an integral part of option selection decision making.

Table 3-3. London Effluent Reuse SRO, Teddington DRA – Carbon Estimates

Components	Gate-2/ WRSE Reference	WRSE Option ID Reference	Embodied Carbon (tCO2e)	Operational Carbon – Fixed including electricity (tCO2e/yr)	Operational Carbon – Variable excluding electricity (tCO2e/Ml)	Operational Carbon – Variable from electricity (tCO2e/Ml)
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	TWU_KGV_HI-RAB_RE2_ALL_ teddington dra 50	39,320	10.41	0.06	0.032
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	TWU_KGV_HI-RAB_RE2_ALL_ teddington dra 75	44,409	6.62	0.07	0.033
River Abstraction and TLT Connection	TWU_KGV_HI-TFR_ teddingtondrated/ tlt	TWU_KGV_HI-TFR_WLJ_ALL_ teddingtondrated/ tlt	5,433	1.86	0	0.001
Treated Effluent Transfer Tunnel	TWU_WLJ_HI-TFR_ teddingtondramog /ted	TWU_WLJ_HI-TFR_WLJ_ALL_ teddingtondramog/ ted	13,723	7.91	0	0.006

1. Thames Water, in line with the Water UK Net Zero 2030 Routemap, are committed that by the year 2030 all electricity purchased is to be zero carbon via either a Renewable Energy Guarantee of Origin (REGO) contract or Power Purchase Agreement (PPA). The carbon from electricity values presented are shown for consistency across SROs, based on 2031 operational date.

3.4 Cost and Carbon for Potential Larger Sizes (up to 150 Ml/d Capacity)

As discussed in Section 1.3, an assessment for potential larger sizes of Teddington DRA scheme (100 Ml/d or 150 Ml/d capacity) are being assessed at Gate 2. The larger capacity combinations would employ a 2nd TTP phase and the two conveyance elements would be up-sized. As a 150Ml/d abstraction pump station and a 150 Ml/d Treated Effluent Transfer Tunnel were costed for at Gate 1 stage, it was agreed to simply use the Gate 1 costs adjusted for inflation for these elements.

Summaries of economics and carbon costs for the Teddington DRA scheme are shown in the table below.

Table 3-4. Summary of Estimated Costs – Teddington DRA

Scheme	Component	Total Capex (£m)	Max Fixed Opex (£m/yr.)	Max Variable Opex (£ / Ml)	Embodied Carbon (tCO2e)
Teddington DRA scheme	100 Ml/d Tertiary Treatment Plant	£233.89m	£0.75m	£240	78,640
	150 Ml/d Tertiary Treatment Plant	£256.20m	£0.81m	£248	88,818
	River Abstraction and TLT Connection (for 150 Ml/d capacity – Gate 1 costs)	£40.99m	£1.01m	£10	8,095
	Treated Effluent Transfer Tunnel (for 150 Ml/d capacity – Gate 1 costs)	£105.83m	£0.16m	£2	17,634

1. "Total Capex" is a sum of Base Capex (including overheads), Costed Risk and Optimism Bias.
2. Conveyance elements ("River Abstraction and TLT Connection" and "Treated Effluent Transfer Tunnel") were sized for 150Ml/d maximum yield from the TTP, based on additional river modelling that demonstrated 100 Ml/d and 150 Ml/d sizes could be consentable.
3. Costs estimates are from WRSE Input Template (J698-GN-DOC-002015-0D WRSE_InputTemplate_v5_Reuse_20220316 - London Reuse SRO). Costs are based on February 2022 base rate.
4. All Opex shown here are for the maximum utilisation of the scheme (100% capacity operating in 'Normal Operation' mode at all times).

3.5 Greenhouse Gases Mitigation and Recommendations

A high-level life cycle carbon assessment of greenhouse gas (GHG) emissions for all the London Effluent Reuse SRO schemes has been carried out by a Carbon and Energy Consulting team. The summary below recommends approaches to mitigate embodied and operational GHG emissions, with emissions in tonnes of carbon dioxide equivalent (tCO2e) reported and evaluated. Whilst the carbon from electricity has been included in the carbon values reported above to be consistent with other SROs, Thames Water are committed to achieving carbon net zero by 2030, which is before the water into supply date of this SRO. Therefore this assessment assumed grid emissions to be zero carbon and sought to identify a strategy for reduction of emissions from non-electricity generation sources.

The mass in tonnes of carbon dioxide equivalent (tCO2e) emissions were analysed for the following schemes 1) Beckton Effluent Reuse 2) Mogden Effluent Reuse 3) Mogden South Sewer Reuse 4) Teddington Direct River Abstraction (DRA).

Operational emissions have been identified as the largest single source of emissions across the four schemes. Sources of these emissions include supply chain emissions from chemicals used in dosing, and process emissions from nitrifying filters (in the case of the Teddington DRA TTP). Grid emissions from electricity use are considered in this assessment as zero due to Thames Water's corporate policy to procure 100% of its electricity from renewable sources. The Advanced Water Recycling Plants (AWRPs) contribute the largest proportion of embodied emissions for the Beckton and Mogden Effluent Reuse schemes, while Sewage Treatment Works are the main contributor for the Mogden South Sewer Effluent Reuse scheme.

To maximise alignment with PAS 2080 and the Water UK Net Zero 2030 Routemap, it is recommended for to follow the emissions hierarchy when deciding which approach to prioritise to mitigate emissions. This prioritises in order demand reduction, efficiency gains and renewable energy integration before pursuing offsets to remove residual carbon emissions. Due to the complexity and long lifetime of these schemes, it is important to take a holistic approach to carbon mitigation, which uses a combination of approaches.

A more robust assessment of carbon emissions is advised, firstly to provide a more complete assessment of the emissions associated with each scheme and to include those sources not captured in this report. Secondly a detailed opportunity cost analysis should be conducted to identify which interventions would allow the greatest reduction in emissions for the lowest cost. This report provides a high-level inclusion of the possible range of interventions, but further analysis is required to select those most appropriate for the chosen scheme.

At this design stage, some scope requirements are largely fixed. This will limit the opportunity to completely ‘design out’ embodied carbon for the schemes. However, there is still sufficient optioneering time to ‘design out’ some embodied carbon. Embodied emissions represent the majority share of total GHG emissions in the short term - as such, focusing on reducing embodied emissions will likely yield significant reductions across the early stage of a site’s operational life. This can be achieved through close engagement with carbon subject matter experts (SMEs) at the design and procurement stages. A focus on 'designing out' carbon can reduce both embodied and operational emissions, in particular for building heating and plant efficiency.

While annual operational emissions are less than those released due to material sources. Over time, across the lifetime of a site operational emissions will contribute more than embodied emissions, therefore reducing operational emissions will achieve the greatest reduction of GHG emissions in the long term. This approach is also line with the Water UK and Thames Water targets of net zero operational carbon by 2030.

Table 3-5 summarises the recommended carbon mitigation approaches, providing a high-level ranking of their potential impact on emissions reduction and alignment with the emissions hierarchy.

Table 3-5: Summary and Ranking of Carbon Emissions Reduction Approaches

Approach to mitigate carbon emissions	Emissions Hierarchy Category	Potential for emissions reduction	Ability for Thames Water to Influence	List of options
Energy management & efficiency (highest priority)	Emissions reduction	High	High	▪ Improved pump efficiency ▪ Metering ▪ Smart control systems ▪ Catchment level analytics
Renewable energy on site	Renewable energy	High	High	▪ Solar ▪ Wind ▪ Storage
Procured Renewable Energy	Renewable energy	High	High	▪ Sleeved PPA ▪ Synthetic PPA ▪ Private Wire PPA ▪ REGO-backed Green Tariffs
Resource Efficiency and Chemical Supply	Emissions reduction	High	Low	▪ Supply chain contracts ▪ Reduced resource use
Embodied emissions reduction	Emissions reduction	Moderate	High	▪ Low carbon concrete ▪ Low carbon steel ▪ Recycled materials ▪ Locally sourced materials
Engineering design	Emissions reduction	Moderate	Moderate	▪ Conveyance routes ▪ Land use ▪ Building size ▪ Building heating
Construction emissions	Emissions reduction	Low	Moderate	▪ Reduced transport ▪ Vehicle energy use ▪ Renewable onsite power ▪ Temporary buildings
Insets	Offset	Low	Moderate	▪ Peatland restoration ▪ Grassland restoration ▪ Tree planting
Offsets (lowest priority)	Offset	Low	High	▪ UK ETS ▪ Voluntary Offset Market

3.6 Key Costed Risks

See below Table 3-6 showing a list of delivery focused key risks with description.

Table 3-6. Delivery focus Key Risks with description

Risk Name	Description
Re-location of site on land owned by TW	Potential conflict between tertiary treatment requirement for WRMP19 DRA scheme and STW upgrade for land due to population growth in catchment. Or Unable to take some of the storm tanks offline to construct tertiary treatment plants. The consequence of this risk is that the land may not be available. New site search required leading to additional or re-design.
Community	Community objections. Compensations may be required or a change in the location and/or the design.
Protected Species	1. Protected Species may be found during surveys. Additional protection and/or mitigation measures may need to be carried out prior to works. 2. Protected Species may create habitat during works. Causing programme delays.
Material Price Increase	There is a risk that materials incorporating metal / oil / plastics could increase by the time this project goes ahead. Leading to additional CAPEX cost.
Costs for nitrifying sand filters	Nitrifying sand filters are required at Mogden to reduce ammonia levels commensurate with Hogsmill WwTW consent levels for river discharge. There is a risk that costs are not accurate as the size of plant sits outside the range of F909 cost curves for Dynasand filters. This may cause additional cost or area requirement due to alternative process requirements.
Discharge consent - Treatment stage requirements	The tertiary nutrient and solids removal has been assumed based on existing Hogsmill WwTW consent parameters and that there is a risk that these will be more onerous for the Teddington DRA abstraction. The consequences of this risk are: 1. Proposed treatment requires further processes. 2. Required process makes option unjustifiable 3. Land space no longer sufficient
Purchase of Land Required	Available space for development on in Mogden STW are not available or sufficient, and additional land will be required. This may cause increased cost. Land owned by Royal Borough Kingston, there may be issues obtaining land. Compensation, redesign, and land search might be required.
Connection - Shutdown of Thames Lee Tunnel	Shutdown of Thames Lee Tunnel will be required. Potential complications/resistance from operations team for shutdown for planned construction window. This may cause delays in construction temporary raw water storage might be required to maintain supply.
Change of Pipeline Route	Change of Pipeline route will be required during Planning and Development stage. Pipe jacking or additional length of pipeline will be required.
Temperature diffusion requirements	Risk that currents level of design does not account for temperature diffusion scope at the outfall to the River Thames. Requirement to increase scope costs for capital and operational expenditure to include for temperature diffusion at the outfall
INNS Treatment Requirements	Risk that Invasive Non-native species could be transferred from the Thames via TLT to the River Lee by this DRA scheme. INNS treatment processes would be required at the abstraction pumping station (filtration, UV, etc). Increased costs and programme delays.

4. Cost Benchmarking

Unit rate benchmarking has been carried out for this SRO to create bottom-up estimates of the base capital costs of specific component of the scheme, with unit rates compared against industry standards and budget quotations from UK Suppliers for the tertiary treatment process equipment and eel screens. It is recommended that further, more detailed scheme benchmarking is undertaken at Gate 3 stage following the completion of the WRSE modelling to understand the base case(s) and likely in-combination schemes.

Base Capex for the majority of capex items were estimated using Thames Water's Engineering Estimating System (EES) cost curves. The EES cost curves were derived from over 6,500 projects totalling £12billion in value, which had been implemented within Thames Water's operational regions. The costs derived are benchmarked and validated through Thames Water's Performance Review 2019 (PR19) process with updates since then, which has been agreed as suitable benchmarking for the EES cost curves.

As tertiary treatment and direct river abstraction schemes are typical engineering processes for Thames Water, no industry "scheme benchmarking" has been carried out for Teddington DRA, unlike the other schemes with Advanced Water Recycling Plants (non-standard engineering for TWUL). The bottom-up estimates with unit rates compared against industry standards and budget quotations from UK Suppliers is viewed as a more accurate method of benchmarking for this scheme.

4.1 Unit Rate Benchmarking

The unit cost rate of the four items listed below had been estimated with a "bottom-up" approach at Gate 2, identifying and summing up possible cost items to arrive at the total unit cost rate. The four items below in the Teddington DRA scheme were the cost estimates which were not derived from EES cost curves due to either unsuitable cost curves for the non-standard item or more accurate Supplier quotations available. Typically, Supplier quotations were used for estimated costs, with verification of costs using the following methods:

- Benchmarking of the abstraction eel-friendly band screens using Supplier quotations for the preferred type of screens which differ in cost range from the standard EES band screen cost curves.
- Benchmarking of the connection works to the existing Thames Lee Tunnel unit-cost rate completed using Construction Management principles and industry experience.
- Benchmarking of the TTP Mechanical filters using Supplier quotations for the preferred type of filters which are believed to be more accurate in cost estimate than the standard EES "Tertiary Treatment Plant – Mechanical" cost curve.
- Benchmarking of the temporary works to use the first drive shaft of the new tunnel as temporary storm storage - 2 overpumping pumpsets, shaft cleaning, and ancillary temporary works. Unit-cost rate completed using Construction Management principles and industry experience.

Impact of price difference in these items on Base Capex for "River Abstraction and TLT Connection" (Gate-2/ WRSE Reference: TWU_KGV_HI-TFR_teddingtondrated/tlt) and the "50Ml/d TTP" and "75Ml/d TTP" (Gate-2/ WRSE References: TWU_KGV_HI-RAB_teddington dra 50, TWU_KGV_HI-RAB_teddington dra 75) were analysed.

All other items in the estimated costs for these Option ID's and the "Treated Effluent Transfer Tunnel" (Gate-2/ WRSE Reference: TWU_WLJ_HI-TFR_teddingtondramog/ted) were derived from the EES cost curves. Therefore, a unit-rate benchmarking exercise was not carried out for all other elements.

OPEX benchmarking is traditionally a difficult task to undertake due to the differences that can occur in working practices, staffing levels, approach to risk for maintenance activities and regional power costs. At this early stage it is not viewed as practical to carry out detailed Opex benchmarking until the WRSE RPv2 Investment Modelling is carried out and a greater understanding of the configuration of schemes and expected utilisation values is confirmed.

5. Net Present Value (NPV) and Average Incremental Cost (AIC)

Construction Capex and Opex costs have been used to generate the NPV and AIC values for the elements using the Treasury Green book with a declining schedule of discount rates and an 80-year period. The All Company Working Group (ACWG) had agreed with RAPID that for consistency across all SRO's, NPV and AIC costings would be completed via the same methodology for inclusion in the Gate 2 Report for direct comparison with the other schemes and SRO's.

The NPV and AIC values were analysed for the following three configurations (i.e., combinations of components) in the Teddington DRA scheme:

- **Teddington DRA (50Ml/d yield):** a combination of the 50Ml/d TTP component, the River Abstraction and TLT Connection component, and the Treated Effluent Transfer Tunnel component. Costs for operation of the conveyance component were calculated assuming it conveys up to 50 Ml/d.
- **Teddington DRA (75Ml/d yield):** a combination of the 75Ml/d TTP component, the River Abstraction and TLT Connection component, and the Treated Effluent Transfer Tunnel component. Costs for operation of the conveyance component were calculated assuming it conveys up to 75 Ml/d.

NPV and AIC for each component were calculated for the estimated utilisation level, using "One Scheme AIC RevB Template" prepared by Mott MacDonald in April 2021 as per ACWG review and agreement.

The costs for all stages (i.e. Planning, Development and 'Construction & Operation') were included for pasting into the "Input" tab. If modelling a real option, the stages will get reprofiled on the 'AIC calc' tab to ensure the Planning, Development and 'Construction & Operation' are done consecutively.

The inputs required for the calculation were:

- Option reference ID: The WRSE Option ID.
- WACC: Weighted Average Cost of Capital used. In the 2019 Final Determination20, Ofwat allowed a real return on capital of 2.92%. The All Company Working Group (ACWG) agreed to applying a WACC of 2.92%, which has therefore been used on all NPV and AIC calculations in this report.
- Operational Year: The year in which Treated Effluent is to be first produced following the end of construction stage. This was taken from the WRSE Input Template in the tab "Summary" from column N "*Opex Start Year*".
- Optimism Bias: As per Final OB% in Table 2-4.
- Deployable Output: A minimum and maximum utilisation was calculated for each configuration. The maximum utilisation was based on the Deployable Output (DO) of the maximum capacity of the configuration continuously for 365 days, 24 hours per day (*e.g*., Teddington DRA 75Ml/d TTP component has a DO of 67 Ml/d for the 1 in 500-year average). This value was taken from the WRSE Input Template in the tab "Summary" from column U "*DO: 1 in 500 averages*".
- Minimum Flow: The minimum utilisation was based on the proposed operating mode for each scheme (refer to CDR section 2.2.6 for detail). For the treatment components, the assumption for minimum flow is the plant being used only in "Hot Standby" mode for 12 months of the year at 25% utilisation rate (e.g., in the "Continuous Sweetening Flow Model". Therefore, it was assumed to be 25% of the maximum capacity. For conveyance components, the minimum flow is assumed as 25% of the total treatment plant capacity (even if it is likely that a smaller proportion would be passed fully through the conveyance – e.g., some would be run-to-waste to the source STW).

Then, a profile of the costs of the component over 80 years was computed. The costs were split into capital (including maintenance and replacement costs), operating (both fixed and variable costs) and financing costs. The NPV of all costs was then calculated using the Treasury Test Discount Rate as set out in the HM Treasury "Green Book" (Appraisal and Evaluation in Central Government, HM Treasury 2003). This is 3.5% for years 0-30 of the appraisal periods, 3.0% for years 31-75, and 2.5% for years 76-125. The outputs of this analysis are NPV Finance (Capex), NPV Opex, NPV WAFU (Water Available for Use, in m3 for the resource benefit over the 80-year period) and AIC (in p/m3). The outputs were given for both the minimum utilisation scenario and maximum utilisation scenario. Note that the Opex values are input as costs at maximum utilisation taken from the WRSE input template and adjusted by the percentage for minimum utilisation.

To calculate the NPV and AIC for each configuration, which is a combination of treatment component and conveyance component, these values were then summed to provide the results in Table 5-1.

Table 5-1. NPV and AIC for Teddington DRA scheme at various configuration sizes (all costs adjusted for 2021/20 Cost Base)

Configuration name	Units	Teddington DRA (50Ml/d yield)	Teddington DRA (75Ml/d yield)
Option benefit	Ml/d	46	67
Total planning period option benefit (NPV)	Ml	335,087	488,061
Total planning period indicative capital cost of option (CAPEX NPV)	£m	229	242
Minimum Flow – based on Hot Standby mode for 12 months of the year			
Total planning period indicative operating cost of option (OPEX NPV)	£m	25	32
Total planning period indicative option cost (NPV)	£m	228	247
Average Incremental Cost (AIC)	p/m^3	68	51
Maximum Flow – full capacity for 12 months of the year			
Total planning period indicative operating cost of option (OPEX NPV)	£m	65	93
Total planning period indicative option cost (NPV)	£m	269	308
Average Incremental Cost (AIC)	p/m^3	80	63
Total Carbon over 80-year period and no discount rate			
Embodied Carbon	tCO2e	58,476	63,565
Variable Operational Carbon – Max Flow	tCO2e/yr.	739	1091

The solution costs detailed have been developed in line with relevant HM Treasury Green Book guidance. All values in Table 5-1 have been adjusted for deflation to 2020/21 cost base for accurate comparison with the Final Determination allowance, using Thames Water's Internal Business Plan (IBP) deflationary factors, based upon a combination of the relevant RPI, CPIH and CPI (forecast) annual average index values. A lifecycle carbon assessment has been carried out here without discount factors, and no adjustment for inflation as per the NPV costs. Carbon values are calculated in Section 3.3 for maximum utilisation presented at first year of operation using Treasury Green Book supplementary appraisal guidance on valuing energy use and greenhouse gas (GHG) emissions. In Table 5-1 above, Operational carbon values are assessed over the 80-year period from first year of operation at the minimum and maximum utilisation levels for the specific scheme. Note that Table 5-1 does not include carbon emissions from electricity. Refer to Section 3.3 for full carbon values.

5.1 NPV and AIC for Potential Larger Sizes (up to 150 Ml/d Capacity)

As discussed in Section 1.3, an assessment for potential larger sizes of Teddington DRA scheme (100 Ml/d or 150 Ml/d capacity) are being assessed at Gate 2. The larger capacity combinations would employ a 2nd TTP phase, and the two conveyance elements would be up-sized. As a 150Ml/d abstraction pump station and a 150 Ml/d Treated Effluent Transfer Tunnel were costed for at Gate 1 stage, it was agreed to simply use the Gate 1 costs adjusted for inflation for these elements.

Summaries of economics and carbon costs for the Teddington DRA scheme are shown in the table below.

Table 5-2. Summary of Average Incremental Costs (AIC) at Minimum and Maximum Utilisation Level – Teddington DRA scheme

Configuration name	Units	Teddington DRA scheme (100Ml/d yield)	Teddington DRA scheme (150Ml/d yield)
Option benefit	Ml/d	88	130
Minimum Flow – based on 25% utilisation for 12 months of the year			
Average Incremental Cost (AIC)	p/m³	59	44
Maximum Flow – full capacity (100% utilisation) for 12 months of the year			
Average Incremental Cost (AIC)	p/m³	80	66

1. Teddington DRA scheme (100Ml/d yield): a combination of 2No. of the 50Ml/d TTP component, the River Abstraction and TLT Connection component at 150 Ml/d sizing from Gate 1 and the Treated Effluent Transfer Tunnel component at 150 Ml/d sizing from Gate 1. Costs for operations of the conveyance component were calculated, assuming it conveys up to 100Ml/d.
2. Teddington DRA scheme (150Ml/d yield): a combination of 2No. of the 75Ml/d TTP component, the River Abstraction and TLT Connection component at 150 Ml/d sizing from Gate 1 and the Treated Effluent Transfer Tunnel component at 150 Ml/d sizing from Gate 1. Costs for operations of the conveyance component were calculated, assuming it conveys up to 150Ml/d.

6. The Journey from Gate 1 to Gate 2

Section 6 lists the changes that took place between Gate 1 to Gate 2, these changes have direct implications on the costs, some changes increase, and some decrease the costs. Section 6 covers CAPEX, OPEX, Optimism Bias, and Costed Risk.

6.1 CAPEX

6.1.1 Tertiary treatment plant

Increases in CAPEX:

- Increased costs for the demolition / reconstruction of new deeper storm tanks based on Gate 2 assessment and discussions with Mogden STW team.
- Added over pumping costs from storm tanks to new drive shaft for temporary storage. This may not be acceptable but significant costs shall be required to account for the temp reduction in storage and this option has been assumed for now.
- Added extensions to FE and Bypass culverts.
- Added site clearance and road costs for the culvert extensions.
- Added wastewater equalisation tanks which were not confirmed as requirement at March 2021 upload.
- Number and kW ratings of all pumps have changed following Gate 2 Hydraulic assessment.

6.1.2 Conveyance from River Thames to the TLT

Increases in CAPEX:

- Screens updated to comply with eel regulations.
- Sheet piling around intake accounted for.

Decreases in CAPEX:

- Updates to the scope to change pipe, pump, and associated equipment sizes to 75 Ml/d max flow and not 150 Ml/d at previous WRSE upload). Significant drop in price.

6.1.3 Conveyance from Mogden treatment to River Thames (Ted weir)

Increases in CAPEX:

- Land clearance, temp/permanent land, etc have been updated to match Design development.
- Added sheet piling costs for the first drive shaft at Mogden STW boundary.
- Pumps are now located at final shaft for submersible pump discharge to the outfall chambers.
- Added further detail of outfall structures and power requirements (e.g. supply, kiosk, etc).

Decreases in CAPEX:

- Reduction in cost based on structures and pumps requiring 75 Ml/d maximum, not 150 ML/d at previous upload. Significant drop in price.

6.2 OPEX

6.2.1 Tertiary treatment plant

- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a major increase in Opex.
- Added the fixed electricity costs for the AWRP (lighting, building services etc).

- Chemical dosing for Ferric changed to "Chemical Dosing" type and not the Temporary treatment type included at previous upload (this adds a variable cost, and carbon included).
- Gate 2 Process Assessment provided more accurate power usage values of up to 1.0MW for the tertiary treatment plant which was significantly greater than that estimated at WRMP19 (previous upload used WRMP19 values as Gate 1 assessment was not complete).
- Electricity and chemical usage set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d - lowest treatment output.

6.2.2 Conveyance from River Thames to the TLT

- Drop from pumps requiring 75 Ml/d only maximum, not 150 ML/d at previous upload.
- Electricity usage set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d - lowest treatment output.
- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a major increase in Opex.
- Added the fixed electricity costs for the AWRP (lighting, building services etc).

6.2.3 Conveyance from Mogden treatment to River Thames (Ted weir)

- Increase in Opex as the pumps were previously included in Teddington Treatment F909s only, not conveyance. Gate 2 assessment demonstrated best design is for discharge pumps at end of conveyance, so now included as Opex in the conveyance item.
- Electricity usage set to a "Percentage at Minimum Output" of 25% of Phased output of 50Ml/d - lowest treatment output.
- Minimum flow changed from 0 Ml/d to 12.5 Ml/d (25% for sweetening flow operation). This causes a major increase in Opex.
- Separated the fixed electricity costs for the AWRP (lighting, building services etc).

6.3 Optimism Bias

6.3.1 Tertiary treatment plant

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Environmental impact: Working near the Local Nature Reserve could pose an environmental challenge. The water quality and temperature of the effluent may also pose some challenges. Reduced confidence, considering temperature impact on the River Thames ecology.
- Site characteristics: Conceptual design is being developed at this stage. High level on EIA aspects. However, rated "Medium" because work will be mainly in the existing footprint of stormwater tank.

6.3.2 Conveyance from River Thames to the TLT

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Government guidelines: at this stage a contract structure has not been defined and may involve DPC. However, as TW has extensive experience of tunnel construction in London, rated at Medium: Low = 0.5:0.5. Amended to Low from OB Consistency Guidelines 19th Feb 2021.
- Design complexity: large diameter pipelines tried and tested construction techniques however early stage of concept design and complexity around the scale of project. Design is inherently complex due

to connection to the existing Thames Lee Tunnel. A risk due to condition of existing tunnel at the tie-in location was added to costed risk.

- Degree of innovation: None of the construction methodology or processes are unknown - however there is complexity and uncertainty at this stage - there is the outstanding issue of variable water quality which impact on this issue.
- Environmental impact: No significant environmental issues when completed. Environmental impacts during construction, including waste disposal, will need to be addressed. Costed risks have been identified for "noise and vibration", "Disposal of Spoil", "Ecology Risk", "Protected Species" and "Contaminated Land". However, there has been no consultation at this stage with local authorities or local communities and confidence around the extent of environmental challenge and associated mitigation cannot be assessed as "High".
- Project management team: Thames Water has significant recent experience of water and wastewater tunnelling in London for water, transportation, and power sector projects. However, large scale Shafts, Tunnels and river abstraction/discharges are not commonly delivered by TW. Large scale pipelines are - but the schemes here have a degree of complexity not common.

6.3.3 Conveyance from Mogden treatment to River Thames (Ted weir)

- Poor contractor capabilities: Some limitation in supply chain with regard to experience of some of the process technologies in this application. The tunnels are business as usual but with complexities and limited suppliers. "Procurement delay due to long lead items" is included in costed risk, so rated as "Medium".
- Design complexity: large diameter pipelines tried and tested construction techniques however early stage of concept design and complexity around the scale of project. "Medium" for both Non-standard and Standard Civil.
- Environmental impact: The solution requires planning permission for the conveyance works. The route / shaft locations could be challenged but should be reasonably flexible to mitigate regarding environmental effects. Costed risks have been identified for "noise and vibration", "Disposal of Spoil", "Ecology Risk", "Protected Species" and "Contaminated Land".
- Poor project intelligence: Not sufficient data for crossings. Sections of tunnelling/ pipe jack were assumed to be no obstacles. No Geotech study available at this moment. Preliminary environmental data available.

6.4 Costed Risk

6.4.1 Tertiary treatment plant

- Increased costed risk due to the reluctance from EA to pass a DRA scheme at larger sizes. The proposed treatment may require further processes, the land space may be insufficient, or the required process may hinder this option unjustifiable. The cost of additional treatment is likely to be significant and will likely require more land.
- Potential conflict between the tertiary treatment requirement for the WRMP19 DRA scheme and the Mogden STW upgrade. Due to population growth in the catchment, there are complex requirements to keep the storm tanks operational during the construction phase. There may not be enough land available for the upgrade resulting in a potential re-design of the scheme.

6.5 Changes from WRSE draft regional plan submission

No changes in cost values have been made since the WRSE submission in February 2022. Deployable Output, Project scope, QRCA & Optimism Bias, Opex & Capes are all the same.

Carbon from electricity was not included in WRSE template, but it was finally included in WRSE modelling.

7. Glossary

Acronym	Definition
ACWG	All Company Working Group
AIC	Average Incremental Cost
AMP	Asse Management Plan
AOP	Advanced Oxidation Process
APS	Asset Planning System
AWRP	Advanced Water Recycling Plant
Base Capex	Base Capital Expenditure
Capex	Capital Expenditure
CDR	Conceptual Design Report
CPES	Conceptual & Parametric Engineering System
CPI	Consumer Price Index
CPIH	Consumer Price Index Including Owner Occupiers' Housing Costs
DO	Deployable Output
DRA	Direct River Abstraction
EES	Engineering Estimating System
ID	Internal Diameter
KGV	King George V Reservoir
Ml/d	Mega litres per day
NPV	Net Present Value
OB	Optimism Bias
Opex	Operating Expenditure
PR	Price Review
QCRA	Quantitative Costed Risk Assessment
RAPID	Regulators' Alliance for Progressing Infrastructure Development
RO	Reverse Osmosis
RPI	Retail Prices Index
SRO	Strategic Regional Water Resource Option
STW	Sewage Treatment Works
TTF	Teddington Target Flows
Thames Water	Thames Water Utilities Limited
TLT	Thames Lee Tunnel
Total Capex	Total Capital Expenditure

Acronym	Definition
UF	Ultrafiltration
WAFU	Water Available for Use
WRMP	Water Resource Management Plan
WRSE	Water Resources South East
WTW	Water Treatment Works
WACC	Weighted Average Cost of Capital

Appendix A. Cost and Carbon Estimates

Gate 1 & 2 Capex Costs Summary - from WRSE Input Templates (Gate 1 - 20210322; Gate 2 - 20220104)

Noted the Gate 2 values are in Cost Base 2020/21 as per APS Outputs. Percentage changes use deflationary factor

Cost Price Base: 2020/21

Components	Gate-2/ WRSE Reference	Gate 1 Base Capex (£)	Gate 2 Base Capex (£)	% Difference	Gate 1 Costed Risk (£)	Gate 2 Costed Risk (£)	% Difference
Teddington DRA							
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	£37,999,418	£66,520,991	75%	£11,710,567	£21,793,725	86%
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	£55,233,660	£71,441,180	29%	£16,981,581	£25,908,793	53%
River Abstraction and TLT Connection (75 Ml/d)	TWU_KGV_HI-TFR_teddington dra ted/tlt	£29,238,021	£20,811,062	-29%	£1,323,253	£1,708,683	29%
Recycled Water Transfer Pipejack (75 Ml/d)	TWU_WLJ_HI-TFR_teddington dra mog/ted	£70,743,132	£50,293,239	-29%	£10,585,943	£9,720,161	-8%

Components	Gate-2/ WRSE Reference	Gate 1 Optimism Bias (£)	Gate 2 Optimism Bias (£)	% Difference	Gate 1 Total Capex (£)	Gate 2 Total Capex (£)	% Difference
Teddington DRA							
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	£17,182,387	£28,631,466	67%	£66,892,372	£116,946,183	75%
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	£24,975,280	£30,749,177	23%	£97,190,521	£128,099,150	32%
River Abstraction and TLT Connection (75 Ml/d)	TWU_KGV_HI-TFR_teddington dra ted/tlt	£12,909,462	£8,385,037	-35%	£43,560,735	£30,904,782	-29%
Recycled Water Transfer Pipejack (75 Ml/d)	TWU_WLJ_HI-TFR_teddington dra mog/ted	£31,139,358	£18,154,233	-42%	£112,468,433	£78,167,633	-30%

Components	Gate-2 WRSE Reference	Gate-1 Max Fixed Opex (£/yr.)	Gate-2 Max Fixed Opex (£/yr.)	% Difference %	Gate-1 Max Variable Opex (£/ML)	Gate-2 Max Variable Opex (£/ML)	% Difference
Teddington DRA							
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	£312,543	£373,649	20%	£30	£120	303%
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	£451,034	£404,717	-10%	£39	£124	219%
River Abstraction and TLT Connection (75 Ml/d)	TWU_KGV_HI-TFR_teddington dra ted/tlt	£1,051,747	£45,933	-96%	£10	£28	169%
Recycled Water Transfer Pipejack (75 Ml/d)	TWU_WLJ_HI-TFR_teddington dra mog/ted	£169,463	£134,569	-21%	£2	£14	482%

Components	Gate-2/ WRSE Reference	Gate 1 - Total Embodied Carbon (tCO2e)	Gate 2 - Total Embodied Carbon (tCO2e)	Difference %	Gate 1 - Max Fixed Operational Carbon (tCO2e/yr.)	Gate 2 - Max Fixed Operational Carbon *including electricity* (tCO2e/yr.)
Teddington DRA						
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	19851.14	39320.12	98%	0	10
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	29683.59	44409.16	50%	0	7
River Abstraction and TLT Connection (75 Ml/d)	TWU_KGV_HI-TFR_teddington dra ted/tlt	8094.9	5432.86	-33%	0	2
Recycled Water Transfer Pipejack (75 Ml/d)	TWU_WLJ_HI-TFR_teddington dra mog/ted	32397.55	13723.42	-58%	0	8

Components	Gate-2/ WRSE Reference	Gate 2 Variable Operational Carbon Excluding Electricity (tCO2e/Ml)	Gate 2 Variable Operational Carbon From Electricity (tCO2e/Ml)	Gate 2 Variable Operational Carbon Total (tCO2e/yr)
Teddington DRA				
50 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 50	0.064053008	0.032	1,377
75 Ml/d Tertiary Treatment Plant	TWU_KGV_HI-RAB_teddington dra 75	0.065927622	0.033	2,121
River Abstraction and TLT Connection (75 Ml/d)	TWU_KGV_HI-TFR_teddington dra ted/tlt	0	0.001	16
Recycled Water Transfer Pipejack (75 Ml/d)	TWU_WLJ_HI-TFR_teddington dra mog/ted	0	0.006	66

Water Company	Jacobs	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Capex			Total		0.50526	2.99772	25.3842	25.3842	25.3842	25.3842	10.1578	10.1578	10.1578	0	0	0	0	0	0	0	0	0	2.46834	0	0	0	0	0	0	0	0	0	33.425	0	0	0	0	0	0	0	0	0	2.46834	0	0	0	0	0	0	0	0	0	33.425	0	0	0	0	0	0	0	0	0	2.79665	0	0	0	0	0	0	0	0	0	74.3648	0	0	0	0	0	0	0	0	0	2.46834	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Opex			Total		0	0	0	0	0	0	0	0	0	3.25954	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778	3.26778
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Financing Cost			Total		0.01033	0.08198	0.76585	2.01098	3.25611	4.50123	5.35539	5.81857	6.28176	10.693	10.5691	10.4453	10.3214	10.1976	10.0737	9.94984	9.82599	9.70214	9.62877	9.5554	9.43155	9.3077	9.18384	9.05999	8.93614	8.81228	8.68843	8.56458	9.12436	9.68414	9.56029	9.43643	9.31258	9.18873	9.06487	8.94102	8.81717	8.69332	8.61995	8.54658	8.42272	8.29887	8.17502	8.05117	7.92731	7.80346	7.67961	7.55575	8.11553	8.67532	8.55146	8.42761	8.30376	8.1799	8.05605	7.9322	7.80834	7.68449	7.61784	7.55118	7.42733	7.30348	7.17962	7.05577	6.93192	6.80807	6.68421	6.56036	7.95747	9.35459	9.23074	9.10688	8.98303	8.85918	8.73532	8.61147	8.48762	8.36377	8.2904	8.21703
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Discount Rate			Total		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Discount Factor			Total		0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Capex	Costed Risk		Total		0	0	7.08112	7.08112	7.08112	7.08112	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Capex	Optimism Bias		Total		0.20255	1.20172	10.1759	10.1759	10.1759	10.1759	4.07201	4.07201	4.07201	0	0	0	0	0	0	0	0	0	0.9895	0	0	0	0	0	0	0	0	0	13.3993	0	0	0	0	0	0	0	0	0	0.9895	0	0	0	0	0	0	0	0	0	13.3993	0	0	0	0	0	0	0	0	0	1.12111	0	0	0	0	0	0	0	0	0	29.8111	0	0	0	0	0	0	0	0	0	0.9895	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Net Present Cost (NPC)			Total		0.00998	0.07653	0.69076	1.75245	2.74155	3.66176	4.20929	4.41869	4.60912	9.89119	9.47752	9.07506	8.68898	8.31864	7.9634	7.62268	7.2959	6.9825	6.70821	6.44449	6.16642	5.89979	5.64414	5.39903	5.16405	4.93878	4.72285	4.51587	4.56958	4.61449	4.43725	4.26641	4.10177	3.94309	3.79018	3.64283	3.50085	3.36405	3.24604	3.13204	3.00894	2.89035	2.77612	2.66609	2.56011	2.45805	2.35976	2.26511	2.31287	2.35593	2.26359	2.17463	2.08893	2.00638	1.92687	1.85029	1.77653	1.7055	1.64575	1.58803	1.52413	1.4626	1.40336	1.34633	1.29144	1.2386	1.18774	1.1388	1.2628	1.37861	1.32532	1.27397	1.22449	1.1768	1.13086	1.09189	1.05415	1.01761	0.98653	0.95635
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Total NPC			Total	268.850404																																																																																		

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Complete for all options <100m (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Opex	Cost		Fixed		0	0	0	0	0	0	0	0	0	0.54591	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415	0.55415
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Opex	Cost		Variable		0	0	0	0	0	0	0	0	0	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363	2.71363
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Land (Non depreciating)			Fixed		0	0.6824	0.57948	0.57948	0.57948	0.57948	0.57948	0.57948	0.57948	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Planning and Development (Non depreciating)			Fixed		0.70781	3.53904	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Vehicles (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Computers and Data Logging (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Fencing (10)		10	Fixed		0	0	0.08385	0.08385	0.08385	0.08385	0.08385	0.08385	0.08385	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0	0	0	0	0	0	0	0	0	0.58696	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Domestic Meters (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Building Services (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Membranes (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed		0	0	0.59258	0.59258	0.59258	0.59258	0.16685	0.16685	0.16685	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0	0	0	0	0	0	0	0	0	2.87089	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Plant and Machinery (15)		15	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed		0	0	9.45213	9.45213	9.45213	9.45213	1.85263	1.85263	1.85263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43.3664	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43.3664	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43.3664	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Raw Water and District Meters (20)		20	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Power Supply (25)		25	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Bridges (40)		40	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed		0	0	0.11498	0.11498	0.11498	0.11498	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.45991	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed		0	0	13.2557	13.2557	13.2557	13.2557	1.21579	1.21579	1.21579	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56.6703	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Roads and Car Parks (60)		60	Fixed		0	0	0.1151	0.1151	0.1151	0.1151	0.07367	0.07367	0.07367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6814	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Water Towers (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Borehole Installation (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Headworks/Valves (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Underwater Assets (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Weirs (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Pipelines (100)		100	Fixed		0	0	10.8365	10.8365	10.8365	10.8365	0.72765	0.72765	0.72765	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Tunnels (100)		100	Fixed		0	0	0.52985	0.52985	0.52985	0.52985	0.52985	0.52985	0.52985	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Aqueducts (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Embankment Works (250)		250	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 50	Teddington DRA scheme (50Ml/d yield)	Costed Risk			Fixed		0	0	7.08112	7.08112	7.08112	7.08112	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company	Jacobs	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49
Complete for all options (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Capex			Total							0.50489	2.99554	26.6143	26.6143	26.6143	26.6143	10.1578	10.1578	10.1578	0	0	0	0	0	0	0	0	0	2.6706	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	0	0	4.63803	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Financing Cost			Total							0.01033	0.08198	0.80643	2.1327	3.45898	4.78525	5.68013	6.14362	6.6071	11.2964	11.1643	11.0322	10.9001	10.768	10.636	10.5039	10.3718	10.2397	10.1623	10.0848	9.95274	9.82066	9.68857	9.55648
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Capex	Costed Risk		Total							0	0	8.10989	8.10989	8.10989	8.10989	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Capex	Optimism Bias		Total							0.20291	1.2039	10.6962	10.6962	10.6962	10.6962	4.08236	4.08236	4.08236	0	0	0	0	0	0	0	0	0	1.0733	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Net Present Cost (NPC)			Total							0.00998	0.07653	0.72735	1.85853	2.91237	3.89281	4.46453	4.66553	4.84784	11.2962	10.8294	10.3758	9.94043	9.52268	9.12182	8.73717	8.36811	8.01402	7.70274	7.40335	7.08885	6.78717	6.49777	6.22019
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Total NPC			Total	308.18193																													

Cost Metric (£m)	Cost Sub-metric (£m)	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77
Capex		0	0	0	0	36.644	0	0	0	0	0	0	0	0	0	2.6706	0	0	0	0	0	0	0	0	0	36.644	0	0	0
Opex		4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627
Financing Cost		9.42439	9.2923	9.16021	9.02812	9.64605	10.264	10.1319	9.9998	9.86771	9.73562	9.60353	9.47144	9.33935	9.20726	9.12984	9.05241	8.92032	8.78823	8.65614	8.52405	8.39196	8.25987	8.12778	7.99569	8.61362	9.23155	9.09946	8.96737
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor		0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	14.7271	0	0	0	0	0	0	0	0	0	1.0733	0	0	0	0	0	0	0	0	0	14.7271	0	0	0
Net Present Cost (NPC)		5.95395	5.69861	5.45373	5.21889	5.27026	5.3122	5.11178	4.91854	4.73221	4.55257	4.37937	4.21241	4.05145	3.8963	3.76167	3.63158	3.49181	3.3571	3.22727	3.10216	2.9816	2.86543	2.7535	2.64566	2.69415	2.73758	2.63254	2.53131
Total NPC																													

Cost Metric (£m)	Cost Sub-metric (£m)	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		0	0	0	0	0	0	2.99891	0	0	0	0	0	0	0	0	0	79.222	0	0	0	0	0	0	0	0	0	2.6706	0
Opex		4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627	4.64627
Financing Cost		8.83528	8.70319	8.5711	8.43902	8.30693	8.17484	8.10413	8.03342	7.90133	7.76924	7.63715	7.50506	7.37297	7.24088	7.1088	6.97671	8.46611	9.95551	9.82342	9.69133	9.55924	9.42715	9.29506	9.16297	9.03088	8.89879	8.82137	8.74394
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor		0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	1.20525	0	0	0	0	0	0	0	0	0	31.839	0	0	0	0	0	0	0	0	0	1.0733	0
Net Present Cost (NPC)		2.43373	2.3397	2.24907	2.16175	2.0776	1.99651	1.92767	1.86115	1.78812	1.71776	1.64999	1.5847	1.52182	1.46126	1.40293	1.34677	1.47509	1.5948	1.53434	1.47605	1.41986	1.36569	1.31347	1.26929	1.22649	1.18501	1.1495	1.11502
Total NPC																													

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49
Complete for all options >£100m (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	0	0	0.57698	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	0	0	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Land (Non depreciating)			Fixed							0	0.6604	0.5799	0.5799	0.5799	0.5799	0.5799	0.5799	0.5799	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Planning and Development (Non depreciating)			Fixed							0.70781	3.53904	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Computers and Data Logging (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Fencing (10)		10	Fixed							0	0	0.08091	0.08091	0.08091	0.08091	0.08091	0.08091	0.08091	0	0	0	0	0	0	0	0	0	0.58738	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Building Services (15)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Membranes (15)		10	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	ICA (Instrumentation, Control & Automation) (15)		10	Fixed							0	0	0.8639	0.8639	0.8639	0.8639	0.16697	0.16697	0.16697	0	0	0	0	0	0	0	0	0	3.15653	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							0	0	10.5163	10.5163	10.5163	10.5163	1.65386	1.65386	1.65386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Power Supply (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							0	0	0.11506	0.11506	0.11506	0.11506	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							0	0	13.8395	13.8395	13.8395	13.8395	1.21867	1.21867	1.21867	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0	0	0.11516	0.11516	0.11516	0.11516	0.07372	0.07372	0.07372	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Headworks/Valves (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Underwater Assets (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Pipelines (100)		100	Fixed							0	0	10.8665	10.8665	10.8665	10.8665	9.73473	9.73473	9.73473	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Tunnels (100)		100	Fixed							0	0	0.53024	0.53024	0.53024	0.53024	0.53024	0.53024	0.53024	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 75	Teddington DRA scheme (75Ml/d yield)	Costed Risk			Fixed							0	0	8.10989	8.10989	8.10989	8.10989	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Total/Fixed/Variable	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77
Opex	Fixed	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522
Opex	Variable	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	0.58738	0	0	0	0	0	0	0	0	0	0.58738	0	0	0	0	0	0	0	0	0	0.58738	0	0	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (15)	Fixed	0	0	0	0	3.15653	0	0	0	0	0	0	0	0	0	3.15653	0	0	0	0	0	0	0	0	0	3.15653	0	0	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	47.6271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47.6271	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Total/Fixed/Variable	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Fixed	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522	0.58522
Opex	Variable	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105	4.06105
Land (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	Fixed	0	0	0	0	0	0	0.58738	0	0	0	0	0	0	0	0	0	0.58738	0	0	0	0	0	0	0	0	0	0.58738	0
Domestic Meters (10)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (15)	Fixed	0	0	0	0	0	0	3.15653	0	0	0	0	0	0	0	0	0	3.15653	0	0	0	0	0	0	0	0	0	3.15653	0
Plant and Machinery (15)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	47.6271	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (20)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	Fixed	0	0	0	0	0	0	0.46025	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59.008	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.6819	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	Fixed	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Water Company	Jacobs	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: [illegible]	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
								1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Complete for all options (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Capex			Total		1.00363	5.95454	40.6107	40.6107	40.6107	40.6107	10.1578	10.1578	10.1578	0	0	0	0	0	0	0	0	0	3.68396	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Opex			Total		0	0	0	0	0	0	0	0	0	10.069	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Financing Cost			Total		0.02067	0.16396	1.30582	3.34431	5.38279	7.42127	8.67353	9.13957	9.60561	16.5762	16.3765	16.1769	15.9772	15.7776	15.5779	15.3783	15.1786	14.979	14.8552	14.7314
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Discount Rate			Total		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Discount Factor			Total		0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892	0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Capex	Costed Risk		Total		0	0	12.5296	12.5296	12.5296	12.5296	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Capex	Optimism Bias		Total		0.41199	2.44434	16.6707	16.6707	16.6707	16.6707	4.16977	4.16977	4.16977	0	0	0	0	0	0	0	0	0	1.51227	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Net Present Cost (NPC)			Total		0.01997	0.15306	1.17778	2.91437	4.53216	6.03721	6.81732	6.94069	7.04793	18.8893	18.1194	17.3745	16.6593	15.9726	15.3133	14.6804	14.0727	13.4893	12.9688	12.468
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Total NPC			Total	518.042518																				

Cost Metric (£m)	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Capex	0	0	0	0	0	0	0	0	56.3399	0	0	0	0	0	0	0	0	0	3.68396	0
Opex	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773
Financing Cost	14.5317	14.3321	14.1324	13.9328	13.7331	13.5335	13.3338	13.1342	14.0947	15.0553	14.8557	14.656	14.4564	14.2567	14.0571	13.8574	13.6578	13.4581	13.3343	13.2105
Discount Rate	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628	0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	0	0	23.1276	0	0	0	0	0	0	0	0	0	1.51227	0
Net Present Cost (NPC)	11.9494	11.4517	10.9739	10.5154	10.0753	9.65296	9.24767	8.85875	8.91339	8.9542	8.62434	8.3061	7.99908	7.70289	7.41718	7.14157	6.87573	6.61931	6.39272	6.17371

Cost Metric (£m)	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Capex	0	0	0	0	0	0	0	0	56.3399	0	0	0	0	0	0	0	0	0	4.34057	0
Opex	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773
Financing Cost	13.0109	12.8112	12.6116	12.4119	12.2123	12.0126	11.813	11.6133	12.5739	13.5345	13.3348	13.1352	12.9355	12.7359	12.5362	12.3366	12.1369	11.9373	11.827	11.7167
Discount Rate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Discount Factor	0.25738	0.24989	0.24261	0.23554	0.22868	0.22202	0.21555	0.20928	0.20318	0.19726	0.19152	0.18594	0.18052	0.17527	0.17016	0.1652	0.16039	0.15572	0.15119	0.14678
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	0	0	23.1276	0	0	0	0	0	0	0	0	0	1.78181	0
Net Present Cost (NPC)	5.9425	5.71953	5.5045	5.29715	5.09721	4.90442	4.71854	4.53932	4.60228	4.65772	4.48382	4.3161	4.15435	3.99835	3.84792	3.70287	3.56299	3.42813	3.31161	3.19897

Cost Metric (£m)	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Capex	0	0	0	0	0	0	0	0	131.776	0	0	0	0	0	0	0	0	0	3.68396	0
Opex	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773	10.0773
Financing Cost	11.5171	11.3174	11.1178	10.9181	10.7185	10.5188	10.3192	10.1195	12.6336	15.1477	14.948	14.7483	14.5487	14.349	14.1494	13.9497	13.7501	13.5504	13.4267	13.3029
Discount Rate	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.025	0.025	0.025	0.025	0.025
Discount Factor	0.14251	0.13836	0.13433	0.13041	0.12662	0.12293	0.11935	0.11587	0.1125	0.10922	0.10604	0.10295	0.09995	0.09704	0.09421	0.09192	0.08967	0.08749	0.08535	0.08327
Capex - Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex - Optimism Bias	0	0	0	0	0	0	0	0	54.0943	0	0	0	0	0	0	0	0	0	1.51227	0
Net Present Cost (NPC)	3.07734	2.96009	2.84705	2.73809	2.63306	2.53183	2.43426	2.34023	2.55489	2.75506	2.65364	2.5558	2.4614	2.37033	2.28249	2.20846	2.1367	2.06711	2.00613	1.94689

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: [illegible]	Total / Fixed / Variable	2019-20	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45
Complete for all options <£100m (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Opex	Cost		Fixed		0	0	0	0	0	0	0	0	0	0.91866	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Opex	Cost		Variable		0	0	0	0	0	0	0	0	0	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Land (Non depreciating)			Fixed		0	1.3209	0.58346	0.58346	0.58346	0.58346	0.58346	0.58346	0.58346	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Planning and Development (Non-depreciating)			Fixed		1.41562	7.07808	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Vehicles (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Computers and Data Logging (4)		4	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Fencing (10)		10	Fixed		0	0	0.08443	0.08443	0.08443	0.08443	0.08443	0.08443	0.08443	0	0	0	0	0	0	0	0	0	0.59099	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Domestic Meters (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Building Services (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Membranes (10)		10	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	ICA (Instrumentation, Control & Automation) (10)		10	Fixed		0	0	1.02531	1.02531	1.02531	1.02531	0.168	0.168	0.168	0	0	0	0	0	0	0	0	0	4.60524	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Plant and Machinery (15)		15	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed		0	0	17.1688	17.1688	17.1688	17.1688	1.86536	1.86536	1.86536	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Raw Water and District Meters (20)		20	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Power Supply (25)		25	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Bridges (40)		40	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed		0	0	0.23154	0.23154	0.23154	0.23154	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed		0	0	25.4695	25.4695	25.4695	25.4695	1.22414	1.22414	1.22414	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Roads and Car Parks (60)		60	Fixed		0	0	0.15761	0.15761	0.15761	0.15761	0.07417	0.07417	0.07417	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Water Towers (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Borehole Installation (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Headworks/Valves (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Underwater Assets (60)		60	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Weirs (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Pipelines (100)		100	Fixed		0	0	12.0274	12.0274	12.0274	12.0274	9.79448	9.79448	9.79448	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Tunnels (100)		100	Fixed		0	0	0.53349	0.53349	0.53349	0.53349	0.53349	0.53349	0.53349	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Aqueducts (100)		100	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Embankment Works (250)		250	Fixed		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 100	Teddington DRA scheme (100Ml/d yield)	Costed Risk			Fixed		0	0	12.5296	12.5296	12.5296	12.5296	1.63269	1.63269	1.63269	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65
Opex (Fixed)	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278
Opex (Variable)	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non-depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0	0	0.59099	0	0	0	0	0	0	0	0	0	0.59099	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	0	0	4.60524	0	0	0	0	0	0	0	0	0	4.60524	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	0	0	74.2712	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85
Opex (Fixed)	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278
Opex (Variable)	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non-depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0	0	0.59099	0	0	0	0	0	0	0	0	0	0.59099	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	0	0	4.60524	0	0	0	0	0	0	0	0	0	4.60524	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	0	0	74.2712	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.92615	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex (Fixed)	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278	0.9278
Opex (Variable)	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947	9.14947
Land (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non-depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)	0	0	0	0	0	0	0	0	0.59099	0	0	0	0	0	0	0	0	0	0.59099	0
Domestic Meters (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (10)	0	0	0	0	0	0	0	0	4.60524	0	0	0	0	0	0	0	0	0	4.60524	0
Plant and Machinery (15)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)	0	0	0	0	0	0	0	0	74.2712	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)	0	0	0	0	0	0	0	0	105.55	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)	0	0	0	0	0	0	0	0	0.85295	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (60)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Profile WRMP24 Table

Water Company	Jacobs	Version		Back to title page

Table 5a: WC Level - Option Level Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.	Total/Fixed/Variable	2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Complete for all options (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Capex			Total							1.00298	5.95068	43.0708	43.0708	43.0708	43.0708	10.1578	10.1578	10.1578	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Opex			Total							0	0	0	0	0	0	0	0	0	15.1917
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Financing Cost			Total							0.02067	0.16396	1.3871	3.58814	5.78917	7.99021	9.32388	9.79019	10.2565	17.7851
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Discount Rate			Total							0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Discount Factor			Total							0.96618	0.93351	0.90194	0.87144	0.84197	0.8135	0.78599	0.75941	0.73373	0.70892
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Capex	Costed Risk		Total							0	0	14.5871	14.5871	14.5871	14.5871	1.63269	1.63269	1.63269	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Capex	Optimism Bias		Total							0.41264	2.44821	17.72	17.72	17.72	17.72	4.17907	4.17907	4.17907	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Net Present Cost (NPC)			Total							0.01997	0.15306	1.25109	3.12685	4.87433	6.50004	7.32849	7.43479	7.52551	23.3778
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Total NPC			Total	643.95635															

Cost Metric (£m)	Cost Sub-metric (£m)	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55
Capex		0	0	0	0	0	0	0	0	4.08848	0	0	0	0	0	0	0	0	0	62.7779	0
Opex		15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999
Financing Cost		17.5689	17.3527	17.1366	16.9204	16.7042	16.488	16.2718	16.0556	15.9237	15.7918	15.5756	15.3594	15.1432	14.927	14.7109	14.4947	14.2785	14.0623	15.1398	16.2172
Discount Rate		0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Discount Factor		0.68495	0.66178	0.6394	0.61778	0.59689	0.57671	0.5572	0.53836	0.52016	0.50257	0.48557	0.46915	0.45329	0.43796	0.42315	0.40884	0.39501	0.38165	0.36875	0.35628
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	1.68207	0	0	0	0	0	0	0	0	0	25.8278	0
Net Present Cost (NPC)		22.4449	21.5428	20.6761	19.8433	19.0432	18.2746	17.5362	16.8268	16.1891	15.5754	14.9437	14.3369	13.7541	13.1943	12.6566	12.1403	11.6443	11.168	11.1877	11.1932
Total NPC																					

Cost Metric (£m)	Cost Sub-metric (£m)	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75
Capex		0	0	0	0	0	0	0	0	4.08848	0	0	0	0	0	0	0	0	0	62.7779	0
Opex		15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999
Financing Cost		16.001	15.7849	15.5687	15.3525	15.1363	14.9201	14.7039	14.4878	14.3558	14.2239	14.0077	13.7915	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Rate		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Factor		0.3459	0.33583	0.32605	0.31655	0.30733	0.29838	0.28969	0.28125	0.27306	0.2651	0.25738	0.24989	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	1.68207	0	0	0	0	0	0	0	0	0	25.8278	0
Net Present Cost (NPC)		10.7924	10.4055	10.0319	9.67132	9.32319	8.98714	8.66275	8.34964	8.07042	7.80038	7.51754	7.24456	6.98111	6.72686	6.48149	6.24471	6.01623	5.79576	5.84587	5.88814
Total NPC																					

Cost Metric (£m)	Cost Sub-metric (£m)	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Capex		0	0	0	0	0	0	0	0	[illegible]	0	0	0	0	0	0	0	0	0	141.491	0	0	0	0	0	0	0	0	0	4.08848	0
Opex		15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999	15.1999
Financing Cost		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Rate		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Discount Factor		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Capex	Costed Risk	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Capex	Optimism Bias	0	0	0	0	0	0	0	0	1.93221	0	0	0	0	0	0	0	0	0	58.2116	0	0	0	0	0	0	0	0	0	1.68207	0
Net Present Cost (NPC)		5.67524	5.46974	5.27141	5.07998	4.89523	4.71694	4.54488	4.37884	4.2334	4.09272	3.9427	3.79796	3.6583	3.52355	3.39355	3.26814	3.14715	3.03043	3.24585	3.44614	3.32285	3.20381	3.08889	2.97794	2.87084	2.78095	2.69373	2.60912	2.53422	2.46142
Total NPC																															

Table 5b: WC Level - Option Level Unit Cost Profile Table

Table Instruction	Option ID	Option Name	Cost Metric (£m)	Cost Sub-metric (£m)	Asset Life: Estimated average number of years an asset is considered useable before its value is fully depreciated.		2019-20	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	2032-33	2033-34	2034-35
Complete for all options >£100m (Feasible and preferred)	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Opex	Cost		Fixed							0	0	0	0	0	0	0	0	0	0.9817
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Opex	Cost		Variable							0	0	0	0	0	0	0	0	0	14.21
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Land (Non depreciating)			Fixed							0	1.3208	0.58384	0.58384	0.58384	0.58384	0.58384	0.58384	0.58384	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Planning and Development (Non depreciating)			Fixed							1.41562	7.07808	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Other Non-Depreciating Assets (Non depreciating)			Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Process-Related Carbon Media including GAC (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Vehicles (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Computers and Data Logging (4)		4	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Fencing (10)		10	Fixed							0	0	0.08446	0.08446	0.08446	0.08446	0.08446	0.08446	0.08446	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Domestic Meters (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Building Services (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Membranes (10)		10	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	ICA (Instrumentation, Control & Automation) (15)		15	Fixed							0	0	1.16872	1.16872	1.16872	1.16872	0.16811	0.16811	0.16811	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Plant and Machinery (15)		15	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		20	Fixed							0	0	19.3089	19.3089	19.3089	19.3089	1.86607	1.86607	1.86607	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Raw Water and District Meters (20)		20	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Power Supply (25)		25	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Steel/Timber/GRP Structures (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Landscaping/Environmental Works (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Borehole Screening and Casing (30)		30	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Bridges (40)		40	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Brick/Concrete Office Structures (50)		50	Fixed							0	0	0.23169	0.23169	0.23169	0.23169	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Treatment and Pumping Station Civils (incl. Intakes) (60)		60	Fixed							0	0	26.842	26.842	26.842	26.842	1.22493	1.22493	1.22493	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Roads and Car Parks (60)		60	Fixed							0	0	0.15771	0.15771	0.15771	0.15771	0.07422	0.07422	0.07422	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Water Towers (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Borehole Installation (60)		60	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Headworks/Valves (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Underwater Assets (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Reinforced Concrete Tanks / Service Reservoirs (80)		80	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Weirs (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Pipelines (100)		100	Fixed							0	0	12.0797	12.0797	12.0797	12.0797	8.80084	8.80084	8.80084	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Tunnels (100)		100	Fixed							0	0	0.53384	0.53384	0.53384	0.53384	0.53384	0.53384	0.53384	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Aqueducts (100)		100	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Embankment Works (250)		250	Fixed							0	0	0	0	0	0	0	0	0	0
	TWU_TED_HI-RAB_RE1_CNO_teddington dra 150	Teddington DRA scheme (150Ml/d yield)	Costed Risk			Fixed							0	0	14.5871	14.5871	14.5871	14.5871	1.63269	1.63269	1.63269	0

Cost Metric (£m)	Cost Sub-metric (£m)	2035-36	2036-37	2037-38	2038-39	2039-40	2040-41	2041-42	2042-43	2043-44	2044-45	2045-46	2046-47	2047-48	2048-49	2049-50	2050-51	2051-52	2052-53	2053-54	2054-55
Opex	Cost	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993
Opex	Cost	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21
Land (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)		0	0	0	0	0	0	0	0	0.59137	0	0	0	0	0	0	0	0	0	0.59137	0
Domestic Meters (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (15)		0	0	0	0	0	0	0	0	5.17918	0	0	0	0	0	0	0	0	0	5.17918	0
Plant and Machinery (15)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82.8352	0
Raw Water and District Meters (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Cost Sub-metric (£m)	2055-56	2056-57	2057-58	2058-59	2059-60	2060-61	2061-62	2062-63	2063-64	2064-65	2065-66	2066-67	2067-68	2068-69	2069-70	2070-71	2071-72	2072-73	2073-74	2074-75
Opex	Cost	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993
Opex	Cost	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21
Land (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)		0	0	0	0	0	0	0	0	0.59137	0	0	0	0	0	0	0	0	0	0.59137	0
Domestic Meters (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (15)		0	0	0	0	0	0	0	0	5.17918	0	0	0	0	0	0	0	0	0	5.17918	0
Plant and Machinery (15)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82.8352	0
Raw Water and District Meters (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Cost Metric (£m)	Cost Sub-metric (£m)	2075-76	2076-77	2077-78	2078-79	2079-80	2080-81	2081-82	2082-83	2083-84	2084-85	2085-86	2086-87	2087-88	2088-89	2089-90	2090-91	2091-92	2092-93	2093-94	2094-95	2095-96	2096-97	2097-98	2098-99	2099-00	2100-01	2101-02	2102-03	2103-04	2104-05
Opex	Cost	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993	0.98993
Opex	Cost	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21	14.21
Land (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Planning and Development (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Non-Depreciating Assets (Non depreciating)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Process-Related Carbon Media including GAC (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Vehicles (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Computers and Data Logging (4)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fencing (10)		0	0	0	0	0	0	0	0	0.59137	0	0	0	0	0	0	0	0	0	0.59137	0	0	0	0	0	0	0	0	0	0.59137	0
Domestic Meters (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Building Services (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Membranes (10)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ICA (Instrumentation, Control & Automation) (15)		0	0	0	0	0	0	0	0	5.17918	0	0	0	0	0	0	0	0	0	5.17918	0	0	0	0	0	0	0	0	0	5.17918	0
Plant and Machinery (15)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M&E (Mechanical and Electrical) Works on Pumping Stations and Treatment Works (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82.8352	0	0	0	0	0	0	0	0	0	0	0
Raw Water and District Meters (20)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Power Supply (25)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Steel/Timber/GRP Structures (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Landscaping/Environmental Works (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Screening and Casing (30)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bridges (40)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Brick/Concrete Office Structures (50)		0	0	0	0	0	0	0	0	0.92675	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Treatment and Pumping Station Civils (incl. Intakes) (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	110.243	0	0	0	0	0	0	0	0	0	0	0
Roads and Car Parks (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.85351	0	0	0	0	0	0	0	0	0	0	0
Water Towers (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Borehole Installation (60)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Headworks/Valves (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Underwater Assets (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Reinforced Concrete Tanks / Service Reservoirs (80)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Weirs (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pipelines (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tunnels (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aqueducts (100)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Embankment Works (250)		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Costed Risk		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0