ANNEX A4

Cost and Carbon Report

This document has been written in line with the requirements of the RAPID gate two guidance and to comply with the regulatory process pursuant to Severn Trent Water's and Affinity 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, Severn Trent Water and Affinity 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.

Minworth SRO

Severn Trent Water & Affinity Water

Cost and Carbon Report

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Severn Trent Water
A7W13155

Minworth SRO
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Cost and Carbon Report

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Executive Summary

Minworth Strategic Resource Option (SRO) was included as an SRO in the Price Review 19 Final Determination as a source option for the Severn to Thames Transfer (STT) SRO and Grand Union Canal (GUC) SRO. The GUC pipeline appraisal is being undertaken by GUC SRO team, whereas this report addresses the costs and carbon values for the treatment and conveyance scope of Minworth SRO.

Jacobs Engineering Group Limited have developed a conceptual design for this scheme and estimated costs and carbon associated with the scheme. This report identifies the methodology for generating the costs for CAPEX, OPEX, Carbon as well as for risk and optimism bias. The full summary of the costs can be reviewed in Appendix A.1

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1. Introduction

1.1. Background and Purpose of Report

Minworth Strategic Resource Option (SRO) was included as an SRO in the Price Review 19 Final Determination as a source option for the Severn to Thames Transfer (STT) SRO and Grand Union Canal (GUC) SRO. The GUC pipeline appraisal is being undertaken by GUC SRO team, whereas this report addresses the conveyance scope of Minworth SRO which proposes the provision of a pipeline to transfer 115Mld from Minworth Wastewater Treatment Works (WwTW) to the River Avon to supply STT SRO.

Jacobs have developed a conceptual design for this scheme and estimated costs and carbon associated with the scheme. The results of cost and carbon estimating were used to compare the different options assessed and are also being issued to Severn Trent Water (STW) to report to the Water Resources South-East (WRSE). WRSE will use the results to update its database for the investment modelling.

The purposes of this report are to present the basis, methodologies and results of cost and carbon estimating for the Minworth SRO.

1.2. Scheme Overview

Minworth SRO overall schematic is shown below. For further details reference Annex 1 CDR.

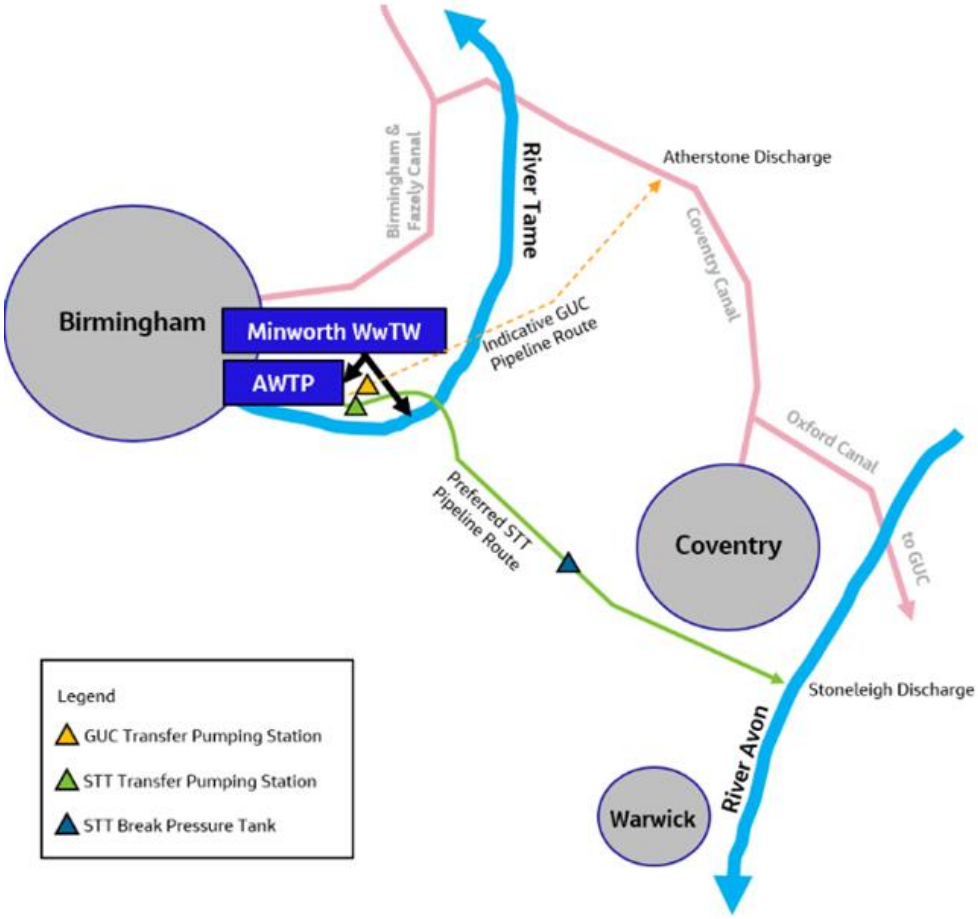

Figure 1-1 Minworth SRO overall schematic

2. Cost and Carbon Estimate Methodology

Total Capital Expenditure (Total CAPEX), Operating Expenditure (OPEX) and Carbon were estimated for the Minworth scheme. Total CAPEX consists of the combination of Base Capital Expenditure (Base CAPEX), Costed Risk and Optimism Bias (OB). This section demonstrates methodologies to estimate these components for the Minworth SRO scheme.

2.1. CAPEX Estimate Methodology

The CAPEX costs were developed for the options using the Severn Trent Cost Tool Lite. Severn Trent's Cost Tool Lite is an in-house tool that contains more than 20 years of historic project cost data and cost models (generated by the Severn Trent Unit Cost Analysis tool) as well as historic uplifts for prelims and client costs.

Process element costs have been benchmarked by requesting 4 vendors' quotations for the principal process elements. The quotes provided by the vendors provided an outline of costs for the key process units for the proposed treatment. The equipment costs are "supply only" from vendors as these quotes are not comprehensive, with no inclusion of costs for civils work or all ancillary equipment required. Vendor quotes could not be obtained for every piece of equipment for each of the 4 flow rates, so the UK sourced quotations were adjusted by using the equipment cost curves from Replica PD (see section 2.4.2 below) to suit the required flow rates.

Table 2-: Summary of the costs provided by the process unit suppliers

Technology	Supplier	Unit cost of technology (£000k)			
		TREAT57 (62.7 MLD)	TREAT115 (126.5 MLD)	TREAT172 (189.2 MLD)	TREAT230 (253 MLD)
CoMAG	Evoqua	2,010	2,195	2,490	2,830
Ozone	Xylem	985	1,800	2,400	3,200
	De Nora	1,140	1,665	2,191	2,717
	Curio	3491	4344	4859	5811
BAC	Xylem	237	421	484	810
	De Nora	1,152	1,925	2,643	3,012
BAF	Curio	3084	3305	4486	4967
GAC	Xylem	258	459	670	892
	De Nora	1,236	2,112	2,684	3,174
	Curio	3309	5479	6732	8036

2.2. Quantitative Costed Risk Assessment (QCRA) Methodology

Risk registers for the four treatment options (TREAT57, TREAT115, TREAT170 and TREAT 230) and the preferred pipeline route (STT115) were prepared, and Monte Carlo analyses were carried out using Palisade @RISK software add-in in ACWG (All Company Working Group) spreadsheet for QCRA (Quantitative Costed Risk Assessment).

2.2.1. Risk Identification and Scoring

Risk registers in the ACWG spreadsheet were reviewed and updated for consistency as per the latest conceptual designs.

Once the draft risk registers had been prepared with the adjustment for consistency among schemes/sub-options, 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.

The ACGW spreadsheet 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 2-1. "Probability Percentage" of the risk events is also required to be entered in the spreadsheets, and these two parameters are used in the QCRA with Monte Carlo Simulation to produce the Cost Risk.

Specific cost impact ranges expected to be incurred by individual risk events had been allocated to some of the risk entries without using the percentages of estimated Base CAPEX, and these cost ranges were also used for Gate 2 estimates, where applicable. It should be noted that the maximum cost impact of each risk is capped at 30% of the total project cost. OPEX risks are included but attract zero costs.

Table 2-1: Minworth SRO Risk Assessment - Cost and Schedule Scoring

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost (%)	Max Cost (%)
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	0.5	1.0
2 - Low	Remote (11-30%)	Small (1.1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2	1.1	2.0
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3	2.1	5.0
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4	5.1	15.0
5 - Very High	Almost certain (71-99%)	Major (>15.1%) increase in project cost	Major (>15.1%) delays to project delivery	5	15.1	30.0

2.2.2. Monte Carlo Analysis

The overall cost risk is estimated by combining the likelihood of the risk events and the cost estimated to be incurred by the risk events using Monte Carlo simulation with the '@Risk' Excel add-in in the ACWG spreadsheet.

A uniform distribution is a probability distribution and was used to model the costs incurred by each risk event. A Bernoulli distribution was used to model the likelihood of the risk event. Each of the identified risks was treated as discrete events, and no dependencies between risk events were considered. Each simulation was run with 50,000 iterations using Latin Hypercube sampling, and the 50th percentile (P50) of the output distribution was used as the Cost Risk of the option.

2.3. Optimism Bias Methodology

Optimism Bias (OB) was derived using the methodology outlined in the "Cost Consistency Methodology – Technical Note and Methodology Revision 3" (Mott MacDonald, 2020), which sets out recommendations for SROs on the common approach to OB assessment. The approach was agreed with the ACWG.

The document recommends that the approach to OB should use an associated Excel template "ACWG - Appendix A-1 - Optimism Bias and QCRA - Rev C" 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.

Following L1 assurance, STW / Affinity provided an amended OB assessment to reflect their individual company's view on the level of OB to consider for the scheme taking into consideration other schemes being developed within the SRO framework.

2.4. OPEX Estimate Methodology

As per the requirements for WRSE, the outputs for OPEX are categorised into fixed and variable expenses for reporting purposes. Each option (GUC & STT) has its own OPEX that's dependent on the operation regime and

the operation mode of that particular solution required. OPEX has been calculated using the water demand requirements identified in the operational philosophy report in A7W13155-GT-REP-200023.

2.4.1. Pipeline

The OPEX of the pipeline is derived from the summary of the following two elements:

- Pumping Station yearly OPEX which accounts for the maintenance activities of the pumping station, and the energy cost considering running time under sweetening and peak flows.
- Pipeline OPEX which accounts for yearly inspections and operations and planned and reactive maintenance, as well as a pre-NPV annualised refurbish, replace, and disposal cost.

Variable OPEX costs have been estimated based on energy usage and fixed OPEX costs have been estimated based on maintenance and inspection activities costs.

2.4.2. Treatment

OPEX for the treatment elements of the SRO required for scheme operation, such as electricity, chemical and employee costs, have been identified and quantified in conceptual design using Jacobs proprietary software Replica PD (Parametric Design). Replica PD is used to generate conceptual-level designs and cost estimates for wastewater projects that facilitate sustainable and economical decision-making early in the project. Replica PD integrates facility design criteria and footprints with construction / OPEX cost estimates to provide a clearer picture of project scope and cost than traditional conceptual estimating techniques. Replica PD utilises parametric engineering algorithms based on the successful implementation of previous projects to provide detailed and accurate scope and cost estimates. Compared with traditional conceptual estimating techniques, Replica PD yields a much clearer picture of the project's unique scope and provides a cost estimate to inform technical decision-making before investing in further detailed design.

Replica PD identifies the requirements for chemicals and maintenance work, and the quantity of each item based on the requirements in the conceptual design. OPEX costs are then derived by multiplying the quantity by the default unit rate according to the operational philosophy.

Treatment OPEX costs will depend on the treatment and conveyance options selected. A total of 8 operating regimes for the Advanced Water Treatment Plant (AWTP) have been defined based on the possible combinations of treatment options and the capacity of the STT and GUC pipelines. OPEX costs have been estimated for each of the operational regimes summarised in Table 2-2.

Table 2-2: AWPT operating regimes and production volumes

Operating regime	Treatment option	Flow requirement	AWTP production			
TREAT57_STT57	TREAT57	STT – 57 Mld GUC – 0	57 Mld 10% of time	11 Mld 90% of time		
TREAT57_GUC57	TREAT57	STT – 0 GUC – 57 Mld	57 Mld 25% of time	28.5 Mld 17% of time	14 Mld 58% of time	
TREAT115_STT115	TREAT115	STT – 115 Mld GUC – 0	115 Mld 10% of time	23 Mld 90% of time		
TREAT115_GUC115	TREAT115	STT – 0 GUC –115 Mld	115 Mld 25% of time	58 Mld 17% of time	29 Mld 58% of time	
TREAT115_STT57_GUC57	TREAT115	STT – 57 Mld GUC –57 Mld	115 Mld 9% of time	60 Mld 17% of time	32 Mld 17% of time	23 Mld 57% of time
TREAT172_STT115_GUC57	TREAT172	STT – 115 Mld GUC – 57 Mld	172 Mld 9 % of time	60 Mld 17% of time	34 Mld 74% of time	

Operating regime	Treatment option	Flow requirement	AWTP production			
TREAT172_STT57_GUC115	TREAT172	STT – 57 Mld GUC – 115 Mld	172 Mld 9% of time	118 Mld 17% of time	61 Mld 17% of time	34 Mld 57% of time
TREAT230_STT115_GUC115	TREAT230	STT – 115 Mld GUC – 115 Mld	230 Mld 9% of time	118 Mld 17% of time	61 Mld 17% of time	46 Mld 57 % of time

Table 2-3: Metrics used within Replica PD for the calculation of OPEX

Item	Item	Units
Power Cost : (Note: "All-in" including usage, demand, and transmission charges)	[redacted]	(£/kWh)
Natural Gas:		(£/kWh)
Maintenance, Repair, and Replacement Costs:		
Chemical Costs:		
Liquid Chemicals:		(£/dry ton)
Ferric Chloride (40%)		
Hydrogen Peroxide (35%)		
Liquid Polymer		
Sodium Bilsulfite (40%)		
Sodium Hydroxide (25%)		
Sodium Hydroxide (50%)		
Sodium Hypochlorite (12.5%)		
Dry Chemicals:		(£/dry ton)
Polymer		
Specialty Chemicals:		(£/dry ton)
Liquid Oxygen		
GAC		
Sand		
Solids:		
Biosolids:		
Biosolids Unit Cost		(£/Dry Ton)
Percent Solids		
Biosolids CALCULATED Unit Cost		(£/Wet Ton)
Haul Distance from Plant (Miles, Round Trip)		
Haulage Cost		(£/Wet Ton/mile)
Trash Disposal:		(Site Returns)
Haul Distance from Plant (Miles, Round Trip)		
Disposal Cost		(£/m3)
Haul Cost		(£/m3)

Item	Item	Units
Other Costs:	[redacted]	
O&M Other Costs: Percent for Misc Annual Costs:		%
O&M Cost Contingency:		
O&M Cost Contingency		%
Overall Plant Labor:		
Average Rate for O&M Staff		(£/hr)

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

Construction CAPEX and OPEX costs are 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.

Appendix A5, AIC sheets are available on request

2.6. Carbon Estimate Methodology

This section of the report covers carbon assessment methodology which includes the principles on which the analysis is based. A carbon inventory is the total Green House Gas (GHG) emissions associated with a particular infrastructure project. The GHG emissions are reported in tonnes of carbon dioxide equivalent (tCO_2e) which standardises the global warming potential of the main GHG into one index based on the global warming potential of carbon dioxide (CO_2). Here after the term carbon is used to refer to the combined GHG emissions.

The GHG assessment used the Severn Trent Carbon Calculator version (STW Carbon Tool_1770826643). This was supported by a combination of carbon modelling tools and publicly available information including the University of Bath's Inventory of Carbon and Energy, which provides data for the embodied carbon of construction materials.

The GHG assessment reported the carbon inventory from development/construction and 71 years of operation. Capital emissions, i.e., those from the construction process are considered under embodied carbon and operational emissions such as energy, fuel & chemical consumption under operational carbon.

PAS 2080 Carbon Management in Infrastructure provides a consistent framework for working through and identifying potential opportunities and interventions. The evaluation followed the Carbon emission reduction hierarchy in order to select the option with the lowest whole life carbon emission and identify potential opportunities to reduce carbon with the chosen option taking into consideration:

- Build nothing: evaluate the basic need for the project and explore alternative approaches to achieve the desired outcome/s.
- Build less: realise potential for re-using and/ or refurbishing existing assets to reduce the extent of new construction required.
- Build clever: apply low carbon solutions (including technologies, materials, and products) to minimise resource consumption during the construction, operation, user's use of the project, and at end-of-life
- Build efficiently: use techniques (e.g., during construction and operation) that reduce resource consumption over the life cycle of the project

2.6.1. Embodied Carbon Calculations

The STW Carbon tool holds a database of approximately 500 assets which can be scaled using the asset yardsticks (functional units, e.g., volume, area, depth, etc) to provide assessments of embodied carbon. Each asset has a set of inclusions and exclusions, showing the components for which embodied carbon values are assessed - in general this can include the construction materials, as well as key construction and installation phases, ensuring a 'cradle to gate' assessment.

The components were chosen and scaled appropriately based on their yardsticks for each scheme option as indicated in the cost models, in close alignment with the descriptions of the assets in the tool. The tool calculates the embodied carbon emissions based on the carbon curves for each asset, summing the total for each option and providing a basis for the comparison of options.

2.6.2. Operational Carbon Calculations

For operational carbon values, specific carbon factors are allocated based on annual consumption quantities of energy, fuel & chemicals for water and wastewater processes.

The tool calculates the annual operational carbon emissions for each utility / chemical based on annual quantities allowing for the comparison of annual emissions between design options, as well as a comparison based on extrapolating the annual emissions to the 80-year lifespan of the programme – which is 9 years development/construction and 71 years operation.

Operational carbon emissions will depend on the treatment and conveyance options selected. A total of 8 operating regimes for the AWTP have been defined based on the possible combinations of treatment options and the capacity of the STT and GUC pipelines. Carbon emissions costs have been estimated for each of the operational regimes summarised in Table 2-2: AWPT operating regimes and production volumes.

2.6.3. **Discussion**

This report summarises the outputs of the whole life carbon assessment, broken down into capital carbon and, operational carbon. The quantified assessment does not include for estimating the potential impact of decommissioning the scheme at the end of its operational life, as this is expected to be over 100 years and the systems in place to re-use, recycle or dispose of these assets will be substantially different in approach and carbon intensity to what they are currently.

This report details a high-level desktop study to develop and appraise a long list of options for the route from Minworth to the River Avon, along with potential combined options to discharge to the GUC at Atherstone and its treatment options and combinations. This desktop study is intended to support water companies in progressing the investigation and development of solutions more quickly to the 'construction ready' state and considering the carbon ambition target in its components which set Net-Zero emissions from Scope 1 and 2 by 2030: and Scope 3 by 2050.

The carbon ambition has been set by an SRO-led task-and-finish group, consisting of the water companies with SROs, Water UK, RAPID and Ofwat, which seeks to cover Scope 1, 2 & 3 carbon emissions:

Scope 1 & 2 aligns with the Water UK stated ambition which set Net-Zero emissions by 2030. Scope 1 refers to emissions directly within an asset owner control, typically emissions from fuel combustion and process emissions (chemical use). Scope 2 refers to indirect emissions from the generation of electricity used by the reporting company.

Scope 3 aligns with the UK 2050 ambition but recognizes there is more to do on standardisation. Scope 3 refers to all other emissions outside the control of the company, notably embodied carbon of capital works and purchased goods (pipeline and plant treatment embodied carbon).

The early stages of the design process and pipeline optioneering provided the greatest opportunity for carbon reduction through optimisation of assets, reduction in the extent of new construction through route analysis and maximizing asset operation. The calculation considers the carbon embedded in construction, as well as operational carbon for the next 71 years. The results of the calculations are presented in Appendix A7. The SRO will reduce carbon through design and mitigations during future gates as necessary.

The carbon appraisal for the Conveyance optioneering and Carbon assessment for the treatment plant were developed separately. The Gate 2 unmitigated solution for Treat115STT115 was taken as a baseline and additional options and combination were assessed in this report.

For the Pipeline Route Options Appraisal, Carbon was considered in the route appraisal where a criterion for selection was developed. In order to allow comparison of the routes, to identify the preferred option, a Multi-Objective Decision Analysis (MODA) has been undertaken to allow the inclusion of non-monetary factors important in option selection. MODA is a method used to rank alternatives based on how well they rate against a chosen set of objectives (evaluation criteria). Criteria are weighted by relative importance, and the overall "decision score" of an alternative is the weighted sum of its rating against each criterion. Criteria are typically derived from critical success factors which includes carbon figures, shaped by key issues, assumptions, and boundaries from decision process definition.

In addition to this, the ST Carbon Tool V.2021 was used for carbon analysis where 9 options were taken into consideration. The main criteria and decision factor for developing the assessment were carbon emission ratios per meter of pipeline built, pipeline diameter, average depth, and ground conditions (Field or highway), crossing areas and energy consumption. This evaluation has not considered carbon emissions from maintenance, repair, refurbishment activities and End-of-Life phase. A detailed assessment and the results can be found in Annex A2 Pipeline Route Options report.

For the AWTP, there are currently multiple flow rates that are being considered for the Minworth. The Minworth SRO is currently envisioned to treat Minworth WwTW effluent and discharge to either the River Avon, the GUC, or both. By combining elements above of the AWTP and pipeline, the following solutions combinations are achieved and summarised in Table 2-4 and Table 2-5 below.

Table 2-4: Pipeline Preferred Option Carbon Assessment

Preferred Route	Embodied Carbon (tCO2e)	Operational Carbon (tCO2e)
STT57	91,073	49,997
STT115	91,073	99,994

Table 2-5: Carbon assessment of solutions combinations

Treatment Option		Embodied Carbon (tCO2e)	Operational Carbon (tCO2e) - Annual		Total Whole Life Carbon (tCO2e)
Project Reference	STW Carbon tool reference		Grid power Operational Carbon (tCO2e)	Non-power related operational carbon	
TREAT57_STT57	Option 1	5,379	572	481	80,097
TREAT57.ALT_STT57	Option 9	732	424	464	63,753
TREAT57_GUC57	Option 5	5,379	1,098	864	144,679
TREAT115_STT115	Option 2	8,014	938	970	143,487
TREA115.ALT_STT115	Option 10	1,280	639	464	79,534
TREAT115_GUC115	Option 6	8,014	1,803	1,743	259,715
TREAT115_STT57_GUC57	Option 7	8,014	1,066	1,203	169,129
TREAT172_STT115_GUC57	Option 3	10,443	1,377	1,585	220,775
TREAT172_STT57_GUC115	Option 8	10,443	1,673	2,029	273,264
TREAT230_STT115_GUC115	Option 4	13,091	1,842	2,395	313,960

The scheme offers a low level of embodied carbon when compared to Gate 1 options and its updated options of North and South Warwick routes in Gate 2. The mitigations against the Gate 2 unmitigated baseline produced a 56,971 tCO2e reduction in the embodied carbon emissions and produced a 46,274 tCO2e reduction in the operational carbon.

Additionally, there are energy recovery and renewable opportunities outlined in Annex A1 CDR which summarises the potential mitigation alternatives based on the design principles established in section 2 of Annex A1 CDR.

- Hydraulic power opportunity: There is approximately 62m pressure available within the gravity pipeline which discharges to the River Avon when the pipeline is transferring 115Mld – it may be possible to install a turbine in this length to recover this head as electricity. Hydraulic analysis has shown that it is not possible to reduce this head to zero (highest carbon saving) so this is an opportunity which could be developed.
- Solar energy opportunity: There is approximately 57Ha of available land owned by STW adjacent to Minworth WwTW. This is the maximum possible size of land that could be used to install solar panels to reduce the carbon impact of the scheme as well as reduce operational cost through renewable energy.

Throughout the design, potential mitigation measures for capital carbon reduction have been considered considering lean construction practices and circular economy principles:

- Low carbon concrete: substituting cement with other materials/ additives such as blast furnace slag or pulverised fly ash.
- Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).
- Inclusion of recycled material in steel, and design for material recovery at end-of-life where possible.
- Specifying resilient materials which have a long-life span and require minimal maintenance and less frequent replacement.

- Reduce demolition through trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas.
- Re-use demolished material and existing available materials, e.g., processing, re-use of excavated material as fill.
- Minimising removal of vegetation to prevent loss of carbon storage in soils. Minimising removal of trees as they have a higher potential to sequester carbon.
- Prioritising local suppliers to reduce the distance travelled to site, and engaging suppliers with certified carbon management systems.
- Minimising import of bulk materials (e.g., aggregates) e.g., by sourcing surplus material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions.
- Adopting energy and fuel management plans in construction compounds
- Encouraging sustainable transport practices for staff, e.g., ride sharing & use of public transport.

It is recommended in the Gate 3 to explore more detailed mitigation measures such as low carbon materials (capital carbon) and assess potential decarbonisation opportunities through the recommendations under the build clever or build efficiently principles. It is also an opportunity for initial engagement with procurement to identify suppliers of more sustainable and resilient construction materials, thereby influencing and reducing Scope 3 emissions, which account for the largest proportion of capital carbon for the project.

2.6.4. **Carbon summary**

The emissions footprint of the project and how those have changed from Gate 1 have been summarised in the Carbon Summary document, Appendix A.8. The document describes how the project has designed down carbon and Green House Gasses (GHG) emissions and describes the design mitigations implemented.

The carbon summary shown in Appendix A.8 is calculated through a three-step process as the following:

- Step 1 - Emissions footprint: in this step the emissions footprint is set out for Gate 1 solutions, and for Gate 2 unmitigated solutions.
- Step 2 - Carbon and greenhouse gas mitigation: this step explains how the project has designed down the carbon and GHGs emissions and describes the design mitigation and shows the total mitigation reductions against baseline realised at Gate 2.
- Step 3 - Opportunities in relation to Water Industry and UK Government net zero targets: if there are still emissions after step 2, then step 3 explores offsetting opportunities in relation to Water Industry and UK Government net zero targets.

For simplicity, we have only considered steps 2 and 3 for TREAT115STT115.

2.6.5. **Carbon Sensitivity Analysis**

A high-level whole-life carbon assessment of GHG emissions has been conducted for the Minworth SRO scheme option TREAT115_STT115. The results are presented in tonnes of carbon dioxide equivalent (tCO2e) emissions, as shown in Table 2-6 below.

The operational carbon values estimates are for the first year of operation, using Treasury Green Book supplementary appraisal guidance on valuing energy use and GHG emissions, which was adopted in the ACWG Cost Consistency Methodology Report. Whole-life Carbon was calculated using the year 2031 as the first year of operation, including the carbon reduction at year 2050 and afterwards.

Table 2-6: Whole Life Carbon Sensitivity Analysis

Treatment Option: TREAT115_STT115		Whole Life Carbon (tCO2e)	Central Values (£)	Low Values (£)	High Values (£)
Operational Carbon	Grid Power	66,619	10,254,256	5,126,318	15,380,840
	Non-Power Related	68,854	10,598,400	5,298,363	15,897,037
Embodied Carbon		8,014	2,211,850	1,105,925	3,317,775
Total Whole Life Carbon		143,487	23,064,506	11,530,606	34,595,653

3. Cost and Carbon Estimate Results

The summary of the costs can be reviewed in Appendix A.1 supported by the documents in Appendix A.2 - A.8

A. Appendices

A.1 Cost Summary
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A.6 OPEX Estimate Details
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A.1 Cost Summary

A7W13155-GT-SPR-200022	Minworth SRO Costs Summary

Costs (CAPEX. OPEX, Carbon, NPV/AIC) which include a GUC element, exclude costs associated with the PS and transfer to GUC

Gate 2 CAPEX Costs Summary

Options	Gate-2 Reference	Gate 2 Base Capex (£)	Gate 2 Costed Risk (£) P50	Gate 2 Optimism Bias (£)	Total Capex (£)	Optimism Bias
Preferred Route Estimate 57Mld	STT57	£96,586,900	£ 6,953,437	£29,082,316	£132,622,653	30.11%
Preferred Route Estimate 115Mld	STT115	£96,586,900	£ 6,953,437	£29,082,316	£132,622,653	30.11%
Treatment 57Mld	TREAT57	£62,463,100	£ 6,640,223	£19,924,167	£89,027,490	31.90%
Treatment 57Mld (ALT)	TREAT57.ALT	£23,084,300	£ 3,520,134	£7,363,315	£33,967,749	31.90%
Treatment 115Mld	TREAT115	£91,642,000	£ 8,996,906	£29,231,507	£129,870,413	31.90%
Treatment 115Mld (ALT)	TREAT115.ALT	£33,054,900	£ 4,064,186	£10,543,687	£47,662,773	31.90%
Treatment 172Mld	TREAT172	£120,030,300	£ 10,996,507	£38,286,665	£169,313,472	31.90%
Treatment 230Mld	TREAT230	£148,484,000	£ 14,061,169	£47,362,684	£209,907,853	31.90%
Solutions						
GUC Transfer 57Mld	TREAT57_GUC57	£62,463,100	£6,640,223	£19,924,167	£89,027,490	
GUC Transfer 115Mld	TREAT115_GUC115	£91,642,000	£8,996,906	£29,231,507	£129,870,413	
STT Transfer 57Mld	STT57 & TREAT57_STT57	£159,050,000	£13,593,660	£49,006,483	£221,650,143	
STT Transfer 57Mld (ALT)	STT57 & TREAT57.ALT_STT57	£119,671,200	£10,473,571	£36,445,630	£166,590,401	
STT Transfer 115Mld	STT115 & TREAT115_STT115	£188,228,900	£15,950,343	£58,313,823	£262,493,066	
STT Transfer 115Mld (ALT)	STT115 & TREAT115.ALT_STT115	£129,641,800	£11,017,623	£39,626,002	£180,285,425	
STT Transfer 57Mld & GUC Transfer 57Mld	STT57 & TREAT115_STT57_GUC57	£188,228,900	£15,950,343	£58,313,823	£262,493,066	
STT Transfer 115Mld & GUC Transfer 57Mld	STT115 & TREAT172_STT115_GUC57	£216,617,200	£17,949,944	£67,368,981	£301,936,125	
STT Transfer 57Mld & GUC Transfer 115Mld	STT57 & TREAT172_STT57_GUC115	£216,617,200	£17,949,944	£67,368,981	£301,936,125	
STT Transfer 115Mld & GUC Transfer 115Mld	STT115 & TREAT230_STT115_GUC115	£245,070,900	£21,014,606	£76,444,999	£342,530,505	

Gate 2 OPEX Costs Summary

Options	Gate-2 Reference	Max Fixed Opex (£ /yr)	Max Variable Opex (£/Ml)
Preferred Route Estimate 57Mld	STT57	£141,544	£67
Preferred Route Estimate 115Mld	STT115	£141,544	£67
Treatment 57Mld (STT)	TREAT57_STT57	£904,951	£355
Treatment 57Mld (STT) (ALT)	TREAT57.ALT_STT57	£278,112	£144
Treatment 57Mld (GUC)	TREAT57_GUC57	£904,951	£304
Treatment 115Mld (STT)	TREAT115_STT115	£1,404,302	£320
Treatment 115Mld (STT) (ALT)	TREAT115.ALT_STT115	£391,013	£116
Treatment 115Mld (GUC)	TREAT115_GUC115	£1,404,302	£272
Treatment 115Mld (STT57 & GUC57)	TREAT115_STT57_GUC57	£1,404,302	£275
Treatment 172Mld (STT115 & GUC57)	TREAT172_STT115_GUC57	£1,869,590	£282
Treatment 172Mld (STT57 & GUC115)	TREAT172_STT57_GUC115	£1,869,590	£245
Treatment 230Mld	TREAT230_STT115_GUC115	£2,334,315	£252
Solutions			
GUC Transfer 57Mld	TREAT57_GUC57	£904,951	£304
GUC Transfer 115Mld	TREAT115_GUC115	£1,404,302	£272
STT Transfer 57Mld	STT57 & TREAT57_STT57	£1,046,495	£422
STT Transfer 57Mld (ALT)	STT57 & TREAT57.ALT_STT57	£419,655	£211
STT Transfer 115Mld	STT115 & TREAT115_STT115	£1,545,845	£386
STT Transfer 115Mld (ALT)	STT115 & TREAT115.ALT_STT115	£532,556	£183
STT Transfer 57Mld & GUC Transfer 57Mld	STT57 & TREAT115_STT57_GUC57	£1,545,845	£341
STT Transfer 115Mld & GUC Transfer 57Mld	STT115 & TREAT172_STT115_GUC57	£2,011,134	£349
STT Transfer 57Mld & GUC Transfer 115Mld	STT57 & TREAT172_STT57_GUC115	£2,011,134	£311
STT Transfer 115Mld & GUC Transfer 115Mld	STT115 & TREAT230_STT115_GUC115	£2,475,858	£318

Gate 2 Carbon Summary

Options	Gate-2 Reference	Total Embodied Carbon (tCO2e)	Max Fixed Operational Carbon (tCO2e) - Lifetime
Preferred Route Estimate 57Mld	STT57	91,073	49,997
Preferred Route Estimate 115Mld	STT115	91,073	99,994
Treatment 57Mld (STT)	TREAT57_STT57	5,379	84,189
Treatment 57Mld (ALT) (STT)	TREAT57.ALT_STT57	732	71,010
Treatment 57Mld (GUC)	TREAT57_GUC57	5,379	156,957
Treatment 115Mld (STT)	TREAT115_STT115	8,014	152,646
Treatment 115Mld (ALT) (STT)	TREA115.ALT_STT115	1,280	88,174
Treatment 115Mld (GUC)	TREAT115_GUC115	8,014	283,607
Treatment 115Mld (STT57 & GUC57)	TREAT115_STT57_GUC57	8,014	181,538
Treatment 172Mld (STT115 & GUC57)	TREAT172_STT115_GUC57	10,443	236,994
Treatment 172Mld (STT57 & GUC115)	TREAT172_STT57_GUC115	10,443	296,137
Treatment 230Mld	TREAT230_STT115_GUC115	13,091	339,006
Solutions			
GUC Transfer 57Mld	TREAT57_GUC57	5,379.40	156,956.80
GUC Transfer 115Mld	TREAT115_GUC115	8,013.95	283,607.20
STT Transfer 57Mld	STT57 & TREAT57_STT57	96,452.62	134,185.89
STT Transfer 57Mld (ALT)	STT57 & TREAT57.ALT_STT57	91,804.89	121,007.49
STT Transfer 115Mld	STT115 & TREAT115_STT115	99,087.17	252,639.78
STT Transfer 115Mld (ALT)	STT115 & TREAT115.ALT_STT115	92,353.09	188,167.78
STT Transfer 57Mld & GUC Transfer 57Mld	STT57 & TREAT115_STT57_GUC57	99,087.17	231,534.69
STT Transfer 115Mld & GUC Transfer 57Mld	STT115 & TREAT172_STT115_GUC57	101,515.94	336,988.58
STT Transfer 57Mld & GUC Transfer 115Mld	STT57 & TREAT172_STT57_GUC115	101,515.94	346,133.89
STT Transfer 115Mld & GUC Transfer 115Mld	STT115 & TREAT230_STT115_GUC115	104,164.63	439,000.58

Gate 2 NPV AIC

Options	Gate-2 Reference	NPV WAFU (m^3)	AIC Min Utilisation (p/m^3)	AIC Max Utilisation (p/m^3)
Preferred Route Estimate 57Mld	STT57	415,216,783	22.99	29.30
Preferred Route Estimate 115Mld	STT115	837,718,072	11.39	17.88
Treatment 57Mld (STT)	TREAT57_STT57	415,216,783	27.25	55.65
Treatment 57Mld (ALT) (STT)	TREAT57.ALT_STT57	415,216,783	10.22	21.74
Treatment 57Mld (GUC)	TREAT57_GUC57	415,216,783	27.75	50.55
Treatment 115Mld (STT)	TREAT115_STT115	837,718,072	22.78	46.78
Treatment 115Mld (ALT) (STT)	TREA115.ALT_STT115	837,718,072	7.44	16.72
Treatment 115Mld (GUC)	TREAT115_GUC115	837,718,072	21.59	42.01
Treatment 115Mld (STT57 & GUC57)	TREAT115_STT57_GUC57	837,718,072	21.66	42.28
Treatment 172Mld (STT115 & GUC57)	TREAT172_STT115_GUC57	1,252,934,855	18.60	41.16
Treatment 172Mld (STT57 & GUC115)	TREAT172_STT57_GUC115	1,252,934,855	17.86	37.46
Treatment 230Mld	TREAT230_STT115_GUC115	1,675,436,143	20.98	41.12
Solutions				
GUC Transfer 57Mld	TREAT57_GUC57	415,216,783	27.75	50.55
GUC Transfer 115Mld	TREAT115_GUC115	837,718,072	21.59	42.01
STT Transfer 57Mld	STT57 & TREAT57_STT57	415,216,783	50.78	84.54
STT Transfer 57Mld (ALT)	STT57 & TREAT57.ALT_STT57	415,216,783	33.75	50.63
STT Transfer 115Mld	STT115 & TREAT115_STT115	837,718,072	38.32	69.28
STT Transfer 115Mld (ALT)	STT115 & TREAT115.ALT_STT115	837,718,072	19.78	34.42
STT Transfer 57Mld & GUC Transfer 57Mld	STT57 & TREAT115_STT57_GUC57	837,718,072	32.62	59.98
STT Transfer 115Mld & GUC Transfer 57Mld	STT115 & TREAT172_STT115_GUC57	1,252,934,855	27.29	55.21
STT Transfer 57Mld & GUC Transfer 115Mld	STT57 & TREAT172_STT57_GUC115	1,252,934,855	26.55	51.51
STT Transfer 115Mld & GUC Transfer 115Mld	STT115 & TREAT230_STT115_GUC115	1,675,436,143	27.90	53.42

A.2 CAPEX Estimate Details

A7W13155-WT-SPR-220015	Treatment Capex estimate (STW lite tool) - TREAT57
A7W13155-WT-SPR-220016	Treatment Capex estimate (STW lite tool) - TREAT57.ALT
A7W13155-WT-SPR-220017	Treatment Capex estimate (STW lite tool) - TREAT115
A7W13155-WT-SPR-220018	Treatment Capex estimate (STW lite tool) - TREAT115.ALT
A7W13155-WT-SPR-220019	Treatment Capex estimate (STW lite tool) - TREAT172
A7W13155-WT-SPR-220020	Treatment Capex estimate (STW lite tool) - TREAT230
A7W13155-CY-SPR-210018	Preferred Route redesign Capex estimate - STT115

SEVERN TRENT WATER

CAPEX Costs

ATKINS ARUP

Element Reference:
Date Issued: March 2022

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 2,679,700	£ 371,600	£ 56,790,500	£ 59,841,800
	Non-Standard Cost	£ 932,900	£ 1,412,600	£ 50,000	£ 2,395,500
19.3%	**Non-Standard Adjustment**	£ 517,200	£ 71,700	£ 10,960,600	£ 11,549,500
	Construction Cost	**£ 4,129,800**	**£ 1,855,900**	**£ 67,801,100**	**£ 73,786,800**
0.0%	**Design Fee**	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 4,129,800**	**£ 1,855,900**	**£ 67,801,100**	**£ 73,786,800**
12.8%	**Internal Costs**	£ 528,600	£ 237,600	£ 8,678,500	£ 9,444,700
18.1%	**External Costs**	£ 747,500	£ 335,900	£ 12,272,000	£ 13,355,400
	Project Total	**£ 5,405,900**	**£ 2,429,400**	**£ 88,751,600**	**£ 96,586,900**
30.1%	**Optimism Bias**	£ 1,627,200	£ 731,200	£ 26,714,200	£ 29,072,600
	Business Case Cost Estimate	**£ 7,033,100**	**£ 3,160,600**	**£ 115,465,800**	**£ 125,659,500**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	B&C P	B&C C	B&C Quantity	B&C Cost	M&E M	M&E P	M&E C	M&E Quantity	M&E Cost	Mains and Sewers M	Mains and Sewers P	Mains and Sewers C	Mains and Sewers Quantity	Mains and Sewers Cost	Notes
INFRA	Distribution	Pressure Mains in Field / Verges	Diameter: 900mm	m											1,413	1	11,113	19,329 m		
INFRA	Distribution	Pressure Mains in Field / Verges	Diameter: 1050mm	m	0		0	m		0		0	m		1,734	1	11,113	12,125 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m	0		0	m		0		0	m		3,695	1	0	147 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m											3,695	1	0	103 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m											3,695	1	0	153 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	77 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m											3,695	1	0	266 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	80 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m											3,695	1	0	119 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	62 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	85 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	84 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	82 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	57 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	72 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	81 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	54 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	50 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1200mm	m											4,223	1	0	294 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	43 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	77 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	127 m		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1200mm	m											4,223	1	0	113 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	98 m		
NON-INFRA	Distribution	Storage	Service Reservoir	m3	44,604	0	0	4,800 m3												
NON-STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	0	mm 1 DN		5,557	1	0	mm 1 DN							
NON-STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	0	mm 1 DN		5,557	1	0	mm 1 DN							
NON-STANDARD	OTHERS	TELEMETRY	Kiosk / Building	Nr						5,557	1	0	1 Nr							
NON-STANDARD	OTHERS	TELEMETRY	Telemetry Outstation	Nr						5,557	1	0	1 Nr							
FREE ENTRY	Pumping	No	Peak Flow		1,080,000	#N/A	#N/A	0		1,080,000	#N/A	#N/A	1							Peak Flow
FREE ENTRY	Pumping	No	Sweetening Flow		216,000	#N/A	#N/A	0		216,000	#N/A	#N/A	1							Sweetening Flow
NON-STANDARD	OTHERS	VALVES	Automated TM Valve	Nr						11,113	1	0	2 Nr							
NON-STANDARD	PRESSURE MANAGEMENT	PRESSURE SUSTAINING / REDUCING VALVES	PRV / PSV inc. Chamber (Large Diameter)	Nr											16,670	1	0	3 Nr		
NON-STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	0	mm 1 DN		5,557	1	0	mm 1 DN							
NON-STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	0	mm 1 DN		5,557	1	0	mm 1 DN							
NON-STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	0	mm 1 DN		5,557	1	0	mm 1 DN							
NON-STANDARD	OTHERS	VALVES	Telemetry for auto valves	Nr						5,557	1	0	5 Nr							
NON-STANDARD	OTHERS	VALVES	Power supply for auto valves	Nr						2,223	1	0	5 Nr							
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m											3,695	1	0	116 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	23 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	55 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	49 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	36 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	77 m		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	36 m		
INFRA	Distribution	Directional Drilling	Diameter: 1200mm	m											2,644	1	0	77 m		
NON-INFRA	Distribution	Surge Vessel	Surge Vessel	m3	8,577	0	0	120 m3		67,007	0	0	120 m3							
NON-STANDARD	ANCILLARY WORKS	INLET / OUTLETS	Outlet into canal (Structure)	Nr	27,783	1	0	1 Nr												
NON-STANDARD	OTHERS	TELEMETRY	Kiosk / Building	Nr						5,557	1	0	1 Nr							
NON-STANDARD	OTHERS	TELEMETRY	Telemetry Outstation	Nr						5,557	1	0	1 Nr							
FREE ENTRY	Outfall control valves, flowmeter and isolation valves	No	Outfall control			#N/A	#N/A			394,225	#N/A	#N/A	1							Outfall control
FREE ENTRY	Outfall structure	No	10m RC stepped weir		488,496	#N/A	#N/A	1			#N/A	#N/A				#N/A	#N/A			10m RC stepped weir

SEVERN TRENT WATER

Element Reference:
Date Issued: 03rd August 2022

CAPEX Costs
TREAT57

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 7,845,600	£ 8,668,200	£ -	£ 16,513,800
	Non-Standard Cost	£ 32,629,900	£ -	£ -	£ 32,629,900
0.5%	Non-Standard Adjustment	£ 39,200	£ 43,300	£ -	£ 82,500
	Construction Cost	**£ 40,514,700**	**£ 8,711,500**	**£ -**	**£ 49,226,200**
0.0%	Design Fee	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 40,514,700**	**£ 8,711,500**	**£ -**	**£ 49,226,200**
18.3%	Internal Costs	£ 7,402,000	£ 1,591,600	£ -	£ 8,993,600
8.6%	External Costs	£ 3,492,400	£ 750,900	£ -	£ 4,243,300
	Project Total	**£ 51,409,100**	**£ 11,054,000**	**£ -**	**£ 62,463,100**
31.9%	Optimism Bias	£ 16,399,500	£ 3,526,200	£ -	£ 19,925,700
	Business Case Cost Estimate	**£ 67,808,600**	**£ 14,580,200**	**£ -**	**£ 82,388,800**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	P	C	Quantity	Cost	M&E M	P	C	Quantity	Cost	Mains and Sewers M	P	C	Quantity	Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		Removed from scope
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	792 m3		3,057	1	0	792 m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	46 kg/d		343,823	0	0	kg/d 46							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/day	9,591	1	0	kg/day		178,910	0	0	kg/day							Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	6 kg/d		343,823	0	0	kg/d 6							Non ionic polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	421 m3		3,057	1	0	421 m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	112 kW		17,996	1	0	112 kW							Inline Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	223 kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	559 kW							Backwash (part of Interstage PS)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	455 kg/d		178,910	0	0	kg/d 455		0		0	0 kg/d		Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	2,231 kg/d		204,317	0	0	kg/d 2,231							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	867 kg/d		204,317	0	0	kg/d 867							Hydrogen Peroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	2,848 kg/d		204,317	0	0	kg/d 2,848							Sodium Hydroxide
FREE ENTRY	Interstage & Backwash PS wet well	No.	3298m3 shaft tank		867,062	#N/A	#N/A	1			#N/A	#N/A								Interstage & Backwash PS
FREE ENTRY	Site Returns PS wet well	No.	3572m3 shaft tank		832,931	#N/A	#N/A	1			#N/A	#N/A								Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	1,160,000	1	0	1 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	4,350,000	1	0	1 No.		0	1	0	0 No.							ICA and Electric upgrades
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	2,900,000	1	0	1 m												
FREE ENTRY	Sitewide items	No.	E/O		7,250,000	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		1,160,000	#N/A	#N/A	1												E/O
FREE ENTRY	Comag	No.	E/O		7,540,000	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS																	OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		5,719,940	#N/A	#N/A	1												Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A													Removed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		433,531	#N/A	#N/A	1												Interstage PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		416,466	#N/A	#N/A	1												Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	14 kg/d		204,317	0	0	kg/d 14							Phosphoirc Acid
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	15 kW							Site Returns Pumps

SEVERN TRENT WATER

Element Reference:
Date Issued: 03 August 2022

CAPEX Costs
TREAT57.ALT

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 2,119,500	£ 1,847,400	£ -	£ 3,966,900
	Non-Standard Cost	£ 14,205,700	£ -	£ -	£ 14,205,700
0.5%	Non-Standard Adjustment	£ 10,600	£ 9,200	£ -	£ 19,800
	Construction Cost	**£ 16,335,800**	**£ 1,856,600**	**£ -**	**£ 18,192,400**
0.0%	Design Fee	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 16,335,800**	**£ 1,856,600**	**£ -**	**£ 18,192,400**
18.3%	Internal Costs	£ 2,984,600	£ 339,200	£ -	£ 3,323,800
8.6%	External Costs	£ 1,408,100	£ 160,000	£ -	£ 1,568,100
	Project Total	**£ 20,728,500**	**£ 2,355,800**	**£ -**	**£ 23,084,300**
31.9%	Optimism Bias	£ 6,612,400	£ 751,500	£ -	£ 7,363,900
	Business Case Cost Estimate	**£ 27,340,900**	**£ 3,107,300**	**£ -**	**£ 30,448,200**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	P	C	Quantity	Cost	M&E M	P	C	Quantity	Cost	Mains and Sewers M	P	C	Quantity	Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		Removed from scope
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	m3		3,057	1	0	m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	46 kg/d		343,823	0	0	46 kg/d							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/day	9,591	1	0	kg/day		178,910	0	0	kg/day							Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	kg/d		343,823	0	0	kg/d							Non-ionic Polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	m3		3,057	1	0	m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	112 kW		17,996	1	0	112 kW							Inline Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Backwash PS (part of Interstage)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	kg/d		178,910	0	0	kg/d		0		0	0 kg/d		Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	2,231 kg/d		204,317	0	0	2,231 kg/d							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0	0	kg/d							Hydrogen Peroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	2,848 kg/d		204,317	0	0	2,848 kg/d							Sodium Hydroxide
NON-INFRA	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Interstage & Backwash PS
NON-INFRA	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW	31,579	1	0	120 kW		17,996	1	0	15 kW							Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	732,250	1	0	1 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	1,464,500	1	0	1 No.		0	1	0	0 No.							ICA and Electric upgrades
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	1,464,500	1	0	1 m												
FREE ENTRY	Sitewide items	No.	E/O		2,929,000	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		0	#N/A	#N/A													E/O
FREE ENTRY	Comag	No.	E/O		7,615,400	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS		0	#N/A	#N/A													OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		0	#N/A	#N/A													Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A													Removed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		0	#N/A	#N/A													Interstage PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		0	#N/A	#N/A													Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0	0	kg/d							Phosphoirc Acid

SEVERN TRENT WATER

Element Reference:
Date Issued: 03 August 2022

CAPEX Costs
TREAT115

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 14,195,400	£ 13,432,900	£ -	£ 27,628,300
	Non-Standard Cost	£ 44,455,100	£ -	£ -	£ 44,455,100
0.5%	Non-Standard Adjustment	£ 71,000	£ 67,200	£ -	£ 138,200
	Construction Cost	**£ 58,721,500**	**£ 13,500,100**	**£ -**	**£ 72,221,600**
0.0%	Design Fee	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 58,721,500**	**£ 13,500,100**	**£ -**	**£ 72,221,600**
18.3%	Internal Costs	£ 10,728,400	£ 2,466,500	£ -	£ 13,194,900
8.6%	External Costs	£ 5,061,800	£ 1,163,700	£ -	£ 6,225,500
	Project Total	**£ 74,511,700**	**£ 17,130,300**	**£ -**	**£ 91,642,000**
31.9%	Optimism Bias	£ 23,769,200	£ 5,464,600	£ -	£ 29,233,800
	Business Case Cost Estimate	**£ 98,280,900**	**£ 22,594,900**	**£ -**	**£ 120,875,800**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	B&C P	B&C C	B&C Quantity	B&C Cost	M&E M	M&E P	M&E C	M&E Quantity	M&E Cost	Mains and Sewers M	Mains and Sewers P	Mains and Sewers C	Mains and Sewers Quantity	Mains and Sewers Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		UV REMOVED
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	1,597 m3		3,057	1	0	1,597 m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	92 kg/d		343,823	0	0	kg/d 92							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	1	0	kg/day		178,910	0	0	kg/day							Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	12 kg/d		343,823	0	0	kg/d 12							Non-ionic Polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	844 m3		3,057	1	0	844 m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	336 kW		17,996	1	0	336 kW							Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	0 kW		17,996	1	0	447 kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	0 kW		17,996	1	0	597 kW							Backwash PS (part of Interstage)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	912 kg/d		178,910	0	0	kg/d 912							Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	4,469 kg/d		204,317	0	0	kg/d 4,469							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	1,736 kg/d		204,317	0	0	kg/d 1,736							Hydrogen Peroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	5,744 kg/d		204,317	0	0	kg/d 5,744							Sodium Hydroxide
FREE ENTRY	Interstage & Backwash PS wet well	No.	4049m3 shaft tank		878,090	#N/A	#N/A	1			#N/A	#N/A								Interstage & Backwash PS
FREE ENTRY	Site Returns PS wet well	No.	4532m3 shaft tank		919,702	#N/A	#N/A	1			#N/A	#N/A								Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	333,390	1	0	4 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	27,783	1	0	365 No.		27,783	1	0	0 No.							
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	4,137	1	0	56,000 m												
FREE ENTRY	Sitewide items	No.	E/O		7,250,000	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		1,450,000	#N/A	#N/A	1												E/O
FREE ENTRY	Comag	No.	E/O		########	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS																	OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		8,679,377	#N/A	#N/A	1												Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A													Not required (prev £364,856)
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		439,045	#N/A	#N/A	1												Interstage PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		459,851	#N/A	#N/A	1												Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	29 kg/d		204,317	0	0	kg/d 29							Phosphoirc Acid
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	37 kW							Site Returns PS

SEVERN TRENT WATER

Element Reference:
Date Issued: 03 August 2022

CAPEX Costs
TREAT115.ALT

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 3,031,800	£ 2,371,900	£ -	£ 5,403,700
	Non-Standard Cost	£ 20,619,300	£ -	£ -	£ 20,619,300
0.5%	**Non-Standard Adjustment**	£ 15,200	£ 11,900	£ -	£ 27,100
	Construction Cost	**£ 23,666,300**	**£ 2,383,800**	**£ -**	**£ 26,050,100**
0.0%	**Design Fee**	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 23,666,300**	**£ 2,383,800**	**£ -**	**£ 26,050,100**
18.3%	**Internal Costs**	£ 4,323,800	£ 435,500	£ -	£ 4,759,300
8.6%	**External Costs**	£ 2,040,000	£ 205,500	£ -	£ 2,245,500
	Project Total	**£ 30,030,100**	**£ 3,024,800**	**£ -**	**£ 33,054,900**
31.9%	**Optimism Bias**	£ 9,579,600	£ 964,900	£ -	£ 10,544,500
	Business Case Cost Estimate	**£ 39,609,700**	**£ 3,989,700**	**£ -**	**£ 43,599,400**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	B&C P	B&C C	B&C Quantity	B&C Cost	M&E M	M&E P	M&E C	M&E Quantity	M&E Cost	Mains and Sewers M	Mains and Sewers P	Mains and Sewers C	Mains and Sewers Quantity	Mains and Sewers Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		UV REMOVED
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	m3		3,057	1	0	m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	92 kg/d		343,823	0	0	92 kg/d							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/day	9,591	1	0	kg/day		178,910	0	0	kg/day							Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	kg/d		343,823	0	0	kg/d							BAC
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	m3		3,057	1	0	m3							
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	336 kW		17,996	1	0	336 kW							Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Backwash PS (part of Interstage)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	kg/d		178,910	0	0	kg/d							Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	4,469 kg/d		204,317	0	0	4,469 kg/d							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0	0	kg/d							Hydrogen Peroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	5,745 kg/d		204,317	0	0	5,745 kg/d							Sodium Hydroxide
NON-INFRA	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW	31,579	1	0	kW		17,996	1	0	kW							Interstage & Backwash PS
NON-INFRA	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW	31,579	1	0	240 kW		17,996	1	0	37 kW							Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	876,180	1	0	1 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	3,650,750	1	0	1 No.		27,783	1	0	0 No.							
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	1,460,300	1	0	1 m												
FREE ENTRY	Sitewide items	No.	E/O		4,380,900	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		0	#N/A	#N/A	0												E/O
FREE ENTRY	Comag	No.	E/O		########	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS																	OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		0	#N/A	#N/A													Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A													Not required (prev £364,856)
FREE ENTRY	Site Returns PS	No.	Site Returns PS oor		29,090	#N/A	#N/A	1												Site Returns PS oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		0	#N/A	#N/A													Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0	0	kg/d							Phosphoirc Acid

SEVERN TRENT WATER

Element Reference:
Date Issued: 03 August 2022

CAPEX Costs
TREAT172

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 20,190,900	£ 17,995,400	£ -	£ 38,186,300
	Non-Standard Cost	£ 56,216,700	£ -	£ -	£ 56,216,700
0.5%	**Non-Standard Adjustment**	£ 101,000	£ 90,000	£ -	£ 191,000
	Construction Cost	**£ 76,508,600**	**£ 18,085,400**	**£ -**	**£ 94,594,000**
0.0%	**Design Fee**	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 76,508,600**	**£ 18,085,400**	**£ -**	**£ 94,594,000**
18.3%	**Internal Costs**	£ 13,978,100	£ 3,304,200	£ -	£ 17,282,300
8.6%	**External Costs**	£ 6,595,000	£ 1,559,000	£ -	£ 8,154,000
	Project Total	**£ 97,081,700**	**£ 22,948,600**	**£ -**	**£ 120,030,300**
31.9%	**Optimism Bias**	£ 30,969,100	£ 7,320,600	£ -	£ 38,289,700
	Business Case Cost Estimate	**£ 128,050,800**	**£ 30,269,200**	**£ -**	**£ 158,320,000**

Commercial information redacted

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Level 1	Level 2	Level 3	Level 4	Units	B&C M	B&C P	B&C C	B&C Quantity	B&C Cost	M&E M	M&E P	M&E C	M&E Quantity	M&E Cost	Mains and Sewers M	Mains and Sewers P	Mains and Sewers C	Mains and Sewers Quantity	Mains and Sewers Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	2,389 m3		3,057	1	0	2,389 m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	138 kg/d		343,823	0	0	kg/d 138							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	1	0	kg/day		178,910	0	0	kg/day							Row22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	18 kg/d		343,823	0	0	kg/d 18							Non-ionic Polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	1,259 m3		3,057	1	0	1,259 m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	597 kW		17,996	1	0	597 kW							Inline Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	0 kW		17,996	1	0	597 kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	746 kW							Backwash PS (part of Interstage)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	1,360 kg/d		178,910	0	0	kg/d 1,360							Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	6,667 kg/d		204,317	0	0	kg/d 6,667							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	8,602 kg/d		204,317	0	0	kg/d 8,602							Sodium Hydroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	2,605 kg/d		204,317	0	0	kg/d 2,605							Hydrogen Peroxide
FREE ENTRY	Interstage & Backwash PS wet well	No.	5962m3 shaft tank		1,031,670	#N/A	#N/A	1			#N/A	#N/A								Interstage & Backwash PS
FREE ENTRY	Site Returns PS wet well	No.	8594m3 shaft tank		1,200,718	#N/A	#N/A	1			#N/A	#N/A								Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	1,160,000	1	0	1 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	########	1	0	1 No.		0	1	0	0 No.							
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	3,625,000	1	0	1 m												
FREE ENTRY	Sitewide items	No.	E/O		8,700,000	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		2,175,000	#N/A	#N/A	1												E/O
FREE ENTRY	Comag	No.	E/O		########	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS																	OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		########	#N/A	#N/A	1												Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A	1												Removed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		619,002	#N/A	#N/A	1												Interstage PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		720,431	#N/A	#N/A	1												Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	43 kg/d		204,317	0	0	kg/d 43							Phosphoirc Acid
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	75 kW							Site Returns PS

SEVERN TRENT WATER

Element Reference:
Date Issued: 03 August 2022

CAPEX Costs
TREAT230

ATKINS ARUP

Notice *Values are rounded*

These on-cost rates may be adjusted from the default values

Rate		B&C	M&E	Mains & Sewers	Total
	Standard Cost	£ 26,052,900	£ 22,176,000	£ -	£ 48,228,900
	Non-Standard Cost	£ 68,547,800	£ -	£ -	£ 68,547,800
0.5%	**Non-Standard Adjustment**	£ 130,300	£ 110,900	£ -	£ 241,200
	Construction Cost	**£ 94,731,000**	**£ 22,286,900**	**£ -**	**£ 117,017,900**
0.0%	**Design Fee**	£ -	£ -	£ -	£ -
	Contractor D&B Cost	**£ 94,731,000**	**£ 22,286,900**	**£ -**	**£ 117,017,900**
18.3%	**Internal Costs**	£ 17,307,400	£ 4,071,800	£ -	£ 21,379,200
8.6%	**External Costs**	£ 8,165,800	£ 1,921,100	£ -	£ 10,086,900
	Project Total	**£ 120,204,200**	**£ 28,279,800**	**£ -**	**£ 148,484,000**
31.9%	**Optimism Bias**	£ 38,345,100	£ 9,021,300	£ -	£ 47,366,400
	Business Case Cost Estimate	**£ 158,549,300**	**£ 37,301,100**	**£ -**	**£ 195,850,400**

These rates and notes may be adjusted from the standard rates
Costs are calculated using a formula of M x (Quantity)^P + C
M is a multiplier adjuster, P is a power adjuster, C is a constant
For Linear Cost Curves set P = 1
For Unit Rate Items set P = 1, C = 0

Commercial information redacted

Level 1	Level 2	Level 3	Level 4	Units	B&C M	B&C P	B&C C	B&C Quantity	B&C Cost	M&E M	M&E P	M&E C	M&E Quantity	M&E Cost	Mains and Sewers M	Mains and Sewers P	Mains and Sewers C	Mains and Sewers Quantity	Mains and Sewers Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/d		171,651	0	0	m3/d		0		0	m3/d		
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	3,194 m3		3,057	1	0	3,194 m3							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	185 kg/d		343,823	0	0	kg/d 185							
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/day	9,591	1	0	kg/day		178,910	0	0	kg/day							Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	24 kg/d		343,823	0	0	kg/d 24							Non-ionic Polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	1,685 m3		3,057	1	0	1,685 m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	746 kW		17,996	1	0	746 kW							Influent PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	746 kW							Interstage PS
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	746 kW							Backwash PS (part of Interstage)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	1,820 kg/d		178,910	0	0	kg/d 1,820		0		0	0 kg/d		Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	8,921 kg/d		204,317	0	0	kg/d 8,921							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	3,466 kg/d		204,317	0	0	kg/d 3,466							Hydrogen Peroxide
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	11,489 kg/d		204,317	0	0	kg/d 11,489							Sodium Hydroxide
FREE ENTRY	Interstage & Backwash PS wet well	No.	7948m3 shaft tank		1,162,937	#N/A	#N/A	1			#N/A	#N/A								Interstage & Backwash PS
FREE ENTRY	Site Returns PS	No.	8701m3 shaft tank		1,206,931	#N/A	#N/A	1			#N/A	#N/A								Site Returns PS
NON-STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	1,160,000	1	0	1 Nr												Influent PS building
NON-STANDARD	Site wide SCADA / control system	No.	x	No.	########	1	0	1 No.		27,783	1	0	0 No.							
NON-STANDARD	PERMANENT SITE WORKS	ACCESS	Access Track	m	2,900,000	1	0	1 m												
FREE ENTRY	Sitewide items	No.	E/O		########	#N/A	#N/A	1												E/O
FREE ENTRY	BAC	No.	E/O		2,900,000	#N/A	#N/A	1												E/O
FREE ENTRY	Comag	No.	E/O		########	#N/A	#N/A	1												E/O
FREE ENTRY	ITEM DESCRIPTION	No.	OTHER DETAILS																	OTHER DETAILS
FREE ENTRY	Ozone	No.	Ozone curve		########	#N/A	#N/A	1												Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A	1												Removed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		697,762	#N/A	#N/A	1												Interstage PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		724,159	#N/A	#N/A	1												Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	57 kg/d		204,317	0	0	kg/d 57							Phosphoirc Acid
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0	75 kW							Site Returns PS

A.3 QCRA Templates

A7W13155-GT-SPR-200004	Costed risk register - STT115
A7W13155-GT-SPR-200005	Costed risk register - TREAT57
A7W13155-GT-SPR-200031	Costed risk register - TREAT57.ALT
A7W13155-GT-SPR-200006	Costed risk register - TREAT115
A7W13155-GT-SPR-200032	Costed risk register - TREAT115.ALT
A7W13155-GT-SPR-200007	Costed risk register - TREAT172
A7W13155-GT-SPR-200008	Costed risk register - TREAT230

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO STT115
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2		
3 - Medium	Possible Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3		
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1 15%) delay to project delivery	4		
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5		

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

[redacted]

Insert output from @risk report #NAME?

Insert output from @risk report #NAME?

Insert output from @risk report #NAME?

Commercial information redacted

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence	Prob score	Cost score	Schedule score	Score	Quant Prob %	Min £ / ML £ / Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £ / ML £ / Max £	Post Mit Risk	OB - Description	Cause	Min (Pre) / Max (Pre) / Ave	Memo
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*	*Calculated based*	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*	*scores, but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Not used on Tab 3a - see Tab 3b.*				
Trenchless solution issue (inc UXO)	Minworth R001	Threat	L = Live	Capex	Technical	Site characteristics and project data	Gound layers including rock causing difficulty of construction of trenchless solutions Owing to the inherent uncertainty with the ground and the fact that a number of assumptions have been made based on available information, there is a risk that the ground conditions encountered are worse than assumed leading to increased structural requirements or increased construction complexity. e.g. Increased bedding costs due to poor ground, increased excavation cost due to presence of rock or de-watering more extensive than planned increasing construction complexity. e.g. Require deeper excavation than 1.2m e.g. UXO removals	Having to extend or change the route alignment which will increase the cost - Programme delay - Additional cost for redesign - Additional cost for permanent works - Additional cost for temporary works	2	3		6	20%	[redacted]	See Tab 3b.	Risk Reduction	Client	Conduct on-site Ground investigaiton Survey	20%	[redacted]	See Tab 3b.	########	Hitting the unforeseen ground layer Underestimated ground conditions	[redacted]	3
Asset owner stipulations delays	Minworth R002	Threat		Opex			Laying the rising main under motorways	Asset owners (e.g. Highways England) stipulations may be imposed upon the works (shaft locations and construction access)				#VALUE!			See Tab 3b.	Risk Reduction	Client	Early engagement with asset owners				Minworth R002 - Laying the rising main under motorways	N/A OPEX		OPEX
Protected Species	Minworth R003	Threat	L = Live	Capex	Technical	Environmental constraints	There is a risk that additional ecological works (for protected spieces) are required or cannot be undertaken/finalised within the target season. Protected Species may be found or they may create habitat during works.	Additional capex cost and time delay to overall project programme.	3	2	1	6	35%		See Tab 3b.	Risk Reduction	Client	Adequate project preparation and scoping of site surveys.	10%			Minworth R003 - There is a risk that additional ecological works (for protected spieces) are required or cannot be undertaken/finalised within the target season. Protected Species may be found or they may create habitat during works.	Lack of survey and unforeseen discovery of protected spieces		2
Existing Infrastructure and buried structures (ISSUE)	Minworth R004	Threat	L = Live	Opex	Technical	Site characteristics and project data	Likelihood of encountering buried structures and uncharted utilities (ISSUE)	Delay to construction programme. Increased cost.	3	2		6	90%		See Tab 3b.	Risk Reduction	Client	Conduct on-site Investigations	90%		See Tab 3b.	Minworth R004 - Likelihood of encountering buried structures and uncharted utilities (ISSUE)	Incorrect utility record. (ISSUE) Unknown buried structures		ISSUE
Material Price Increase (EXCLUSION)	Minworth R005	Threat			Commercial	Procurement	There is a risk that materials incorporating plastic pipe and metal tank could increase by the time this project goes ahead due to market changes. Large pipeline order leading to lack of raw material availability or manufacturing capacity (EXCLUSION)	Additional CAPEX cost due to - Programme delay - Increased construction duration				0	30%		See Tab 3b.	Risk Reduction	Client	Adequate project preparation and planning consultation	30%			########	Unforeseen change to market condition And Lack of raw material availability or manufacturing capacity (EXCLUSION)		EXCLUSION
Procurement Delays / Commissioning	Minworth R006	Threat	L = Live	Capex	Commercial	Procurement	There is a risk that long lead items (pipes, pumps, process equipments) are delayed due supply chain disruption. (e.g. Covid-19/Global conflict) There may be delay in commissioning as both the conveyance and treatment works commissioning may need to be coordinated.	Additional CAPEX cost / construction programme delay. May cause an overall delay in the SRO delivery	3	2	3	9	35%		See Tab 3b.	Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	20%			########	Due to supply chain disruption. (e.g. Covid-19)		2
More trenchless crossings	Minworth R007	Threat	L = Live	Capex	External	Stakeholder	Extensive engagement with 3rd Parties (local authority, national highways, network rail) is required to construct at major road crossings such as road, rail and watercourses. There is a risk that requirements are more onerous than expected.	Increase in cost and delay to programme due to unforeseen stakeholder requirements	3	3		9	35%		See Tab 3b.	Risk Reduction	Client		30%			########	Inability to gain permission to go open cut		3
BPT relocation	Minworth R008	Threat		Opex			BPT (Break Pressure Tank) being relocated closer to the discharge/source due to land access/ecology/archaeology	Higher operational cost due to rising main being longer/ gravity main being longer				#VALUE!			See Tab 3b.	Risk Reduction	Client					Minworth R008 - BPT (Break Pressure Tank) being relocated closer to the discharge/source due to land access/ecology/archaeology	N/A OPEX		OPEX
Availability of water	Minworth R009	Threat		Opex			Risk that the increase in demand of water is higher than the forecasted. Also droughts in the Thames and Severn regions are projected to be more frequent due to climate change which can Increase operation cost for operating additional capacity.	Incur additional cost as scheme is unable to realise their objectives in terms of serviceability.				#VALUE!			See Tab 3b.	Risk Reduction	Client					########	N/A OPEX		OPEX
Planning Approval OR Planning consent delay due to public enquiry	Minworth R010	Threat	L = Live	Capex	External	Planning and approvals	Risk that the timescales and level of engagement involved in approving this new planning application are greater than assumed in the schedule, leading to key milestones being missed. Risk relates to delay and additional public information days, public enquiry.	- Delay to programme - Additional cost of undertaking further assessments, redesign or public enquiry or judicial review	3	1	3	9	35%		See Tab 3b.	Risk Reduction	Client	Adequate project preparation and confirmation with local DNO supplier.	15%			########	planning timescales not as assumed Underestimated project timescale and resource required		1
Archaeological discoveries	Minworth R011	Threat	L = Live	Capex	Technical	Environmental constraints	Significant additional archaeology is encountered during construction at the site of the permanent infrastructure, and on critical path items	Programme delay While investigations are carried out. - Additional cost for redesign - Additional cost for diversions - Additional cost for watching brief	2	1	4	8	20%		See Tab 3b.	Risk Reduction	Client	Construction and material for disposal risk	15%			Minworth R011 - Significant additional archaeology is encountered during construction at the site of the permanent infrastructure, and on critical path items	Encounter significant additional archaeology during construction		1
Service diversions	Minworth R012	Threat	L = Live	Capex	Technical	Site characteristics and project data	Service diversions are more numerous or more difficult to incorporate than anticipated resulting in potential rerouting or additional protection or diversion works.	- Programme delay 4- 12wks - Additional cost for redesign 4- 12wks - Additional cost for diversions 1km	2	2		4	25%		See Tab 3b.	Risk Reduction	Client		25%			Minworth R012 - Service diversions are more numerous or more difficult to incorporate than anticipated resulting in potential rerouting or additional protection or diversion works.	Require more numerous / difficult to incorporate service diversions		2
Ground water levels (inc due to Adverse Weather)	Minworth R013	Threat	L = Live	Capex	Technical	Site characteristics and project data	Groundwater levels higher than expected during construction (Should be mainly Design phase). Risk that adverse weather will delay the construction programme	- Programme delay - Additional cost for redesign and mitigation if impacts permanent works - Additional dewatering / protection may be necessary for construction and access	2	3		6	20%		See Tab 3b.	Risk Reduction	Client		20%			Minworth R013 - Groundwater levels higher than expected during construction (Should be mainly Design phase). Risk that adverse weather will delay the construction programme	Higher than forecasted groundwater level Working on site throughout the year.		3
Access to construction site/ Land acquisition/Construction working area	Minworth R014	Threat	L = Live	Capex	External	Planning and approvals	Existing land owner/land user rights of access to sites, crossings etc may impose unforeseen restrictions resulting in delays in on site start for survey or construction works. Delay in agreement with the landowner regarding land acquisition and compensation. Land sizes estimated at this stage are not sufficient Owing to a need to purchase / lease large parcels of land for above ground infrastructure and pipe routes and the current lack of information, there is a risk that the assumptions made around the process are proved to be incorrect	Increase in cost - delay to programme due to additional design / construction activities - Programme delay to allow for additional stakeholder engagement timescales - Increased costs - higher acquisition costs and potential requirement for CPOs	3	1	1	3	50%		See Tab 3b.	Risk Reduction	Client		15%			########	Unforeseen restrictions imposed by land owner / land user rights -Due to dispute on compensation amount -Estimated land size was insufficient -need to purchase / lease large parcels of land		1
Energy cost for pumps, plant	Minworth R015	Threat		Opex			There is an increase in energy cost (e.g. pumps, plant) that would make the transfer less viable.	- Increase in operational cost				#VALUE!			See Tab 3b.	Risk Reduction	Client					Minworth R015 - There is an increase in energy cost (e.g. pumps, plant) that would make the transfer less viable.	N/A OPEX		OPEX
Impact of strategic planning applications	Minworth R016	Threat	L = Live	Capex	Management	Communication	Owing to the length of the route and the timescales involved in the planning process, there is a risk that the delivery team are not aware of a Strategic Planning Application scheme	Impacting (redesign, realignment) on the final design and planning process for the scheme, which has knock-on. Impact to the planning on regional level, not only the local authority. Cost of change in the route	2	3	2	6	20%		See Tab 3b.	Risk Reduction	Client		20%			Minworth R016 - Owing to the length of the route and the timescales involved in the planning process, there is a risk that the delivery team are not aware of a Strategic Planning Application scheme	Delivery team unaware of a Strategic Planning Application scheme		3
Contaminated material	Minworth R017	Threat	L = Live	Capex	Technical	Site characteristics and project data	Contaminated material excavated from uncharted landfill sites requires suitable handling and disposal. Assumption that the majority of excavated material can be reused is not true	Delay to programme to appropriately dispose of contaminated land. Potential to redesign/reroute. Requirement for specialist storage and removal of contaminated spoil.	3	1	4	12	50%		See Tab 3b.	Risk Reduction	Client	Adequate project preparation and detailed surveys.	20%			Minworth R017 - Contaminated material excavated from uncharted landfill sites requires suitable handling and disposal. Assumption that the majority of excavated material can be reused is not true	Excavated material can not be reused		1
Alternative discharge location	Minworth R018	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Alternative discharge location leading to additional design requirement and programme delay	Increase in cost and delay to programme due to additional design	2	1		2	25%		See Tab 3b.	Risk Reduction	Client		10%			Minworth R018 - Alternative discharge location leading to additional design requirement and programme delay	Alternative discharge location		1
Operational regime	Minworth R019	Opportunity		Opex			Consider emptying and recharging pipe rather than sweetening flow	Reduce opex				#VALUE!			See Tab 3b.	Risk Reduction	Client					Minworth R019 - Consider emptying and recharging pipe rather than sweetening flow	N/A OPEX		OPEX
HS2	Minworth R020	Threat	L = Live	Capex	External	Stakeholder	Pipe route crosses HS2 route which will be highly protected	Risk of delay due to complications of crossing HS2 route	3	3	2	9	40%		See Tab 3b.	Risk Reduction	Client	Begin dialogue with HS2 early	40%			Minworth R020 - Pipe route crosses HS2 route which will be highly protected	Route crosses HS2		1

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT57
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2		
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3		
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4		
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5		

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

Risk (Static) values:

P10	[redacted]	*Insert output from @risk*	#NAME?
P50		*Insert output from @risk*	#NAME?
P90		*Insert output from @risk*	#NAME?

Commercial information redacted

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence	Prob score	Cost score	Schedule score	Score	Quant Prob %
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*	*Caluclated based*	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.	5	1	5	25	75%
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.	2	1	3	6	20%
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.	2	2	3	6	25%
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations				#VALUE!	
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)	2			0	20%
Inadequacy of treatment solution	Minworth R026	Threat	L = Live	Capex	Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution	5	1		5	80%
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade	3	3	1	9	40%
Process unit costs	Minworth R032	Threat	L = Live	Capex	Technical	Environmental constraints	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs	3	4		12	50%
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required	2	4	2	8	25%

Risk Title	Cost Estimates: Min £	ML £	Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk	ID - Description2
	scores, but if better information available then	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the*	*Not used on Tab 3a - see Tab 3b.*	*ID - Description to allow consideration of risks against OB contributory factors*
Discharge Consent (inc Planning consultation)	[redacted]				Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	75%	[redacted]				Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.
Works construction in floodplain					Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%					Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.
					Risk Reduction	Client		0%					-
Environmental consents (inc Compensatory habitats)					Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%					##
Invasive species					Risk Reduction	Client							Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.
Changes to quality of existing works final effluent					Risk Reduction	Client		20%					Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for
Inadequacy of treatment solution					Risk Reduction	Client		80%					Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.
Reduce raw water treatment requirements (inc optimising gravity main)					Risk Reduction	Client							##
Reduce phosphate treatment requirements					Risk Reduction	Client							Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.
					Risk Reduction	Client		0%					-
Power Supply					Risk Reduction	Client		40%					Minworth R030 - Power supply from the local network may not be sufficient
					Risk Reduction	Client		0%					-
Process unit costs					Risk Reduction	Client		50%					Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice
UV requirement					Risk Reduction	Client		25%					Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors.

Risk Title	OB Filter: Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	OB Filter: Design complexity	Degree of Innovation	Environmental impact	OB Filter: Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	OB Filter: Public relations	Site characteristics	Permits / consents / approvals	OB Filter: Political	Economic	Legislations / regulations	Technology	Further (*Insert any furthe*)
Discharge Consent (inc Planning consultation)											Y						Y			Y	Y	
Works construction in floodplain														Y		Y						
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Environmental consents (inc Compensatory habitats)									Y													
Invasive species	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Changes to quality of existing works final effluent									Y													
Inadequacy of treatment solution									Y													
Reduce raw water treatment requirements (inc optimising gravity main)			Y		Y		Y	Y													Y	
Reduce phosphate treatment requirements			Y		Y		Y	Y													Y	
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Power Supply			Y		Y		Y	Y													Y	
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Process unit costs									Y													
UV requirement									Y													

Risk Title	Cause	Min (Pre)	Max (Pre)	Ave	Memo
Discharge Consent (inc Planning consultation)	Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party.	[redacted]			1
Works construction in floodplain	Underestimated flood protection measures				1
					3
Environmental consents (inc Compensatory habitats)	Underestimated environmental approval processes Compensatory habitats are required				2
Invasive species	N/A OPEX				OPEX
Changes to quality of existing works final effluent	Change in the catchment in Birmingham.				0
Inadequacy of treatment solution	Raw water quality is specific to each site and in order to inform permitting discussions, treatment effectiveness may need to be demonstrated.				1
Reduce raw water treatment requirements (inc optimising gravity main)	remove/reduce treatment requirements Due to hydraulic efficiency.				4
Reduce phosphate treatment requirements	remove/reduce phosphate treatment requirement				3
					3
Power Supply	Insufficient local power that can be tapped into				3
					3
Process unit costs	Historically STW have been given lower costs at estimating stage to those that are actually realised				4
UV requirement	Introduction of bathing waters consent may reintroduce requirement to have UV treatment				4

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT115
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	[redacted]
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2	[redacted]	[redacted]
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3	[redacted]	[redacted]
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1 15%) delay to project delivery	4	[redacted]	[redacted]
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	[redacted]	[redacted]

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

Risk (Static) values:

P10	[redacted]	*Insert output from @risk report for 10 percentile*
P50	[redacted]	*Insert output from @risk report for 50 percentile*
P90	[redacted]	*Insert output from @risk report for 90 percentile*

Commercial information redacted

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)
Inadequacy of treatment solution	Minworth R026	Threat	L = Live	Capex	Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade
Process unit costs	Minworth R032	Threat	L = Live	Capex	Technical	Environmental constraints	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required

ID	Prob score	Cost score	Schedule score	Score	Scoring Justification	Quant Prob %	Min £	ML £	Max £	Risk
	Caluclated based	*Insert score*	*Insert score*	*Calculated risk score*	*Provide justification for scores allocated*	*Insert probability as percentage that risk occurs*	*scores, but if better information available then* (Cost Estimates)	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*
Minworth R020	5	1	5	25	EA position not clear at the time of design Min- Required to provide additional information to support proposed design Max - Significant changes to design Min: £1k x 6mths = £180k+10% uplift of the structure cost £1.5m Max: £1k x 24mths = £730k+20% uplift of the structure cost £1.5m	75%	[redacted]	[redacted]	[redacted]	
Minworth R021	2	1	3	6	Min - Contractor unable to access working area and/or location of materials + additional pumping equipment required Max - Loss of contractors plant and/or materials + major disruption to programme & access to site Min 10% uplift from the item (civil structure) cost. £3M x 10% Max 20% uplift from the item cost £3M x 20%	20%	[redacted]	[redacted]	[redacted]	
							[redacted]	[redacted]	[redacted]	
Minworth R023	2	2	3	6	Min- Delay in completion of EIA surveys - 12mths Max - Delay in completion of EIA surveys - 24mths Existing land already in curtailedge of site - minimal permanent impact elsewhere Min: £2k x 30days x 12mths + Creating habitat: Cost per hectare £36k x 2.2 hectares Max: £2k x 30days x 24mths + £36k x 6.2 (i.e. 2.2 + Minworth site 4.0 hectares) Probability: 25%	25%	[redacted]	[redacted]	[redacted]	
Minworth R024					OPEX		[redacted]	[redacted]	[redacted]	
Minworth R025	2			0	Scheme is scheduled for the future and a high level of maintenance will be required to achieve consent Loss of revenue equal to number of days unable to produce water Min: £1k x 4mths delay = £120k Max: £1k x 6mths delay = £180k	20%	[redacted]	[redacted]	[redacted]	
Minworth R026	5	1		5	Min: £1k x 12mths = £360k Max: £1k x 24mths = £720k Probability 80%.	80%	[redacted]	[redacted]	[redacted]	
Minworth R027					Benefit - Removal of BAC from the scheme. Min: £16.5M (BAC cost) + 5000meters x £10 Max: £16.5M (BAC cost) + 7000meters x £10 Probability: 10%		[redacted]	[redacted]	[redacted]	
Minworth R028					Some elements of Phosphate treatment may not be required. Equipment is also used for solids removals and total organic carbon. Min: £2.83M (mechanical) + Reaction tank & Clarifier (£2.34M) Max: £2.83M (mechanical) + Reaction tank & Clarifier (£2.34M) Probability: 5%		[redacted]	[redacted]	[redacted]	
					Cost of additional scope (water capacity) Min: 5% of Gate 1 base cost estimates £50M Max: 7.5% of £50M Probability: 35%		[redacted]	[redacted]	[redacted]	
Minworth R030	3	2	1	6	Cost of cable upgrade. Min: £1M per 1km x 1km = £1M Max: £1M per 1km x 2km = £2M Probability: 40%	40%	[redacted]	[redacted]	[redacted]	
							[redacted]	[redacted]	[redacted]	
Minworth R032	3	4		12	Potential multiplier to treament costs to be requested from STW. (Ops 115) Min: Min Multiplier 10% x Treatment Cost (£66,148,120) Max: Max Multiplier 20% x Treatment Cost (£66,148,120)	50%	[redacted]	[redacted]	[redacted]	
Minworth R033	2	4	2	8	Use actual costs from estimate	25%	[redacted]	[redacted]	[redacted]	

ID	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk	ID - Description2
	Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the*	*Not used on Tab 3a - see Tab 3b.*	*ID - Description to allow consideration of risks against OB contributory factors*
Minworth R020	Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	75%	[redacted]	[redacted]	[redacted]		Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.
Minworth R021	Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%	[redacted]	[redacted]	[redacted]		Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.
	Risk Reduction	Client		0%	[redacted]	[redacted]	[redacted]		-
Minworth R023	Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%	[redacted]	[redacted]	[redacted]		##
Minworth R024	Risk Reduction	Client			[redacted]	[redacted]	[redacted]		Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.
Minworth R025	Risk Reduction	Client		20%	[redacted]	[redacted]	[redacted]		Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for
Minworth R026	Risk Reduction	Client		80%	[redacted]	[redacted]	[redacted]		Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.
Minworth R027	Risk Reduction	Client			[redacted]	[redacted]	[redacted]		##
Minworth R028	Risk Reduction	Client			[redacted]	[redacted]	[redacted]		Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.
				0%	[redacted]	[redacted]	[redacted]		-
Minworth R030	Risk Reduction	Client		40%	[redacted]	[redacted]	[redacted]		Minworth R030 - Power supply from the local network may not be sufficient
					[redacted]	[redacted]	[redacted]		
Minworth R032	Risk Reduction	Client		50%	[redacted]	[redacted]	[redacted]		Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice
Minworth R033	Risk Reduction	Client		25%	[redacted]	[redacted]	[redacted]		Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors.

ID	OB Filter: Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	OB Filter: Design complexity	Degree of Innovation	Environmental impact	OB Filter: Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	OB Filter: Public relations	Site characteristics	Permits / consents / approvals	OB Filter: Political	Economic	Legislations / regulations	Technology	Further (*Insert any furthe*)
Minworth R020											Y						Y			Y	Y	
Minworth R021														Y		Y						
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R023									Y													
Minworth R024	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R025									Y													
Minworth R026									Y													
Minworth R027			Y		Y		Y	Y													Y	
Minworth R028			Y		Y		Y	Y													Y	
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R030			Y		Y		Y	Y													Y	
	#N/A	#N/A		#N/A		#N/A			#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Minworth R032									Y													
Minworth R033									Y													

ID	Cause	Min (Pre)	Max (Pre)	Ave	Memo
Minworth R020	Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party.	[redacted]	[redacted]	[redacted]	1
Minworth R021	Underestimated flood protection measures	[redacted]	[redacted]	[redacted]	1
		[redacted]	[redacted]	[redacted]	3
Minworth R023	Underestimated environmental approval processes Compensatory habitats are required	[redacted]	[redacted]	[redacted]	2
Minworth R024	N/A OPEX	[redacted]	[redacted]	[redacted]	OPEX
Minworth R025	Change in the catchment in Birmingham.	[redacted]	[redacted]	[redacted]	0
Minworth R026	Raw water quality is specific to each site and in order to inform permitting discussions, treatment effectiveness may need to be demonstrated.	[redacted]	[redacted]	[redacted]	1
Minworth R027	remove/reduce treatment requirements Due to hydraulic efficiency.	[redacted]	[redacted]	[redacted]	5
Minworth R028	remove/reduce phosphate treatment requirement	[redacted]	[redacted]	[redacted]	3
		[redacted]	[redacted]	[redacted]	3
Minworth R030	Insufficient local power that can be tapped into	[redacted]	[redacted]	[redacted]	3
		[redacted]	[redacted]	[redacted]	3
Minworth R032	Historically STW have been given lower costs at estimating stage to those that are actually realised	[redacted]	[redacted]	[redacted]	4
Minworth R033	Introduction of bathing waters consent may reintroduce requirement to have UV treatment	[redacted]	[redacted]	[redacted]	4

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT172
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	[redacted]
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2	[redacted]	[redacted]
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3	[redacted]	[redacted]
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4	[redacted]	[redacted]
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	[redacted]	[redacted]

Capex [redacted] *Insert total scheme capex, excluding optimism bias*

Commercial information redacted

Risk (Static) values:

P10	[redacted]	*Insert output from @risk*	#NAME?
P50	[redacted]	*Insert output from @risk*	#NAME?
P90	[redacted]	*Insert output from @risk*	#NAME?

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence	Prob score	Cost score	Schedule score	Score	Quant Prob %
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*	*Calculated based*	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.	5	1	5	25	75%
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.	2	1		2	20%
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.	2	1	3	6	25%
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations				#VALUE!	
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)				0	20%
Inadequacy of treatment solution	Minworth R026	Threat			Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution				0	80%
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade	3	2	1	6	40%
Process unit costs	Minworth R032	Threat	L = Live	Capex	Technical	Environmental constraints	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs	3	4		12	50%
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required	2	4	2	8	25%

ID	Cost Estimates: Min £	ML £	Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk
	scores, but if better information available	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Not used on Tab 3a - see Tab 3b.*
Minworth R020	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	75%	[redacted]	[redacted]	[redacted]	
Minworth R021	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		0%	[redacted]	[redacted]	[redacted]	
Minworth R023	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%	[redacted]	[redacted]	[redacted]	
Minworth R024	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]	
Minworth R025	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		20%	[redacted]	[redacted]	[redacted]	
Minworth R026	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		80%	[redacted]	[redacted]	[redacted]	
Minworth R027	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]	
Minworth R028	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		0%	[redacted]	[redacted]	[redacted]	
Minworth R030	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		40%	[redacted]	[redacted]	[redacted]	
	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		0%	[redacted]	[redacted]	[redacted]	
Minworth R032	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		50%	[redacted]	[redacted]	[redacted]	
Minworth R033	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		25%	[redacted]	[redacted]	[redacted]	

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors.

ID	ID - Description2	OB Filter: Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	OB Filter: Design complexity	Degree of Innovation	Environmental impact	OB Filter: Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	OB Filter: Public relations	Site characteristics	Permits / consents / approvals	OB Filter: Political	Economic	Legislations / regulations	Technology	Further
	ID - Description to allow consideration of risks against OB contributory factors																						*Insert any furthe*
Minworth R020	Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.											Y						Y			Y	Y	
Minworth R021	Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.														Y		Y						
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R023	##									Y													
Minworth R024	Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R025	Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for									Y													
Minworth R026	Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.									Y													
Minworth R027	##			Y		Y		Y	Y													Y	
Minworth R028	Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.			Y		Y		Y	Y													Y	
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R030	Minworth R030 - Power supply from the local network may not be sufficient			Y		Y		Y	Y													Y	
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R032	Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice									Y													
Minworth R033	Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required									Y													

ID	Cause	Min (Pre)	Max (Pre)	Ave	Memo
Minworth R020	Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party.	[redacted]	[redacted]	[redacted]	1
Minworth R021	Underestimated flood protection measures	[redacted]	[redacted]	[redacted]	1
		[redacted]	[redacted]	[redacted]	3
Minworth R023	Underestimated environmental approval processes Compensatory habitats are required	[redacted]	[redacted]	[redacted]	1
Minworth R024	N/A OPEX	[redacted]	[redacted]	[redacted]	OPEX
Minworth R025	Change in the catchment in Birmingham.	[redacted]	[redacted]	[redacted]	0
Minworth R026	is specific to each site and in order to inform permitting	[redacted]	[redacted]	[redacted]	0
Minworth R027	remove/reduce treatment requirements Due to hydraulic efficiency.	[redacted]	[redacted]	[redacted]	2
Minworth R028	remove/reduce phosphate treatment requirement	[redacted]	[redacted]	[redacted]	3
		[redacted]	[redacted]	[redacted]	3
Minworth R030	Insufficient local power that can be tapped into	[redacted]	[redacted]	[redacted]	2
		[redacted]	[redacted]	[redacted]	3
Minworth R032	Historically STW have been given lower costs at estimating stage to those that are actually realised	[redacted]	[redacted]	[redacted]	4
Minworth R033	Introduction of bathing waters consent may reintroduce requirement to have UV treatment	[redacted]	[redacted]	[redacted]	4

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT230
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2		
3 - Medium	Possible Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3		
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4		
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5		

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

Commercial information redacted

Risk (Static) values:

P10	[redacted]	*Insert output from @risk*	#NAME?
P50		*Insert output from @risk*	#NAME?
P90		*Insert output from @risk*	#NAME?

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence	Prob score	Cost score	Schedule score	Score	Quant Prob %
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*	*Calculated based*	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.	5	1	5	25	75%
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.	2	1		2	20%
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.	2	1	3	6	25%
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations				#VALUE!	
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)				0	20%
Inadequacy of treatment solution	Minworth R026	Threat			Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution				0	80%
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.				#VALUE!	
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade	3	2	1	6	40%
Process unit costs	Minworth R032	Threat	L = Live	Capex	Commercial	Procurement	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs	3	4		12	50%
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required	2	4	2	8	25%
inability to discharge the proposed flow	Minworth R034	Threat	L = Live	Capex	Technical	Environmental constraints	In certain periods the discharge of 230Ml/d may not be allowed because of the impact on the receiving river systems	additional mitigation measures need to be in place to cope with the threat (e.g. storage tanks)	3	2	2	6	25%

ID	Cost Estimates: Min £	ML £	Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk
	scores, but if better information available	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Not used on Tab 3a - see Tab 3b.*
Minworth R020	[redacted]				Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	75%	[redacted]			
Minworth R021					Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%				
					Risk Reduction	Client		0%				
Minworth R023					Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%				
Minworth R024					Risk Reduction	Client						
Minworth R025					Risk Reduction	Client		20%				
Minworth R026					Risk Reduction	Client		80%				
Minworth R027					Risk Reduction	Client						
Minworth R028					Risk Reduction	Client						
					Risk Reduction	Client		0%				
Minworth R030					Risk Reduction	Client		40%				
					Risk Reduction	Client		0%				
Minworth R032					Risk Reduction	Client		50%				
Minworth R033					Risk Reduction	Client		25%				
Minworth R034					Risk Reduction	Client		25%				

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors.

ID	ID - Description2	OB Filter: Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	OB Filter: Design complexity	Degree of Innovation	Environmental impact	OB Filter: Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	OB Filter: Public relations	Site characteristics	Permits / consents / approvals	OB Filter: Political	Economic	Legislations / regulations	Technology	Further	Cause	Min (Pre)	Max (Pre)	Ave	Memo
	ID - Description to allow consideration of risks against OB contributory factors																						*Insert any furthe*					
Minworth R020	Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.											Y						Y			Y	Y		Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party	[redacted]			1
Minworth R021	Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.														Y		Y							Underestimated flood protection measures				1
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R023	##									Y														Underestimated environmental approval processes Compensatory habitats are required				1
Minworth R024	Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		N/A OPEX				OPEX
Minworth R025	Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for									Y														Change in the catchment in Birmingham.				0
Minworth R026	Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.									Y														Raw water quality is specific to each site and in order to inform				0
Minworth R027	##			Y		Y		Y	Y													Y		remove/reduce treatment requirements Due to hydraulic efficiency.				
Minworth R028	Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.			Y		Y		Y	Y													Y		remove/reduce phosphate treatment requirement				
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R030	Minworth R030 - Power supply from the local network may not be sufficient			Y		Y		Y	Y													Y		Insufficient local power that can be tapped into				2
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R032	Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Y	Y	Y	Y	Y																		Historically STW have been given lower costs at estimating stage to those that are actually realised				4
Minworth R033	Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required									Y														Introduction of bathing waters consent may reintroduce requirement to have UV treatment				4
Minworth R034	Minworth R034 - In certain periods the discharge of 230Ml/d may not be allowed because of the impact on the receiving river systems									Y																		

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT57.ALT
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Description	Probability	Cost impact	Schedule Impact	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2		
3 - Medium	Possible - Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3		
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1-15%) delay to project delivery	4		
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5		

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

Risk (Static) values:

P10	[redacted]	*Insert output from @risk report for 10 percentile*
P50		*Insert output from @risk report for 50 percentile*
P90		*Insert output from @risk report for 90 percentile*

Commercial information redacted

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)
Inadequacy of treatment solution	Minworth R026	Threat	L = Live	Capex	Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade
Process unit costs	Minworth R032	Threat	L = Live	Capex	Technical	Environmental constraints	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required

ID	Prob score	Cost score	Schedule score	Score	Quant Prob %	Min £	ML £	Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk
	Calculated based	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*	*scores, but if better information available then* (Cost Estimates)	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the*	*Not used on Tab 3a - see Tab 3b.*
Minworth R020	2	3	5	10	15%	[redacted]				Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	15%	[redacted]			
Minworth R021	2	2	3	6	20%					Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%				
										Risk Reduction	Client		0%				
Minworth R023	2	3	3	6	25%					Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%				
Minworth R024				#VALUE!						Risk Reduction	Client						
Minworth R025	2	1		2	20%					Risk Reduction	Client		20%				
Minworth R026	5	2		10	80%					Risk Reduction	Client		80%				
Minworth R027				#VALUE!						Risk Reduction	Client						
Minworth R028				#VALUE!						Risk Reduction	Client						
										Risk Reduction	Client		0%				
Minworth R030	3	4	1	12	40%					Risk Reduction	Client		40%				
										Risk Reduction	Client		0%				
Minworth R032	3	4		12	50%					Risk Reduction	Client		50%				
Minworth R033	2	5	2	10	25%					Risk Reduction	Client		25%				

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors.

ID	ID - Description2	OB Filter: Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	OB Filter: Design complexity	Degree of Innovation	Environmental impact	OB Filter: Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	OB Filter: Public relations	Site characteristics	Permits / consents / approvals	OB Filter: Political	Economic	Legislations / regulations	Technology	Further	Cause	Min (Pre)	Max (Pre)	Ave	Memo
	ID - Description to allow consideration of risks against OB contributory factors																						*Insert any furthe*					
Minworth R020	Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.											Y						Y			Y	Y		Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party.	[redacted]			1
Minworth R021	Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.														Y		Y							Underestimated flood protection measures				1
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R023	##									Y														Underestimated environmental approval processes Compensatory habitats are required				2
Minworth R024	Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		N/A OPEX				OPEX
Minworth R025	Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for									Y														Change in the catchment in Birmingham.				0
Minworth R026	Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.									Y														Raw water quality is specific to each site and in order to inform permitting discussions, treatment effectiveness may need to be demonstrated.				1
Minworth R027	##			Y		Y		Y	Y													Y		remove/reduce treatment requirements Due to hydraulic efficiency.				4
Minworth R028	Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.			Y		Y		Y	Y													Y		remove/reduce phosphate treatment requirement				3
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R030	Minworth R030 - Power supply from the local network may not be sufficient			Y		Y		Y	Y													Y		Insufficient local power that can be tapped into				3
	-	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						3
Minworth R032	Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice									Y														Historically STW have been given lower costs at estimating stage to those that are actually realised				4
Minworth R033	Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required									Y														Introduction of bathing waters consent may reintroduce requirement to have UV treatment				4

3a. Quantitative Costed Risk Assessment - Register Tab

Option Name	Minworth SRO - TREAT115.ALT
Option Reference	A7W13155
Date of QCRA Review	02/08/2022

Score - Descriptic	Probabilit	Cost impact	Schedule Impac	Score	Min Cost	Max Cost
1 - Very Low	Improbable (1-10%)	Minimal (<1%) effect on project cost	No delay to project delivery	1	[redacted]	[redacted]
2 - Low	Remote (11-30%)	Small (1-2%) effect on project cost	Minimal (1-2%) effect on project delivery	2	[redacted]	[redacted]
3 - Medium	Possible Likely (31-50%)	Moderate (2.1-5%) increase in project cost	Small (2.1 - 5%) delay to project delivery	3	[redacted]	[redacted]
4 - High	Probable (51-70%)	Significant (5.1-15%) increase on project cost	Significant (5.1 15%) delay to project delivery	4	[redacted]	[redacted]
5 - Very High	Almost certain (71-99%)	Major (>15%) increase in project cost	Major (>15%) delays to project delivery	5	[redacted]	[redacted]

Capex: [redacted] *Insert total scheme capex, excluding optimism bias*

Risk (Static) values:

P10	[redacted]	*Insert output from @risk*	#NAME?
P50	[redacted]	*Insert output from @risk*	#NAME?
P90	[redacted]	*Insert output from @risk*	#NAME?

Commercial information redacted

Risk Title	ID	Type	Status	Category	RBS1	RBS2	Description	Consequence	Prob score	Cost score	Schedule score	Score	Quant Prob %
	Insert Risk ID	*Select either Threat*	*Select risk status*	*Insert risk category*	*Select risk category*	*Select risk category*	*Describe nature of risk, including cause and event.*	*Describe consequences if risk is realised*	*Calcula ted based*	*Insert score*	*Insert score*	*Calculated risk score*	*Insert probability as percentage that risk occurs*
Discharge Consent (inc Planning consultation)	Minworth R020	Threat	L = Live	Capex	External	Planning and approvals	There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.	Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.	2	2	5	10	15%
Works construction in floodplain	Minworth R021	Threat	L = Live	Capex	Technical	Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.	Delays to programme during construction. Increase in cost due to additional design / construction activities. Leading to methodology mitigations being required and delays to the assumed construction programme.	2	2	3	6	20%
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat	L = Live	Capex	Technical	Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engagement and mitigations across the option. Potential EIA At present, the assumption is that compensatory habitats will not be required (as per WRMP). There is a risk that compensatory habitats are however required	- Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further assessments - Additional cost of mitigations - Additional stakeholder engagement and mitigation - potential delays depending on the habitat required.	2	3	3	6	25%
Invasive species	Minworth R024	Threat		Opex			Additional mitigation measures are required to prevent transfer of invasive species.	- Delay to programme - Additional cost of undertaking further assessments - Additional cost of mitigations					
Changes to quality of existing works final effluent	Minworth R025	Threat			Technical	Environmental constraints	Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for	- Delay to programme - Additional design investigations - Potential for Additional operational costs The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of transfer availability (days)	2			0	20%
Inadequacy of treatment solution	Minworth R026	Threat	L = Live	Capex	Technical	Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.	Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the solution	5	2		10	80%
Reduce raw water treatment requirements (inc optimising gravity main)	Minworth R027	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce treatment requirements for raw water WTW including consideration for a more nature based solution to remove sediment/turbidity/zinc. Optimising the preferred pipeline route by reducing size of gravity main at a certain section due to hydraulic efficiency.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.					
Reduce phosphate treatment requirements	Minworth R028	Opportunity			Technical	Design uncertainty / complexity	Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.					
Power Supply	Minworth R030	Threat	L = Live	Capex	Technical	Design uncertainty / complexity	Power supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade	3	3	1	9	40%
Process unit costs	Minworth R032	Threat	L = Live	Capex	Technical	Environmental constraints	Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Increased process unit costs	3	4		12	50%
UV requirement	Minworth R033	Threat	L = Live	Capex	Technical	Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required	2	5	2	10	25%

ID	Min £ (Cost Estimates)	ML £	Max £	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob %	Post Mit Min £	Post Mit ML £	Post Mit Max £	Post Mit Risk	ID - Description2
	scores, but if better information available then	*using a*	*but if better information available then should be*	*Not used on Tab 3a - see Tab 3b.*	*Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'*	*Insert the name or role of the person best placed to manage the risk.*	*Insert specific risk response actions, i.e. the steps required to mitigate the risk.*	*Set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated probability of*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the anticipated*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to*	*Should be set by defalut to the pre-mitigation value. However, can overwrite to record the*	*Not used on Tab 3a - see Tab 3b.*	*ID - Description to allow consideration of risks against OB contributory factors*
Minworth R020	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.	15%	[redacted]	[redacted]	[redacted]		Minworth R020 - There is a risk that there will be a delay with obtaining the discharge consent. Following public consultation of the treatment, there is a risk that capacity limitations are imposed by external organisations & stakeholders.
Minworth R021	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an option	20%	[redacted]	[redacted]	[redacted]		Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.
	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		0%	[redacted]	[redacted]	[redacted]		-
Minworth R023	[redacted]	[redacted]	[redacted]		Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	25%	[redacted]	[redacted]	[redacted]		##
Minworth R024	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]		Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.
Minworth R025	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		20%	[redacted]	[redacted]	[redacted]		Minworth R025 - Scheme as proposed assumes Minworth continues to treat at current level continually. There are significant negative changes to the raw water quality compared to what is currently being designed for
Minworth R026	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		80%	[redacted]	[redacted]	[redacted]		Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.
Minworth R027	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]		##
Minworth R028	[redacted]	[redacted]	[redacted]		Risk Reduction	Client			[redacted]	[redacted]	[redacted]		Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ considerations with impact of climate change which could remove the need for chemical dosing and clarification.
	[redacted]	[redacted]	[redacted]					0%	[redacted]	[redacted]	[redacted]		-
Minworth R030	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		40%	[redacted]	[redacted]	[redacted]		Minworth R030 - Power supply from the local network may not be sufficient
	[redacted]	[redacted]	[redacted]						[redacted]	[redacted]	[redacted]		
Minworth R032	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		50%	[redacted]	[redacted]	[redacted]		Minworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice
Minworth R033	[redacted]	[redacted]	[redacted]		Risk Reduction	Client		25%	[redacted]	[redacted]	[redacted]		Minworth R033 - If bathing waters requirements are introduced then UV treatment will be required

Use the filters as an initial guide on which risks are most relevant to different OB contributory factors. To be used when considering whether the costed risks influence the level of confidence for OB contributory factors. (OB Filter:)

ID	Complexity of contract structure	Late contractor involvement in design	Poor contractor capabilities	Government guidelines	Disputes & claims occurred	Information management	Design complexity	Degree of Innovation	Environmental impact	Inadequacy of the Business Case	Large number of stakeholders	Funding availability	Project management team	Poor project intelligence	Public relations	Site characteristics	Permits / consents / approvals	Political	Economic	Legislations / regulations	Technology	Further (*Insert any furthe*)
Minworth R020											Y						Y			Y	Y	
Minworth R021														Y		Y						
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R023									Y													
Minworth R024	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R025									Y													
Minworth R026									Y													
Minworth R027			Y		Y		Y	Y													Y	
Minworth R028			Y		Y		Y	Y													Y	
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	
Minworth R030			Y		Y		Y	Y													Y	
	#N/A	#N/A		#N/A		#N/A			#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		
Minworth R032									Y													
Minworth R033									Y													

ID	Cause	Min (Pre)	Max (Pre)	Ave	Memo
Minworth R020	Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demanrds from 3rd party.	[redacted]	[redacted]	[redacted]	1
Minworth R021	Underestimated flood protection measures	[redacted]	[redacted]	[redacted]	1
		[redacted]	[redacted]	[redacted]	3
Minworth R023	Underestimated environmental approval processes Compensatory habitats are required	[redacted]	[redacted]	[redacted]	2
Minworth R024	N/A OPEX	[redacted]	[redacted]	[redacted]	OPEX
Minworth R025	Change in the catchment in Birmingham.	[redacted]	[redacted]	[redacted]	0
Minworth R026	Raw water quality is specific to each site and in order to inform permitting discussions, treatment effectiveness may need to be demonstrated.	[redacted]	[redacted]	[redacted]	1
Minworth R027	remove/reduce treatment requirements Due to hydraulic efficiency.	[redacted]	[redacted]	[redacted]	5
Minworth R028	remove/reduce phosphate treatment requirement	[redacted]	[redacted]	[redacted]	3
		[redacted]	[redacted]	[redacted]	3
Minworth R030	Insufficient local power that can be tapped into	[redacted]	[redacted]	[redacted]	3
		[redacted]	[redacted]	[redacted]	3
Minworth R032	Historically STW have been given lower costs at estimating stage to those that are actually realised	[redacted]	[redacted]	[redacted]	4
Minworth R033	Introduction of bathing waters consent may reintroduce requirement to have UV treatment	[redacted]	[redacted]	[redacted]	4

A.4 Optimism Bias Templates

A7W13155-GT-SPR-200026	Optimism bias assessment - Pipeline
A7W13155-GT-SPR-200027	Optimism bias assessment - Treatment

Optimism Bias Pipeline

Option Name	Minworth SRO Pipeline options
Option Reference	A7W13155-GT-SCH-20026
Date of OB Review 1	01/08/2020
Date of OB Review 2	13/06/2022

Contributory factors	Non-standard Civ. Eng. (fixed values - do not adjust)	Standard Civ. Eng. (fixed values - do not adjust)	Combined weight (calculated value - do not adjust)	Confidence Grade Criteria: High Confidence	Confidence Grade Criteria: Medium Confidence	Confidence Grade Criteria: Low Confidence	Additional Guidance
Description	*Fixed values - do not adjust*			*Guidance to inform scoring*	*Guidance to inform scoring*	*Guidance to inform scoring*	*Guidance to inform scoring*
Procurement							
Complexity of contract structure				Clear, well establishment procurement route and processes and/or detailed procurement plan or full commercial business case in place	Contract strategy or outline commercial business case in place, but details still to be developed	No contract strategy or commercial business case in place.	*For business as usual options that will be procured through existing water company frameworks then these may be assessed as high confidence. Options should score low confidence where they involve multiple water companies / asset owners, or may be procured through Direct Procurement for Customers, and where detailed procurements plans have not been developed.*
Late contractor involvement in design		3		Design is business as usual and costs are based upon accurate cost models, or significant contractor involvement in design	Design is business as usual and costs are based upon cost models with medium confidence, or initial contractor involvement in key aspects of design	Design is not business as usual for company and the contractor has not been involved in design	*Where there has not been early contractor involvement then low confidence should be assigned, unless the confidence in the cost models gives an equivalent level of confidence in the estimate.*
Poor contractor capabilities				Contractors and suppliers expected to bid for work have recent experience of similar construction projects and supply of similar process plant and equipment	Contractors and suppliers expected to bid for work have limited recent experience of similar construction projects and supply of similar process plant and equipment	Contractors and suppliers expected to bid for work have little/no recent experience of similar construction projects and supply of similar process plant and equipment	*Option types where there is limited recent experience in the UK (including large reservoirs, reuse and desalination options) should be scored as medium/low confidence.*
Government guidelines				There are multiple recent precedents of procuring projects of a similar nature and detailed procurement guidance is in place	Some recent precedents of procuring projects of a similar nature and detailed procurement guidance is in place	There is limited recent experience of procuring projects of a similar nature and detailed procurement guidance is not in place	*Where an option may be implemented though Direct Procurement for Customers, or other less well established procurement routes then low confidence should be assigned.*
Disputes & claims occurred		21		Scope and payment mechanism clearly defined in contract and no dependencies on third parties	Scope and payment mechanism partially defined and there are no major dependencies on third parties	Scope and payment mechanism currently ill-defined and/or there are significant dependencies on third parties	
Information management				Information management systems between key stakeholders are in place, clearly defined and effective (e.g. project specific, or already existing for a project under an existing framework)	Some key stakeholders for procurement identified and information management system has been initiated, but details are still to be developed before it can be effective	Key stakeholders for procurement not identified, or information management systems not in place and effective (e.g. project specific, or already existing for a project under an existing framework)	*Where information management systems for contract and stakeholder management have not been initiated then assign low confidence.*
Other	2						
Procurement combined			13.0%				
Project specific							
Design complexity	9			Design is business as usual or design contains complexities but these are well understood and detailed plans and designs are in place to address them	Design is not business as usual due to several complexities. The design mitigations to address these complexities have only been partially understood and addressed	Design is complex, for example due to the nature of the project or interfaces with existing assets, or constraints. Design mitigations are not yet in place.	*Options with significant design complexities, or constrained sites, and significant integration with existing operational infrastructure may be assigned low confidence. Options that are business as usual, on greenfield, unconstrained sites may be assigned high confidence.*
Degree of Innovation	9			Design is business as usual and/or innovations are well developed and tested for the specific application	Design incorporates technology / innovations that have been partially tested and proven for the specific application	Design incorporates new technologies and these have not yet been fully tested and proven for the specific application	*Options using technologies that are well established in the UK should be assigned high confidence. Options where technologies, or the application of technologies, is less well established in the UK (e.g. reuse, desalination) should be assigned medium confidence*
Environmental impact	5	22		Environmental impacts well understood (e.g. impact on receiving water bodies, noise, INNS transfer, designated sites, visual amenity etc), mitigations identified where required and included in costs	Some assessment of environmental impacts has been carried out and mitigations have been identified and costed to address the most significant of these. Other mitigations will be required that have not yet been built into the costs	Environmental impacts poorly understood (e.g. impact on receiving water bodies, noise, INNS transfer, designated sites, visual amenity etc), or significant environmental issues identified without agreement on mitigation to be built into costs	*Except for options that are free from environmental constraints/risks it is unlikely that options at Gate 1 would achieve a higher level of confidence than medium at Gate 1 unless environmental risks have been identified, detailed and costed in the QCRA. For options with significant environmental risks that require investigation a low confidence score would be more applicable before accounting for the QCRA.*
Other		18					
Project specific combined			31.0%				
Client specific							
Inadequacy of the Business Case	35	10		Needs have been clearly identified. Key stakeholders needs identified and included in scope where applicable	Partial identification of needs and initial engagement with stakeholders to refine requirements	Initial identification of needs and output specification, without engagement with stakeholders to refine requirements	*Confidence likely to be low at Gate 1 unless initial stakeholder requirements identified and reflected in option scope and/or specifically accounted for in QCRA.*
Large number of stakeholders				Stakeholder approvals not required, or key stakeholder approvals obtained, or key stakeholders largely supportive	Some key stakeholders identified and views obtained, however some other stakeholders remain unidentified	Stakeholders not clearly identified, views not known or some stakeholders are in active opposition	
Funding availability	5			Funding for the project is secure (e.g. project fully funded through price review / pass through arrangement)	Project funding uncertain e.g. project subject to efficiency challenges at price review which may require business case to be revisited	Project funding not secure, e.g. project dependent in part on partnership funding which is not secure.	*For options to be funded through the RAPID gated SRO process, or through a price review, a medium confidence score is considered appropriate.*
Project management team	2			Scope of work is business as usual for company delivery teams.	Company delivery team has some experience in implementing projects of this nature, but their relevant experience is not extensive	Company delivery teams are not experienced in implementing projects of this nature	
Poor project intelligence	9	7		Good understanding of key project data and no key assumptions made where there is significant uncertainty (e.g. ground conditions, condition of existing assets, treatment requirements)	Partial understanding of key project data and there has been some work undertaken to reduce the uncertainty around key assumptions (e.g. ground conditions, condition of existing assets, treatment requirements)	Significant gaps in project data and key assumptions made where there is significant uncertainty	
Other							
Client specific combined			34.0%				
Environment							
Public relations		9		Project business as usual and not expected to raise local opposition, or local stakeholders aware and largely primarily supportive, no protest expected.	Project could lead to some local opposition, however there has been some engagement with key stakeholders and it is likely that the major concerns raised can be resolved	Project could lead to local opposition once local stakeholders aware, or stakeholders aware and evidence of significant local opposition	
Site characteristics	5	3		Site information well understood (e.g. archaeology, heritage assets, contamination etc.), mitigations identified where required and included in costs	Site information partially understood (e.g. archaeology, heritage assets, contamination etc.), mitigations identified where required and included in costs	Site information poorly understood (e.g. archaeology, heritage assets, contamination etc.) and mitigations not identified	
Permits / consents / approvals				No permits and consents required, or permits and consents obtained.	Permits and consents required, but regulators, planning authorities and Government supportive	Permits, consents and approvals required from regulators, planning authorities and/or Government and obtaining these presents a material risk	*Confidence likely to be low at Gate 1 unless option is business as usual or risks well developed and costed in QRA.*
Other							
Environment combined			8.5%				
External influences							
Political				Project is either unlikely to attract political attention, or political stakeholders are supportive	Project could attract political attention, while there is not cross party political support the majority of political stakeholders are likely to be supportive	Project has the potential to attract political attention and lacks cross-party political support	*Projects that are high profile and considered likely to be controversial should be assigned low confidence.*
Economic	3	7		Project has a short lead time and is less vulnerable to changes in funding and input costs	Project has a medium lead time so there is some risk that a change in the economic environment could impact demands and / or input costs	Project has long lead time and change in economic environment could impact demands and/or input costs	*When considering lead times (including planning and development time) assume short for ≤5 years, Medium for 6-10 years, Long for >10years.*
Legislations/regulations	8			Project is business as usual and /or required standards and regulations are well established and unlikely to change	Required standards and regulations are relatively new and therefore less well established.	Key standards and regulations are under development, or subject to change.	*For new technologies or novel applications of existing technologies in the UK that potentially require regulatory approvals (e.g. for environmental or drinking water quality reasons) then a medium or low confidence should be applied. High confidence should be applied for business as usual schemes where no regulatory or legislative risks are envisaged.*
Technology	8			Technology (e.g. treatment processes, smart metering technology) is well established, accepted by regulators and unlikely to change during the project lead time	Technology (e.g. treatment processes, smart metering technology) is relatively new. While it has not yet been accepted by regulators, it is likely to be and therefore a change in the requirements is unlikely	Technology (e.g. treatment processes, smart metering technology) is new and/or is subject to rapid innovation which may lead to changes in requirements	*Treated water transfers and conventional treatment processes should be scored high confidence. For novel treatment processes or novel application of tested treatment processes (e.g. for INNS transfer mitigation, desalination or reuse) medium confidence is considered appropriate*
Other	1						
External influences combined			13.5%				

OB Review 1

Non-Standard Civil Engineering: Proportion of Non-Standard Civil Engineering Capex 20%; Upper Bound 66%; Lower bound 6%. Standard Civil Engineering: Proportion of Standard Civil Engineering Capex 80%; Upper Bound 44%; Lower bound 3%.

Proportion of cost in each confidence band – Non-Standard Civil Engineering Components included - therefore proportion of cost required to be assigned to confidence bands in these columns / Standard Civil Engineering Components included - therefore proportion of cost required to be assigned to confidence bands in these columns.

Contributory factors	Combined Upper Bound Optimism Bias (%) – Result from: 48.40%	NS High	NS Medium	NS Low	NS Mitigation Factor	S High	S Medium	S Low	S Mitigation Factor	Adjusted Optimism Bias (%) – Result from: 41.14%	Check for Non-Standard components	Check for Standard components	Scoring comment	Associated costed risk	Change as a result of considering the costed risks
Description	*Calculated cell*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Calculated cell*	*Check proportion sums to 1 where option contains Non-Standard components*	*Check proportion sums to 1 where option contains Standard components*	*Describe the reasoning behind assignment to confidence bands.*	*List the risks from QCRA which are relevant for the OB contributory factor. These can be found by using the filters on the QCRA register which makes use of the Risk to OB Contributory Factor mapping table provided in the "Reference Information" tab*	*Outline how the OB mitigation factor has been changed when accounting for associated costed risks in the QCRA.*
Procurement		Required	Required	Required		Required	Required	Required							
Complexity of contract structure				1	0			1	0		OK	OK	Contract strategy has not yet been agreed either in terms of Gate 2 or longer term vehicle for delivery (DPC). Consideration should be given to splitting the network and treatment elements into a minimum of two contracts. Due to the length of the transmission main there is the potential that the conveyance infrastructure elements could also be split into two or more contracts.		
Late contractor involvement in design				1	0			1	0		OK	OK	No reliable cost models for treatment elements at this scale. No contractor involvement to date. ECI is now a well established process; therefore, this risk should be minimal and will be mitigated.		
Poor contractor capabilities			1		0.5		1		0.5		OK	OK	It is likely that the tender process will be a staged OJEU process with only competent contractors passing through the second tender stage.		
Government guidelines				1	0			1	0		OK	OK	This project considered unusual, in terms of procurement, based on size and scale.		
Disputes & claims occurred				1	0			1	0		OK	OK	No contracts in place; however, this is a risk which will be mitigated as the project proceeds.		
Information management				1	0			1	0		OK	OK	Information management at early stage of development. Some stakeholders have been identified during the Concept Design investigations. This risk will be mitigated as the scheme advances through the Gate process.		
Procurement combined	6.29%	Average Mitigation Factor			0.083	Average Mitigation Factor			0.083	5.807%	Average Mitigation Factor				
Project specific		Required	Required	Required		Required	Required	Required							
Design complexity				1	0			1	0		OK	OK	Design is considered complex. There will be significant interfaces on the WFP site required to enable the upgrading works to proceed without affecting current treatment processes. No mitigation yet in place.		
Degree of Innovation		1			1	1			1		OK	OK	No proposed treatment processes or proposed conveyance elements are considered to be unproven.		
Environmental impact				1	0			1	0		OK	OK	Desktop analysis of environmental impact has only partially been assessed (WFD status) and the Concept Designs have proceeded based on the information provided through that work. Ecology and hydrology impacts to be assessed in next phase of environmental studies but will not be available prior to price submission. At this stage no major environmental issues are expected; however, there will be a need to further environmental assessments as the project proceeds through the Gate system.		
Project specific combined	15.00%	Average Mitigation Factor			0.333	Average Mitigation Factor			0.333	10.375%	Average Mitigation Factor				
Client specific		Required	Required	Required		Required	Required	Required							
Inadequacy of the Business Case				1	0			1	0		OK	OK	As one of 17 SROs, the need for this particular scheme (or any other) will be unclear until the gated process is much further developed.		
Large number of stakeholders				1	0			1	0		OK	OK	Some stakeholders have been identified through the work undertaken at Concept Design. However, this work was limited and must continue to be developed. No stakeholders have been engaged thus far.		
Funding availability				1	0			1	0		OK	OK	Project funding is uncertain at this stage.		
Project management team				1	0			1	0		OK	OK	Project management team yet to be identified. Last in-house high value scheme suffered significant problems.		
Poor project intelligence				1	0			1	0		OK	OK	There are significant gaps in the data required to enable an accurate evaluation to be completed. This risk will be mitigated as the Gate system advances.		
Client specific combined	16.46%	Average Mitigation Factor			0.000	Average Mitigation Factor			0.000	16.456%	Average Mitigation Factor				
Environment		Required	Required	Required		Required	Required	Required							
Public relations				1	0			1	0		OK	OK	Due to the size of the conveyance works and the potentially emotive issue of transferring water (treated effluent) into another catchment, it is likely that local opposition will arise.		
Site characteristics			1		0.5		1		0.5		OK	OK	The following desktop analysis of the conveyance route and WwTP site has been completed: Environment, Archaeology and Building Heritage, Geotechnical and Flood Risk potential. Some mitigation measures have already been identified. These risks will be further mitigated as additional site investigations progress.		
Permits / consents / approvals				1	0			1	0		OK	OK	No permits sought to date. This risk will be mitigated as investigative works and designs proceed.		
Environment combined	4.11%	Average Mitigation Factor			0.167	Average Mitigation Factor			0.167	3.479%	Average Mitigation Factor				
External influences		Required	Required	Required		Required	Required	Required							
Political				1	0			1	0		OK	OK	Project likely to attract political attention. Political party support unknown.		
Economic				1	0			1	0		OK	OK	Project has a long lead in time during which many factors e.g. treatment technology, energy tariffs etc. could change and affect the selection of the preferred solution.		
Legislations/regulations				1	0			1	0		OK	OK	The current key standards are understood and have been partially investigated. However, issues such as the required standard of effluent treatment could potentially change. Legislation and regulatory issues remain (DCO / Put & Take) remain. These external influences could also change significantly over the life cycle of the scheme which, even if selected, may not be called upon for decades.		
Technology		1			1	1			1		OK	OK	The proposed treatment processes are based on proven technology which can meet the required effluent standards. There are no elements of the conveyance system, in terms of operation, materials and installation methodologies, which are not based on current practices.		
External influences combined	6.53%	Average Mitigation Factor			0.250	Average Mitigation Factor			0.250	5.022%	Average Mitigation Factor				

OB Review 2

Non-Standard Civil Engineering: Proportion of Non-Standard Civil Engineering Capex 26%; Upper Bound 66%; Lower bound 6%. Standard Civil Engineering: Proportion of Standard Civil Engineering Capex 74%; Upper Bound 44%; Lower bound 3%.

Contributory factors	Combined Upper Bound Optimism Bias (%) – Result from: 49.72%	NS High	NS Medium	NS Low	NS Mitigation Factor	S High	S Medium	S Low	S Mitigation Factor	Adjusted Optimism Bias (%) – Result from: 30.11%	Check for Non-Standard components	Check for Standard components	Scoring comment	Associated costed risk	Change as a result of considering the costed risks
Description	*Calculated cell*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Calculated cell*	*Check proportion sums to 1 where option contains Non-Standard components*	*Check proportion sums to 1 where option contains Standard components*	*Describe the reasoning behind assignment to confidence bands.*	*List the risks from QCRA which are relevant for the OB contributory factor. These can be found by using the filters on the QCRA register which makes use of the Risk to OB Contributory Factor mapping table provided in the "Reference Information" tab*	*Outline how the OB mitigation factor has been changed when accounting for associated costed risks in the QCRA.*
Procurement		Required	Required	Required		Required	Required	Required							
Complexity of contract structure		1			1	1			1		OK	OK	Contract strategy has not yet been agreed either in terms of Gate 2 or longer term vehicle for delivery (DPC). Consideration should be given to splitting the network and treatment elements into a minimum of two contracts. Due to the length of the transmission main there is the potential that the conveyance infrastructure elements could also be split into two or more contracts. Confirmation received from KPMG that procurement will not be through DPC route.	R005 - material prices; R006 - procurement delays	No change
Late contractor involvement in design				1	0			1	0		OK	OK	Cost models for treatment elements may not be reliable at this scale. No contractor involvement to date. ECI is now a well established process; therefore, this risk should be minimal and will be mitigated. No ECI yet.	R005 - material prices; R006 - procurement delays	No change
Poor contractor capabilities		1			1	1			1		OK	OK	It is likely that the tender process will be a staged OJEU process with only competent contractors passing through the second tender stage. For NS, GAC as tertiary treatment. For Standard pipeline install	R005 - material prices; R006 - procurement delays; R018 - alternative discharge location	No change
Government guidelines			1		0.5		1		0.5		OK	OK	This project considered unusual, in terms of procurement, based on size and scale. KPMG have confirmed that procurement will not be via DPC routes	R005 - material prices; R006 - procurement delays	No change
Disputes & claims occurred				1	0			1	0		OK	OK	No contracts in place; however, this is a risk which will be mitigated as the project proceeds.	R005 - material prices; R006 - procurement delays; R018 - alternative discharge location	No change
Information management			1		0.5		1		0.5		OK	OK	Information management at early stage of development. Some stakeholders have been identified during the Concept Design investigations. This risk will be mitigated as the scheme advances through the Gate process. A site set up but not effective yet.	R016 - strategic planning applications	No change
Procurement combined	6.46%	Average Mitigation Factor			0.500	Average Mitigation Factor			0.500	3.478%	Average Mitigation Factor				
Project specific		Required	Required	Required		Required	Required	Required							
Design complexity			0.5	0.5	0.25	1			1		OK	OK	Design is considered complex only for the non standard element of the pipeline which is the trenchless crossings Trenchless crossing considerations	R018 - alternative discharge location	No change
Degree of Innovation		1			1	1			1		OK	OK	No proposed treatment processes or proposed conveyance elements are considered to be unproven.	R018 - alternative discharge location	No change
Environmental impact			0.5	0.5	0.25		0.5	0.5	0.25		OK	OK	Desktop analysis of environmental impact has only partially been assessed and the Concept Designs have proceeded based on the information provided through that work. Ecology and hydrology impacts to be assessed in next phase of environmental studies but will not be available prior to price submission. At this stage no major environmental issues are expected; however, there will be a need to further environmental assessments as the project proceeds through the Gate system.	R003 - additional ecological works; R011 - archaelogical remains	OB scored accordingly bearing in mind the impact of these costed risks
Project specific combined	15.41%	Average Mitigation Factor			0.500	Average Mitigation Factor			0.750	5.941%	Average Mitigation Factor				
Client specific		Required	Required	Required		Required	Required	Required							
Inadequacy of the Business Case			1		0.5		1		0.5		OK	OK	As one of 17 SROs, the need for this particular scheme (or any other) will be unclear until the gated process is much further developed.	NA	NA
Large number of stakeholders			0.7	0.3	0.35		0.7	0.3	0.35		OK	OK	Some stakeholders have been identified through the work undertaken at Concept Design. However, this work was limited and must continue to be developed. No stakeholders have been engaged thus far. For NS Stakeholder manager in post	R007 - Trenchless crossing engagement; R010 - planning approval delay; R020 - HS2 crossing	OB scored accordingly bearing in mind the impact of these costed risks
Funding availability				1	0		1		0.5		OK	OK	Project funding is uncertain at this stage. Jacobs scored this low, moved to medium to be consistent with treatment element	NA	NA
Project management team				1	0		1		0.5		OK	OK	Project management team yet to be identified. Last in-house high value scheme suffered significant problems. Jacobs scored this low, moved to medium to be consistent with treatment element	NA	NA
Poor project intelligence			0.5	0.5	0.25			1	0		OK	OK	There are significant gaps in the data required to enable an accurate evaluation to be completed. This risk will be mitigated as the Gate system advances. For NS and S No GI undertaken Jacobs scored this 0.5 M 0.5 L. Moved to Low to be consistent with treatment element	R001 - ground conditions; R004 - buried utilities and structures; R012 - numerous service diversions; R013 - groundwater levels higher than anticipated; R017 - contaminated land	OB scored accordingly bearing in mind the impact of these costed risks
Client specific combined	16.90%	Average Mitigation Factor			0.220	Average Mitigation Factor			0.370	11.921%	Average Mitigation Factor				
Environment		Required	Required	Required		Required	Required	Required							
Public relations			0.5	0.5	0.25		0.5	0.5	0.25		OK	OK	Due to the size of the conveyance works and the potentially emotive issue of transferring water (treated effluent) into another catchment, it is likely that local opposition will arise. For NS No known major objectors	R007 - Trenchless crossing engagement; R020 - HS2 crossing	OB scored accordingly bearing in mind the impact of these costed risks
Site characteristics				1	0		0.5	0.5	0.25		OK	OK	The following desktop analysis of the conveyance route and WwTP site has been completed: Environment, Archaeology and Building Heritage, Geotechnical and Flood Risk potential. Some mitigation measures have already been identified. These risks will be further mitigated as additional site investigations progress. For NS No GI undertaken	R001 - ground conditions; R004 - buried utilities and structures; R012 - numerous service diversions; R013 - groundwater levels higher than anticipated; R017 - contaminated land	OB scored accordingly bearing in mind the impact of these costed risks
Permits / consents / approvals				1	0		0.5	0.5	0.25		OK	OK	No permits sought to date. This risk will be mitigated as investigative works and designs proceed. For NS permitting not confirmed	R010 - planning approval delay; R014 - land access	OB scored accordingly bearing in mind the impact of these costed risks
Environment combined	4.23%	Average Mitigation Factor			0.083	Average Mitigation Factor			0.250	3.471%	Average Mitigation Factor				
External influences		Required	Required	Required		Required	Required	Required							
Political				1	0			1	0		OK	OK	Project likely to attract political attention. Political party support unknown. For NS Public may view as effluent reuse Jacobs scored medium, moved to low to be consistent with Treatment	R007 - Trenchless crossing engagement; R020 - HS2 crossing	OB scored accordingly bearing in mind the impact of these costed risks
Economic				1	0			1	0		OK	OK	Project has a long lead in time during which many factors e.g. treatment technology, energy tariffs etc. could change and affect the selection of the preferred solution.	NA	NA
Legislations/regulations			0.5	0.5	0.25		0.5	0.5	0.25		OK	OK	The current key standards are understood and have been partially investigated. However, issues such as the required standard of effluent treatment could potentially change. Legislation and regulatory issues remain (DCO / Put & Take) remain. These external influences could also change significantly over the life cycle of the scheme which, even if selected, may not be called upon for decades.	R010 - planning approval delay; R014 - land access	No change
Technology				1	0	1			1		OK	OK	There are only limited elements of the conveyance system (tunnelling), in terms of operation, materials and installation methodologies, which are not based on current practices.	R010 - planning approval delay; R014 - land access; R018 - alternative discharge location	No change
External influences combined	6.71%	Average Mitigation Factor			0.063	Average Mitigation Factor			0.313	5.301%	Average Mitigation Factor				

Optimism Bias Treatment

Option Name	Minworth SRO Treatment options
Option Reference	A7W13155-GT-SCH-20027
Date of OB Review 1	01/08/2020
Date of OB Review 2	13/06/2022

Non-Standard Civil Engineering: Proportion of Non-Standard Civil Engineering Capex 100%; Upper Bound 66%; Lower bound 6%. Proportion of cost in each confidence band – Non-Standard Civil Engineering Components included - therefore proportion of cost required to be assigned to confidence bands in these columns.

Standard Civil Engineering: Proportion of Standard Civil Engineering Capex 0%; Upper Bound 44%; Lower bound 3%. Proportion of cost in each confidence band – No Standard Civil Engineering Component - therefore no proportion of cost required to be assigned to confidence bands in these columns.

Combined Upper Bound Optimism Bias (%) – Result from: **66.00%**

Adjusted Optimism Bias (%) – Result from: **31.90%**

Contributory factors	Non-standard Civ. Eng. (fixed values - do not adjust)	Standard Civ. Eng. (fixed values - do not adjust)	Combined weight (calculated value - do not adjust)	Confidence Grade Criteria: High Confidence	Medium Confidence	Low Confidence	Additional Guidance
Description	*Fixed values - do not adjust*			*Guidance to inform scoring*	*Guidance to inform scoring*	*Guidance to inform scoring*	*Guidance to inform scoring*
Procurement							
Complexity of contract structure				Clear, well establishment procurement route and processes and/or detailed procurement plan or full commercial business case in place	Contract strategy or outline commercial business case in place, but details still to be developed	No contract strategy or commercial business case in place.	*For business as usual options that will be procured through existing water company frameworks then these may be assessed as high confidence. Options should score low confidence where they involve multiple water companies / asset owners, or may be procured through Direct Procurement for Customers, and where detailed procurements plans have not been developed.*
Late contractor involvement in design		3		Design is business as usual and costs are based upon accurate cost models, or significant contractor involvement in design	Design is business as usual and costs are based upon cost models with medium confidence, or initial contractor involvement in key aspects of design	Design is not business as usual for company and the contractor has not been involved in design	*Where there has not been early contractor involvement then low confidence should be assigned, unless the confidence in the cost models gives an equivalent level of confidence in the estimate.*
Poor contractor capabilities				Contractors and suppliers expected to bid for work have recent experience of similar construction projects and supply of similar process plant and equipment	Contractors and suppliers expected to bid for work have limited recent experience of similar construction projects and supply of similar process plant and equipment	Contractors and suppliers expected to bid for work have little/no recent experience of similar construction projects and supply of similar process plant and equipment	*Option types where there is limited recent experience in the UK (including large reservoirs, reuse and desalination options) should be scored as medium/low confidence.*
Government guidelines				There are multiple recent precedents of procuring projects of a similar nature and detailed procurement guidance is in place	Some recent precedents of procuring projects of a similar nature and detailed procurement guidance is in place	There is limited recent experience of procuring projects of a similar nature and detailed procurement guidance is not in place	*Where an option may be implemented though Direct Procurement for Customers, or other less well established procurement routes then low confidence should be assigned.*
Disputes & claims occurred		21		Scope and payment mechanism clearly defined in contract and no dependencies on third parties	Scope and payment mechanism partially defined and there are no major dependencies on third parties	Scope and payment mechanism currently ill-defined and/or there are significant dependencies on third parties	
Information management				Information management systems between key stakeholders are in place, clearly defined and effective (e.g. project specific, or already existing for a project under an existing framework)	Some key stakeholders for procurement identified and information management system has been initiated, but details are still to be developed before it can be effective.	Key stakeholders for procurement not identified, or information management systems not in place and effective (e.g. project specific, or already existing for a project under an existing framework)	*Where information management systems for contract and stakeholder management have not been initiated then assign low confidence.*
Other	2						
Procurement combined			13.0%				
Project specific							
Design complexity	8			Design is business as usual or design contains complexities but these are well understood and detailed plans and designs are in place to address them	Design is not business as usual due to several complexities. The design mitigations to address these complexities have only been partially understood and addressed.	Design is complex, for example due to the nature of the project or interfaces with existing assets, or constraints. Design mitigations are not yet in place.	*Options with significant design complexities, or constrained sites, and significant integration with existing operational infrastructure may be assigned low confidence. Options that are business as usual, on greenfield, unconstrained sites may be assigned high confidence.*
Degree of Innovation	9			Design is business as usual and/or innovations are well developed and tested for the specific application	Design incorporates technology / innovations that have been partially tested and proven for the specific application.	Design incorporates new technologies and these have not yet been fully tested and proven for the specific application.	*Options using technologies that are well established in the UK should be assigned high confidence. Options where technologies, or the application of technologies, is less well established in the UK (e.g. reuse, desalination) should be assigned medium confidence*
Environmental impact	5	22		Environmental impacts well understood (e.g. impact on receiving water bodies, noise, INNS transfer, designated sites, visual amenity etc), mitigations identified where required and included in costs	Some assessment of environmental impacts has been carried out and mitigations have been identified and costed to address the most significant of these. Other mitigations will be required that have not yet been built into the	Environmental impacts poorly understood (e.g. impact on receiving water bodies, noise, INNS transfer, designated sites, visual amenity etc), or significant environmental issues identified without agreement on mitigation to	*Except for options that are free from environmental constraints/risks it is unlikely that options at Gate 1 would achieve a higher level of confidence than medium at Gate 1 unless environmental risks have been identified, detailed and costed in the QCRA. For options with significant environmental risks that require investigation a low confidence score would be more applicable before accounting for the QCRA.*
Other		18					
Project specific combined			31.0%				
Client specific							
Inadequacy of the Business Case	35	10		Needs have been clearly identified. Key stakeholders needs identified and included in scope where applicable.	Partial identification of needs and initial engagement with stakeholders to refine requirements.	Initial identification of needs and output specification, without engagement with stakeholders to refine requirements	*Confidence likely to be low at Gate 1 unless initial stakeholder requirements identified and reflected in option scope and/or specifically accounted for in QCRA.*
Large number of stakeholders				Stakeholder approvals not required, or key stakeholder approvals obtained, or key stakeholders largely supportive	Some key stakeholders identified and views obtained, however some other stakeholders remain unidentified.	Stakeholders not clearly identified, views not known or some stakeholders are in active opposition	
Funding availability	5			Funding for the project is secure (e.g. project fully funded through price review / pass through arrangement)	Project funding uncertain e.g. project subject to efficiency challenges at price review which may require business case to be revisited	Project funding not secure, e.g. project dependent in part on partnership funding which is not secure.	*For options to be funded through the RAPID gated SRO process, or through a price review, a medium confidence score is considered appropriate.*
Project management team	2			Scope of work is business as usual for company delivery teams.	Company delivery team has some experience in implementing projects of this nature, but their relevant experience is not extensive.	Company delivery teams are not experienced in implementing projects of this nature	
Poor project intelligence	9	7		Good understanding of key project data and no key assumptions made where there is significant uncertainty (e.g. ground conditions, condition of existing assets, treatment requirements)	Partial understanding of key project data and there has been some work undertaken to reduce the uncertainty around key assumptions (e.g. ground conditions, condition of existing assets, treatment requirements)	Significant gaps in project data and key assumptions made where there is significant uncertainty	
Other							
Client specific combined			34.0%				
Environment							
Public relations		9		Project business as usual and not expected to raise local opposition, or local stakeholders aware and largely primarily supportive, no protest expected.	Project could lead to some local opposition, however there has been some engagement with key stakeholders and it is likely that the major concerns raised can be resolved	Project could lead to local opposition once local stakeholders aware, or stakeholders aware and evidence of significant local opposition	
Site characteristics	5	3		Site information well understood (e.g. archaeology, heritage assets, contamination etc.), mitigations identified where required and included in costs	Site information partially understood (e.g. archaeology, heritage assets, contamination etc.), mitigations identified where required and included in costs	Site information poorly understood (e.g. archaeology, heritage assets, contamination etc.) and mitigations not identified	
Permits / consents / approvals				No permits and consents required, or permits and consents obtained.	Permits and consents required, but regulators, planning authorities and Government supportive	Permits, consents and approvals required from regulators, planning authorities and/or Government and obtaining these presents a material risk	*Confidence likely to be low at Gate 1 unless option is business as usual or risks well developed and costed in QRA.*
Other							
Environment combined			8.5%				
External influences							
Political				Project is either unlikely to attract political attention, or political stakeholders are supportive	Project could attract political attention, while there is not cross-party political support the majority of political stakeholders are likely to be supportive	Project has the potential to attract political attention and lacks cross-party political support	*Projects that are high profile and considered likely to be controversial should be assigned low confidence.*
Economic	3	7		Project has a short lead time and is less vulnerable to changes in funding and input costs	Project has a medium lead time so there is some risk that a change in the economic environment could impact demands and / or input costs.	Project has long lead time and change in economic environment could impact demands and/or input costs	*When considering lead times (including planning and development time) assume short for ≤5 years, Medium for 6-10 years, Long for >10years.*
Legislations/regulations	8			Project is business as usual and /or required standards and regulations are well established and unlikely to change	Required standards and regulations are relatively new and therefore less well established.	Key standards and regulations are under development, or subject to change.	*For new technologies or novel applications of existing technologies in the UK that potentially require regulatory approvals (e.g. for environmental or drinking water quality reasons) then a medium or low confidence should be applied. High confidence should be applied for business as usual schemes where no regulatory or legislative risks are envisaged.*
Technology	8			Technology (e.g. treatment processes, smart metering technology) is well established, accepted by regulators and unlikely to change during the project lead time	Technology (e.g. treatment processes, smart metering technology) is relatively new. While it has not yet been accepted by regulators, it is likely to be and therefore a change in the requirements is unlikely.	Technology (e.g. treatment processes, smart metering technology) is new and/or is subject to rapid innovation which may lead to changes in requirements	*Treated water transfers and conventional treatment processes should be scored high confidence. For novel treatment processes or novel application of tested treatment processes (e.g. for INNS transfer mitigation, desalination or reuse) medium confidence is considered appropriate*
Other	1						
External influences combined			13.5%				

Contributory factors	Combined Upper Bound Optimism Bias (%)	Non-Standard: High	Non-Standard: Medium	Non-Standard: Low	Mitigation Factor	Standard: High	Standard: Medium	Standard: Low	Mitigation Factor	Adjusted Optimism Bias (%)	Check for Non-Standard components	Check for Standard components	Scoring comment	Associated costed risk	Change as a result of considering the costed risks
	66.00%	Required	Required	Required		Not required	Not required	Not required		31.90%					
Description	*Calculated cell*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Insert proportion in confidence band (0 - 1)*	*Calculated mitigation factors*	*Calculated cell*	*Check proportion sums to 1 where option contains Non-Standard components*	*Check proportion sums to 1 where option contains Standard components*	*Describe the reasoning behind assignment to confidence bands.*	*List the risks from QCRA which are relevant for the OB contributory factor. These can be found by using the filters on the QCRA register which makes use of the Risk to OB Contributory Factor mapping table provided in the "Reference Information" tab.*	*Outline how the OB mitigation factor has been changed when accounting for associated costed risks in the QCRA.*
Procurement		Required	Required	Required		Not required	Not required	Not required							
Complexity of contract structure		1			1				0		OK	OK	This is likely to be conventional procurement due to interaction with exiting elements and relatively low cost (DPC>£150m now proposed by Ofwat) KPMG confirmed this will not be procured through DPC route	R032 - Historic Information on costs	No change
Late contractor involvement in design				1	0				0		OK	OK	No contractor involvement to date. ECI is now a well established process; therefore, this risk should be minimal and will be mitigated. No ECI yet.	R032 - Historic Information on costs	No change
Poor contractor capabilities			1		0.5				0		OK	OK	It is likely that the tender process will be a staged OJEU process with only competent contractors passing through the second tender stage.	R032 - Historic Information on costs R030 - Power Supply insufficient R028 - Phosphate removal opportunity R027 - Opportunity to reduce treatment requirements	No change
Government guidelines				1	0				0		OK	OK	This project considered major, in terms of procurement, based on size and scale. KPMG confirmed this will not be procured through DPC route	R032 - Historic Information on costs	No change
Disputes & claims occurred			1		0.5				0		OK	OK	We are looking at a worst case scenario here, so effectively no dependence on third parties	R032 - Historic Information on costs R030 - Power Supply insufficient R028 - Phosphate removal opportunity R027 - Opportunity to reduce treatment requirements	No change
Information management			1		0.5				0		OK	OK	Information management at early stage of development. Some stakeholders have been identified during the Concept Design investigations. This risk will be mitigated as the scheme advances through the Gate process. Asite set up but not effective yet.	NA	NA
Other															
Procurement combined	8.58%	Average Mitigation Factor			0.417	Average Mitigation Factor			0.000	5.330%	Average Mitigation Factor				
Project specific		Required	Required	Required		Not required	Not required	Not required							
Design complexity				1	0				0		OK	OK	Design is considered complex. There will be significant interfaces on the WwTP site required to enable the upgrading works to proceed without affecting current treatment processes.	R030 - Power Supply insufficient R028 - Phosphate removal opportunity R027 - Opportunity to reduce treatment requirements	OB scored accordingly bearing in mind the impact of these costed risks
Degree of Innovation			1		0.5				0		OK	OK	New to UK but used elsewhere is medium as per guidance	R030 - Power Supply insufficient R028 - Phosphate removal opportunity R027 - Opportunity to reduce treatment requirements	OB scored accordingly bearing in mind the impact of these costed risks
Environmental impact		1			1				0		OK	OK	Process is now designed to meet all possible consenting needs	R023 - Compensatory habitats R025 - Treatment capacity of Minworth R026 - Treatment proposed is satisfactory R033 - Bathing Waters R034 - Diversion of flow not achievable	OB scored accordingly bearing in mind the impact of these costed risks
Other															
Project specific combined	20.46%	Average Mitigation Factor			0.500	Average Mitigation Factor			0.000	11.160%	Average Mitigation Factor				
Client specific		Required	Required	Required		Not required	Not required	Not required							
Inadequacy of the Business Case			1		0.5				0		OK	OK	As one of 17 SROs, the need for this particular scheme (or any other) will be unclear until the gated process is much further developed.	NA	NA
Large number of stakeholders		1			1				0		OK	OK	For Minworth treatment the only stakeholder is the EA, and we have designed for worst case	R020 - delay to consent	OB scored accordingly bearing in mind the impact of these costed risks
Funding availability			1		0.5				0		OK	OK	Funding is ring fenced and will be allowed for under enhancement if it goes ahead	NA	NA
Project management team			1		0.5				0		OK	OK	Project management team yet to be identified. Last in-house high value scheme suffered significant problems. For NS Water treatment on a Waste site	NA	NA
Poor project intelligence			1		0.5				0		OK	OK	We have effectively gone worst case on need - no reason for bias on this element	R021 - anti-floatation and dewatering	No change
Other															
Client specific combined	22.44%	Average Mitigation Factor			0.600	Average Mitigation Factor			0.000	10.200%	Average Mitigation Factor				
Environment		Required	Required	Required		Not required	Not required	Not required							
Public relations		1			1				0		OK	OK	Due to the size of the conveyance works and the potentially emotive issue of transferring water (treated effluent) into another catchment, it is likely that local opposition will arise. For NS No known major objectors.	NA	NA
Site characteristics			1		0.5				0		OK	OK	The following desktop analysis of the WwTP site has been completed: Environment, Archaeology and Building Heritage, Geotechnical and Flood Risk potential. Some mitigation measures have already been identified. These risks will be further mitigated as additional site investigations progress.	R021 - anti-floatation and dewatering	No change
Permits / consents / approvals		1			1				0		OK	OK	No permits sought to date. This risk will be mitigated as investigative works and designs proceed. Permitting not confirmed.	R020 - delay to consent	OB scored accordingly bearing in mind the impact of these costed risks
Other															
Environment combined	5.61%	Average Mitigation Factor			0.833	Average Mitigation Factor			0.000	1.360%	Average Mitigation Factor				
External influences		Required	Required	Required		Not required	Not required	Not required							
Political		1			1				0		OK	OK	Project likely to attract political attention. Political party support unknown. For NS Public may view as effluent reuse	NA	NA
Economic			1		0.5				0		OK	OK	Should be medium based on guidance	NA	NA
Legislations/regulations			1		0.5				0		OK	OK	As above - although uncertain we have designed for the worst case so bias not appropriate	R020 - delay to consent	No change
Technology			1		0.5				0		OK	OK	The proposed treatment processes are based on proven process treatment units. However, this may be the first combination of these treatment units in one works to remediate waste water final effluent.	R020 - delay to consent R030 - Power Supply insufficient R028 - Phosphate removal opportunity	OB scored accordingly bearing in mind the impact of these costed risks
Other															
External influences combined	8.91%	Average Mitigation Factor			0.625	Average Mitigation Factor			0.000	3.848%	Average Mitigation Factor				

A.5 NPV / AIC Templates

The following AIC sheets are available on request:

Options	
A7W13155-GT-SPR-200033	AIC RevG Tool STT57
A7W13155-GT-SPR-200034	AIC RevG Tool STT115
A7W13155-GT-SPR-200035	AIC RevG Tool TREAT57_STT57
A7W13155-GT-SPR-200036	AIC RevG Tool TREAT57 ALT STT57
A7W13155-GT-SPR-200037	AIC RevG Tool TREAT57_GUC 57
A7W13155-GT-SPR-200038	AIC RevG Tool TREAT115 STT115
A7W13155-GT-SPR-200039	AIC RevG Tool TREAT 115 ALT_STT15
A7W13155-GT-SPR-200040	AIC RevG Tool TREAT115_GUC 115
A7W13155-GT-SPR-200041	AIC RevG Tool TREAT_115_STT57_GUC57
A7W13155-GT-SPR-200043	AIC RevG Tool TREAT172_STT115_GUC57
A7W13155-GT-SPR-200044	AIC RevG Tool TREAT172_STT57_GUC115
A7W13155-GT-SPR-200045	AIC RevG Tool TREAT230_STT115_GUC115

Solutions	
A7W13155-GT-SPR-200053	AIC RevG Tool STT15_TREAT230_STT115_GUC115
A7W13155-GT-SPR-200054	AIC RevG Tool STT57&TREAT115_STT57_GUC57
A7W13155-GT-SPR-200055	AIC RevG Tool STT57&TREAT172_STT57_GUC115
A7W13155-GT-SPR-200056	AIC RevG Tool STT57_TREAT57 ALT_STT57
A7W13155-GT-SPR-200057	AIC RevG Tool STT115_TREAT115 ALT STT115
A7W13155-GT-SPR-200058	AIC RevG Tool STT115_TREAT115_STT115
A7W13155-GT-SPR-200059	AIC RevG Tool STT115_TREAT115_STT115
A7W13155-GT-SPR-200060	AIC RevG Tool STT115_TREAT172_STT15_GUC57
A7W13155-GT-SPR-200061	AIC RevG Tool STT57_TREAT57_STT57

A.6 OPEX Estimate Details

A7W13155-CY-SPR-210008	Preferred Route OPEX estimate - STT115
A7W13155-WT-SPR-220006	Treatment OPEX Summary
A7W13155-WT-SPR-220022	Treatment OPEX estimate - TREAT57_STT57
A7W13155-WT-SPR-220023	Treatment OPEX estimate - TREAT57.ALT_STT57
A7W13155-WT-SPR-220024	Treatment OPEX estimate - TREAT57_GUC57
A7W13155-WT-SPR-220025	Treatment OPEX estimate - TREAT115_STT115
A7W13155-WT-SPR-220026	Treatment OPEX estimate - TREAT115.ALT_STT115
A7W13155-WT-SPR-220027	Treatment OPEX estimate - TREAT115_GUC115
A7W13155-WT-SPR-220028	Treatment OPEX estimate - TREAT115_STT57_GUC57
A7W13155-WT-SPR-220030	Treatment OPEX estimate - TREAT172_STT115_GUC57
A7W13155-WT-SPR-220031	Treatment OPEX estimate - TREAT172_STT57_GUC115
A7W13155-WT-SPR-220032	Treatment OPEX estimate - TREAT230_STT115_GUC115

Commercial information redacted

STT115/57: Input Data		
Running Time	24	hrs
Density	1000	kg/m^3
g	9.81	m/s^2
Pumping Station Overall Efficiency	65%	%
Energy Cost	[redacted]	£/kWh
Sweet Flow	10%	of Peak Flow

Sweetening flow	3.00	Ml/d
	0.035	m^3/s
Percentage of the time operating with sweet flow per year	90%	
Pump lift (m) Sweetening Flow	68.2	m
Power (MW) Sweetening Flow	0.04	MW
Energy Cost per year (£)	£ [redacted]	£/year
Mega liters of water transferred per year	986	Ml/year
Max Variable Opex (£/Ml)	£ [redacted]	£/Ml

Peak flow STT115	115	Ml/d
	1.33	m^3/s
Percentage of the time operating with peak flow per year	10%	
Pump lift (m) Peak Flow	142.9	m
Power (MW) Peak Flow	2.87	MW
Energy Cost per year (£)	£ [redacted]	£/year
Mega liters of water transferred per year	4,198	Ml/year
Max Variable Opex (£/Ml)	£ [redacted]	£/Ml

Peak flow STT57	57	Ml/d
	0.66	m^3/s
Percentage of the time operating with peak flow per year	10%	
Pump lift (m) Peak Flow	142.9	m
Power (MW) Peak Flow	1.42	MW
Energy Cost per year (£)	£ [redacted]	£/year
Mega liters of water transferred per year	2,081	Ml/year
Max Variable Opex (£/Ml)	£ [redacted]	£/Ml

Maintenance Activity for Pumping Station	Servicing Hours	Nos of Activity per year	Manhours [i]	Nos. of Staff [ii]	Labour cost per hr [iii]	Total labour cost [1] = [i] x [ii] x [iii]	Total material cost [2]	Total activity cost per pumpset = [1] + [2]
Quarterly inspection/lubrication/condition monitoring	[redacted]							
Yearly inspection/alignment check								
Change mechanical seals								
Pump overhaul								
Annual OPEX cost for each pumpsets (irresptive of pump size)								

Pumping Station	Flow rate	Pump configuration	Annual OPEX
Peak flow	115MLD	4 pumps	[redacted]
Sweetening flow	11.5 MLD	1 pump	
Annual Pumpset OPEX (£)			

Fixed OPEX valid for STT57 & 115 - same pump installation

Pipeline	Annual OPEX
Inspection	[redacted]
Operations	
Planned maintenance	
Reactive maintenance	
Refurb, Replace & Disposal (Pre-NPV Annualised)	
Annual Pipeline OPEX (£) Pre-NPV	

Max Fixed Opex (£ /yr)	[redacted]
Max Variable Opex (£/Ml)	
Max Variable Opex (£ /yr)	

Treatment OPEX summary

Options	Max Fixed Opex (£ /yr)	Variable (£/yr)	AWTP Max Capacity (Mld)	Mega liters treated per year (Ml/yr)	Max Variable Opex (£/Ml)
TREAT57_STT	£ 904,951	£ 1,942,628	57	5472	£ 355
TREAT57.ALT_STT	£ 278,112	£ 787,953	57	5472	£ 144
TREAT57_GUC	£ 904,951	£ 2,991,240	57	9833	£ 304
TREAT115_STT	£ 1,404,302	£ 3,530,440	115	11040	£ 320
TREAT115.ALT_STT	£ 391,013	£ 1,281,364	115	11040	£ 116
TREAT115_GUC	£ 1,404,302	£ 5,401,137	115	19838	£ 272
TREAT115_STT57_GUC57	£ 1,404,302	£ 3,764,955	115	13698	£ 275
TREAT172 STT115 & GUC57	£ 1,869,590	£ 5,087,896	172	18048	£ 282
TREAT172 STT57 & GUC115	£ 1,869,590	£ 5,655,201	172	23094	£ 245
TREAT230	£ 2,334,315	£ 6,865,857	230	27270	£ 252

Commercial information redacted

TREAT57_STT

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5	UV Disinfection							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT57.ALT_STT

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5	UV Disinfection							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT57_GUC

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT115_STT

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5	UV Disinfection							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT115.ALT_STT

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5	UV Disinfection							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT115_GUC

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT115_STT57_GUC57

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5								
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT172 STT115 & GUC57

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5								
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

Commercial information redacted

TREAT172 STT57 & GUC115

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5								
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

TREAT230

Commercial information redacted

Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Repair & Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station	[redacted]						
2	Ozone (Serpetine)							
3	BAC Filter							
4	GAC Filter							
5								
6	Backwash Returns							
7	Floc-Sed (CoMag)							
8	Liquid Chemical - Ferric							
9	Liquid Chemical - CatPoly							
10	Liquid Chemical - Peroxide							
11	Liquid Chemical - SBS							
12	Liquid Chemical - PhosAcid							
13	Liquid Chemical - FilterPoly							
14	Liquid Chemical - Hypo							
15	Liquid Chemical - NaOH							
16	Interstage PS							
Total								

A.7 Carbon Estimate Details

A7W13155-GT-SPR-200046	Carbon calculations summary
A7W13155-CY-SPR-210012	Preferred Route Carbon calculation - STT57
A7W13155-CY-SPR-210013	Preferred Route Carbon calculation - STT115
A7W13155-WT-SPR-220033	Treatment Carbon calculation - TREAT57_STT57
A7W13155-WT-SPR-220034	Treatment Carbon calculation - TREAT57.ALT_STT57
A7W13155-WT-SPR-220035	Treatment Carbon calculation - TREAT57_GUC57
A7W13155-WT-SPR-220036	Treatment Carbon calculation - TREAT115_STT115
A7W13155-WT-SPR-220037	Treatment Carbon calculation - TREAT115.ALT_STT115
A7W13155-WT-SPR-220038	Treatment Carbon calculation - TREAT115_GUC115
A7W13155-WT-SPR-220039	Treatment Carbon calculation - TREAT115_STT57_GUC57
A7W13155-WT-SPR-220041	Treatment Carbon calculation - TREAT172_STT115_GUC57
A7W13155-WT-SPR-220042	Treatment Carbon calculation - TREAT172_STT57_GUC115
A7W13155-WT-SPR-220043	Treatment Carbon calculation - TREAT230_STT115_GUC115

Preferred Route	Embodied Carbon (tCO2e)	Operational Carbon (tCO2e)
STT57	91,073	49,997
STT115	91,073	99,994

Years of Operation
71

Treatment Option		Embodied Carbon (tCO2e)	Operational Carbon (tCO2e) - Annual		Total Whole Life Carbon (tCO2e)
Project Reference	STW Carbon tool reference		Grid power Operational Carbon (tCO2e)	Non-power related operational carbon	
TREAT57_STT57	Option 1	5,379	572	481	80,097
TREAT57.ALT_STT57	Option 9	732	424	464	63,753
TREAT57_GUC57	Option 5	5,379	1,098	864	144,679
TREAT115_STT115	Option 2	8,014	938	970	143,487
TREA115.ALT_STT115	Option 10	1,280	639	464	79,534
TREAT115_GUC115	Option 6	8,014	1,803	1,743	259,715
TREAT115_STT57_GUC57	Option 7	8,014	1,066	1,203	169,129
TREAT172_STT115_GUC57	Option 3	10,443	1,377	1,585	220,775
TREAT172_STT57_GUC115	Option 8	10,443	1,673	2,029	273,264
TREAT230_STT115_GUC115	Option 4	13,091	1,842	2,395	313,960

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option B

Brief Description of works

Gate 2 - WRMP19 - B (115 MLD)
Total Pipe Length: 31,400 m.

Key
User Selection / Input
Information - No Input Required
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

	Item	Works	Staee	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
				Click to view Asset Index												
Free Entry	Asset 1								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 2								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 3								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 4								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 5								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 6								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 7								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 8								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 9								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 10								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 11								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 12								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 13								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 14								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 15								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 16								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 17								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 18								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 19								N/A - Free Entry				N/A - Free Entry			
Free Entry	Asset 20								N/A - Free Entry				N/A - Free Entry			
Choose assets from drop-downs	Pipe Rising Main Length within field	Sewerage (Infra)	Sewerage (Infra)	Sewerage (Infra)	Sewer Rising Main - Open Cut Depth 3 - 5m Field / Verge	17,663.0	Length (m)	Int. Diameter (mm)	75.0	2,400.0	900.00	Not Applicable	N/A	N/A		49511.74
Choose assets from drop-downs	Pipe Gravity Main Length within field	Sewerage (Infra)	Sewerage (Infra)	Sewerage (Infra)	Sewer (Gravity) - Open Cut Depth 3 - 5m Field / Verge	11,111.0	Length (m)	Int. Diameter (mm)	75.0	2,400.0	1,050.00	Not Applicable	N/A	N/A		39445.64
Choose assets from drop-downs																
Choose assets from drop-downs	Building	Cross Functional	Site Wide	Site Wide	Building	1.0	Number	Area (m2)	10.0	4,500.0	500.00	Height(m)	2.0	10.0	10.00	374.14
Choose assets from drop-downs	Sewerage PS	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2	3,000.0	2,220.00	Not Applicable	N/A	N/A		263.16
Choose assets from drop-downs	Sewerage PS	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	2.0	Number	T_Power (KW)	0.2	3,000.0	900.00	Not Applicable	N/A	N/A		73.15
Choose assets from drop-downs	Break Pressure Tank	Sewerage (Non-Infra)	Shaft Tank	Shaft Tank	Shaft Tank	2.0	Number	Capacity (m3)	14.0	7,800.0	2,420.00	Not Applicable	N/A	N/A		408.71
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Surge Vessel	Surge Vessel	3.0	Number	Volume (m3)	0.2	30.0	30.00	Not Applicable	N/A	N/A		45.69
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Valves	Valve - Air Release	2.0	Number	Diameter (mm)	20.0	250.0	50.00	Not Applicable	N/A	N/A		0.14
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Valves	Valve - Air Release	1.0	Number	Diameter (mm)	20.0	250.0	75.00	Not Applicable	N/A	N/A		0.09
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	147.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	147.00	57.02
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	103.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	103.0	27.99
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	153.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	153.0	61.77
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	77.0	15.64
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	266.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	266.0	186.70
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	80.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	80.0	16.89
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	119.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	119.0	37.37
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	62.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	62.0	10.14
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	85.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	85.0	19.06
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	84.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	84.0	18.62
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	82.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	82.0	17.74
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	57.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	57.0	8.57
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	72.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	72.0	13.68
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	81.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	81.0	17.64
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	54.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	54.0	7.84
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	50.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	50.0	6.72
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	294.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	294.0	232.37
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	43.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	43.0	4.97
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	77.0	15.94
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	77.0	15.94
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	127.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	127.0	43.36
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	113.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	113.0	34.33
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	98.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	98.00	25.82
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	116.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	116.00	35.51
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	23.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	23.00	1.40
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	55.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	55.00	7.98
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	49.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	49.00	6.34
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	36.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	36.00	3.42
Choose assets from drop-downs	Asset 59															
Choose assets from drop-downs	Asset 60															
Choose assets from drop-downs	Asset 61															
Choose assets from drop-downs	Asset 62															
Choose assets from drop-downs	Asset 63															
Choose assets from drop-downs	Asset 64															
Choose assets from drop-downs	Asset 65															
Choose assets from drop-downs	Asset 66															
Choose assets from drop-downs	Asset 67															
Choose assets from drop-downs	Asset 68															
Choose assets from drop-downs	Asset 69															
Choose assets from drop-downs	Asset 70															
Choose assets from drop-downs	Asset 71															
Choose assets from drop-downs	Asset 72															
Choose assets from drop-downs	Asset 73															
Choose assets from drop-downs	Asset 74															
Choose assets from drop-downs	Asset 75															
Choose assets from drop-downs	Asset 76															
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Choose assets from drop-downs	Asset 78															
Choose assets from drop-downs	Asset 79															
Choose assets from drop-downs	Asset 80															
Choose assets from drop-downs	Asset 81															
Choose assets from drop-downs	Asset 82															
Choose assets from drop-downs	Asset 83															
Choose assets from drop-downs	Asset 84															
Choose assets from drop-downs	Asset 85															
Choose assets from drop-downs	Asset 86															
Choose assets from drop-downs	Asset 87															

Severn Trent Water Carbon Calculator

Operation - Gate 2, Option B

Description of operational activities / annual requirements

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	5,886,720.00	1,249.97	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year			
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year			
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year			
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems, Septicity control (Networks)	Liquid	kg / year			

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option B
Brief Description of works

Gate 2 - WRMP19 - B (57 MLD)
Total Pipe Length: 31,400 m.

Key
User Selection / Input
Information - No Input Required
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

	Item	Works	Staee	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
		Click to view Asset Index														
Free Entry	Asset 1							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 2							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 3							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 4							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 5							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 6							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 7							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 8							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 9							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 10							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 11							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 12							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 13							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 14							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 15							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 16							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 17							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 18							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 19							N/A - Free Entry				N/A - Free Entry				
Free Entry	Asset 20							N/A - Free Entry				N/A - Free Entry				
Choose assets from drop-downs	Pipe Rising Main Length within field	Sewerage (Infra)	Sewerage (Infra)	Sewerage (Infra)	Sewer Rising Main - Open Cut Depth 3 - 5m Field / Verge	17,663.0	Length (m)	Int. Diameter (mm)	75.0	2,400.0	900.00	Not Applicable	N/A	N/A		49511.74
Choose assets from drop-downs	Pipe Gravity Main Length within field	Sewerage (Infra)	Sewerage (Infra)	Sewerage (Infra)	Sewer (Gravity) - Open Cut Depth 3 - 5m Field / Verge	11,111.0	Length (m)	Int. Diameter (mm)	75.0	2,400.0	1,050.00	Not Applicable	N/A	N/A		39445.64
Choose assets from drop-downs																
Choose assets from drop-downs	Building	Cross Functional	Site Wide	Site Wide	Building	1.0	Number	Area (m2)	10.0	4,500.0	500.00	Height(m)	2.0	10.0	10.00	374.14
Choose assets from drop-downs	Sewerage PS	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2	3,000.0	2,220.00	Not Applicable	N/A	N/A		203.16
Choose assets from drop-downs	Sewerage PS	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	2.0	Number	T_Power (KW)	0.2	3,000.0	900.00	Not Applicable	N/A	N/A		73.15
Choose assets from drop-downs	Break Pressure Tank	Sewerage (Non-Infra)	Shaft Tank	Shaft Tank	Shaft Tank	2.0	Number	Capacity (m3)	14.0	7,800.0	2,420.00	Not Applicable	N/A	N/A		408.71
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Surge Vessel	Surge Vessel	3.0	Number	Volume (m3)	0.2	30.0	30.00	Not Applicable	N/A	N/A		45.69
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Valves	Valve - Air Release	2.0	Number	Diameter (mm)	20.0	250.0	50.00	Not Applicable	N/A	N/A		0.14
Choose assets from drop-downs	Surge	Cross Functional	Site Wide	Valves	Valve - Air Release	1.0	Number	Diameter (mm)	20.0	250.0	75.00	Not Applicable	N/A	N/A		0.09
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	147.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	147.00	57.02
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	103.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	103.0	27.99
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	153.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	153.0	61.77
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	77.0	15.64
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	266.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	266.0	186.70
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	80.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	80.0	16.89
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	119.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	119.0	37.37
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	62.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	62.0	10.14
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	85.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	85.0	19.06
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	84.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	84.0	18.62
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	82.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	82.0	17.74
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	57.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	57.0	8.57
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	72.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	72.0	13.68
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	81.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	81.0	17.64
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	54.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	54.0	7.84
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	50.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	50.0	6.72
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	294.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	294.0	232.37
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	43.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	43.0	4.97
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	77.0	15.94
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	77.0	15.94
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	127.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	127.0	43.36
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	113.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	113.0	34.33
Choose assets from drop-downs	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	98.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0	98.00	25.82
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	116.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	116.00	35.51
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	23.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	23.00	1.40
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	55.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	55.00	7.98
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	49.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	49.00	6.34
Choose assets from drop-downs	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	36.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	36.00	3.42
Choose assets from drop-downs	Asset 59															
Choose assets from drop-downs	Asset 60															
Choose assets from drop-downs	Asset 61															
Choose assets from drop-downs	Asset 62															
Choose assets from drop-downs	Asset 63															
Choose assets from drop-downs	Asset 64															
Choose assets from drop-downs	Asset 65															
Choose assets from drop-downs	Asset 66															
Choose assets from drop-downs	Asset 67															
Choose assets from drop-downs	Asset 68															
Choose assets from drop-downs	Asset 69															
Choose assets from drop-downs	Asset 70															
Choose assets from drop-downs	Asset 71															
Choose assets from drop-downs	Asset 72															
Choose assets from drop-downs	Asset 73															
Choose assets from drop-downs	Asset 74															
Choose assets from drop-downs	Asset 75															
Choose assets from drop-downs	Asset 76															
Choose assets from drop-downs	Asset 77															
Choose assets from drop-downs	Asset 78															
Choose assets from drop-downs	Asset 79															
Choose assets from drop-downs	Asset 80															
Choose assets from drop-downs	Asset 81															
Choose assets from drop-downs	Asset 82															
Choose assets from drop-downs	Asset 83															
Choose assets from drop-downs	Asset 84															
Choose assets from drop-downs	Asset 85															
Choose assets from drop-downs	Asset 86															
Choose assets from drop-downs	Asset 87															

Severn Trent Water Carbon Calculator

Operation - Gate 2, Option B
Description of operational activities / annual requirements

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	2,943,360.00	624.99	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year			
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year			
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year			
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems, Septicity control (Networks)	Liquid	kg / year			

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 1

Brief Description of works

TREAT57_STT57

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Free Entry															
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		5,400.00	tCO2e/m3	N/A - Free Entry		0.03	185.93
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Choose assets from drop-downs															
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2	3,000.0	112.00	Not Applicable	N/A	N/A		14.03
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	160.00	Height(m)	2.0	15.0	12.00	143.67
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	131.00	Not Applicable	N/A	N/A		72.52
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	443.50	Not Applicable	N/A	N/A		85.72
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	103.87	Not Applicable	N/A	N/A		52.68
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	782.00	Height(m)	2.0	15.0	12.00	808.18
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	6.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		93.89
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	4.0	Number	T_Volume (m3)	25.0	8,000.0	421.00	Not Applicable	N/A	N/A		62.58
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	3.0	Number	T_Power (KW)	0.5	1,000.0	223.00	Not Applicable	N/A	N/A		27.69
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	4.0	Number	Volume (m3)	5.0	300.0	198.00	Not Applicable	N/A	N/A		93.92
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	19.00	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	3.0	Number	T_Power (KW)	0.5	1,000.0	559.00	Not Applicable	N/A	N/A		68.69
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	336.00	Height(m)	2.0	15.0	12.00	301.71
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	56.00	Height(m)	2.0	15.0	12.00	57.87
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	23.00	Not Applicable	N/A	N/A		9.46
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	15.00	Not Applicable	N/A	N/A		8.81
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	210.70	Not Applicable	N/A	N/A		46.84
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	78.90	Not Applicable	N/A	N/A		31.58
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,500.00	Height(m)	2.0	15.0	12.00	1550.22
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	375.00	Height(m)	2.0	15.0	12.00	387.56
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	12.00	89.79
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	500.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		41.70
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	15.00	Not Applicable	N/A	N/A		0.68
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	36,000.00	Not Applicable	N/A	N/A		0.00
Asset 55															
Asset 56															
Asset 57															
Asset 58															
Asset 59															
Asset 60															
Asset 61															
Asset 62															
Asset 63															
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Asset 83															
Asset 84															
Asset 85															
Asset 86															
Asset 87															

Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 1

Description of operational activities / annual requirements

57 MLD - 10% of the year // 11 MLD 90% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	2692466.294	571.69	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	1,287.53	1.55	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	41,040.00	15.18	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	198260.8696	159.20	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	4651.2	3.78	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	273600	300.96	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 2

Brief Description of works

TREAT115_STT115

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Scale Min	Primary Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Scale Min	Secondary Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		5,700.00	tCO2e/m3	N/A - Free Entry		0.03	196.26
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	4.0	Number	T_Power (KW)	0.2	3,000.0	336.00	Not Applicable	N/A	N/A		55.39
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	374.00	Height(m)	2.0	15.0	12.00	335.83
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	264.00	Not Applicable	N/A	N/A		114.89
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	858.50	Not Applicable	N/A	N/A		149.70
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	201.06	Not Applicable	N/A	N/A		100.80
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,443.00	Height(m)	2.0	15.0	12.00	1491.31
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	12.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		187.77
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	6.0	Number	T_Volume (m3)	25.0	8,000.0	844.00	Not Applicable	N/A	N/A		176.62
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	447.00	Not Applicable	N/A	N/A		73.45
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	6.0	Number	Volume (m3)	5.0	300.0	266.00	Not Applicable	N/A	N/A		173.29
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	28.75	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	597.00	Not Applicable	N/A	N/A		97.72
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	512.00	Height(m)	2.0	15.0	12.00	459.75
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	168.00	Height(m)	2.0	15.0	12.00	173.62
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	2.0	Number	Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		18.99
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	20.00	Not Applicable	N/A	N/A		9.21
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	422.10	Not Applicable	N/A	N/A		61.90
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	2.0	Number	Capacity (m3)	70.0	3,000.0	80.80	Not Applicable	N/A	N/A		63.77
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,000.00	Height(m)	2.0	15.0	12.00	2066.96
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	625.00	Height(m)	2.0	15.0	12.00	645.93
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	175.00	Height(m)	2.0	15.0	12.00	157.14
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	700.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		58.38
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	37.00	Not Applicable	N/A	N/A		1.59
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	38,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
Asset 56															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 2

Description of operational activities / annual requirements

115 MLD - 10% of the year // 23 MLD 90% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	4419025.397	938.29	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	2,597.65	3.12	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	82,800.00	30.64	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	400,000.00	321.20	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	9,384.00	7.63	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	552,000.00	607.20	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 3

Brief Description of works

TREAT172_STT115_GUC57

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Scale Min	Primary Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Scale Min	Secondary Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		6,300.00	tCO2e/m3	N/A - Free Entry		0.03	216.92
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	5.0	Number	T_Power (KW)	0.2	3,000.0	597.00	Not Applicable	N/A	N/A		122.15
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	459.00	Height(m)	2.0	15.0	12.00	412.16
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	394.00	Not Applicable	N/A	N/A		155.92
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	1,341.40	Not Applicable	N/A	N/A		221.71
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	314.16	Not Applicable	N/A	N/A		155.39
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,106.00	Height(m)	2.0	15.0	12.00	2176.51
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	18.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		281.66
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	8.0	Number	T_Volume (m3)	25.0	8,000.0	1,259.00	Not Applicable	N/A	N/A		349.02
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	5.0	Number	T_Power (KW)	0.5	1,000.0	597.00	Not Applicable	N/A	N/A		122.15
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	8.0	Number	Volume (m3)	5.0	300.0	299.00	Not Applicable	N/A	N/A		251.95
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	43.00	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	746.00	Not Applicable	N/A	N/A		121.68
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	150.00	Height(m)	2.0	15.0	5.00	56.12
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	576.00	Height(m)	2.0	15.0	12.00	517.22
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	298.50	Height(m)	2.0	15.0	12.00	308.49
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	3.0	Number	Volume (m3)	1.0	40.0	23.33	Not Applicable	N/A	N/A		28.45
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	25.00	Not Applicable	N/A	N/A		9.62
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	629.70	Not Applicable	N/A	N/A		72.68
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	3.0	Number	Capacity (m3)	70.0	3,000.0	79.80	Not Applicable	N/A	N/A		95.18
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,500.00	Height(m)	2.0	15.0	12.00	2583.70
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	750.00	Height(m)	2.0	15.0	12.00	775.11
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	250.00	Height(m)	2.0	15.0	12.00	224.49
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	900.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		75.06
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	74.60	Not Applicable	N/A	N/A		3.14
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	42,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
Asset 56															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 3

Description of operational activities / annual requirements

172 MLD - 9% of the year // 60 MLD 17% of the year // 34 MLD 74% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	6485419.405	1,377.05	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	4,246.59	5.10	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	135,360.00	50.08	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	653,913.05	525.09	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	15,340.80	12.47	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	902,400.02	992.64	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 4

Brief Description of works

TREAT230_STT115_GUC115

Key

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Scale Min	Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Scale Min	Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		7,800.00	tCO2e/m3	N/A - Free Entry		0.03	268.57
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	6.0	Number	T_Power (KW)	0.2	3,000.0	746.00	Not Applicable	N/A	N/A		182.52
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	544.00	Height(m)	2.0	15.0	12.00	488.48
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	527.00	Not Applicable	N/A	N/A		197.50
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	1,774.00	Not Applicable	N/A	N/A		283.98
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	415.50	Not Applicable	N/A	N/A		203.00
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,760.00	Height(m)	2.0	15.0	12.00	2852.41
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	24.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		375.55
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	10.0	Number	T_Volume (m3)	25.0	8,000.0	1,685.00	Not Applicable	N/A	N/A		588.75
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	6.0	Number	T_Power (KW)	0.5	1,000.0	746.00	Not Applicable	N/A	N/A		182.52
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	10.0	Number	Volume (m3)	5.0	300.0	300.00	Not Applicable	N/A	N/A		315.73
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	46.00	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	5.0	Number	T_Power (KW)	0.5	1,000.0	746.00	Not Applicable	N/A	N/A		152.10
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	150.00	Height(m)	2.0	15.0	5.00	56.12
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	750.00	Height(m)	2.0	15.0	12.00	673.46
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	373.00	Height(m)	2.0	15.0	12.00	385.49
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	3.0	Number	Volume (m3)	1.0	40.0	31.33	Not Applicable	N/A	N/A		30.38
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	30.00	Not Applicable	N/A	N/A		10.02
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	842.50	Not Applicable	N/A	N/A		81.68
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	3.0	Number	Capacity (m3)	70.0	3,000.0	106.90	Not Applicable	N/A	N/A		107.03
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	3,000.00	Height(m)	2.0	15.0	12.00	3100.44
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,050.00	Height(m)	2.0	15.0	12.00	1085.16
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	300.00	Height(m)	2.0	15.0	12.00	269.38
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	1,100.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		91.74
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	74.60	Not Applicable	N/A	N/A		3.14
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	52,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
Asset 56															
Asset 57															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 4

Description of operational activities / annual requirements

230 MLD - 9% of the year // 118 MLD 17% of the year // 61 MLD 17% of the year // 34 MLD 57% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	8675732.712	1,842.12	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	6,416.47	7.70	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	204,525.00	75.67	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	988,043.50	793.40	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	23,179.50	18.84	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	1,363,500.03	1,499.85	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 5

Brief Description of works

TREAT57_GUC57

Key

- User Selection / Input
- Information - No Input Required
- Calculation - LOCKED
- Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		5,400.00	tCO2e/m3	N/A - Free Entry		0.03	185.93
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2	3,000.0	112.00	Not Applicable	N/A	N/A		14.03
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	160.00	Height(m)	2.0	15.0	12.00	143.67
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	131.00	Not Applicable	N/A	N/A		72.52
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	443.50	Not Applicable	N/A	N/A		85.72
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	103.87	Not Applicable	N/A	N/A		52.68
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	782.00	Height(m)	2.0	15.0	12.00	808.18
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	6.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		93.89
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	4.0	Number	T_Volume (m3)	25.0	8,000.0	421.00	Not Applicable	N/A	N/A		62.58
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	3.0	Number	T_Power (KW)	0.5	1,000.0	223.00	Not Applicable	N/A	N/A		27.69
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	4.0	Number	Volume (m3)	5.0	300.0	198.00	Not Applicable	N/A	N/A		93.92
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	19.00	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	3.0	Number	T_Power (KW)	0.5	1,000.0	559.00	Not Applicable	N/A	N/A		68.69
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	336.00	Height(m)	2.0	15.0	12.00	301.71
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	56.00	Height(m)	2.0	15.0	12.00	57.87
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	23.00	Not Applicable	N/A	N/A		9.46
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	15.00	Not Applicable	N/A	N/A		8.81
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	210.70	Not Applicable	N/A	N/A		46.84
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	78.90	Not Applicable	N/A	N/A		31.58
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,500.00	Height(m)	2.0	15.0	12.00	1550.22
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	375.00	Height(m)	2.0	15.0	12.00	387.56
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	12.00	89.79
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	500.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		41.70
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	15.00	Not Applicable	N/A	N/A		0.68
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	36,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 5

Description of operational activities / annual requirements

57 MLD - 25% of the year // 28.5 MLD 17% of the year // 14 MLD 58% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	5172369.459	1,098.25	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	2,313.53	2.78	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	73,743.75	27.29	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	356250	286.07	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	8357.625	6.79	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	491625	540.79	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

Severn Trent Water Carbon Calculator
Embodied - Gate 2, Option 6
Brief Description of works

TREAT115_GUC115

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page
Click to view Inclusions & Exclusions for all assets
Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology
The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Scale Min	Primary Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Scale Min	Secondary Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		5,700.00	tCO2e/m3	N/A - Free Entry		0.03	196.26
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	4.0	Number	T_Power (KW)	0.2	3,000.0	336.00	Not Applicable	N/A	N/A		55.39
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	374.00	Height(m)	2.0	15.0	12.00	335.83
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	264.00	Not Applicable	N/A	N/A		114.89
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	858.50	Not Applicable	N/A	N/A		149.70
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	201.06	Not Applicable	N/A	N/A		100.80
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,443.00	Height(m)	2.0	15.0	12.00	1491.31
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	12.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		187.77
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	6.0	Number	T_Volume (m3)	25.0	8,000.0	844.00	Not Applicable	N/A	N/A		176.62
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	447.00	Not Applicable	N/A	N/A		73.45
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	6.0	Number	Volume (m3)	5.0	300.0	266.00	Not Applicable	N/A	N/A		173.29
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	28.75	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	597.00	Not Applicable	N/A	N/A		97.72
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	512.00	Height(m)	2.0	15.0	12.00	459.75
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	168.00	Height(m)	2.0	15.0	12.00	173.62
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	2.0	Number	Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		18.99
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	20.00	Not Applicable	N/A	N/A		9.21
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	422.10	Not Applicable	N/A	N/A		61.90
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	2.0	Number	Capacity (m3)	70.0	3,000.0	80.80	Not Applicable	N/A	N/A		63.77
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,000.00	Height(m)	2.0	15.0	12.00	2066.96
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	625.00	Height(m)	2.0	15.0	12.00	645.93
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	175.00	Height(m)	2.0	15.0	12.00	157.14
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	700.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		58.38
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	37.00	Not Applicable	N/A	N/A		1.59
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	38,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
Asset 56															
Asset 57															
Asset 58															
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Asset 87															

Severn Trent Water Carbon Calculator
Operation - Gate 2, Option 6
Description of operational activities / annual requirements

115 MLD - 25% of the year // 58 MLD 17% of the year // 29 MLD 58% of the year

Click to return to Project Setup & Navigation page
Click to enter Embodied Carbon / Asset Information
Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	8489180.368	1,802.51	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	4668	5.60	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	148781	55.05	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	718,750.00	577.16	Manually corrected values in the summary table. The spreadsheet does not consider the factor of 80 years for the calculation of chemicals
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	16,861.88	13.71	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	991875	1,091.06	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 7

Brief Description of works

TREAT115_STT57_GUC57

Key

- User Selection / Input
- Information - No Input Required
- Calculation - LOCKED
- Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Scale Min	Primary Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Scale Min	Secondary Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		5,700.00	tCO2e/m3	N/A - Free Entry		0.03	196.26
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	4.0	Number	T_Power (KW)	0.2	3,000.0	336.00	Not Applicable	N/A	N/A		55.39
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	374.00	Height(m)	2.0	15.0	12.00	335.83
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	264.00	Not Applicable	N/A	N/A		114.89
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	858.50	Not Applicable	N/A	N/A		149.70
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	201.06	Not Applicable	N/A	N/A		100.80
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	1,443.00	Height(m)	2.0	15.0	12.00	1491.31
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	12.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		187.77
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	6.0	Number	T_Volume (m3)	25.0	8,000.0	844.00	Not Applicable	N/A	N/A		176.62
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	447.00	Not Applicable	N/A	N/A		73.45
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	6.0	Number	Volume (m3)	5.0	300.0	266.00	Not Applicable	N/A	N/A		173.29
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	28.75	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	597.00	Not Applicable	N/A	N/A		97.72
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	512.00	Height(m)	2.0	15.0	12.00	459.75
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	168.00	Height(m)	2.0	15.0	12.00	173.62
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	2.0	Number	Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		18.99
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	20.00	Not Applicable	N/A	N/A		9.21
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	422.10	Not Applicable	N/A	N/A		61.90
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	2.0	Number	Capacity (m3)	70.0	3,000.0	80.80	Not Applicable	N/A	N/A		63.77
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,000.00	Height(m)	2.0	15.0	12.00	2066.96
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	625.00	Height(m)	2.0	15.0	12.00	645.93
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	175.00	Height(m)	2.0	15.0	12.00	157.14
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	700.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		58.38
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	37.00	Not Applicable	N/A	N/A		1.59
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	38,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
Asset 56															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 7

Description of operational activities / annual requirements

115 MLD - 9% of the year // 60 MLD 17% of the year // 31 MLD 17% of the year // 23 MLD 57% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	5020245.431	1,065.95	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	3,223.06	3.87	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	102,735.00	38.01	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	496,304.35	398.53	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	11,643.30	9.47	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	684,900.01	753.39	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 8

Brief Description of works

TREAT172_STT57_GUC115

Key
User Selection / Input
Information - No Input Required
Calculation - LOCKED
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

Click to view Asset Index

Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Scale Min	Primary Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Scale Min	Secondary Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		6,300.00	tCO2e/m3	N/A - Free Entry		0.03	216.92
Asset 2								N/A - Free Entry				N/A - Free Entry			
Asset 3								N/A - Free Entry				N/A - Free Entry			
Asset 4								N/A - Free Entry				N/A - Free Entry			
Asset 5								N/A - Free Entry				N/A - Free Entry			
Asset 6								N/A - Free Entry				N/A - Free Entry			
Asset 7								N/A - Free Entry				N/A - Free Entry			
Asset 8								N/A - Free Entry				N/A - Free Entry			
Asset 9								N/A - Free Entry				N/A - Free Entry			
Asset 10								N/A - Free Entry				N/A - Free Entry			
Asset 11								N/A - Free Entry				N/A - Free Entry			
Asset 12								N/A - Free Entry				N/A - Free Entry			
Asset 13								N/A - Free Entry				N/A - Free Entry			
Asset 14								N/A - Free Entry				N/A - Free Entry			
Asset 15								N/A - Free Entry				N/A - Free Entry			
Asset 16								N/A - Free Entry				N/A - Free Entry			
Asset 17								N/A - Free Entry				N/A - Free Entry			
Asset 18								N/A - Free Entry				N/A - Free Entry			
Asset 19								N/A - Free Entry				N/A - Free Entry			
Asset 20								N/A - Free Entry				N/A - Free Entry			
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	5.0	Number	T_Power (KW)	0.2	3,000.0	597.00	Not Applicable	N/A	N/A		122.15
Influent Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	459.00	Height(m)	2.0	15.0	12.00	412.16
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	394.00	Not Applicable	N/A	N/A		155.92
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	1,341.40	Not Applicable	N/A	N/A		221.71
CoMag Settlement Tanks (Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	314.16	Not Applicable	N/A	N/A		155.39
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,106.00	Height(m)	2.0	15.0	12.00	2176.51
BAC	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	18.0	Number	Volume (m3)	5.0	2,000.0	100.00	Not Applicable	N/A	N/A		281.66
BAC	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	8.0	Number	T_Volume (m3)	25.0	8,000.0	1,259.00	Not Applicable	N/A	N/A		349.02
Interstage Pumping Station (Wet Well) - Conveyance Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	5.0	Number	T_Power (KW)	0.5	1,000.0	597.00	Not Applicable	N/A	N/A		122.15
GAC	Water Treatment (Non-Infra)	GAC	GAC	GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	8.0	Number	Volume (m3)	5.0	300.0	299.00	Not Applicable	N/A	N/A		251.95
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0	43.00	Not Applicable	N/A	N/A		0.00
Interstage Pumping Station (Wet Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0	746.00	Not Applicable	N/A	N/A		121.68
Site Returns Pumping Station	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	150.00	Height(m)	2.0	15.0	5.00	56.12
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	576.00	Height(m)	2.0	15.0	12.00	517.22
Chemical Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	298.50	Height(m)	2.0	15.0	12.00	308.49
CoMag Magnetite Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17
CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Tank	Tank - Chemical	3.0	Number	Volume (m3)	1.0	40.0	23.33	Not Applicable	N/A	N/A		28.45
Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	25.00	Not Applicable	N/A	N/A		9.62
Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Capacity (m3)	70.0	3,000.0	629.70	Not Applicable	N/A	N/A		72.68
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	225.00	Height(m)	2.0	15.0	12.00	232.53
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	3.0	Number	Capacity (m3)	70.0	3,000.0	79.80	Not Applicable	N/A	N/A		95.18
GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,500.00	Height(m)	2.0	15.0	12.00	2583.70
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	750.00	Height(m)	2.0	15.0	12.00	775.11
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393,700.0	292,800.00	Not Applicable	N/A	N/A		168.61
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	250.00	Height(m)	2.0	15.0	12.00	224.49
Pipe Work Treatment	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	900.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		75.06
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	1.0	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		20.27
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		62.32
Site Returns Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	74.60	Not Applicable	N/A	N/A		3.14
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	42,000.00	Not Applicable	N/A	N/A		0.00
Asset 54															
Asset 55															
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Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 8

Description of operational activities / annual requirements

172 MLD - 9% of the year // 118 MLD 17% of the year // 61 MLD 17% of the year // 34 MLD 57% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	7879575.369	1,673.07	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year	5,433.88	6.52	
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year	173,205.00	64.09	
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	836,739.14	671.90	Manually corrected values in the summary table. The spreadsheet does not consider the factor of 80 years for the calculation of chemicals
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	19,629.90	15.96	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid	kg / year	1,154,700.01	1,270.17	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 9

Brief Description of works

TREATS7.ALT_STT

Key
User Selection / Input
Information - No Input Required
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

	Item	Works	Staee	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
		Click to view Asset Index														
Free Entry	**Asset 1**	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		4,200.00	tCO2e/m3	N/A - Free Entry		0.03	**144.61**
Free Entry	**Asset 2**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 3**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 4**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 5**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 6**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 7**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 8**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 9**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 10**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 11**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 12**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 13**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 14**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 15**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 16**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 17**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 18**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 19**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 20**								N/A - Free Entry				N/A - Free Entry			
Choose assets from drop-downs	**Influent Pumping Station**	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2	3,000.0	112.00	Not Applicable	N/A	N/A		**14.08**
Choose assets from drop-downs	**Influent Pumping Station**	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	160.00	Height(m)	2.0	15.0	12.00	**143.67**
Choose assets from drop-downs	**CoMag Mixing and Flocculation Tanks**	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	131.00	Not Applicable	N/A	N/A		**72.52**
Choose assets from drop-downs	**CoMag Ferric Storage and Dosing**	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	443.50	Not Applicable	N/A	N/A		**85.72**
Choose assets from drop-downs	**CoMag Settlement Tanks (Clarifiers)**	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	103.87	Not Applicable	N/A	N/A		**52.68**
Choose assets from drop-downs	**Site Returns Pumping Station**	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	**37.41**
Choose assets from drop-downs	**Chemical Building**	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	56.00	Height(m)	2.0	15.0	12.00	**57.87**
Choose assets from drop-downs	**CoMag Magnetite Storage and Dosing**	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		**8.41**
Choose assets from drop-downs	**CoMag Magnetite Transfer System**	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	**5.17**
Choose assets from drop-downs	**CoMag Ferric Storage and Dosing**	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	23.00	Not Applicable	N/A	N/A		**9.46**
Choose assets from drop-downs	**Pipe Work Treatment**	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	400.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		**33.36**
Choose assets from drop-downs	**Fencing**	Cross Functional	Site Wide	Site Wide	Fencing	0.8	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		**16.22**
Choose assets from drop-downs	**Access Road**	Cross Functional	Site Wide	Roads and footpaths	Footpath	0.8	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		**49.86**
Choose assets from drop-downs	**Site Returns Pumping Station**	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	15.00	Not Applicable	N/A	N/A		**0.68**
Choose assets from drop-downs	**Site Clearance**	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	28,000.00	Not Applicable	N/A	N/A		**0.00**
Choose assets from drop-downs	**Asset 54**															
Choose assets from drop-downs	**Asset 55**															
Choose assets from drop-downs	**Asset 56**															
Choose assets from drop-downs	**Asset 57**															
Choose assets from drop-downs	**Asset 58**															
Choose assets from drop-downs	**Asset 59**															
Choose assets from drop-downs	**Asset 60**															
Choose assets from drop-downs	**Asset 61**															
Choose assets from drop-downs	**Asset 62**															
Choose assets from drop-downs	**Asset 63**															
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Choose assets from drop-downs	**Asset 71**															
Choose assets from drop-downs	**Asset 72**															
Choose assets from drop-downs	**Asset 73**															
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Choose assets from drop-downs	**Asset 86**															
Choose assets from drop-downs	**Asset 87**															

Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 9

Description of operational activities / annual requirements

57 MLD - 10% of the year // 11 MLD 90% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	1997505.602	424.13	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophophoric acid			kg / year			
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year			
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	198260.8696	159.26	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	4104	3.34	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems, Septicity control (Networks)	Liquid	kg / year	273600	205.96	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							

SEVERN TRENT WATER

Jacobs

Severn Trent Water Carbon Calculator

Embodied - Gate 2, Option 10

Brief Description of works

TREAT115.ALT_SITT

Key
User Selection / Input
Information - No Input Required
Validation Note - Action

Click to return to Project Setup & Navigation page

Click to view Inclusions & Exclusions for all assets

Click to enter Operational Information

Embodied Carbon Calculations - Source Methodology

The embodied carbon calculations consider the materials used in each item, applying factors from CESMM, Defra and the Bath Inventory of Carbon and Energy. Calculations are undertaken for each item in a range of sizes for primary and secondary metrics (where applicable). These are then regressed to the most appropriate formula and tested for fit, turning points and limits.

Assets 1-20 are Free Entry. Please use drop-downs to enter information in each column for assets 21-200. All assets can be renamed if required.

Embodied Carbon

	Item	Works	Staee	Process	Asset Name	Quantity	Unit of Quantity	Primary Metric: Unit of measurement	Primary Metric: Scale Min	Primary Metric: Scale Max	Primary Measurement	Secondary Metric: Unit of measurement	Secondary Metric: Scale Min	Secondary Metric: Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)
		Click to view Asset Index														
Free Entry	**Asset 1**	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3	N/A - Free Entry		4,800.00	tCO2e/m3	N/A - Free Entry		0.03	**165.27**
Free Entry	**Asset 2**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 3**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 4**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 5**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 6**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 7**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 8**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 9**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 10**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 11**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 12**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 13**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 14**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 15**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 16**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 17**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 18**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 19**								N/A - Free Entry				N/A - Free Entry			
Free Entry	**Asset 20**								N/A - Free Entry				N/A - Free Entry			
Choose assets from drop-downs	**Influent Pumping Station**	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	4.0	Number	T_Power (KW)	0.2	3,000.0	336.00	Not Applicable	N/A	N/A		**55.39**
Choose assets from drop-downs	**Influent Pumping Station**	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	374.00	Height(m)	2.0	15.0	12.00	**335.83**
Choose assets from drop-downs	**CoMag Mixing and Flocculation Tanks**	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0	264.00	Not Applicable	N/A	N/A		**114.89**
Choose assets from drop-downs	**CoMag Ferric Storage and Dosing**	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number	Volume (m3)	5.0	2,000.0	858.50	Not Applicable	N/A	N/A		**149.70**
Choose assets from drop-downs	**CoMag Settlement Tanks (Clarifiers)**	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8	201.06	Not Applicable	N/A	N/A		**100.80**
Choose assets from drop-downs																
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Choose assets from drop-downs																
Choose assets from drop-downs																
Choose assets from drop-downs	**Site Returns Pumping Station**	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	**87.41**
Choose assets from drop-downs																
Choose assets from drop-downs	**Chemical Building**	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	168.00	Height(m)	2.0	15.0	12.00	**173.62**
Choose assets from drop-downs	**CoMag Magnetite Storage and Dosing**	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		**8.41**
Choose assets from drop-downs	**CoMag Magnetite Transfer System**	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	**5.17**
Choose assets from drop-downs	**CoMag Ferric Storage and Dosing**	Cross Functional	Site Wide	Tank	Tank - Chemical	2.0	Number	Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		**18.99**
Choose assets from drop-downs																
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Choose assets from drop-downs																
Choose assets from drop-downs	**Pipe Work Treatment**	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	560.0	Length (m)	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		**46.71**
Choose assets from drop-downs	**Fencing**	Cross Functional	Site Wide	Site Wide	Fencing	0.8	Number	Length (m)	5.0	10,000.0	660.00	Not Applicable	N/A	N/A		**16.22**
Choose assets from drop-downs	**Access Road**	Cross Functional	Site Wide	Roads and footpaths	Footpath	0.8	Number	Area (m2)	5.0	5,000.0	1,650.00	Not Applicable	N/A	N/A		**49.86**
Choose assets from drop-downs	**Site Returns Pumping Station**	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2	3,000.0	37.00	Not Applicable	N/A	N/A		**1.59**
Choose assets from drop-downs	**Site Clearance**	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400,000.0	32,000.00	Not Applicable	N/A	N/A		**0.00**
Choose assets from drop-downs	**Asset 54**															
Choose assets from drop-downs	**Asset 55**															
Choose assets from drop-downs	**Asset 56**															
Choose assets from drop-downs	**Asset 57**															
Choose assets from drop-downs	**Asset 58**															
Choose assets from drop-downs	**Asset 59**															
Choose assets from drop-downs	**Asset 60**															
Choose assets from drop-downs	**Asset 61**															
Choose assets from drop-downs	**Asset 62**															
Choose assets from drop-downs	**Asset 63**															
Choose assets from drop-downs	**Asset 64**															
Choose assets from drop-downs	**Asset 65**															
Choose assets from drop-downs	**Asset 66**															
Choose assets from drop-downs	**Asset 67**															
Choose assets from drop-downs	**Asset 68**															
Choose assets from drop-downs	**Asset 69**															
Choose assets from drop-downs	**Asset 70**															
Choose assets from drop-downs	**Asset 71**															
Choose assets from drop-downs	**Asset 72**															
Choose assets from drop-downs	**Asset 73**															
Choose assets from drop-downs	**Asset 74**															
Choose assets from drop-downs	**Asset 75**															
Choose assets from drop-downs	**Asset 76**															
Choose assets from drop-downs	**Asset 77**															
Choose assets from drop-downs	**Asset 78**															
Choose assets from drop-downs	**Asset 79**															
Choose assets from drop-downs	**Asset 80**															
Choose assets from drop-downs	**Asset 81**															
Choose assets from drop-downs	**Asset 82**															
Choose assets from drop-downs	**Asset 83**															
Choose assets from drop-downs	**Asset 84**															
Choose assets from drop-downs	**Asset 85**															
Choose assets from drop-downs	**Asset 86**															
Choose assets from drop-downs	**Asset 87**															

Severn Trent Water Carbon Calculator

Operation - Gate 2, Option 10

Description of operational activities / annual requirements

115 MLD - 10% of the year // 23 MLD 90% of the year

Click to return to Project Setup & Navigation page

Click to enter Embodied Carbon / Asset Information

Click to jump to Sludge Tankering Module

Operational Carbon

Enter Operational Carbon Information in rows 19-46. See Headings in row 48 for Sludge Tankering Module

OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
Power	Grid Electricity			kWh / year	3,007,895.36	638.67	
Fuel	Diesel - Vehicles			Litres / year			
Fuel	Fuel Oil - Generator			Litres / year			
Fuel	Fuel Oil - Heating			Litres / year			
Fuel	Imported Natural Gas			m3 / year			
Chemicals - Water	Aluminium Sulphate			kg / year			
Chemicals - Water	Chlorine Gas			kg / year			
Chemicals - Water	Ferric Chloride			kg / year			
Chemicals - Water	Lime			kg / year			
Chemicals - Water	Monosodium Phosphate (MSP)			kg / year			
Chemicals - Water	Orthophosphoric acid			kg / year			
Chemicals - Water	Polyaluminium Chloride (PACl)			kg / year			
Chemicals - Water	Polyelectrolytes (various)			kg / year			
Chemicals - Water	Sodium Hydroxide (NaOH)			kg / year			
Chemicals - Water	Sodium Hypochlorite			kg / year			
Chemicals - Water	Sulphur Dioxide / Bisulphate			kg / year			
Chemicals - Water	Sulphuric Acid			kg / year			
Chemicals - Wastewater	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg / year			
Chemicals - Wastewater	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg / year			
Chemicals - Wastewater	Calcium Nitrate	Septicity control (Networks)	Liquid	kg / year			
Chemicals - Wastewater	Ferric Chloride	Coagulation (P Removal)	Liquid	kg / year	198,260.87	159.26	
Chemicals - Wastewater	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg / year			
Chemicals - Wastewater	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg / year			
Chemicals - Wastewater	Methanol	Carbon Source for BNR	Liquid	kg / year			
Chemicals - Wastewater	Polyaluminium Chloride (PACl)		Liquid	kg / year			
Chemicals - Wastewater	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg / year	4,104.00	3.34	
Chemicals - Wastewater	Sodium Carbonate	pH correction	Liquid	kg / year			
Chemicals - Wastewater	Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems, Septicity control (Networks)	Liquid	kg / year	273,600.00	200.96	

Sludge Tankering

	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							
Sludge Tankering							

A.8 Carbon Summary

A7W13155-GT-SPR-200029	Carbon Summary

1\A	B	C	D	E	F	G	H
2	**Step 1: set out emissions footprint**	**Footprint**			**Comments**		
3		**Embodied Carbon tCO2e**	**Operational Carbon tCO2e (71 years)**	**Whole Life Carbon (80 years) tCO2e** ***(Embodied Carbon + Operational Carbon)***			
4	**Gate 1 solution**						
6	Minworth (Treatment and Conveyance)	22,629	235,152	257,781	Gate 1 Preliminary Feasibility Assessment: Table 10.1 base on a Carbon Tool V.2009		
7							
8	**Gate 2 baseline (Unmitigated)**						
10	STT115	119,614	132,721	252,336			
14	TREAT115 - STT115	10,434	149,021	159,454			
21							
22	CO2 reduction owner for Treatment and Pipeline	Designer/Contractor	Operations	Energy			
23		Designer/Contractor	Operations	Chemicals			
24		Designer/Contractor	Operations	Materials			
25		Designer/Contractor	Operations	Transport			
26							
27	**Step 2: how has the project designed down carbon and GHGs**						
28	What policies, frameworks and approaches have been used to drive down whole life carbon in option choices and within solution design? e.g. those listed in RAPID Gate 2 guidance, STW policies, consultant policies	Carbon Ambition 2030 ACWG PAS 2080 Carbon Management in Infrastructure STT Carbon Tool					
29							
30	**Describe the Design Mitigation** **This is for the TREAT115 & STT115 transfer as an example**	**Carbon reduction hierarchy?** Build Nothing Build Less Build Clever Build Efficiently	**Are Scope 1, 2 or 3 emissions reduced?** Scope 1: emissions from Operations Scope 2: emissions from electricity Scope 3: indirect emissions in value chain	**Which part of the STW Triple Pledge does this mitgation contribute to?** A. net zero carbon emissions; B. generating 100% of our power from renewable sources; C. making our fleet of vehicles 100% electric	**Carbon reduction - Embodied tCO2e**	**Carbon reduction - Operational tCO2e**	**Whole life carbon reduction tCO2e** ***(Embodied Reduction + Operational Reduction)***
31	The design shows multiple flow rates with different combinations that allow evaluating the electrical consumption and the use of chemicals. For option TREAT115_STT115, there is an operational carbon saving compared to the unmitigated option.	Build Clever	Scope 1 Scope 2 Scope 3	A. net zero carbon emissions	-	46,274	46,274
32	There was carbon saving by choosing the route and pumping requirement among 9 options including the reevaluated route of Gate 1. The opportunities are the use of trenchless techniques avoiding earthworks during construction.	Build Clever	Scope 3	A. net zero carbon emissions	28,541	-	28,541
33	There was carbon saving by building a more efficient treatment plant and changing the treatment processes to more sustainable options				2,420		2,420
34	A 20% redution at G5 associated with: Low carbon concrete, substituting cement with other materials/ additives Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars). Reduce demolition trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas. Re-use demolished material. Re-use existing available materials, e.g., processing, re-use of excavated material as fill. Sustainable construction materials. Efficient methods of work, e.g., more sustainable transport solutions. Minimising removal of vegetation to prevent loss of carbon storage in soils. In particular, minimising removal of trees as they have a higher potential to sequester carbon. Prioritising local suppliers to reduce the distance travelled to site. Minimising material import. Where required sourcing material from other nearby projects to reduce the amount of virgin material used and also reduce transport emissions. Where new materials are required, utilising materials that have a high recycled content such as recycled steel and concrete mixes with ground granulated blast furnace slag. Selecting materials that have a long-life span and require minimal maintenance. Consider electric fleet for earthworks operations	Build Clever Build Efficiently	Scope 1 Scope 2 Scope 3	A. net zero carbon emissions C. making our fleet of vehicles 100% electric	26,010	-	26,010
35	**Total mitigation reductions against baseline realised at G2**				**56,971**	**46,274**	**103,245**
36					***F35 = F31 + F32 + F33 + F34***	***G35 = G31 + G32 + G33 + G34***	***H35 = H31 + H32 + H33 + H34***
37	**Total remaining whole life carbon emissions for offsetting to UK Government target for Scope 1 , Scope 2 and Scope 3 being net zero by 2050**				**73,078**	**235,467**	**308,545**
38					***F37 = C10 + C14 - F35***	***G37 = D10 + D14 - G35***	***H37 = G37 + F37***
39	**Total remaining whole life carbon emissions for offsetting to achieve Water Industry target for Scope 1 and 2 being net zero by 2030**				**0**	**235,467**	**235,467**
40							
41							

42	**Step 3: if there are still emissions after Step 2, explore offsetting opportunities in relation to Water Industry net zero targets eg:** **Solar - 1 Ha (0.5MW) Ground mounted solar array generates a saving of 95tCO2e per year. Net saving (costs less income) = £83,000/Ha/year (at July 2022 prices).** **Trees - The amount of carbon dioxide a tree will offset depends on many factors, such as the type of tree, where it is planted and the amount of room it has to grow. On average, one British broad-leaved tree will absorb in the region of 1 tCO2e during its full lifetime.** **Onshore wind turbines - 1Ha has potential to generate 40GWh/year, highly dependent on location/planning, however this represents a saving of 8,493 tCO2e per year.**	**Offsetting opportunities**	**Asset in use by 2030 - required offset (tCO2e) to achieve Water Industry target for Scope 1 and 2 being net zero** **Operational Carbon (Scope 1 &2) to be offset per year = 235,467 tCO2e / 71 years** **Operational carbon Offset per year = 3,316 tCO2e/year** **E43 = G37 / 71**	**Asset in use by 2050 - required offset (tCO2e) to achieve UK Government target for Scope 1 , Scope 2 and Scope 3 being net zero** **Capital Carbon (Scope 3) to be offset = 73,078 tCO2e** **F43 = F37**
43			**3,316**	**73,078**
44	Hydropower	62m pressure available within the gravity pipeline which discharges to the River Avon when the pipeline is transferring 115Mld	Carbon Offset is 156 tCO2e/year Remaining carbon (Scope 1 and 2) = 3,316 - 156 = 3,160 tCO2e/year	
45			*3,160*	
46	Solar	There is approximately 57Ha of available land owned by STW adjacent to Minworth WwTW. This is the maximum possible size of land that could be used to install solar panels to reduce the carbon impact of the scheme as well as reduce operational cost through renewable energy. 1 Ha (0.5MW) Ground mounted solar array generates a saving of 95tCO2e per year.	Carbon Offset: 3,160tCO2e/ year Required Area = 3,160/95 = 33 Ha.	Years from 2050 to 2102 = 52 years. Carbon to be offset = 73,078 tCO2e. Annual amount = 73,078/52 = 1,405 tCO2e. Area of solar array required = 1405/95 = 14.8 Ha
47			*33*	*14.8*
48	Tree Planting	Trees are essential to maintaining our climate and biodiversity. Trees contribute to the environment by improving air quality, conserving water, preserving soil and supporting wildlife. Trees also absorb atmospheric carbon as part of the process of photosynthesis, which enables them to grow. Through this process, carbon dioxide is converted into stored carbon, and this is why trees are sometimes referred to as 'carbon sinks'	Tree Planting = 235,467 trees	Embodied Carbon offset trees 73,078 tCO2e Remaining carbon (Scope 3) = 73,078 - 73,078 = 0 tCO2e/year
49			*235,467*	*0*
50	Wind turbine	All power to be renewable generated inhouse or sourced as net zero by ST by 2030 as part of triple pledge commitment	Carbon Offset: 3,160 tCO2e/ year Required Area = 3,160/8,493 = 0.37 Ha. Of wind Turbines	
51			*0.37*	

* Operation Phase to Start 2030