

# **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.

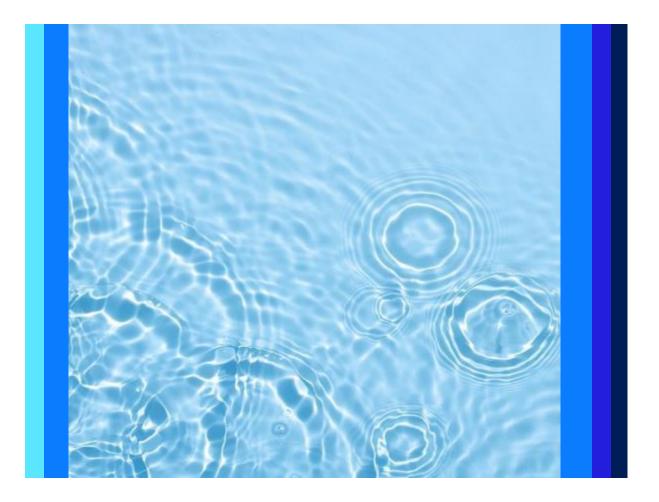
Minworth SRO Severn Trent Water & Affinity Water

# **Cost and Carbon Report**

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Severn Trent Water A7W13155

Minworth SRO 24 October 2022



# Jacobs

### **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.

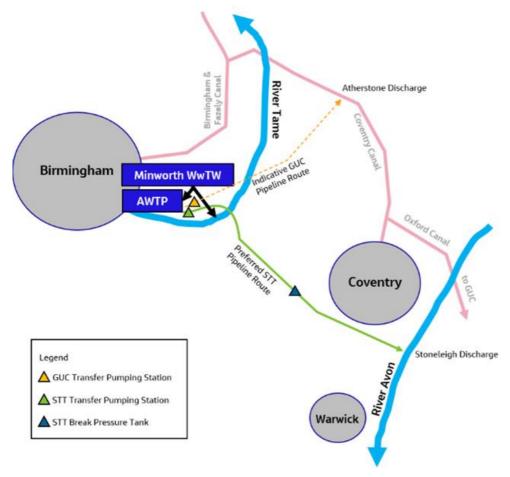


Figure 1-1 Minworth SRO overall schematic

# 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.

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	
	Xylem	985	1,800	2,400	3,200	
Ozone	De Nora	1,140	1,665	2,191	2,717	
	Curio	3491	4344	4859	5811	
BAC	Xylem	237	421	484	810	
DAC	De Nora	1,152	1,925	2,643	3,012	
BAF	Curio	3084	3305	4486	4967	
	Xylem	258	459	670	892	
GAC	De Nora	1,236	2,112	2,684	3,174	
	Curio	3309	5479	6732	8036	

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

# 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/suboptions, 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.

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

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

### 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.

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	

Table 2-2: AWPT operating regimes and production volumes

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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

ltem	ltem	Units
Power Cost : (Note: "All-in" including usage, demand, and transmission charges)		(£/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)

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ltem	ltem	Units
Other Costs:		
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.

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

### Table 2-4: Pipeline Preferred Option Carbon Assessment

### Table 2-5: Carbon assessment of solutions combinations

Treatment Option		Embodied	Operational ( (tCO2e) - Ani		
Project Reference	STW Carbon tool reference	Carbon (tCO2e)	Grid power Operational Carbon (tCO2e)	Non-power related operational carbon	Total Whole Life Carbon (tCO2e)
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: TF	REAT115_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
Operational Carbon	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 Carl	oon	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
A.2 CAPEX Estimate Details
A.3 QCRA Templates
A.4 Optimism Bias Templates
A.5 NPV / AIC Templates
A.6 OPEX Estimate Details
A.7 Carbon Estimate Details

A.8 Carbon Summary

# A.1 Cost Summary

A7W13155-GT-SPR-200022	Minworth SRO Costs Summary
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### Gate 2 CAPEX Costs Summary

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

Options	Gate-2 Reference	Gate 2 Base Capex (£)	Gate 2 Costed Risk (£) P50	Gate 2 Optimism Bias (£)	Total Capex (£)
Preferred Route Estimate 57Mld	STT57	£96,586,900	£ 6,953,437	£29,082,316	£132,622,65
Preferred Route Estimate 115Mld	STT115	£96,586,900	£ 6,953,437	£29,082,316	£132,622,65
Treatment 57Mld	TREAT57	£62,463,100	£ 6,640,223	£19,924,167	£89,027,49
Treatment 57Mld (ALT)	TREAT57.ALT	£23,084,300	£ 3,520,134	£7,363,315	£33,967,74
Treatment 115Mld	TREAT115	£91,642,000	£ 8,996,906	£29,231,507	£129,870,41
Treatment 115Mld (ALT)	TREAT115.ALT	£33,054,900	£ 4,064,186	£10,543,687	£47,662,77
Treatment 172Mld	TREAT172	£120,030,300	£ 10,996,507	£38,286,665	£169,313,47
Treatment 230Mld	TREAT230	£148,484,000	£ 14,061,169	£47,362,684	£209,907,85
Solutions					
GUC Transfer 57Mld	TREAT57_GUC57	£62,463,100	£6,640,223	£19,924,167	£89,027,49
GUC Transfer 115Mld	TREAT115_GUC115	£91,642,000	£8,996,906	£29,231,507	£129,870,41
STT Transfer 57Mld	STT57 & TREAT57_STT57	£159,050,000	£13,593,660	£49,006,483	£221,650,14
STT Transfer 57Mld (ALT)	STT57 & TREAT57.ALT_STT57	£119,671,200	£10,473,571	£36,445,630	£166,590,40
STT Transfer 115Mld	STT115 & TREAT115_STT115	£188,228,900	£15,950,343	£58,313,823	£262,493,06
STT Transfer 115Mld (ALT)	STT115 & TREAT115.ALT_STT115	£129,641,800	£11,017,623	£39,626,002	£180,285,42
STT Transfer 57Mld & GUC Transfer 57Mld	STT57 & TREAT115_STT57_GUC57	£188,228,900	£15,950,343	£58,313,823	£262,493,06
STT Transfer 115Mld & GUC Transfer 57Mld	STT115 & TREAT172_STT115_GUC57	£216,617,200	£17,949,944	£67,368,981	£301,936,12
STT Transfer 57Mld & GUC Transfer 115Mld	STT57 & TREAT172_STT57_GUC115	£216,617,200	£17,949,944	£67,368,981	£301,936,12
STT Transfer 115Mld & GUC Transfer 115Mld	STT115 & TREAT230_STT115_GUC115	£245,070,900	£21,014,606	£76,444,999	£342,530,50

#### 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	AIC Min Utilisation	AIC Max Utilisation
options		(m <sup>3</sup> )	(p/m <sup>3</sup> )	(p/m <sup>3</sup> )
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

30.11% 30.11% 31.90% 31.90%

31.90% 31.90% 31.90% 31.90% 31.90%

# A.2 CAPEX Estimate Details

Treatment Capex estimate (STW lite tool) - TREAT57
Treatment Capex estimate (STW lite tool) - TREAT57.ALT
Treatment Capex estimate (STW lite tool) - TREAT115
Treatment Capex estimate (STW lite tool) - TREAT115.ALT
Treatment Capex estimate (STW lite tool) - TREAT172
Treatment Capex estimate (STW lite tool) - TREAT230
Preferred Route redesign Capex estimate - STT115

SEVER TRENT WATER Notice		Element Reference: Date Issued:	March 2022															C/	APEX Costs		ARUP
					1																
from	Rate		<u> </u>				B	&C	2 670 700	-		M	&E	274 600	6		Mains & S	Sewers	56 700 500		Total
adjusted from es		_	Standar Non-Standar						2,679,700 932,900					371,600 1,412,600					56,790,500 50,000		59,841,800 2,395,500
adju: es	19.3%		Non-Standard Adjus						517,200	£				71,700					10,960,600	£	11,549,500
be alu			Constructio						4,129,800					1,855,900	-				67,801,100		73,786,800
s may fault v	0.0%		Contractor D&	gn Fee B Cost					4,129,800	f f				1,855,900	£				67,801,100	£	- 73,786,800
rates e def	12.8%		Interna			_			528,600	£				237,600	f	_			8,678,500	£	9,444,700
-cost th	18.1%		Externa						747,500					335,900					12,272,000	£	13,355,400
e on-			Project Optimis						<b>5,405,900</b> 1,627,200	£				<b>2,429,400</b> 731,200	£				88,751,600	£	96,586,900
These	30.1%		Business Case Cost Es						7,033,100	£				<b>3,160,600</b>	-				26,714,200 <b>115,465,800</b>	£	29,072,600 <b>125,659,500</b>
					Comme	ercial		tion redacte	ed		Сс	osts are calco s a multiplie F	ulated using a r adjuster, P is For Linear Cos or Unit Rate Ite	adjusted from formula of M x a power adjust t Curves set P = ems set P = 1, C	(Quantity)^F ter, C is a con = 1	Р+С					
Level 1	Level 2	Level 3	Level 4	Units	м	Р	BA C	&C Quantity	Cost	м	Р	C M	&E Quantity	Cost	м	Р	Mains and C	Sewers Quantity	Cost		Notes
		Pressure Mains in Field									-										
INFRA	Distribution	/ Verges Pressure Mains in Field	Diameter: 900mm	m											1,413	1	11,113	19,329 m			
INFRA	Distribution	/ Verges	Diameter: 1050mm	m	0		c	m		o		C	) m		1,734	1	11,113	12,125 m			
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m	0		c	) m		0		c	) m		3,695	1	0	147 m			
INFRA	Distribution			m												1	0				
	Distribution	Tunnelling / Pipejacking		m											3,695	1	0	103 m			
INFRA INFRA	Distribution Distribution	Tunnelling / Pipejacking Directional Drilling		m m											3,695 2,313		0	153 m 77 m			
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,515	1	0	77 m	-		
INFRA	Distribution	Tunnelling / Pipejacking		m											3,695		0	266 m	-		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	80 m	-		
INFRA	Distribution	Tunnelling / Pipejacking		m											3,695	1	0	119 m			
INFRA INFRA	Distribution Distribution		Diameter: 1050mm Diameter: 1050mm	m m											2,313 2,313	1	0	62 m 85 m			
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	84 m			
INFRA INFRA	Distribution Distribution	Directional Drilling Directional Drilling	Diameter: 1050mm Diameter: 1050mm	m m											2,313 2,313	1	0	82 m 57 m	-		
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	72 m			
INFRA INFRA	Distribution Distribution		Diameter: 1200mm Diameter: 1200mm	m m											2,644 2,644		0	81 m 54 m			
INFRA	Distribution			m											2,644		0	50 m	-		
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1200mm	m											4,223	1	0	294 m			
INFRA	Distribution			m											2,644		0	43 m			
INFRA INFRA	Distribution Distribution	Directional Drilling Directional Drilling	Diameter: 1200mm Diameter: 1200mm	m m											2,644		0	77 m 127 m	-		
INTRA	Distribution	Directional Drining	Diameter: 1200mm												2,044		0	127 111	-		
INFRA INFRA	Distribution Distribution	Tunnelling / Pipejacking Directional Drilling	Diameter: 1200mm Diameter: 1200mm	m m											4,223 2,644		0	113 m 98 m	-		
NON-INFRA	Distribution	-	Service Reservoir	m3	44,604	0	C	4,800 m3							2,044	1	0	56 11			
NON- STANDARD	Flowmeter	mm DN	v	mm D	5,557	1		mm 1 DN		5,557	1		mm 0 1 DN								
NON-								mm					mm								
STANDARD NON-	Flowmeter	mm DN	x	mm D	5,557	1	(	1 DN		5,557	1		0 1 DN								
STANDARD	OTHERS	TELEMETRY	Kiosk / Building	Nr						5,557	1	1 C	0 1 Nr								
NON- STANDARD	OTHERS	TELEMETRY	Telemetry Outstation	Nr						5,557	1	1 C	) 1 Nr								
FREE ENTRY	Pumping	No	Peak Flow		1,080,000			0		1,080,000			1							Peak Flov	
FREE ENTRY NON-	Pumping	No	Sweetening Flow		216,000	#N/A	#N/A	0		216,000	#N/A	. #N/A	1							Sweeteni	ng Flow
STANDARD	OTHERS		Automated TM Valve PRV / PSV inc. Chamber							11,113	1	ı c	) 2 Nr								
STANDARD	MANAGEMENT	/ REDUCING VALVES	(Large Diameter)	Nr											16,670	1	0	3 Nr			
NON- STANDARD	Flowmeter	mm DN	x	mm D	5,557	1	C	mm 1 DN		5,557	1	1 0	mm 0 1 DN								
NON-								mm					mm								
STANDARD NON-	Flowmeter	mm DN	X	mm D	5,557	1		1 DN mm		5,557	1	0	D 1 DN mm								
STANDARD NON-	Flowmeter	mm DN	x Telemetry for auto	mm D	5,557	1	C	1 DN		5,557	1	1 C	) 1 DN								
STANDARD	OTHERS	VALVES	valves	Nr						5,557	1	1 C	) 5 Nr								
NON- STANDARD	OTHERS	VALVES	Power supply for auto valves	Nr						2,223	1		) 5 Nr								
INFRA	Distribution	Tunnelling / Pipejacking	Diameter: 1050mm	m						2,223			5 10		3,695	1	0	116 m			
	Distribution		Diameter: 1050mm	m											2,313	1	0	23 m			
INFRA INFRA	Distribution Distribution		Diameter: 1050mm Diameter: 1050mm	m m											2,313 2,313		0	55 m 49 m			
INFRA	Distribution	Directional Drilling	Diameter: 1050mm	m											2,313	1	0	36 m			
INFRA NON-INFRA	Distribution Distribution		Diameter: 1200mm Surge Vessel	m m3	8,577	0	C	120 m3		67,007	0		) 120 m3		2,644	1	0	77 m			
NON-			Outlet into canal							.,											
STANDARD NON-	ANCILLARY WORKS	INLET / OUTLETS	(Structure)	Nr	27,783	1	C	1 Nr													
STANDARD	OTHERS	TELEMETRY	Kiosk / Building	Nr						5,557	1	1 C	0 1 Nr								
NON- STANDARD	OTHERS	TELEMETRY	Telemetry Outstation	Nr						5,557	1	1 0	) 1 Nr								
	Outfall control valves,									5,557	-										

- F		Outfall control valves,															
		flowmeter and															
F	REE ENTRY	isolation valves	No	Outfall control		#N/A	#N/A		394,225 #	≠N/A	#N/A	1					Outfall control
F	REE 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

SEVER																		CA	PEX Cost	ATKINS
WATER		Element Reference: Date Issued:	03rd August 2022															TR	REAT57	ARUP
E.	Rate						B	&C				м	&E				Mains & Sewers	s		Total
d frc			Standar	d Cost	£				7,845,600	£				8,668,200	£				-	£ 16,513,800
adjusted from es			Non-Standar							£				-	£				-	£ 32,629,900
	0.5%		Non-Standard Adjus						,	£				43,300	£				-	£ 82,500
	0.0%		Constructio Desi	gn Fee					40,514,700	£				8,711,500	£				-	£ 49,226,200 £ -
rates ma e default	01070		Contractor D&						40,514,700	£				8,711,500	£				-	£ 49,226,200
29	18.3%		Interna Externa						7,402,000	£				1,591,600	£				-	£ 8,993,600
ę	8.6%		Project						3,492,400 <b>51,409,100</b>					750,900 <b>11,054,000</b>	£				-	£ 4,243,300 £ 62,463,100
se on	31.9%		Optimis						16,399,500					3,526,200	£					£ 19,925,700
These			Business Case Cost Es	timate	£				67,808,600	£				14,580,200	£				-	£ 82,388,800
				1 1	ercial int	orma		dacted			Cos	sts are calco a multiplie F	ulated using a j r adjuster, P is For Linear Cos	adjusted from t formula of M x a power adjust t Curves set P = ems set P = 1, C	(Quantity)^ er, C is a co 1	P + C	Mains and Sewe	rs		
Level 1	Level 2	Level 3	Level 4	Units	м	Р	с	Quantity	Cost	м	Р	с	Quantity	Cost	м	Р	C Qua		Cost	Notes
NON-INFRA	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/ d		171,651	0		m3/ D d		,		0	m3/ d		Removed from scope
	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	C	) 792 m3		3,057	1	(	) 792 m3					-		
	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995			) 46 kg/d		343,823			kg/ 0 46 d							
	Water Treatment	Chlorination	De-chlorination	kg/d	9,591	1	c	kg/d kg/d ay		178,910	0	(	kg/ D day							Row 22 duplicate
NON-INERA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0		) 6 kg/d		343,823	0		kg/ 0 6 d							Non ionic polymer
	Water Treatment	GAC	GAC , RGF Type	m3	4,260		0	) 421 m3		3,057	1		0 421 m3							BAC
NON-INFRA	Water Treatment	Major Water Pumping Station Major Water Pumping	Major Water Pumping	kW	31,579	1	C	) 112 kW		17,996	1	(	) 112 kW							Inline Influent PS
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	C	kw		17,996	1	(	223 kW							Interstage PS
	Water Treatment	Major Water Pumping Station	Major Water Pumping	LAA/	31,579	1		) kW		17,996	1		559 kW							Backwash (part of Interstage PS)
	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	C	455 kg/d		178,910	0		kg/ 0 455 d		(		0	0 kg/d		Bisulphite
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	c	) 2,231 kg/d		204,317	0		kg/ 2,231 d							Ferric
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	C	) 867 kg/d		204,317	0		kg/ 0 867 d							Hydrogen Peroxide
													kg/							
NON-INFRA	Water Treatment Interstage & Backwash	pH Correction	Chem Dosing	kg/d	35,286	0	C	) 2,848 kg/d		204,317	0	(	2,848 d							Sodium Hydroxide
	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
STANDARD		All locations	greater than 500m2	Nr	1,160,000	1	c	) 1 Nr												Influent PS building
NON- STANDARD	Site wide SCADA / control system	No.	×	No.	4,350,000	1		) 1 No.		0	1		0 No.							ICA and Electric upgrades
NON-	PERMANENT SITE		<u> </u>	140.	4,350,000	1		, INO.		0	1									tor and electric upgrades
STANDARD		ACCESS	Access Track	m	2,900,000		0	) 1 m												5/0
FREE ENTRY	Sitewide items BAC	No. No.	E/O E/O		7,250,000			1 1												E/O E/O
FREE ENTRY	Comag	No.	E/O		7,540,000			1												E/O
FREE ENTRY	ITEM DESCRIPTION	No. No.	OTHER DETAILS		5 710 040	#N1/A	#N/A	1												OTHER DETAILS
FREE ENTRY		No. No.	Ozone curve UV uplift oor		5,719,940 0	#N/A #N/A		1												Ozone curve Removed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		433,531	#N/A	#N/A	1												Interstage PS uplift oor
	Backwash PS uplift	No.	Backwash PS uplift oor		416,466		#N/A	1					kg/							Backwash PS uplift oor
NON-INFRA	Water Treatment	pH Correction Major Water Pumping	Chem Dosing	kg/d	35,286	0	C	) 14 kg/d		204,317	0	(	D 14 d							Phosphoirc Acid
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	C	) kW		17,996	1	(	0 15 kW							Site Returns Pumps

SEVER																			CA	PEX Cos	ts	ATKINS
WATER		Element Reference: Date Issued:	03 August 2022																	EAT57./		ARUP
ε	Rate	Ι					Bé	&C				м	&E				Main	s & Sev	vers			Total
d from			Standa	rd Cost	£				2,119,500	£				1,847,400	£					-	£	3,966,900
adjusted res			Non-Standa						14,205,700					-	£					-		14,205,700
	0.5%		Non-Standard Adjus						10,600					9,200	£					-	_	19,800
ry be t valı	0.00/		Constructio						16,335,800	£				1,856,600	£					-	£ £	18,192,400
s may fault v	0.0%		Contractor D8	gn Fee B Cost					16,335,800	-				1,856,600	£							18,192,400
rates e defo	18.3%		Interna						2,984,600					339,200	£					-	£	3,323,800
cost th	8.6%		Externa						1,408,100					160,000						-	£	1,568,100
-uo			Project						20,728,500					2,355,800						-	-	23,084,300
These	31.9%		Optimis Business Case Cost Es						6,612,400 <b>27,340,900</b>					751,500 <b>3,107,300</b>						-	-	7,363,900 <b>30,448,200</b>
F			Busilless Case Cost Es	umate	Ľ	_			27,340,900	Ľ				3,107,300	Ľ	_	_	_		-	L L	30,448,200
											Thes	se rates and	notes may be a	djusted from t	the standar	d rates						
													ulated using a fo									
			C	omm	ercial in	forma	tion rec	dacted			IVI IS		r adjuster, P is a For Linear Cost			nstant						
													or Unit Rate Ite									
Level 1	Level 2	Level 3	Level 4	Units		_		&C			_		&E			-		and Se				Notes
					м	P	с	Quantity m3/	Cost	м	Р	c	Quantity m3/	Cost	M	P	c		uantity m3/	Cost		
	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	C	b C		171,651	0	0 0	D d			0		0	d		Remov	ed from scope
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	C	) m3		3,057	1	L (	) m3									
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	C	0 46 kg/d		343,823	0		kg/ 0 46 d									
								kg/d					kg/									
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	. 1	C	) ay		178,910	0	0 (	) day								Row 2	2 duplicate
	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	c	) kg/d		343,823	0		kg/ D d								Non-ic	nic Polymer
	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	C	0 m3		3,057	1	1 (									BAC	
		Major Water Pumping			24 570					17.000												()
NON-INFRA	Water Treatment	Station Major Water Pumping	Major Water Pumping	ĸw	31,579	1	0	0 112 kW		17,996	1		0 112 kW								Inline	nfluent PS
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	C	b kW		17,996	1	L C	b kW								Interst	age PS
		Major Water Pumping			24.570					17.000												ash PS (part of
NUN-INFRA	Water Treatment	Station	Major Water Pumping	ĸw	31,579	1		0 kW		17,996	1		0 kW kg/								Interst	age)
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	. 1	C	) kg/d		178,910	0	o (	D d			0		0	0 kg/d		Bisulpl	iite
			Chara Daalaa		25.200			2 224 1-14		204.247			kg/								<b>F</b> ound of	
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286			0 2,231 kg/d		204,317	0		2,231 d kg/								Ferric	
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	C	) kg/d		204,317	0	0 0	b C								Hydro	en Peroxide
			Chara Daalaa	1-1-1	25.200			2 0 40 1 - (1		204.247			kg/								C Ili	. Developmental a
	Water Treatment Sewage Treatment	pH Correction Interstage Pumping	Chem Dosing Interstage Pumping	kg/d kW	35,286 31,579		0	2,848 kg/d		204,317 17,996	1		2,848 d kW									n Hydroxide age & Backwash PS
	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW	31,579	1	C	0 120 kW		17,996	1	L (										turns PS
NON-		All locations	greater than 500m2	Nir	722.250			1 1													Influe	+ DS building
STANDARD NON-	Site wide SCADA /	All locations	greater than 500m2	Nr	732,250	, 1		0 1 Nr													muer	t PS building
STANDARD	control system	No.	x	No.	1,464,500	1	C	0 1 No.		0	1	L C	0 No.								ICA an	d Electric upgrades
NON- STANDARD	PERMANENT SITE	ACCESS	Access Track	_	1 464 500			1														
	Sitewide items	ACCESS No.	Access Track E/O	m	1,464,500 2,929,000		#N/A	0 1 m 1													E/O	
FREE ENTRY	BAC	No.	E/O		0	) #N/A	#N/A														E/O	
FREE ENTRY	Comag ITEM DESCRIPTION	No. No.	E/O OTHER DETAILS		7,615,400	#N/A	#N/A #N/A	1													E/O	DETAILS
FREE ENTRY		No.	Ozone curve			#N/A	#N/A #N/A															curve
FREE ENTRY		No.	UV uplift oor			#N/A	#N/A															ed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		C	#N/A	#N/A														Interst	age PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		C	#N/A	#N/A														Backw	ash PS uplift oor
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	i 0	С	) kg/d		204,317	0		kg/ D d								Phosp	noirc Acid

SEVERI	N															<b>ATKINS</b>
TRENT WATEF		Element Reference:													CAPEX Cost TREAT115	sARUP
Notice	Values are rounded	Date Issued:	03 August 2022												INLATIIS	
mo	Rate						B8	kC				M&E			Mains & Sewers	Total
adjusted from res			Standar	rd Cost	£				14,195,400	£			13,432,900	£	-	£ 27,628,300
juste			Non-Standar						44,455,100				-	£	-	£ 44,455,100
e ad	0.5%		Non-Standard Adjus						71,000				67,200		-	£ 138,200
y be t valu	0.00/		Constructio						58,721,500	f			13,500,100	£	•	£ 72,221,600
s may fault v	0.0%		Contractor D&	gn Fee					58,721,500	£			13,500,100		•	£ - £ 72,221,600
rates e defa	18.3%		Interna						10,728,400				2,466,500		-	f 13,194,900
cost r the	8.6%		Externa						5,061,800				1,163,700		-	f 6,225,500
o-uo			Project	Total	£				74,511,700	£			17,130,300	£	-	£ 91,642,000
	31.9%		Optimis						23,769,200	£			5,464,600	£	-	£ 29,233,800
These			Business Case Cost Es	timate	£				98,280,900	£			22,594,900	£	-	£ 120,875,800
												e rates and notes may				
				_					_			ts are calculated using a multiplier adjuster, I				
				C	ommerc	ial inf	formatic	on redacted	d		141 15		Cost Curves set P			
													e Items set P = 1, 0			
Level 1	Level 2	Level 3	Level 4	Units			B8					M&E			Mains and Sewers	Notes
					м	Р	с	Quantity	Cost	м	Р	C Quantit		M P	C Quantity Cost	
	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033	0	0	m3/ d		171,651	0	0 d		0	m3/ 0 d	UV REMOVED
	Water Treatment		GAC , RGF Type	m3	4,260	1	0	1,597 m3		3,057	1			0	0	OV REMOVED
					.,		-			-,		kį				
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	92 kg/d		343,823	0	0 92 d				
								kg/d				k				
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	1	0	ау		178,910	0	0 da				Row 22 duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	12 kg/d		343,823	0	k 0 12 d				Non-ionic Polymer
	Water Treatment		GAC , RGF Type	m3	4,260	1	0	844 m3		3,057	1	0 844 m				BAC
		Major Water Pumping														
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	0	336 kW		17,996	1	0 336 kV	N			Influent PS
	Water Treatment	Major Water Pumping Station	Major Water Dumping	LAN/	31,579	1	0	0 kW		17,996	1	0 447 kV	~			Interstage PS
NON-INFRA	water freatment	Major Water Pumping	Major Water Pumping	KVV	51,575	1	0	UKW		17,990	1	0 447 K	7V			Backwash PS (part of
NON-INFRA	Water Treatment		Major Water Pumping	kW	31,579	1	0	0 kW		17,996	1	0 597 k	N			Interstage)
												kį				
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	912 kg/d		178,910	0	0 912 d				Bisulphite
	Water Treatment	pH Correction	Chem Dosing	ka /d	35,286		0	4,469 kg/d		204,317	0	k 0 4,469 d				Ferric
NON-INFRA	water freatment	predrector	Chem Dosing	kg/d	55,280	0		4,403 Kg/u		204,317	0	6 4,409 d				renic
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	1,736 kg/d		204,317	0	0 1,736 d				Hydrogen Peroxide
												kį				
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	5,744 kg/d		204,317	0	0 5,744 d				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
	Site Returns PS wet				0,050	,										
FREE ENTRY	well	No.	4532m3 shaft tank		919,702	#N/A	#N/A	1			#N/A	#N/A				Site Returns PS
NON-																
STANDARD NON-	BUILDINGS Site wide SCADA /	All locations	greater than 500m2	Nr	333,390	1	0	4 Nr								Influent PS building
	control system	No.	x	No.	27,783	1	0	365 No.		27,783	1	0 0 N	o.			
NON-	PERMANENT SITE															
STANDARD			Access Track	m	4,137		0	56,000 m								
FREE ENTRY	Sitewide items		E/O		7,250,000		#N/A	1								E/O
FREE ENTRY			E/O E/O		1,450,000 ########		#N/A #N/A	1 1								E/O E/O
	ITEM DESCRIPTION		OTHER DETAILS													OTHER DETAILS
FREE ENTRY			Ozone curve		8,679,377			1								Ozone curve
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A									Not required (prev £364,856)
EREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		439,045	#N/A	#N/A	1								Interstage PS uplift oor
TREE ENTRY	interstage P5 uplift	140.	interstage PS uplift OOr		459,045	mN/A	#N/A	1								interstage PS upint oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		459,851	#N/A	#N/A	1								Backwash PS uplift oor
												kį				
NON-INFRA	Water Treatment		Chem Dosing	kg/d	35,286	0	0	29 kg/d		204,317	0	0 29 d				Phosphoirc Acid
NON-INERA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1	0 37 k\	N			Site Returns PS
	and a reached		and a state of a state		51,575	-	0			17,550	-	<b>5</b> 7 Ki				

SEVER TRENT WATER Notice		Element Reference: Date Issued:	03 August 2022																APEX Cost REAT115		ATKINS ARUP
в	Rate	1					B8	kC					M&E				Mains 8	& Sewers			Total
l from			Standar	d Cost	f				3,031,800	£				2,371,900	£				-	£	5,403,700
istec			Non-Standar						20,619,300					-	£				-	£	20,619,300
adjusted es	0.5%		Non-Standard Adjus	tment	£				15,200	£				11,900	£				-	£	27,100
v be valu			Constructio						23,666,300					2,383,800					-	£	26,050,100
ma) ault	0.0%			gn Fee					-	£				-	£					£	-
rates e def	18.3%		Contractor D& Interna						<b>23,666,300</b> 4,323,800	£				<b>2,383,800</b> 435,500	-				-	f f	<b>26,050,100</b> 4,759,300
cost n the	8.6%		Externa						2,040,000	£				205,500					-	f	2,245,500
on-ca			Project		-				30,030,100	£				3,024,800	£				-	£	33,054,900
ese c	31.9%		Optimis						9,579,600	£				964,900	£				-	£	10,544,500
The			Business Case Cost Est	timate	£				39,609,700	£				3,989,700	£				-	£	43,599,400
				C	Commerc	<mark>cial in</mark>	formatic B8	on redacte	:d		Cos	ts are ca a multipl	lculated using c lier adjuster, P i For Linear Co	e adjusted from a formula of M x s a power adjust ost Curves set P = tems set P = 1, C	(Quantity) ter, C is a co = 1	^P + C	Maina au	nd Sewers			
Level 1	Level 2	Level 3	Level 4	Units	м	Р	C B6	Quantity	Cost	м	Р	c	Quantity	Cost	м	Р	C C	Quantity	Cost		Notes
						-		m3/			-		m3,			-		m3	/		
	Water Treatment	UV Disinfection	UV Plant	m3/d			0	d		171,651	0		0 d	_		0	(	b d			IVED
	Water Treatment	GAC	GAC , RGF Type	m3	4,260	1	0	m3		3,057	1		0 m3 kg/								
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	92 kg/d		343,823	0		0 92 d								
								kg/d					kg/								
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	1	0	ау		178,910	0		0 day							Row 22 d	uplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	0	kg/d		343,823	0		kg/ 0 d							BAC	
	Water Treatment	GAC	GAC , RGF Type	m3	4,260		0	m3		3,057	1		0 m3								
		Major Water Pumping																			
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	0	336 kW		17,996	1		0 336 kW							Influent F	S
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1		0 kW							Interstag	e PS
		Major Water Pumping																		Backwash	n PS (part of
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	0	kW		17,996	1		0 kW							Interstag	e)
NON-INERA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	0	kg/d		178,910	0		kg/ 0 d							Bisulphite	<b>,</b>
													kg/								
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	4,469 kg/d		204,317	0		0 4,469 d							Ferric	
NON-INERA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0		kg/ 0 d							Hydroger	Peroxide
	and the second second			ng/u	00,200		0	Kg/U		204,017	0		kg/								
	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286		0	5,745 kg/d		204,317	0		0 5,745 d							Sodium H	
	Sewage Treatment	Interstage Pumping	Interstage Pumping	kW kW	31,579		0			17,996 17,996	1		0 kW 0 37 kW							Interstage Site Retu	e & Backwash PS
NON-INFRA	Sewage Treatment	Interstage Pumping	Interstage Pumping	KVV	31,579		0	240 KW		17,996	1		0 37 KW							Site Ketu	115 17 3
STANDARD		All locations	greater than 500m2	Nr	876,180	1	0	1 Nr												Influent F	S building
NON-	Site wide SCADA /																				
STANDARD NON-	control system PERMANENT SITE	No.	x	No.	3,650,750	1	0	1 No.		27,783	1		0 0 No.								
STANDARD		ACCESS	Access Track	m	1,460,300	1	0	1 m													
FREE ENTRY	Sitewide items	No.	E/O		4,380,900	#N/A		1												E/O	
FREE ENTRY		No.	E/O		0	#N/A	#N/A #N/A	0												E/O E/O	
FREE ENTRY		No. No.	E/O OTHER DETAILS		#########	#N/A	#N/A	1												E/O OTHER DI	TAILS
FREE ENTRY		No.	Ozone curve			#N/A	#N/A													Ozone cu	
FREE ENTRY		No.	UV uplift oor			#N/A	#N/A														red (prev £364,856)
FREE ENTRY	Site Returns PS	No.	Site Returns PS oor		29,090	#N/A	#N/A	1												Site Retu	rns PS oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		0	#N/A	#N/A													Backwast	n PS uplift oor
													kg/								
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	0	kg/d		204,317	0		0 d							Phosphoi	rc Acid
	1	1																			

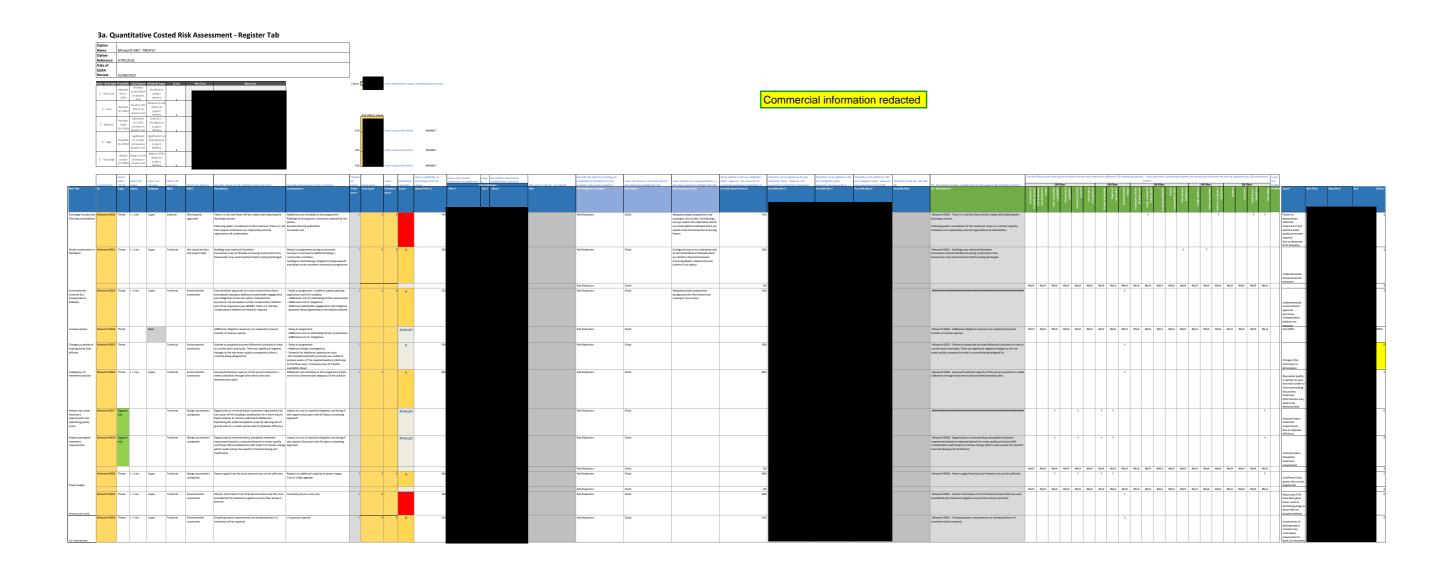
SEVERI																				<b>ATKINS</b>
WATER		Element Reference: Date Issued:	03 August 2022															APEX Cost REAT172		ARUP
Notice	Values are rounded	bate issued.	007/05012022																	
rom	Rate					B8	&C				M	&E				Mains &	Sewers			Total
adjusted from es			Standar					20,190,900	£				17,995,400	£				-	£	38,186,300
suļbr	0.5%		Non-Standar Non-Standard Adjus					56,216,700 101,000					- 90,000	£				-	£	56,216,700 191,000
be Jalu	0.376		Constructio					76,508,600					18,085,400	£				-	£	94,594,000
may ault v	0.0%			gn Fee				-	£				-	£					£	-
rates e defi	18.3%		Contractor D& Interna					<b>76,508,600</b> 13,978,100	£				<b>18,085,400</b> 3,304,200	f f				-	£	<b>94,594,000</b> 17,282,300
cost i the	8.6%		Externa					6,595,000					1,559,000	£				-	£	8,154,000
-uo			Project					97,081,700					22,948,600					-	£	120,030,300
These	31.9%		Optimis Business Case Cost Est					30,969,100 <b>128,050,800</b>					7,320,600 <b>30,269,200</b>	f f					£ £	38,289,700 <b>158,320,000</b>
			business case cost Es	unate	-			120,030,000	-				30,203,200	-	-				-	130,320,000
													adjusted from							
						·							formula of M x a power adjust							
				C	Commercial in	ormatic	n redacte	u				For Linear Cos	st Curves set P =	1						
						B8	۶C				Fi Mi		ems set P = 1, C	c = 0		Mains an	d Sewers			
Level 1	Level 2	Level 3	Level 4	Units	M P	с	Quantity	Cost	м	Р	C	Quantity	Cost	м	Р	C	Quantity	Cost		Notes
	Water Treatment	UV Disinfection	UV Plant	m3/d	20,033 0	0	m3/ d		171,651	0		m3/ d			0	0	m3/ d			
	Water Treatment	GAC	GAC , RGF Type	m3	4,260 1	0			3,057	1	C					Ŭ	ų			
	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995 0	0	138 kg/d		343,823	0		kg/ ) 138 d								
NON-INFRA	water freatment	Poly Dosing	Poly Dosing	kg/u	24,595 0	0	138 kg/d kg/d		545,625	0		kg/								
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591 1	0	) ay		178,910	0	C	) day							Row22	duplicate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995 0	o	18 kg/d		343,823	0	c	kg/ 18 d							Non-ior	nic Polymer
NON-INFRA	Water Treatment	GAC	GAC , RGF Type	m3	4,260 1	0	1,259 m3		3,057	1	C	) 1,259 m3							BAC	
NON-INFRA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW	31,579 1	o	597 kW		17,996	1		) 597 kW							Inline Ir	nfluent PS
		Major Water Pumping																		
NON-INFRA	Water Treatment	Station Major Water Pumping	Major Water Pumping	kW	31,579 1	0	0 kW		17,996	1	C	) 597 kW							Intersta	age PS ash PS (part of
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579 1	0	kW		17,996	1	C	746 kW							Intersta	
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591 1	0	1,360 kg/d		178,910	0		kg/ 1,360 d							Bisulph	ite
				NB/ C						-		kg/								
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286 0	0	6,667 kg/d		204,317	0	C	6,667 d kg/							Ferric	
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286 0	0	8,602 kg/d		204,317	0	c	8,602 d							Sodium	Hydroxide
	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286 0	0	2,605 kg/d		204,317	0		kg/ 2,605 d							Hydrog	en Peroxide
	Interstage & Backwash	prediceton		NB/ C	55,200 0		2,000 Kg/ d		204,017	0		2,000 0							iny aros	
FREE ENTRY	PS wet well Site Returns PS wet	No.	5962m3 shaft tank		1,031,670 #N/A	#N/A	1			#N/A	#N/A								Intersta	age & Backwash PS
FREE ENTRY		No.	8594m3 shaft tank		1,200,718 #N/A	#N/A	1			#N/A	#N/A								Site Ret	turns PS
NON- STANDARD		All locations	greater than 500m2	Nr	1,160,000 1	0	1 Nr												Influent	t PS building
NON-	Site wide SCADA /	All locations	Breater than 500m2			0	TINI												muen	- o building
STANDARD NON-	control system PERMANENT SITE	No.	x	No.	######## 1	0	1 No.		0	1	C	0 No.								
NON- STANDARD		ACCESS	Access Track	m	3,625,000 1	0	1 m													
	Sitewide items	No.	E/O		8,700,000 #N/A	#N/A #N/A	1												E/O	
FREE ENTRY		No. No.	E/O E/O		2,175,000 #N/A ######## #N/A	#N/A #N/A	1 1												E/O E/O	
	ITEM DESCRIPTION	No.	OTHER DETAILS			415: / 6														DETAILS
FREE ENTRY		No. No.	Ozone curve UV uplift oor		######## #N/A 0 #N/A	#N/A #N/A	1												Ozone o Remove	curve ed from scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		619,002 #N/A	#N/A	1												Intersta	age PS uplift oor
FREE ENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		720,431 #N/A	#N/A	1												Backwa	ash 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/ 0 43 d							Phosph	oirc Acid
		Major Water Pumping																		
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	<u>31,579</u> 1	0	kW kW		17,996	1	C	) <mark>75 kW</mark>							Site Ret	turns PS

SEVERI TRENT WATER		Element Reference:																CAPEX Cos		ATKINS ARUP
	Values are rounded	Date Issued:	03 August 2022															TREAT230		ARUP
шо	Rate						В	&C				М	&E			Mains	& Sewers		Т	Гotal
adjusted from Ies			Standar						26,052,900					22,176,000				-	£	48,228,900
ljusti			Non-Standar						68,547,800					-	£			-	£	68,547,800
r be aa values	0.5%		Non-Standard Adjus Constructio						130,300 94,731,000					110,900 22,286,900	f				£	241,200 117,017,900
lay b	0.0%			gn Fee					-	f				-	£			-	f	-
rates may e default v			Contractor D&	B Cost	£				94,731,000	£				22,286,900	£			-	£	117,017,900
st rat the d	18.3%		Interna						17,307,400	£				4,071,800	£			-	£	21,379,200
ę	8.6%		Externa						8,165,800	-				1,921,100					£	10,086,900
ie on	21.0%		Project Optimis						<b>120,204,200</b> 38,345,100					<b>28,279,800</b> 9,021,300				-	f f	<b>148,484,000</b> 47,366,400
These	31.9%		Business Case Cost Es						158,549,300					37,301,100				-	f	195,850,400
															the standard rate	s				
															(Quantity)^P + C er, C is a constan	t				
				C	ommerc	al in	formatio	on redacte	d					t Curves set P =		-				
		1			1									ems set P = 1, C	= 0		1.0			
Level 1	Level 2	Level 3	Level 4	Units	м	Р	С	&C Quantity	Cost	м	Р	C M	&E Quantity	Cost	M P	iviains a	nd Sewers Quantit	y Cost	N	Notes
								m3/					m3/				n	1 <mark>3/</mark>		
	Water Treatment Water Treatment	UV Disinfection GAC	UV Plant GAC , RGF Type	m3/d m3	20,033 4,260	0	(	0 d 0 3,194 m3		171,651 3,057	0	0	0 d 0 3,194 m3		0		0 <mark>d</mark>			
NON-INFRA	water meatment	GAC	GAC, KGP Type	1115	4,200			5 5,154 1115		3,037			kg/							
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	(	0 185 kg/d		343,823	0	(	0 185 d							
	Mater Tereter at	Chlorization	De ablerinstien	1	0.504			kg/d		170.010			kg/						Dave 22 deadle	L.
NON-INFRA	Water Treatment	Chlorination	De-chlorination	kg/da	9,591	1	(	0 ay		178,910	0	(	0 day kg/						Row 22 duplic	ate
NON-INFRA	Water Treatment	Poly Dosing	Poly Dosing	kg/d	24,995	0	(	0 24 kg/d		343,823	0	(	0 24 d						Non-ionic Pol	ymer
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	
	Water Heatment	Major Water Pumping		KUU	51,575	-		5 740 KW		17,550	-								lindent i o	
NON-INFRA	Water Treatment	Station	Major Water Pumping	kW	31,579	1	(	0 kW		17,996	1	(	0 746 kW						Interstage PS	
NON-INERA	Water Treatment	Major Water Pumping Station	Major Water Pumping	kW.	31,579	1		D kW		17,996	1		0 746 kW						Backwash PS Interstage)	(part of
				KVV	51,575					17,550			kg/						interstuge,	
NON-INFRA	Water Treatment	Chlorination	Chlorination Dosing	kg/d	9,591	1	(	0 1,820 kg/d		178,910	0	(	0 1,820 d		0		0 0 k	<mark>g/d</mark>	Bisulphite	
NON-INERA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286			0 8,921 kg/d		204,317	0		kg/ 0 8,921 d						Ferric	
NON-INITIA	water rreatment	pheonection	Chem Dosing	Kg/U	33,200			0,521 Kg/U		204,517			kg/						reme	
NON-INFRA	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286	0	(	0 3,466 kg/d		204,317	0	(	0 3,466 d						Hydrogen Per	roxide
	Water Treatment	pH Correction	Chem Dosing	kg/d	35,286			0 11,489 kg/d		204,317	0		kg/ 0 11,489 d						Sodium Hydro	ovide
	Interstage & Backwash		Chem Dosing	Kg/U	33,280	0		5 11,405 Kg/u		204,517	0		J 11,405 U						Soulann Hydro	Mide
FREE ENTRY		No.	7948m3 shaft tank		1,162,937			1			#N/A	#N/A								Backwash PS
FREE ENTRY NON-	Site Returns PS	No.	8701m3 shaft tank		1,206,931	#N/A	#N/A	1			#N/A	#N/A							Site Returns P	'S
STANDARD	BUILDINGS	All locations	greater than 500m2	Nr	1,160,000	1		0 1 Nr											Influent PS bu	uilding
NON-	Site wide SCADA /																			
STANDARD NON-	control system PERMANENT SITE	No.	x	No.	#########	1	(	0 1 No.		27,783	1	(	0 No.							
STANDARD		ACCESS	Access Track	m	2,900,000		(	0 1 m												
	Sitewide items	No.	E/O		#########	#N/A	· · · ·	1											E/O	
FREE ENTRY		No. No.	E/O E/O		2,900,000 ########			1 1											E/O E/O	
	ITEM DESCRIPTION	No.	OTHER DETAILS			min/A	min/A	1											OTHER DETAI	LS
FREE ENTRY	Ozone	No.	Ozone curve		#########			1											Ozone curve	
FREE ENTRY	UV uplift	No.	UV uplift oor		0	#N/A	#N/A	1											Removed from	n scope
FREE ENTRY	Interstage PS uplift	No.	Interstage PS uplift oor		697,762	#N/A	#N/A	1											Interstage PS	uplift oor
	Deskursk PC lift																			
FREEENTRY	Backwash PS uplift	No.	Backwash PS uplift oor		724,159	#N/A	#N/A	1					kg/						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 57 d						Phosphoirc A	cid
	Water Treatment	Major Water Pumping	Major Water Pumping	LAN (	21.570					17,996									Sito Poture P	os
	Water Treatment	Station	water Pumping	KVV	31,579	1	(	0 kW		17,996	1	(	0 75 kW						Site Returns P	5

# A.3 QCRA Templates

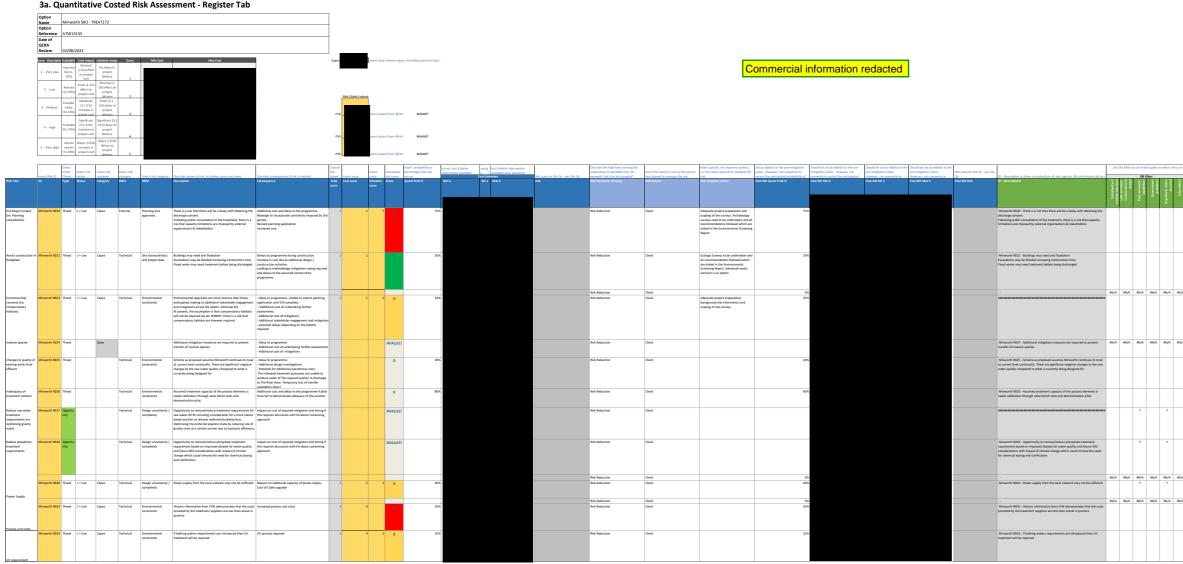
F	
A7W13155-GT-SPR-200004	Costed risk register - STT115
A7W13155-GT-SPR-200005	Costed risk register - TREAT57
A7W13155-GT-SPR-200031	Costed risk register - TREAT57.ALT
A7W13155-GT-SPR-200006	Costed risk register - TREAT115
A7W13155-GT-SPR-200032	Costed risk register - TREAT115.ALT
A7W13155-GT-SPR-200007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

			sk Assessment - Register Tab																	
Option Name Option Refere	Minworth SRI nce A7W13155 f 02/08/2022	O STT115																		
Date o QCRA Review	02/08/2022			_	_															
2 - Ver	Improba (<2%)	mal No delay to	Min Cost Max Cost		insert total scheme capes, escluding	aptimium bias				Co	ommercial info	rmation redacte	ed							
2 - 6	w Remote Small ( (11- effec 30%) project Possible - Mode	spect	-																	
3 - Ma	flum Likely (2.1- (31- increa 52%) proint Probable Signifi	5%) 5%) delay to so in project tout delivery <b>3</b> icant Significant (5.1- (5%) 15%) delay to		e	insert output from illnisk repo	INAME?														
4 - H 5 - Ven	gh (52- 70%) project Almost Maj certain (>25	t cost delivery 4 (or Major (>53%) delays to t cost delivery 5		5	insert output from Grak repo	INVAUE?														
	Codient.	ta in project t cost delivery 5			itsert output from @risk repo	INVANE?	f better information	Describe the high level strategy	for the same or rule of the same	s last or finite states for the second sector is	(blut to the pre-mitigation Should be set by de mitigation usine. It mitigation usine. It	lat to the pre- sever, con pre-miligation solue. pre-mi	id be set by defailut to the mitigation value. However, Not used on Tab Jo - see	7.0	Use the filters as an initial guide on wh	ch risks are most relevant to different QB cor	tributory foctors. To be used when considering factors.	whether the costed risks influence the level of conflu	lence for DB contributory insert	
Risk Title ID	ID Threat status Type Status	colepory colepory Category RISSI	Solicit risk category Describe asbure of risk, including cases and event. 8532 Description	Describe consequences if this is realised data Consequence Pro- too	taad bhaart acore acore acore occu rob Cost score Scheshule Score Qua score score	Cost Externation of the Cost E		ab 20. exemple fold is to be accepted" Intel Response Strategy	bert ploced to monope the risk. Rink Owner	the slops required to milipate the risk. record the Unit response action Post Mit	le anticipated probability of convertier to record Quant Prob % Post Mit Min £	le anticipated Rowever, can avenuette la can av Peet Mit ML & Peet M	ournantie to record the 28. Mit Max 2 Post Mit Risk	<ul> <li>D- Description is allow consideration of olds agreed CH contribute</li> <li>D- Description2</li> </ul>	ry fotori or of the second se	OI Liper. occurred on the matter occurred on the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of the matter of	a solution of the solution of	Nov profect Interaction of contractors in the Approvals Mellicea	Of Filter: Lutho The second s	Mis (Pre) Max (Pre) Ave Me mo
Trenchless solution Minworth Issue (Inc UND)	8001 Threat L=Live	Capex Technical	Site characteristics Gound layers including rock causing difficulty of construct and project data of trenchiess solutions		2 3 6	20%		Risk Reduction	Clert	Conduction-site Ground Investigation Survey	22%					Cran Develo	inside Inside Fourth Fourth	A Store C	Mitting the unforeseen eround liver	3
			Dang to be alread an unstrately with the ground of the fact that a constrainty of any other to be alread to the scalable structure of an unstrate to the tart of ground monotone fact structure of ground and the monotone fact structure of ground and the monotone fact structure of ground and the scalable structure of ground and a scalable structure of ground and a	nd ora X-			1er 1e 25.						200 Tab 70.						growthap Understand growt condition	
Asset owner Minworth stipulations delays	8002 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 Tub 3b. See Tub 3b.	Rak Reduction	Cient	Early engagement with asset owners				Minworth R002 - Laying the rising stulin under motorways	atuja atuja atuja	anya anya anya a	Alpha Alpha Alpha Alpha Alpha	angin angin angin angin a	nya anya anya Nya DPCX	PE X
Protected Species Minworth	8003 Threat L=Live	Capes Technical	Environmental There is a nix that additional ecological works (for protect spieces) are required or cannot be undertaken/Traileed within the target season. Protected Sponters may be found or they may create habit during works.	hed Additional capes cost and time delay to overall project programme.	3 2 3 6	15%	See Tab 3b.	Rick Reduction	Clent	Adequate project preparation and scoping of site surveys.	225			Minworth R023 - There is a nisk that additional ecological works (fo spisses) are required or cannot be undertakes/finalised within the ta season. Protected Species may be found or they may create habitat during s	protected argst		¥.		Lack of survey and unforesteen discovery of protected spinors	2
Existing Infrastructure and buried structures (ISSUE)	RD04 Threat L=Live	Opex Technical	Site characteristics Likelihood of encountering buried structures and unchart utilities (ISSUE)	ed Delay to construction programme. Increased cost.	3 2 6	90%		Rek Reduction	Cient	Conduct on-site investigations	90%			Minworth RDM - Likelihood of encountering buried structures and utilizes (ISSUE)	ancharted			Y Y	Incorrect utility record.(USSUE) Unknown buried structures	IS S U E
Material Price Minworth Increase (EXCLUSION)	ROOS Threat	Commercial	Procurement There is a risk that materials in corporating plantic pipe an metattank could increase by the time this project goes an due to market changes. Large pipeline order leading to lack of raw material availability or manufacturing capacity (IXXLISDIN)	d Additional CAPEX cost due to and - Programme datay - Increased construction duration	0	20%	See Tab 2b. See Tab 2b.	Rick Reduction	Client	Adequate project preparation and planning consultation	225		See Tab 2b.			¥			Unforeseen charge to market condition	EX CL U
Procurement Delays / Minworth	RDG Threat L=Live	Capex Commercial					See Tab 3b.									-			Unformation chargeto mutuch and Lask of main material or autoimatical registric (DVCLUSION)	0 23
Commissioning	NOCE INVEST		Procurement There is a risk that long lead items (gipes, pumps, process equipments) are delayed daw upply chain diaruption. (e.j Covid-19/Clobal conflict) There may be delay in commissioning as both the convegance and treatment works commissioning may nee to be coordinated.	Additional CAVEX COLY CONSTRUCTION programme g. delay. May cause an overall delay in the SRO delivery ed		224		ALL REDUCTOR	Lant	Adequate project preparation, background site information and scoping of site surveys.	200								Due to supply chain disruption. (e.g. Covid-19)	2
More trenchiess Minworth crossings	8007 Threat L=Live	Capes Diternal	conveyance and treatment works commissioning may ne to be operational. Stakeholder Determined and the second state of particle and attempty, national lightways, natives call in availed to construct major road cossings such as road, nall and watercoarses. There is a risk that requirements are nore overous than executed.	Increase in cost and delay to programme due to at unforeseen stakeholder requirements	3 3 g	355	See Tab 20. See Tab 30.	Rak Reduction	Olet		325			Annuard RODE - BPT (Dreak Pressure Tank) being relocated closer			Y	Y Y AND X AN	Inability to gain permission to go	3
Availability of water Minworth	8009 Threat	Opex Opex	exacted. BPT (Break Pressure Task) being relocated closer to the discherge/source due to land access/ecology/schaeolog Risk that the increase in demand of water is higher than th forwarded interaction in the time of closer one		#VALUE!		See Tab Jb.	Rak Reduction	Cient					Minimotti Aude - arri Janear resulte i anci bang reactede colar dicharge/hource due to land access/ecology/archeology						PE
Planning Approval OR Minworth	R010 Threat L=Live	Capex Daternal	Bish that the increase in demand of water is higher than the forecastick, shie changed is in the Taman and deven ring are projected to be more in speed due to demand and which can forware supervision cost for operating addition capacity.     Planning and Bish that timescales and level of engegement involves approvals, and providing applications are present operating additional deprovals, the speed operating application are present than the proprioring its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application are present than the providing its may be neight application and the present the providing its may be neight application and the providing its may be neight application and the providing application are present than the providing its may be neight application and the providing application and the providing application and the providing application are presented and the providing its may be neight application and the providing application and the providing application and the providing its may be neight application and the providing application application and the providing application a		3 1 1 g	25%	See Tab 2b.	Rick Reduction	Ciet	Adequate project preparation and	255				NULLUN		Y	Y	Y Y planning	PE X
Planning conset delay due to public enquity			assumed in the schedule, leading to key milestones being missed.							confirmation with local DND supplier.									Y Y S S S S S S S S S S S S S S S S S S	
Archaeological Minworth discoveries	8011 Threat L=Live	Capes Technical	Risk netwes to delay and additional guildic information day public enquiry. Environmental Significant additional inchanelogy is encountered during constructions at the of the permanent infrastructure, a on critical path items	Programme delay While Investigations are carried out. - Additional cost for nedesign - Additional cost for diversions - Additional cost for diversions	2 2 4 8	20%	See Tab 2b.	Rak Reduction	Clant	Construction and material for disposal risk	25%			Minworth RD11 - Significant additional archaeology is encountered construction at the site of the permanent infrastructure, and on orb terms	during cal path		A.		Encounter significant addisional archaeology during	1
Service diversions Minworth	8012 Threat L=Live	Capes Technical	Site characteristics Service diversions are more numerous or more difficult to and project data incorporate than anticipated resulting in potential rerouts or additional protection or diversion works.	Programme delay 4-12 wks     - Additional cost for redexign 4-12 wks     - Additional cost for diversions 1km	2 2 4	253	See Tab 3b.	Rak Reduction	Client		255			Minworth RD12 - Service diversions are more numerous or more di incorporate than anticipated resulting in potential nerouting or addit protection or diversion works.	flouit to Ional			Y Y	Construction Require more numerous / difficult to	2
Ground water levels Minworth (In: due to Adverse Weather)	R013 Threat L=Live	Capex Technical	Site characteristics: Groundwater levels higher than expected during construction (Should be mainly Owige phase). Roak that adverse weather will delay the construction programme	Programme delay     Additional cost for refering and mitigation if Impacts permanent works     Additional develating / protection may be necessary for construction and access	2 3 6	20%	See Tab 3b.	Rek Reduction	Cient		20%			Minworth RD13 - Groundwater levels higher than expected during o (Should be mainly Design phase). Risk that adverse weather will delay the construction programme	onstruction			Y Y	Require more numerous / difficult to incorporate arerice durarizens lighter than forecashed ground batter lighter than forecashed throughout the Water Water	3
Access to construction Minworth site/Land acquisition/Constructi on working area	8014 Threat L=Live	Capex Diternal	Planning and Approvals delays in on site start for survey or constructions results delays in on site start for survey or construction works. Include the survey or construction works.	Increase in cost g in - delay to programme due to additional design / construction activities	a a a a	50%	See Tab 2b.	Rak Reduction	Clant		255						Y	Y	Y Y Y	1
			Land clean individual of the bacage are not willness Grant part of the probability and provide and the datase graned informations and part maters and for our mater amount the process are proved to be incorrect made amount the process or proved to be incorrect	-increased rgas-Night regulation can band protection regulations of the ODA															NA MAX 400 A	
Energy cost for pumps, plant Impact of strategic planning applications	R015 Threat	Opex Capex Management	There is an increase in energy cost (e.g. pumps, plant) the would make the transfer less viable. Communication During to the length of the route and the Interscales invol-		2 2 2 6	20%	See Tab 3b.	Rick Reduction	Client		20%			Minworth 2015 - There is an increase in energy cost (e.g. pumps, pl would make the transfer less viable. Minworth 2016 - Daving to the length of the route and the timescal in the densitie moreous there is shift the fibe delaws term as not	s involved	Alpha Alpha Alpha Alpha	Alphe Alphe Alphe Alphe Alphe Alphe	<ul> <li>Alpha Alpha Alpha Alpha Alpha Alpha</li> </ul>		PE X 3
			Communication Using to the weight of the focus and the timelocate indo to the factoring of the strength of the timelocate indo the strength of a Strategic Planning Application scheme are not aware of a Strategic Planning Application scheme	Impact to the planning on regional level, not only the local authority.										In the planning process, there is a risk that the delivery team are not Strategic Planning Application scheme					Delivery team unaware of a Santagic Planning Application scheme	c .
Contervinated Minwort material	8017 Threat L=Live	Gapex Technical	Sine dependents. Contractivities development of even under the second se	Dety to grayment is appropriately dispose of contaminated in Alternitia is nodely information of Regularement for specialist storage and removal of contaminated spoil.		50%	See Tab 3b.	Rak Reduction	Clert	Adequate project preparation and detailed surveys.	20%			Memory RUT-Contentional material excesses the multi- content regime match handling and diparticles. Assumption that the m encounted material can be reused in not true	Sworth E			Y Y		
Alternative discharge Minworth location	RO18 Threat L=Live	Capes Technical	Design uncertainty / Alternative discharge location leading to additional design complexity requirement and programme delay	Increase in cost and delay to programme due to additional design	2 2 2	25%	See Tab 2b.	Rick Reduction	Clent		10%			Minworth RDII - Alternative discharge location leading to additiona requirement and programme delay	idmign Y	Y Y Y			Y Alternative	1
Operational regime Minworth	R019 Opportu nity	Opex	Consider emplying and recharging pipe rather than sweetening flow	Reduce open	#VALUE!		See Tab 3b.	Rick Reduction	Client					Minworth R019 - Consider emptying and recharging pipe rather that sweetening flow	Ajama Ajama Ajama n	a Ajpta Ajpta Ajpta Ajpta		ang (A an		PE
HS2 Minworth	R020 Threat L=Live	Capex External	Stakeholder Pipe route crosses HG2 route which will be highly protect	ed Risk of delay due to complications of crossing HS2 route	3 3 2 g	40%	See Tab 2b.	Rak Reduction	Clant	Begin dialogue with 162 early	42%			Minworth R020 - Pipe route crosses H52 route which will be highly	protected		Y	¥ ¥	Route crosses H52	X 1



	Option Name Minworth SR Option Reference A7W13155 Date of QCRA																											
	1 - Very Low bie (1- on no	mal fflect hert		Min Cont	Max Cost		Caperc: [	scheme capue, excluding optimism blos						Com	mercial info	ormation redact	ed											
	2 - Low         (11- 30%)         effect project           3 - Medium         Possible (11- (12- 50%)         Modulation (11- (11- (11- 50%)           Project         Possible (11- (11- (11- (11- (11- (11-)))         Modulation (11- (11- (11-))           Possible (11- (11- (11-))         Modulation (11- (11-))         Modulation (11- (11-))           Possible (11- (11-))         Modulation (11-))         Modulation (11-))           Possible (11-))         Modulation (11-))         Modulation (11-))           Possible (11-))         Modulation (11-))         Possible (11-))           Possible (11-))         Modulation (11-))         Possible (11-))           Possible (11-))         Possible (11-))         Modulation (11-))           Possible (11-))         Possible (11-))         Possible (11-))           Possible (11-))         Possible (11-))         Possible (11-))	delvery     delvery     delvery     delvery     delvery     zx3, deltcan     zx3, deltcan     project     delvery     crate     genicat     delvery     crate     semal(2.1-     delvery     delvery     crate     semal(2.1-     delvery     delvery     crate     semal(2.1-     delvery     delvery     delvery     delvery	2			-	Rick (Static) values:	at from Brisk report for 20 percentile																				
							PSD Americalps	at from Girlsk report for 50 percentile at from Girlsk report for 90 percentile																				
Risk Title	ether Selectr InertRik ID Threat inten D Type Statum	hit Invertinist Sa cotingory co Category D	051 R852	risk cotrgory D	nerðer nature of rísð, including casar and runnt. Skrigtfon		nd Jouant acore acore Insent acore acore Neste Cost score Schedule score		processage thetrik access Quant Prob %	szere, Jacf Antire uka Jacf I ketter előpenden Elformátion audibár hen a uka Jáck Hen Havál Are Cest Elformátes Min E Mis E Mis E Mis E	Notuund on Tob Jo - une Tob Jo.	reponding to identified niki, for example 'hiek is to be accepted' Rick Brancene Strategy	Insert the name or role of the person bed ploced to manage the risk. This Counce	Inserf specific risk response actions, Le. the deps required to milipate the risk. Talk response action	islue, Hourser, can bernette to recard the anticipated probability of Past Mit Quart Prob S	Nigolini scher, Rowener, can enventile is recard file anklacted bet Mit Min 6 Pett Mit Min 6	le: pre-chippiler colar. Rowers, 1 can oversette lo record the 2 Pack Mithdau 2 P	Rot used on Tab 20 - see Tab 20 Poet Mitt Rok	<ol> <li>Description is a flow construction of table agence (24 contributory factors 10 - Description2</li> </ol>	Correlation of the second seco	Balance Actions Departs Actions accurate Information restriction	Col Filter: Property of the second of the s	Fictors Of Filter: paragram of any sequences paragram of any sequences	Proor project In told genero Proof is relation Sile of a set risk on	Permits / Converts / approvals Nationa Economie	day farthe farthe stopped au farthe farthe farthe farthe farthe	ause Milin (Pre)	Max(Pre) Ave Merro
Discharge Consent (inc Planning consultation)	Vinworth RO20 Threat L = Live				Bowing public consultation of the treatment, there is a risk at capacity limitations are imposed by external garisations & stakeholders.		s 1 s	CA position not clear at the time of design     Min-Regards to provide additional information     proposed design     Max-Significant changes to design     Min: Class Sents = C1808-2055 upilit of the strue     Clam     Max: Class Sents = C7208-2055 upilit of the strue     Clam	ure cost dure cost	755		RakReduction		Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Davisonmental Screening Report.					Meworth 2022 - There is a nick that there will be a delay with obtaining the delarange consult. Tollowing public consultation of the treatment, there is a nick that capacity initiations are imposed by estimatiogeniculous. It stallaholders.				Y		Y		allure to emonstrute difficient treatment i line with the water safity parameter equired we to demands one 3nd party.	1
Works construction in floodplain	Minworth R021 Threat L=Live	Сарих Те	ichnical Site chand p	haracteristics Bi roject data Di Fi	lådings may ened anti Roastaton custorisen may be kolodel increasing construction time, sod water may need treatment before being discharged.	Delivity to programme during continuction. Increase in catada to additional design / contruction activities. Leading to methodology miligations being required and delays to the assumed construction programme.	2 1 3	6 Min - Contractor unable to access working area a of materials - additional perioding explanet met Max - Loss of contractors plant and/or materials disruption to programme & access to alle Min 10% upfit from the laten (out structure) cost Max 20% upfit from the laten cost 21M x 20%	red major	20%		Rak Reduction	Over	Ecology Surveys to be undertaken and all recommendation followed which an stated in the Environmental Screening Report. Advanced works contract is an option	205				Mework NZL - Sublig: may need on Totation Executions may benedic increasing constraints these Faced water may need treatment before being discharged.	muja muja muja muja	ania ania ania	h mula mula mula	h #1/2 #1/4 #1/4	Y Y	m/A m/A m/A		Inderestimated lood protection reasures	
Environmental consents (inc Compeniatory habitats)	Winworth R023 Threat L=Live	Capex Te	echnical Enviro	raints ar ar Ar	vironmental approvals are more onessus than those tricester, loading to additional stabilized engagement of migliona aroas the option histotic compensatory habitat prevent, the assumption is that compensatory habitat in the brengaving day entitlet. The mission of the mponutatory habitats are however required		2 2 3	6 Min-Delay in completion of EA surveys - 12mbh Mas - Delay in completion of EA surveys - 12mbh Dating build already in consisting of the -mining impact diversions Min: C2A 20day is 21mbh = 0 setting habitat: C heatra EGA 22 heatraw Mar. C2A 23 heatraw Mar. C2A 24 heatraw Mar. C2A 2	l permanent it per	25%		Buk Reduction	Clert	Adequate project preparation, background site information and scoping of site surveys.	235							Y					inderestimated wirosmental perowi processes impecuatory	2
Invasive species Changes to quality of	Vieworth R024 Threat	Opex	echnical Enviro		ditional mitigation measures are required to prevent insfer of invasive species.	- Additional cost of mitigations	_	CPEX	Lef.	20%		Risk Reduction	Clent		200				Minworth RDH - Additional milligation measures are required to prevent transfer of invasive species.	Alpes Alpes Alpes	anja aljan Aljan	Algen Algen Algen A	Alpha Alpha Alpha A	Aljim Aljim Aljim	Alyra Alyra Alyra	etu/A etu/A 7	abitats are required (A GPEX	DPEX
existing works final effluent			const	d a		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 Scheme is schedule for the future and a high le maintenance will be required to achieve conset Loss of nermone sequid to conditive didge unable water Min: Elix 4 fembra delay = E120k Max: Elix 4 fembra delay = E120k	produce										Minworth RD21 - Scheme as proposed assumes Minworth continues to treat current level continues, Then are significant seguine changes to the new water quality compared to what is currently being designed for								hange in the atchment in irmingham.	
Inadequacy of treatment solution	Vinworth R026 Threat L = Live		echnical Enviro	4	monstration plot.	Additional cost and delay to the programme if plint trials fail to demonstrate adequacy of the solution	5 1	S Mitt: C1k x 12methin = C300k Main: C1k x 24methin = C720k Probability 00%.		80%		Rak Reduction	Clant		80%				Monarch RCE - Assumed tradment capacity of the process elements is need calibration through valuebanch tests and demonstration plat.	5		Y					atomiet in iminghan aw water quality is pecific to each site form permitting houssion, matiment flectiveness may eed to be emonstrated.	1
Reduce raw water treatment requirements (inc optimising gravity main)	Vinworth R027 Opportu nity	14	comp	lexity ra D B	poprtantly to remove/reduce treatment requirements for watter WW localing considerations for a more returner and solution to remove sediment/burbidly/sinc. doming the preferred pipeline route by reducing size of with main it a certain section due to hydraulic efficiency.	this requires discussion with EA about consenting approach.		Bendfi - Bennoval of BAC from the scheme. Mile: 155:554 (UAK-cost) + 5000-mitera x £10 Max: £35:554 (BAC-cost) + 7000metera x £10 Probability: 10%				Risk Reduction	Ciert								Y Y	Ŷ					emove/reduce satment quivements uar to hydraulic fficiency.	5
Reduce phosphate treatment requirements	Venworth R028 Opporte		echnical Desig comp	lexity re	portunity to remove/reduce phosphate treatment guinement based on improved dataset for water quality of hours vQL considerations with impact of climate change with could remove the need for chemical dosing and influention.	Impact on cost of required mitigation and timing if this requires discussion with EA about consenting approach.		Some elements of Phosphate treatment may not Equipment is also used for subin removals and to carbon. Mit: 2.2.33M (mechanical) - Practice trafts & Car Max: 2.2.23M (mechanical) - Practice trafts & Car Probability: 555 Cant of additional scope (weter capacity) Mit: 55 of cada : Dano acts entimates (2504	al organic ur (C2 34M)			Ruk Reduction	Clert		0%				Mework NZI - Oppertunity to memory/whole phosphare tradiment requirement based in improve distant for weight and future NQ considerations with impact of clinitie charge which could remove the reset for hermical during and derification.	Y 	Y Y	Y Algens Algens A	A) #8% (A) #8% (A)	804/A 804/A 804/A	A),018 A),018 A),018	Y S	emove/reduce hosphate restment resultement	3
Power Supply	Minworth R030 Threat L=Dve	Capex Te	echnical Desig	n uncertainty / Pr lealty	wer supply from the local network may not be sufficient	Require an additional capacity of power supply. Cost of Cable upgrade	3 2 1	Min: 5% of Gala 1 base cost estimates ESDM Mar. 7% of SSDM Probability: 35% 6 Cost of cable upgrafis. Min: ESM per Linn x Linn = ESM Mar. ESM per Linn x Linn = ESM Probability: 40%		4075		Risk Reduction	Client		425				Minworth 8030 - Power supply from the local network may not be sufficient		Y Y	¥					nufficient local over that can be apped into	3
Froman unit room	Vinworth R032 Threat L=Uve		const	raints pr	storic information from STW demonstrates that the costs ovided by the treatment suppliers are less than actualin actice		3 4	<ul> <li>Potential multiplier to treament costs to be required.</li> <li>STW. (Ops. 113)</li> <li>Min: Min Multiplier 10% x Treatment Cost (D66, 1)</li> <li>Max: Max Multiplier 20% x Treatment Cost (D66, 1)</li> </ul>		50%		Rak Reduction	Cient		52%				Mnworth R032 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice	Alpha Alpha Alpha	any A	Y	s m(A M(A M(A	mijA #N/A #N/A	move angle angle		Intorically STW ave been given swer costs at stimating stage to hose that are churdle cashed!	4
Process unit costs UV requirement	Vinworth R033 Threat L = Live	Сарих Ти	echnical Enviro	ormental If raints tr	bathing waters requirements are introduced then UV astment will be required	UV process required	2 4 2	g Uke actual costs from extension		258		Ruk Reduction	Client		255			1	Minworth KD33 - If bathing waters requirements are introduced then UV treatment will be required			Y					nois that are clually realised throduction of athing waters onsent may eintroduce enquirement to have IV treatment	4

#### 3a. Quantitative Costed Risk Assessment - Register Tab



ore mo	st relevor	nt to differ	ent OB co	ntributor)	factors. ibutory fa		when co	nsidering	whether t	he costed	risks influ	ence the h	rvel of cor	fidence fa	v OB	insert any					
		OB Filter:		contr	isstory Jo	OB filter:	_			OB filter:			08.5	iter:		furthe				_	
Informution management	De sign complexity	Degree of Innovation	Ervironmentel Impact	ina dequacy of the Bushess Care	Large number of state hold ers	Funding a withbillity	Project mana gement beam	Poor project Intelligence	Public relations	Ste characteristics	Permits / coments / approvals	Political	Economic	la gidations / regulations		Further		Min (Pre)	Max (Pre)	Ave	Memo
					Y						Ŧ			¥	¥		Failure to demonstrate sofficient treatment in line with the water quality parameter required Due to demands from 3rd party.				2
IN/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	Y #N/A	#N/A	¥ #N/A	#N/A	#N/A	#N/A	#N/A	#N/A		Underestimated flood protection measures				1
			Y														Underestimated environmental approval processes Compensiatory habitos are resulted				1
IN/A	#N/A	A/AB	WN/A	#N(A	#N/A	#N/A	#N/A	#N/A	#N/A	A/AB	#N/A	#N/A	#N/A	#N/A	#N/A		N/A OPEX				OPEX 0
			Y														Change in the catchment in <u>Birmingham</u> is specific to each site and in order				0
	¥	Y													Y		to inform permitting remove/reduce treatment requirements				2
	¥	Y													Y		Due to hydraulic efficiency.				3
IN/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	AN/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		remove/reduce phosphate treatment requirement				3
	Y	Y													Y		Insufficient local power that can be tapped into				2
IN/A	#N/A	#N/A	WN/A Y	#N(A	#N/A	#N/A	#N/A	an/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A		Historically STW have been given lower costs at estimating stage to those that are actually realised				4
			¥														Introduction of bathing waters consent may reintroduce requirement to have UV treatment				4

					ssment - Register Tab	b																							
	Option Name	Minworth SR	IO - TREAT230																										
	Date of	A7W13155																											
	QCRA Review																												
	tore - Description	hobabilit Cost i Improba ble (1-	impact Schedüle im imal effect project	to	Max Cost		Capex:	ert total scheme capex,	x, excluding optimism bios					1	Commercia	al information	redacted												
		10%) on pr cp	(1-2%) Minimal (	1											Commercia		Tedacted												
	2 - Low	(11-30%) effect project	ct on project ct cost delivery lerate Small (2.1	on 7 2			Rink (Static) values:																						
	3 - Medium	Likely (2.3- (32-50%) increa projec	Intrust extra for the form infrat. No delay y and conject project delivery attantion of the formation of the formation (1-23) effect to a project delivery project delivery project delivery project delivery project delivery project delivery project delivery project delivery project delivery project delivery project delivery (>253) delivery project delivery (>253) delivery (>253) delivery (>255)	to			P10	ert outaut from Melsk	MAME?																				
	4 - 11gh	Signif Probable (5.1- (51-70%) increa	ficant Significant ( 15%) 15%) delay ase on project	(5.2 / to																									
	5 - Very Hish	Almost Major	(>15%) Major (>15 delays to	7 <b>4</b> 556) 0			P50 (m)	ert autput from Ørisk	#NAME?																				
		(71-99%) projec	ct cost delivery	5			P90	ert output from Brisk	enante?																				
	Insert Risk ID	Select either Select of Threat status	riak insert riak category	Select risk category Select risk category	<ul> <li>Describe nature of risk, including cause and event.</li> </ul>	Describe consequences (frisk is realised	Calucia ted insert score sco	ert Calculated p risk score a	Insert probability as s percentage that risk a occurs	scares, but (f better asing but (f better information information available a available then should be Not Cost Ettimates	t used on Tab 3a - 1 r Tab 3b.	Describe the high level strategy fo responding to identified risk, for example 'risk is to be accepted'	r Insert the name or role of the pers best placed to manage the risk.	Insert specific risk response actions, on <i>Le.</i> the steps required to mitigate the risk.	Set by defalut to the pre-mitigation value. However, can overwrite to recard the anticipated probability of	Should be set by default to the pre- mitigation value. However, can pre overwrite to record the anticipated How	ould be set by defalut to the Should be set by defalut to e-mitigation value. pre-mitigation value. wever, can overwrite to However, can overwrite to	n the Not used on Tab 3a - see Tai 3b.	D - Description to allow consideration of risks against OB contributory factors	Use the filters as an in	nitiol guide on which risks an B Filter:	e most relevant to dj	ifferent OS contributory fact contribute ter:	tors. To be used when ory factors. OS Filter:	n considering whether the co	ted risks influence the lev	el of confidence for O8 In ar OB Filter: fu	uert V the	
Risk Title	D	Type Status	Category	R851 8852	Description	Consequence	Prob Cast score Sch score sco	redule Score C	Quant Prob %	Min 1 Min 1 Min 1 Min 1	•		Rak Demar	Risk response action	Post Mit Quant Prob %	Post Mit Min £ Pos	nt Mit ML E Post Mit Max E	Post Mit Risk	ID - Description2	Combiolity of complexity of Late contractor Late contractor de sign	ografiters Government gubberde mense ocurred information	rnar agene n teign complexity De gree of	Environmental Environmental Instancy of the Bustness Core	Lange number of saleebolders nding a witability Project	ense gerrent beam No or project In beligger or Public relations	te characterisios rmite / coments / approvals Polisios	Economic logislations / rogulations Technology	rther Cause Min	(Pre) Max (Pre) Ave Memo
Discharge Consent (inc Planning consultation)	Minworth R020	Threat L = Live	e 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	Additional cost and delay to the programme Redelign to incorporate constraints imposed by	5 1	s 25	75%		1	Risk Reduction	Client	Adequate project preparation and scoping of site surveys. Archaeology	725				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					Y I	-	Y	Y Y	Failure to demonstrate	3
Constanting					risk that capacity limitations are imposed by external organisations & stakeholders.	al Revised planning application Increased cost.								scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are stated in the Environmental Screening Report.					Imitations are imposed by external organisations & stakeholders.									all of the second secon	
																												required Due to demands from 3rd narty	
Works construction in floodplain	Minworth R021	Threat L = Live	e Capex	Technical Site characteristics and project data	Buildings may need anti floatation Excavations may be flooded increasing construction t Flood water may need treatment before being discha	Delays to programme during construction. time. Increase in cost due to additional design / sarged. construction activities.	2 1		205			Risk Reduction	Client	Ecology Surveys to be undertaken an all recommendation followed which are stated in the Environmental Screening Report. Advanced works	225				Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Flood water may need treatment before being discharged.										1
						Leading to methodology mitigations being required and delays to the assumed construction programme.								contract is an option														Underestimated	
											1	Risk Reduction	Clent							#14/A #14/A #14/A	a. #10(A #10(A #10)	(A #10/A #10/	fits Algets Al	N/A #N/A #N/	(A #33/A #33/A #3	(A #N/A #N/A	#N/A #N/A #N/A	Underestimated flood protection measures	3
Environmental consents (inc Compensatory habitats)	Minworth R023	Threat L = Live	e Capex	Technical Environmental constraints	Environmental approvals are more onerous than tho anticipated, leading to additional stakeholder engagement and mitigations across the option. Poter	ose - Delay to programme. Unable to submit planning application until EIA complete. - Additional cost of undertaking further	2 1	3 6	25%		1	Risk Reduction	Client	Adequate project preparation, background site information and scoping of site surveys.	255	-							Y						1
habitats)					EIA At present, the assumption is that compensatory hab will not be required (as per WRMP). There is a risk th	assessments - Additional cost of mitigations hat - Additional stakeholder engagement and																						Underestimated environmental approval processes Compensatory habitats are	
					compensatory habitats are however required	mitigation - potential delays depending on the habitat required.																						Compensatory habitats are required	
Invasive species	Minworth R024	Threat	Opex		Additional mitigation measures are required to preve transfer of invasive species.	- Additional cost of undertaking further assessments		#VALUE!			1	Risk Reduction	Client						Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.	#10/A #10/A #10/A	A MALA MALA MAL	/A #N/A #N/J	A sty/A sty/A at	N/A #N/A #N/	(A #15(/A #15(/A #15	(A #11(/A #11(/A	en/A en/A en/A	N/A OPEX	OPEX
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 significan negative changes to the raw water quality compared	- Additional cost of mitirations     o - Delay to programme     t - Additional design investigations     t - Detactial for Additional operational meta		0	205		1	Risk Reduction	Client		205				Minworth 8025 - 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						0
					what is currently being designed for	The intended treatment processes are unable to produce water of The required quality to discharge to The River Avon. Temporary loss of																						Change in the catchment in	
Inadequacy of treatment solution	Minworth R026	Threat		Technical Environmental constraints	Assumed treatment capacity of the process elements needs calibration through valve bench tests and	transfer availability (rises) is Additional cost and delay to the programme if pilot trials fail to demonstrate adequacy of the		0	82%			Risk Reduction	Client		125	-			Minworth 8026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.				Y					Change in the catchment in Birmingham. Raw water quality is specific to each site and in order to inform	0
Reduce raw water	Minworth R027	Opportu		Technical Design uncertainty complexity	demonstration pilot. (/ Opportunity to remove/reduce treatment requirement for raw were WTW including moniferation for a mon	solution ents Impact on cost of required mitigation and timing if the remotres discussion with FA shout consection		#VALUE!			1	Risk Reduction	Client			-				v	Y	Y Y					Y		
treatment requirements (inc optimising gravity main)					nature based solution to remove sediment/turbidity/ Optimising the preferred pipeline route by reducing a of gravity main at a certain section due to hydraulic efficiency.	ore this requires discussion with EA about consenting //tinc approach.																						remove/reduce treatment requirements	
Reduce phosphate treatment	Minworth R028	Opportu		Technical Design uncertainty complexity	/ Opportunity to remove/reduce phosphate treatment	t Impact on cost of required mitigation and timing if uality this requires discussion with EA about conserting		#VALUE!			1	Risk Reduction	Clent			-			Minworth R028 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and future WQ	Y	Y	Y Y					Y	Due to hydraulic efficiency.	
requirements		,		Competency	and future WQ considerations with impact of climate change which could remove the need for chemical do and clarification.	approach. Iosing													considerations with impact of climate change which could remove the need for chemical dosing and clarification.									remove/reduce	
																				#10/A #10/A #10/A	amu/a amu/a amu/a			N/A #N/A #N/	(a m1/a m1/a m			remove/reduce phosphate treatment requirement	
	Minworth R030	Threat L = Live	e 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	42%		1	Risk Reduction Risk Reduction	Clent		425				Minworth R030 - Power supply from the local network may not be sufficient	#N/A #N/A #N/A Y	A. #N(A #N(A #N) Y	X IN/A IN/A IN/A	n A/gen A/gen A	N/A #N/A #N/	(A #35/A #35/A #5	(A #N(A #N(A	en/A en/A en/A		3
Power Supply		-			Historic information from STW damonstrates that the							Risk Reduction	Clent						•	MN/A MN/A MN/A	a. #01(A #01(A #01)	/A #N/A #N//	ta A/j/ta A/j/ta A	N/A #N/A #N/	(A #33/A #33/A #3	(A #11(A #11(A	81N/A 81N/A	Insufficient local power that can be tapped into	3
	Minworth R032	Threat L = Live	e Capex	Commercial Procurement	Nistoric information from STW demonstrates that the costs provided by the treatment suppliers are less the actual in practice		3 4	12	50%			Risk Reduction	Client		525				Minworth R032 - Historic information from 57W 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	4
Process unit costs	Minworth R033	Threat L = Live	e Capex	Technical Environmental	8 bathing waters requirements are introduced then 0	UV UV process required	2 4	2 8	25%			Risk Reduction	Cient		235				Minworth R033 - If bathing waters requirements are introduced then UV									Introduction of	4
				constraints	treatment will be required														treatment will be required									bathing waters consent may reintroduce requirement to have UV	
UV requirement		-		Technical - Technical	In matching and all all all the second states							This Restantion	Clent															requirement to have UV treatment	
inability to discharge the proposed flow	Menworth R034	Threat L = Live	e Capex	Technical Environmental constraints	in certain periods the discharge of 230M/d may not allowed because of the impact on the receiving river systems.	t be additional mitigation measures need to be in place to cope with the threat (e.g. storage tanks)	3 2	2 6	25%			Risk Reduction	Litent		255				Minworth R034 - In certain periods the discharge of 230M/d may not be allowed because of the impact on the receiving river systems										
one anabosed form																		-											

	3a. (	Quantit	ative Cos	ted Risk Asse	ssment - Register Tab																							
	Option Name Option	Minworth	SRO - TREATS7.ALT																									
	Review	02/08/202	2				-																					
	2 - Low 3 - Media 4 - High	iow Improba bie (1- 10%) v Remote Sm (11- 30%) pn Likely ( (31- in 50%) pn	All simal Speedect sproject delivery all (1-255) All constraint all (1-255) All constraint all (1-255) All constraint all (1-255) All constraint all (1-255) Second project delivery forderate Second	2	With Chris	Coperc	nert bild scheme coper	, oncluding optimism bios negari for 10 percentile						Comme	ercial informa	ation red	dacted											
	5 - Very H	Almost sigh (71- 925) pr	prificant Significant (5. 1 5.1-255) 255) delay to project aject cost delivery (or (>1555) delays to project aject cost delivery project aject cost	4		P50		report for 50 percentile report for 90 percentile																				
	Insert Risk 8	Failert	scholsk änsertinisk las cotegory	Select risk category Select risk category	Describe nature of risk, including cause and event. Describe consequences if risk is realised	Colucio Ind Josef Insertacore	Insert Colculated score claik score	Insert probability as an percentage that risk in accurs	tores, but if better using but if better information formation available them is a statistical them should be Cest Elements	ot used on Tab Ja - see Tab Jb.	Describe the high level strategy for responding to identified risk, for example 'risk is to be accepted'	insert the name or role of the perso best placed to manage the risk.	on Insert specific risk response actions, i.e the steps required to milipple the risk.	Set by default to the pre-miligation value. However, can overwrite to record the anticipated probability of	Should be set by default to the pre- mitigation value. However, can p overwrite to record the anticipated	hould be set by default to the re-miligation value. lowever, can overwrite to	e Should be set by default to the pre-milipation value. However, Not use can overwrite to record the 2b.	ed on Tab Ja - see Tab	7-Smortpillen to allow consideration of risks applied CR contributory factors	Use the filters as an initial guid	on which risks are most releva	ont to different OB contributory; OB Filter:	factors. To be used when consi factors. OB Filter:	dering whether the costed risk	is influence the level of co littler:	ofidence for OII contributory OB Filter:	linert any furthe	
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Discharge Co Planning con	sent (inc. Minworth R dilation)	1020 Threat L+I	Live Capex	External Planning and approvals	There a value of the off the sector with classified point. References the sector of	2	2 5 10	15%			Rijk Reduction	Clert	Adequate project preparation and scoping of site surveys. Archaeology surveys, need to be undertaken and all recommendations followed which are stated in the Emirrormental Screening Report.	25	2				Anworth 1020 - There Is a risk that there will be a delay with closing the linkings conserved. In the gradient constraints of the tradement, there is write that capacity obtaines are reposed by external organizations. Is claim/olders.				Y		Y	Y Y	Failure to demonstrate sufficient treatment in line with the water quality parameter required Due to demands from 3rd party.	1
Works const floodplain	uction in Minworth R	8021 Threat L =	Live Capex	Technical Site characteristics and project data	Indelage my and refi Belation Constraints my the distribution being disclusion Rood water may need traditional barling disclusion. Longing to methoding mitigations barling required and adapts to the assumed construction programme.	2	2 3 6	205			Risk Reduction	Clert	Ecology Surveys to be undertaken and all recommendation followed which as stated in the Environmental Screening Report. Advanced works contract is an option	28				1 1 1	Manuen Bull 21 Suddige and production maximum may be for discussing a constraint from load water may need tradiment before being discharged.					Y	Ŷ		Underestimated flood protection measures	
Environments consents (inc Compensator habitats)	Minworth R	8023 Threat L=1	Live Capex	Technical Environmental constraints	Destrumental agenvals ar hors sinces that these antigrades, duals a statistical statistical segments approaches, duals and the approximation of the approximation of the approaches, the anothese the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the approximation of the	2	3 3 6	255			Rak Reduction	Clet Clet	Adequate project preparation, background site information and scoping of site surveys.	23	51 53				11 19 19 19 19 19 19 19 19 19 19 19 19 1	Aljate Aljate Aljate	Aijm Aijm Aijm	V Aline Aline Aline Aline	njiA anjiA anjiA anj		Algen Algen Alge	Aljate Aljate Aljate	A Underestimated environmental approval processes Companatory hubitats are required A N(A CPEX	2
Invasive spec	n Minworth R	8024 Threat	Opex		Additional mitigation measures are required to prevent transfer of invasive species Additional cost of undertaking further assessments - Additional cost of mitigations		#VALUE!				Risk Reduction	Clent							Winworth R024 - Additional mitigation measures are required to prevent randler of invasive species.	Alyna Alyna Alyna	angia angia	mija mija m	N/A #N/A #N/A #N	te Alytte Alytte Al	N/A MN/A MN/A	Alyme Alyme Alyme	N/A OPEX	OPEX
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Inadequacy of treatment so	tion	8026 Threat L =1	Capex C	constraints	Assumed transmission of capacity of the process servers it as Additional calleration three process servers in an demonstration plot. This fails demonstrate adequery of the solution	5	2 10	80%			Risk Reduction	Clert		80	5				Almouth 1925 - Assumed treatheric capacity of the process elements is needs allowed in through value banch tests and demonstration plot.			¥					Raw water quality is specific to each site and in order to inform permitting discussions, treatment effectiveness may need to be demonstrated.	
Reduce raw w treatment requirement optimising gr main)	inc	027 Opportu nity			Oppertuitive to encounterfunction transmission of the second of experience of estimation of estimate and temp of the second of experience of the second of experience and the second of experience and the second of experience and the second of experience of the second of polence in the second of experience of the second of polence in the second of experience of the second of polence in the second of experience of the second of the se		#VALUE!				Risk Reduction	Clert								Y	Y	A A				Y	remove/reduce treatment requirements Due to hydraulic efficiency.	
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Power Supply		8030 Threat L+I	Dve 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	4 1 12	42%			Risk Reduction Risk Reduction	Clent		40	25				Kinwarth R000 - Power supply from the local network may not be sufficient.	Y	Y	Y Y		th Alpha Alpha Al	nya Milija Milija	milick BBU/A BBU/A	`	1
Property	Minworth R	1012 Threat L+I	Uve Capex		Nature's Monnation from STM demonstrates that the could process und costs provided by the transformer suppliers are less than actual in practice.	3	4 12	52%			Risk Reduction	Clet Clet		50	25			2	Moworth RDI2 - Historic Information from STME demonstrates that the costs revolved by the treatment suppliers are less than actual in practice	Alyne Alyne Alyne	Alyme Alyme Alyme	mula mula mula m	N/A #N/A #N/A #N	te Alyre Alyre Al	N/A #N/A #N/A	Alyme Alyme Alyme	Insufficient local power that can be tapped into N Historically STW have been given lower costs at estimating tage to those the are actually malked	
UV requireme	Minworth R	8033 Threat L+I	Dive Capex	Technical Environmental constraints	If hatflog usins requirements an introduced then UV VI process required transmet will be required	2	5 <sup>2</sup> 10	25%			Risk Reduction	Clert		2					Almorth 8031 - If balling waters requirements are introduced from UV waters for M be required			Ŷ					actually realised Introduction of bathing waters consent may relintroduce requirement to have UV treatment	a 8.

:	a. Quant	itative Cos	ted Risk Asse	ssment - Register Tal	5																		
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			score Min Cost	Max Cost		Capera:	insert total scheme cap	per, excluding optimism bios								_							
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L						P90	insert output from Gri	IN INAME?															_
	Select either nt Risk ID Threat	Select risk status collegory	Select risk category Select risk category	Describe nature of risk, including cause and event.	Ca ter Describe consequences (frisk is realised ba	alucia nd aued insert score	Insert Colculated	insert probability as d percentage that risk occurs	scores, but if better using but if better information information available then cost information	Not used on Tab 3a - are 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.	<ul> <li>Insert specific risk response actions, i.e. the steps required to millipole the risk.</li> </ul>	Set by default to the pre-mitigation S value. However, can overwrite to n record the anticipated probability of a	auld be set by default to the pre- Should be set by default to the Should be set by default to pre-mitigation value. It pre-mitigation value. It pre-mitigation value. It p	to the owner, Not used on Tob 3o - see T the 3b.	bb D - Description to allow consideration of risks against OF contributory factors	Use the filters as an initial guide on which risks are s OB Filter:	ost relevant to different OB contributor	y factors. To be used when consideri factors. OB Filter:	g whether the costed risks influence the OB Filter:	e level of confidence for GB contributory inae any OB Filter: furt	
Risk Title 10	Type	Status Category	R051 R052	Description	Consequence Ph BO	Prob Cost score come	Schedule Score score	Quart Prob %	Min E MLE Max E	Risk	Risk Response Strategy	Risk Owner	Risk response action	Post Mit Quant Prob S P	nt Mit Min £ Poet Mit ML £ Poet Mit Max £	Post Mit Rok	ID - Description2	Pholity of Protocore version in design design padd tites versenen padd tites s & claims	formation negeration Degrae of moviation unmental impact	acy of the ress Case writes r of behaltiny or tabliny or to arm	or project od ligen o od ligen o relation scorestics	Publicad Economic Islasions / Bulations Islasions	n Cause Min (Pre) Max (Pre) Ave Merro
																		Contract Contract Name Contract Contrac	er tite	Londour Buy Star Landour Landour	Po In	3. 1	
Discharge Consent Au (inc Planning consultation)	worth R020 Threat	L=Live Capex	External Planning and approvals	There is a risk that there will be a delay with obtaining to discharge consent. Following public consultation of the treatment, there is	he Additional cost and delay to the programme Redesign to incorporate constraints imposed by 3rd parties. Revised planning application Increased cost.	2 2	2 5 10	19	55		Risk Reduction	Clent	Adequate project preparation and scoping of site surveys. Archaeology surveys need to be undertaken and all recommendations followed which are	155			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			¥	Y	Y Y	Pailure to 2 demonstrate sufficient treatment to line with the water
				that capacity limitations are imposed by external organisations & stakeholders.	Revised planning application Increased cost.								recommendations followed which are stated in the Environmental Screening Report.				limitations are imposed by external organisations & stakeholders.						in line with the water quality parameter neguined Due to demands from 3rd party.
Works construction in A	worth R021 Threat	L=Live Capex	Technical Site characteristics	Definition was used and fitness for	Polos in concernent de la conciencia de		2 3 6				The Designation	Chest	Table Tarana baratabarat	~			Marcal 2011 Bulley are under Bulley						LOUIDS Certainest
floodplain		L-Lie Capit	Technical Site characteristics and project data	Excavations may be flooded increasing construction tim Flood water may need treatment before being discharg	Delays to programme during construction. Increase in cost due to additional design / ed. construction activities. Leading to methodology mitigations being required and definitions in the service of		11				A	Cana Cana Cana Cana Cana Cana Cana Cana	Ecology Surveys to be undertaken and all recommendation followed which are stated in the Environmental Screening Report. Advanced works contract is an				Minworth R021 - Buildings may need anti floatation Excavations may be flooded increasing construction time. Rood water may need treatment before being discharged.						
					and delays to the assumed construction programme.								option										Underestimated flood protection
Environmental		L=Live Capex									Risk Reduction	Clent						Alges Alges Alges Alges Alges	ny/A any/A any/A any/A	etuja etuja etuja	Alyre Alyre Alyre Alyre	A),/R A),/R A),/R	measures 2
Environmental A consents (inc Compensatory habitats)	worth Huza Triveat	L+Dive Capex	Technical Environmental constraints	Environmental approvals are more onerous than those anticipated, leading to additional stakeholder engageme and mitigations across the option. Potential EIA At present, the assumption is that compressiony habits	- Deay to programme. Unade to submit planning application until EIA complete. - Additional cost of undertaking further assessments. - Additional and admitted too.	- · ·	3 3 6		25		Kisk Heducton	Claire	Adequate project preparation, background site information and scoping of site surveys.	255									z
(actual)				will not be required (as per WRMP). There is a nisk that compensatory habitats are however required	Additional stakeholder engagement and mitigation     potential delays depending on the habitat required.																		Underestimated mylipottential
																							Uder infinited and constant approval process Companisatory hobitas are regulard NA.OPEC OPEC
Invasive species	worth 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						Rsk Reduction	Clert					Minworth R024 - Additional mitigation measures are required to prevent transfer of invasive species.	Alpen Alpen Alpen Alpen Alpen	my/A ang/A ang/A ang/A	ançia ançia ançia	Alyze Alyze Alyze Alyze	Alyne Alyne Alyne Alyne	N/A OPEX OPEX
Changes to quality of a existing works final effluent	worth R025 Threat		Technical Environmental constraints	Scheme as proposed assumes Minworth continues to t at current level continually. There are significant negative		2	0	207	2%		Rsk Reduction	Clert		225			Minworth R025 - Scheme as proposed assume. Minworth continues to treat at current lived continually. There are significant negative changes to the raw water quality compared to what is currently being designed for		Y				
effluent				changes to the raw water quality compared to what is currently being designed for	east - Celay to programme e - Additional design investigations - Potential for Additional operational costs The Interded treatment processes are unable to produce water of the required quality to discharge to The River Aven. Temporary loss of transfer are inferred.												water quality compared to what is currently being designed for						Change in the catchment in
Inadequacy of Automation	worth R026 Threat	L=Live Capex	Technical Environmental constraints	Assumed treatment capacity of the process elements is needs calibration through valve bench tests and		s :	2 10	12	2%		Risk Reduction	Clent		125			Minworth R026 - Assumed treatment capacity of the process elements is needs calibration through valve bench tests and demonstration pilot.		Y				denomin       three starts (unlish)     to control to c
				demonstration pilot.																			and in order to inform permitting discussion.
					_																		treatment effectiveness may need to be
Reduce raw water A	worth R027 Opportu nity		Technical Design uncertainty complexity	/ Opportunity to remove/reduce treatment requirement raw water WTW including consideration for a more nat	s for Impact on cost of required mitigation and timing if this requires discussion with EA about consenting						Rok Reduction	Clert						Y Y	Y Y			Y	5
Reduce raw water M treatment requirements (inc optimizing gravity main)				raw water WTW including consideration for a more nat based solution to remove sediment/harbidity/bioc. Optimising the preferred pipeline route by reducing size gravity main at a certain section due to hydraulic efficie	approach. a of noy.																		nemove/reduce treatment nequirements Due to hydraulic
Reduce phosphate M treatment requirements	worth R025 Opportu		Technical Design uncertainty complexity	/ Opportunity to remove/reduce phosphate treatment	Impact on cost of required mitigation and timing if						Rok Reduction	Clent					Minworth R028 - Opportunity to remove/reduce phosphate treatment	Y Y	Y Y			Y	Due to hydraulic efficiency. 2
requirements	nity		complexity	/ Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water qual and future WQ considerations with impact of climate ch which could remove the need for chemical dosing and clarification.	by this requires discussion with EA about consenting ange approach.												Minworth RD28 - Opportunity to remove/reduce phosphate treatment requirement based on improved dataset for water quality and fature WQ considerations with impact of classist change which could remove the need for chemical dooing and classification.						remove/reduce
				curnation.	_																		remove/recice phosphate treatment requirement
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	worth R030 Threat	L=Live Capex	Technical Design uncertainty complexity	Power supply from the local network may not be suffici	ent Require an additional capacity of power supply. Cost of Cable upgrade	3 3	3 2 9	42	2%		Risk Reduction	Clent		425			Minworth R030 - Power supply from the local network may not be sufficient	Y Y	Y Y			Y Y	Insufficient local
Power Supply											-							Alges Alges	n/A m/A	enu(A enu)A enu(A	muja muja muja muja	A/298 A/298 A/298	power that can be taxoed into
	worth R032 Threat	L=Live Capes	Technical Environmental constraints	Historic information from STW demonstrates that the c provided by the treatment suppliers are less than actua practice	asts Increased process unit costs	3 4	4 12	52	25		Risk Reduction	Clent		52%			Minworth R012 - Historic information from STW demonstrates that the costs provided by the treatment suppliers are less than actual in practice		Y				Historically STW     A     Historically STW     A     Lower costs at     entrology tage to     those that are
Process unit costs																							entimating stage to those that are actually realised
	worth R013 Threat	L=Live Capex	Technical Environmental constraints	If bathing waters requirements are introduced then UV treatment will be required	UV process required	2	s <sup>2</sup> 10	25	25		Rak Reduction	Clert		255			Minworth R023 - If bathing waters requirements are introduced then UV treatment will be required		Y				to a last all and all
UV requirement																							relations to have UV treatment

## A.4 Optimism Bias Templates

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

### Optimism Bias Pipeline

Dation Reference A7A Date of DE Review 1 01/0 Date of DE Review 2 13/0	955-953 Pipeline options 1055-97-5214-20036 /2020 /2022																					
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		Property having an available and the second	or non industrigates an event applications of validity industrigation is the G share interfails provide marketing approach (i) and for enconversation is a relation provide analytement) from a materian as how confidence strategistics. Figli and phase and and an expeditor as a consist where an eleven as exploited, which are determined as a strategistic and where an eleven as exploited with the share encodinged.								The same is in production for an electricate of their hear particulity result (print). However, some such as the enquired sciencific effects in sciencific and primerically change algorithm and regulatory issues remain(\$202). Park \$2 adjr series. These relates is indicated as the graphicary issues remain(\$202). Park \$3 adjr series. These relates is indicated as the graphicary is used to the life system of the voltenerability, name 1 when the part of the scaling on the factories.									The sameth Strycholden is an existence of these hans particle's products when the homes, hand as the regime of submind of Hamiltonian energies and products product and the same of equations remain (2002) (Artik Sate) senses. These area involved influences and of a schwarp significantly now the the equivalence of the schwarp and a schwarp significantly neer the first sense in the schwarp significantly neer to the schwarp size of the schwarp size of the schwarp significantly neer the equivalence of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp size of the schwarp sis of the schwarp size of the schwarp size o		
Technology		Nakaning (ng kasalawat Mahaning (ng kasalawat Mahaning) (ng kasalawat Mahaning	neide wahr isonglen, and anomitanal involvent prasmars should be usered high officients. For scale involvent processes or navel opplication of (motol involvent mounds by by by high bandye mitgation, detailmation or read; mediam angletener considered appropriate							a a	1 To proposal instancia of processor are intendent on process biointinging which can work for sequired effects observed. These areas or alomatic affects comparency priors in the other and providen, metricula and minimization methodologies, which are next laced on commitgeneites.								ox ox	There are and it behind alteration of the consequence system (based) ingl. in terms of specificae, makerials, and insidiation methodologies, which are not based on correct particus.	NEED - Jacoming approval addrey NEED - Jonatennes NEED - Jaharnation discharge insulien	No change
Dhe Island Inflamon carbined				40	Di Away Wigelan Solar	0.200	Annap Mitgelan Padar	8250	1.82	Jar op Wilgrins faster				478	ier op Wigston Taster	0.381	Awap Wigston Tech	0.323	13225 Jersey Migrise Tarler			

27W13105-07-094-202024

#### **Optimism Bias Treatment**

Option Name								7												
Option Name Option Reference Date of OB Review 1	A7W13155-0	O Treatment options GT-SCH-20027						-												
Date of OB Review 2																				
									Non-Standa	ard Civil Engineering		Sta	andard Civil Engineering	1	1				I	
	ot adjus	(just) t adjust)					Combined Upper Bound Optimism Bias (%)	d Proportion of No Upper Bound	on-Standard Civil Engi	neering Capex	100%	Proportion of Standard Civil Engli	neering Capex	0% 44%	Adjusted Optimism Bias (%)					
	s-don	do not ac		Confidence Grade Criteria				Lower bound			6%	Lower bound		3%		0.0.0	portions have been provided			
Contributory factors	ed valu	alues - o		Combence Grade Orcena		Additional Guidance		-	on of cost in each cont			Proportion of cost in each		-		across the requir	red confidence bands	Scoring comment	Associated costed risk	Change as a result of considering the costed risks
	Eng. (fb	(fixed v (calcular					Result from:	therefore propo	Civil Engineering Com ortion of cost require idence bands in these	d to be assigned to		No Standard Civil Engineering Co proportion of cost required to b bands in these	e assigned to confidence	2	Result from:					
	fard Cv.	Civ. Eng		. <u>.</u>					Required		n Factor	Not required Not require	ed Not required	n Factor						
	lon-stand	tandard	High Confidence	Medium Confidence	Low Confidence		66.00%	High	Medium	Low	Aitigatio	High Medium	Low	ditigatio	31.90%	Check for Non-Standard components	Check for Standard components			
Description	Fixed values - da	o not adjust	Guidance to inform scoring	Guidance to inform scoring	Guidance to inform scoring	Guideane to inform scoring	Calculated cell	Insert proportion	n Insert proportion	Insert proportion	Calculated mitigation	Insert proportion Insert propor	tion Insert proportion	Colculated mitigation	Calculated cell	Check proportion sums to 1 where ontion contains Non-	Check proportion sums to 1	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	Outline how the OB milligation factor has been changed when accounting for associated coste
Procurement			Curdulet to injoin acoing	container to injoini acornig	outduice to injoint acomy	Condenses of injection according	Concorned Con	band (0 - 1) Required	band (0 - 1) Required	band (0 - 1)	factors	band (0 - 1) band (0 - 1) Not required Not require	ed Not required	foctors		Standard components	Standard components	been an one reactioning become assignments of being around being and	on sin econo regional anticompania par of ene mar ne ou constructory rocco mopping source promote in ene "Reference information" tab.	risks in the QCRA.
Complexity of contract structure			Clear, well establishment procurement route and processes	Contract strategy or outline commercial business case in place	No contract strategy or commerciate business case in place.	al For business as usual options that will be procured through existing water company frameworks then these may be assessed as high confidence. Options		1			1			0		OK	OK	This is likely to be conventional procurement due to interaction with exiting elements and relatively low cost (DPC-EISOm now proposed by Ofwat) KPMG confirmed this will not	R032 - Historic Information on costs	No change
			or full commercial business case in place	but details still to be developed		should score low confidence where they involve multiple water companies / asset owners, or may be procured through Direct Procurement for Customers, and where detailed orocurements alons have not been developed.												be procured through DPC route		
Late contractor involvement in design		3	Design is business as usual and costs are based upon accurate cost models, or significant contractor	Design is business as usual and t costs are based upon cost models with medium confidence, or initia	s company and the contractor has	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.				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
			involvement in design	contractor involvement in key aspects of design																
Poor contractor capabilities			Contractors and suppliers expected to bid for work have recent experience of similar construction		ed Contractors and suppliers expecte to bid for work have little/no rece experience of similar construction	d Option types where there is limited recent experience in the UK (including large nt reservoirs, reuse and desalination options) should be scored as medium/low confidence.			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	No change
			projects and supply of similar process plant and equipment																R027 - Opportunity to reduce treatment requirements	
Government guidelines			There are multiple recent precedents of procuring projects o	Some recent precedents of procuring projects of a similar	There is limited recent experience of procuring projects of a similar	Where an aption may be implemented though Direct Procurement for Customers, or other less well established procurement routes then low				1	0			0		OK	ОК	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
Diseaster & dat			a similar nature and detailed procurement guidance is in place	nature and detailed procurement guidance is in place	t nature and detailed procurement guidance is not in place	Confidence should be assigned.													2013 Utilated Information on parts	Markener
Disputes & claims occurred		-		Scope and payment mechanism partially defined and there are no major dependencies on third	currently ill-defined and/or there				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	No change
Information management			Information management systems	oarties Some key stakeholders for	third parties Key stakeholders for procurement	Where information management systems for contract and stakeholder management have not been initiated then assign low confidence.	-		1		0.5			0		OK	OK	Information management at early stage of development. Some stakeholders have been	R027 - Opportunity to reduce treatment requirements NA	NA
			between key stakeholders are in place, clearly defined and effective (e.g. project specific, or already	<ul> <li>information management system has been initiated, but details are</li> </ul>	and effective (e.g. project specific,	management nave not been initiated then assign low conpaence.												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.		
Other	2		existing for a project under an existing framework)	still to be developed before it can be effective.	or already existing for a project under an existing framework)															
Procurement combined Project specific		13	.0%				8.58	8% Required	Average Mitigation Fa Required	ctor Required	0.417	Average Mitigati Not required Not require	on Factor ed Not required	0.000	5.330	K Average M	litigation Factor			
Design complexity			Design is business as usual or design contains complexities but these are well understood and	Design is not business as usual du to several complexities. The design	ue Design is complex, for example du gn to the nature of the project or interfaces with existing assets, or constraints. Design mitigations ar	Deprivation of the provided				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	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
			detailed plans and designs are in place to address them	complexities have only been partially understood and addresse	constraints. Design mitigations ar ed. not yet in place.	e sites may be assigned high confidence.												processes.	NO27 - Opportunity to reduce insument requirements	
Degree of Innovation	8		Design is business as usual and/or innovations are well developed and	Design incorporates technology /	Design incorporates new ally technologies and these have not y been fully tested and proven for the	Options using technologies that are well established in the UK should be et assigned high confidence. Options where technologies, or the application of	-		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	OB scored accordingly bearing in mind the impact of these costed risks
	9			application.	specific application.	be assigned medium confidence													R027 - Opportunity to reduce treatment requirements	
Environmental impact			Environmental impacts well understood (e.g. impact on receiving water bodies, noise, INNS	Some assessment of environment impacts has been carried out and	tal Environmental impacts poorly	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 15 medium at Gate 1 unless environmental risks have been identified, detailed and		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	OB scored accordingly bearing In mind the Impact of these costed risks
			transfer, designated sites, visual amenity etc), mitigations identified	and costed to address the most significant of these. Other	transfer, designated sites, visual amenity etc), or significant	costed in the QCRA. For options with significant environmental risks that require investigation a low confidence score would be more applicable before													R033 - Bathing Waters R034 - Diversion of flow not achievable	
Other	5	22 18	where required and included in	mitigations will be required that	environmental issues identified	accounting for the QCRA.														
Project specific combined Client specific Inadequacy of the Business Case	35	10	Needs have been clearly identified	Partial identification of needs and	d Initial identification of needs and	Confidence likely to be low at Gate 1 unless initial stakeholder requirements	20.46	6% Required	Average Mitigation Fa Required	Required	0.500	Average Mitigati	on Factor ed Not required	0.000	11.160	Average M	Itigation Factor OK	As one of 17 SRDs, the need for this particular scheme (or any other) will be unclear until	NA	NA
			Key stakeholders needs identified and included in scope where	initial engagement with stakeholders to refine	output specification, without engagement with stakeholders to	identified and reflected in option scope and/or specifically accounted for in QCRA.												the gated process is much further developed.		
Large number of stakeholders			applicable. Stakeholder approvals not required or key stakeholder approvals	d, Some key stakeholders identified and views obtained, however som			-	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			obtained, or key stakeholders larzelv supportive Funding for the project is secure	other stakeholders remain unidentified.	stakeholders are in active occosition	For options to be funded through the RAPID gated SRO process, or through a	-				0.5						OK	Funding is ring fenced and will be allowed for under enhancement if it goes ahead		14
Ponding availability	3		(e.g. project fully funded through price review / pass through	challenges at price review which		price review, a medium confidence score is considered appropriate.					43					UK	UK UK	Parking is ring reliced and will be allowed for brider email.center, it is gots anead	194	RA
Project management team	2		arrangement) Scope of work is business as usual	may require business case to be revisited Company delivery team has some			-				0.5			0	-	OK	ОК	Project management team yet to be identified. Last in-house high value scheme suffered	NA	NA
roject management team			for company delivery teams.	experience in implementing projects of this nature, but their	experienced in implementing													significant problems. For NS Water treatment on a Waste site		107
Poor project intelligence	9	7	Good understanding of key project	relevant experience is not extensive. t Partial understanding of key proje	ect Significant gaps in project data an	d	-		1		0.5			0	-	OK	ОК	We have effectively gone worst case on need - no reason for bias on this element	R021 - anti-floatation and dewatering	No chanse
			data and no key assumptions made where there is significant	e data and there has been some wo undertaken to reduce the	ork key assumptions made where ther is significant uncertainty	re														
			uncertainty (e.g. ground conditions condition of existing assets, treatment requirements)	s, uncertainty around key assumptions (e.g. ground conditions, condition of existing																
Other			0%	assets. treatment requirements)				45			0.000									
Client specific combined Environment Public relations		9	Project business as usual and not	Project could lead to some local	Project could lead to local		22.44	Required	Average Mitigation Fa Required	Required	0.600	Average Mitigati	ed Not required	0.000	10.200	N Average M	OK	Due to the size of the conveyance works and the potentially emotive issue of transferring	NA	NA
			or local stakeholders aware and	some engagement with key	Project could lead to local opposition once local stakeholders aware, or stakeholders aware and	5												water (treated effluent) into another catchment, it is likely that local opposition will arise For NS No known major objectors.		
				stakeholders and it is likely that th major concerns raised can be resolved																
Site characteristics	5	3	Site information well understood (e.g. archaeology, heritage assets,	understood (e.g. archaeology,	Site information poorly understoo (e.g. archaeology, heritage assets,	d			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	R021 - anti-floatation and dewatering	No change
			contamination etc.), mitigations identified where required and included in costs	heritage assets, contamination etc.), mitigations identified where required and included in costs	e not identified	ns.												mitigation measures have already been identified. These risks will be further mitigated as additional site investigations progress.		
Permits / consents / approvals			No permits and consents required.	Permits and consents required, but regulators, planning authorities and	ut Permits, consents and approvals and required from regulators, planning	Confidence likely to be low at Gate I unless option is business as usual or risks well developed and costed in QRA.		1			1			0		DK	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
				Government supportive	authorities and/or Government an obtaining these presents a materia risk	al														
Other Environment combined External influences		8	.5%				5.61	1%	Average Mitigation Fa Required	ictor	0.833	Average Mitigati	on Factor	0.000	1.360	K Average M	Itigation Factor			
Political				Project could attract political attention, while there is not cross	Project has the potential to attract political attention and lacks cross-	Projects that are high profile and considered likely to be controversial should be     assigned low confidence.		1	Required	negured	1	Not required Not requir	HIST required	0		OK	ОК	Project likely to attract political attention. Political party support unknown. For NS Public may view as effluent reuse	NA	NA
			stakeholders are supportive	party political support the majorit of political stakeholders are likely to be supportive	ty party political support															
Economic	3	7	Project has a short lead time and is less vulnerable to changes in	s Project has a medium lead time so there is some risk that a change in	<ul> <li>Project has long lead time and change in economic environment could impact demands and/or inp</li> </ul>	When considering lead times (including planning and development time) assume short for sS years, Medium for 6-10 years, Long for >10years.			1		0.5			0		OK	OK	Should be medium based on guidance	NA	NA
			funding and input costs	the economic environment could impact demands and / or input costs	could impact demands and/or inp costs	ut i i i i i i i i i i i i i i i i i i i														
Legislations/regulations	8		Project is business as usual and /or required standards and regulations	s are relatively new and therefore	Key standards and regulations are under development, or subject to	For new technologies or novel applications of existing technologies in the UK that potentially require regulatory approvals (e.g. for environmental or drinking			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
			are well established and unlikely to change	o less well established.	change.	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	Technology (e.g. treatment	Technology (e.g. treatment	Treated water transfers and conventional treatment processes should be scored			1		0.5			0		ОК	ОК	The proposed treatment processes are based on proven process treatment units.	R020 - delay to consent	OB scored accordingly bearing in mind the impact of these costed risks
			processes, smart metering technology) is well established, accepted by regulators and unlikely	processes, smart metering technology) is relatively new. While it has not yet been accepted	processes, smart metering technology) is new and/or is subject to rapid innovation which	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												However, this may be the first combination of these treatment units in one works to remediate waste water final effluent.	R030 - Power Supply insufficient R028 - Phosphate removal opportunity	
				by regulators, it is likely to be and therefore a change in the																
Other External influences combined	1	13	.5%	requirements is unlikely.			8.91	15	Average Mitimitar 7-	ctor	0.625	harren Hirert	n Factor	0.000	3.848	S Aurora 10	Stigation Factor			
success of the second s		4					. 0.51		Average Mitigation Fa		0.040	Average Mitigation			. 3.040	HING AGE M	litigation 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

STT115/57: Input Data		
Running Time	24	hrs
Density	1000	
g	9.81	m/s²
Pumping Station Overall Efficiency	65%	%
Energy Cost		£/kWh
Sweet Flow	10%	of Peak Flow

Sweetening flow			Ml/d
Sweetening now		0.035	m³/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 (£)	£		£/year
Mega liters of water transferred per year		986	Ml/year
Max Variable Opex (£/Ml)	£		£/ML

Peak flow STT115			Ml/d
reakitow STITIS		1.33	m³/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 (£)	£		£/year
Mega liters of water transferred per year		4,198	Ml/year
Max Variable Opex (£/Ml)	£		£/Ml

Fixed OPEX valid for STT57 & 115 - same pump installation

Peak flow STT57			Ml/d
reak now 51157		0.66	m³/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 (£)	£		£/year
Mega liters of water transferred per year		2,081	Ml/year
Max Variable Opex (£/Ml)	£		£/Ml

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

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

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

Max Fixed Opex (£ /yr)
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

#### TREAT57\_STT

						Repair &		
tem Ref	Item	Equipment Power	<b>Building Electrical</b>	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station				i			
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							
otal								

#### TREAT57.ALT\_STT

		Equipment	Building			Repair &		
Item Ref	Item	Power	Electrical	Chemicals	Specialty Items	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								

#### TREAT57\_GUC

						Repair &		
Item Ref	Item	Equipment Power	<b>Building Electrical</b>	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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								

#### TREAT115\_STT

						Repair &		
Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	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								

#### TREAT115.ALT\_STT

						Repair &		
Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	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								

#### TREAT115\_GUC

						Repair &		
Item Ref	Item	Equipment Power	<b>Building Electrical</b>	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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								

#### TREAT115\_STT57\_GUC57

						Repair &		
Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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								

#### TREAT172 STT115 & GUC57

						Repair &		
Item Ref	Item	Equipment Power	Building Electrical	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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								

#### TREAT172 STT57 & GUC115

						Repair &		
Item Ref	Item	Equipment Power	<b>Building Electrical</b>	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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								

						Repair &		
Item Ref	Item	Equipment Power	<b>Building Electrical</b>	Chemicals	Specialty Items	Maintenance	Other	Total
		Variable	Variable	Variable	Variable	Fixed	Variable	
1	Influent Pumping Station							
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



Treatme	nt Option	Fuch a diad Carbon (CO2a)	Operational Carbon	Total Whole Life Carbon	
Project Reference	STW Carbon tool reference	Embodied Carbon (tCO2e)	Grid power Operational Carbon (tCO2e)	Non-power related operational carbon	(tCO2e)
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

Name         Name </th <th>obs</th> <th>Key User Selection / Input</th> <th>Embodied - Gate 2, Option 8 Brief Description of works</th> <th>Gate 2 - WRMP19 - B (115 MLI Total Pipe Length: 31,400 m.</th> <th>)</th> <th>Click to</th> <th>o return to Project Setup &amp;</th> <th>Navigation page</th> <th></th> <th></th> <th></th> <th>Embodied Carbon Calculation</th> <th>s - Source Methods</th> <th>ology</th> <th></th> <th></th> <th></th>	obs	Key User Selection / Input	Embodied - Gate 2, Option 8 Brief Description of works	Gate 2 - WRMP19 - B (115 MLI Total Pipe Length: 31,400 m.	)	Click to	o return to Project Setup &	Navigation page				Embodied Carbon Calculation	s - Source Methods	ology			
Norm Norm<		Information - No Input Require Calculation - LOCKED Validation Note - Action		i doues to enter information in and minute former the	OD All assets can be renamed if construct	Cick to	o view Inclusions & Exclusi Dick to enter Operational Ir	ons for all assets	The embodied can undertaken for ea points and limits.	rbon calculations o ach item in a range	consider the materials of sizes for primary a	used in each item, applying factors fro nd secondary metrics (where applicabl	m CESMM, Defra an e). These are then re	d the Bath Invento gressed to the mos	ory of Carbon and Ener st appropriate formula	gy. Calculations are and tested for fit, turning	
Image: Control         Contro         Contro         Contro         Contro         Contro         Contro         Contro         Contro <thcontro< th="">         Contro         Co</thcontro<>		A5365 1	20 are Free endy. Flease use urop	-covers to enter anomaton ar each country to assets 21-	oo, Ak assess can be renamed in required.	Embodied Ca	erbon		Primary Metr	ic			Secondary Me	tric			
···· ····	Item	Works	Stage		Asset Name	Quantity	Unit of Quantity	Unit of measurement			Primary Measurement	Unit of measurement			Secondary Measurement	Embodied Carbon (tCD2e)	OpEx Cate
Image in the set of th	Asset 1																Powe
Math Mat																	
Image																	2
Math Math<																	
Image	Asset 6					_											
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matrix     matrix <td></td>																	
Mat <td></td> <td>a a</td>																	a a
Image	Asset 11								N/A - F	Free Entry	-		N/A - 1	Free Entry	_		ats - We
Image     Image    <																	Genic
Image																	
Image     Image    Image    <																	
Image         Image <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>N/A - F</td> <td>Free Entry</td> <td></td> <td></td> <td>N/A -1</td> <td>Free Entry</td> <td></td> <td></td> <td></td>									N/A - F	Free Entry			N/A -1	Free Entry			
Image         Image <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>																	
Partner         <																	
Partner         Partner <t< td=""><td>Asset 20</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	Asset 20																
M-         Norm         N	field e Gravity Main Length withi	Sewerage (Infra) in															w ater
John         Dirac         Dirac <thd< td=""><td>field</td><td>Sewerage (Infra)</td><td>Sewerage (Infra)</td><td>Sewerage (infra)</td><td>Sewer (Gravity) - Open Cut Depth 3 - Sm Field / Verge</td><td>11,111.0</td><td>Length (m)</td><td>Int. Diameter (mm)</td><td>75.0</td><td>2,400.0</td><td>1,050.00</td><td>Not Applicable</td><td>N/A</td><td>N/A</td><td></td><td>39445.64</td><td>Waster</td></thd<>	field	Sewerage (Infra)	Sewerage (Infra)	Sewerage (infra)	Sewer (Gravity) - Open Cut Depth 3 - Sm 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	Waster
imple     imple    imple    <	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	micats
Image         Image <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>ŝ</td></th<>																	ŝ
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Mode         Mode <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>																	
JMP         JMP <td></td>																	
Image         Norme         Norme <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<>																	
Image         Original         Original <thoriginal< th="">         Original         <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></th<></thoriginal<>																	
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Nome         Nome         Nome         No         No        No        No <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td></th<>																	2
Norme         Norme <th< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Tanker</td></th<>																	Tanker
Norme         Norme <th< td=""><td>Trenchless Rising Main</td><td>Cross Functional</td><td>Site Wide</td><td>Crossings</td><td>Crossings &gt; 700mm Dia</td><td></td><td></td><td>Int. Diameter (mm)</td><td>700.0</td><td>1,800.0</td><td>1,050.00</td><td>Length (m)</td><td>10.0</td><td>400.0</td><td></td><td>16.89</td><td>Sudge .</td></th<>	Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia			Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0		16.89	Sudge .
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indem     indem<     indem     indem<     indem<     indem     indem<     indem< </td <td></td> <td></td> <td></td> <td></td> <td></td> <td>84.0</td> <td>Length (m)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>84.0</td> <td></td> <td></td>						84.0	Length (m)								84.0		
NumberNumb	Trenchless Rising Main	Cross Functional	Site Wide		Crossings > 700mm Dia			Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0		17.74	
NormalNorma																	
indem andindem and <td></td>																	
MathematicalMathMathMathMathematicalMathMathematicalMath						54.0	Length (m)								54.0		
Indication<	Trenchless Gravity Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia			Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m)	10.0	400.0		6.72	
ImageMather																232.37	
Index <th< td=""><td></td><td></td><td>Site Wide</td><td>Crossings</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1,200.00</td><td></td><td></td><td></td><td></td><td>4.97</td><td></td></th<>			Site Wide	Crossings							1,200.00					4.97	
IndemoSimultation <td></td> <td></td> <td>Site Wide</td> <td>Crossings</td> <td></td> <td>77.0</td> <td>Length (m)</td> <td></td> <td></td> <td></td> <td>1,200.00</td> <td></td> <td></td> <td></td> <td>77.0</td> <td>15.94</td> <td></td>			Site Wide	Crossings		77.0	Length (m)				1,200.00				77.0	15.94	
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AndImageI		Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	,	- to dive (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	36.00	3.42	
AndImage: AndImag																	
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Asset 86	Asset 85	-	+								<u> </u>						

	Severn Trent Water Carbon Calculator						
	Operation - Gate 2, Option 8 Description of operational activities / annual requirements		Click to return to	Project Setup &	Navigation name		
			the second s			_	
			Click to enter Emb				
			Click to jump	to Sludge Tanke	ring Module		
			Operational Carbon				
		Enter Operational Carbon Informa		gs in row 48			
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	1,249.93	
	Diesel - Vehicles			Litres / year			
2	Fuel Oil - Generator			Litres / year			
	Fuel Oil - Heating			Litres / year			
	Imported Natural Gas			m3 / year			
	Aluminium Sulphate			kg/year			
	Chlorine Gas			kg/year			
	Ferric Chloride			kg/year			
	Lime			kg/year			
Water	Monosodium Phosphate (MSP)			kg/year			
	Orthophosphoric acid			kg/year			
micats.	Polyaluminium Chloride (PACI)			kg/year			
ě	Polyelectrolytes (various)			kg/year			
	Sodium Hydroxide (NaOH)			kg/year			
	Sodium Hypochlorite			kg/year			
	Sulphur Dioxide / Bisulphate			kg/year			
	Sulphuric Acid			kg/year			
	Acetic Acid	Optimisation of Trade Waste facilities	Liquid	kg/year			
	Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid	kg/year			
	Calcium Nitrate	Septicity control (Networks)	Liquid	kg/year			
3	Ferric Chloride	Coagulation (P Removal)	Liquid	kg/year			
stewa	Ferric Sulphate	Coagulation (P Removal)	Liquid	kg/year			
- Was	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid	kg/year			
micals	Methanol	Carbon Source for BNR	Liquid	kg/year			
ŝ	Polyaluminium Chloride (PACI)		Liquid	kg/year			
	Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid	kg/year			
	Sodium Carbonate	pH correction	Liquid	kg/year			
	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
Sudge Tarikering							
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and a second							

n DS	Key User Selection / Innut	Embodied - Gate 2, Option 8 Brief Description of works	Gate 2 - WRMP19 - B (S Total Pice Length: 31 400 c	r MLD)	Gick to	return to Project Setup & N	lavigation page				Embodied Carbon Calculations					
	Information - No Input Required Calculation - LOCKED Validation Note - Action		Total Pipe Length: 31,400 m.				ns for all assets	The induction of the second se								
	A3283 1-4	u are Free Entry. Please use grop	-bowns to enter information in each column for assets 21	cuu. An assets can be renamed if required.	Embodied Ca	rbon		Primary Metri	c			Secondary Me	etric			
Item	Works	Stage	Process Click to view Asset Index	Asset Name	Quantity	Unit of Quantity	Unit of measurement	Sc Min		Primary Measurement	Unit of measurement	Min	Scale Max	Secondary Measurement	Embodied Carbon (tCO2e)	OpEx Cate
Asset 1					_				ree Entry				Free Entry			Power
Asset 2 Asset 3									ree Entry				Free Entry Free Entry			3
Asset 4								N/A - Fi	ree Entry			N/A -	Free Entry			
Asset 5 Asset 6									ree Entry				Free Entry Free Entry			
Asset 7									ree Entry				Free Entry			
Asset 8									ree Entry				Free Entry			
Asset 9 Asset 10									ree Entry				Free Entry Free Entry			1
Asset 11									ree Entry				Free Entry			kals - W
Asset 12 Asset 13					-				ree Entry				Free Entry Free Entry			Ge
Asset 14									ree Entry				Free Entry			
Asset 15									ree Entry				Free Entry Free Entry			
Asset 16 Asset 17									ree Entry				Free Entry			
Asset 18									ree Entry				Free Entry			
Asset 19 Asset 20								N/A - Fi N/A - Fi	ree Entry				Free Entry Free Entry			
e Rising Main Length within field Gravity Main Length withi	Sewerage (Infra)	Sewerage (Infra)	Sewerage (infra)	Sewer Rising Main - Open Cut Depth 3 - Sm 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	vater
Gravity Main Length withi field	n Sewerage (Infra)	Sewerage (Infra)	Sewerage (infra)	Sewer (Gravity) - Open Cut Depth 3 - Sm 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	Wastere
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	e mic als
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	6
Sewerage PS Break Pressure Tank	Sewerage (Non-Infra) Sewerage (Non-Infra)	Sewerage PS Shaft Tank	Sewerage PS Shaft Tank	SPS Pump - 24 Hrs / Day Running Shaft Tank	2.0	Number	T_Power (KW) Capacity (m3)	0.2	3,000.0	900.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		73.15 408.71	
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	
Surge	Cross Functional	Site Wide	Valves Valves	Valve - Air Release	2.0	Number	Diameter (mm)	20.0	250.0	50.00	Not Applicable	N/A	N/A		0.14	
Surge Trenchless Rising Main	Cross Functional Cross Functional	Site Wide Site Wide	Valves Crossings	Valve - Air Release Crossings > 700mm Dia	147.0	Length (m)	Diameter (mm)	20.0	250.0	75.00	Not Applicable Length (m)	N/A 10.0	N/A 400.0	147.00	0.08	
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	
Trenchless Rising Main Trenchless Rising Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	77.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m) Length (m)	10.0	400.0	77.0	61.77	
Trenchless Rising Main	Cross Functional	Site Wide	Crossines	Crossines > 700mm Dia	266.0	Length (m)	Int. Diameter (mm)	700.0	1.800.0	1.050.00	Lenath (m)	10.0	400.0	266.0	186.70	Tankeri
Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	80.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	80.0	16.89	Sudge
Trenchless Rising Main Trenchless Rising Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	62.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m) Length (m)	10.0	400.0	62.0	37.37	
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	
Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	84.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m)	10.0	400.0	84.0	18.62	
Trenchless Rising Main Trenchless Rising Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	57.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Length (m) Length (m)	10.0	400.0	57.0	17.74 8.57	
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	
Frenchless Gravity Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	54.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m) Length (m)	10.0	400.0	54.0	17.54	
Frenchless 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	
Frenchless Gravity Main	Cross Functional	Site Wide	Crossines	Crossines > 700mm Dia	294.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1.800.0	1.200.00	Length (m)	10.0	400.0	294.0 43.0	232.37	
Frenchless Gravity Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	77.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m) Length (m)	10.0	400.0	77.0	4.97	
Frenchless 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	
Frenchless Gravity Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	127.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,200.00	Length (m) Length (m)	10.0	400.0	127.0	43.36 34.33	
Frenchless Gravity Main		Site Wide	Crossines	Crossines > 700mm Dia	98.0	Length (m)	Int. Diameter (mm)	700.0	1.800.0		Length (m)	10.0	400.0	98.00	25.82	
Trenchless Rising Main	Cross Functional	Site Wide	Crossings	Crossings > 700mm Dia	23.0	Length (m) Length (m)	Int. Diameter (mm)	700.0	1,800.0		Length (m)	10.0	400.0	116.00	35.51	
Trenchless Rising Main Trenchless Rising Main	Cross Functional Cross Functional	Site Wide	Crossings Crossings	Crossings > 700mm Dia Crossings > 700mm Dia	55.0	Length (m)	Int. Diameter (mm)	700.0	1,800.0	1,050.00	Longth (m) Longth (m)	10.0	400.0	23.00	1.40	
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	634	
Trenchless Rising Main Asset 59	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	
Asset 60																
Asset 61																
Asset 62 Asset 63																
Asset 64																
Asset 65 Asset 66																
Asset 66 Asset 67																
Asset 68										$\vdash$				$\vdash$		
Asset 69 Asset 70																
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Asset 81 Asset 82																
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Asset 84 Asset 85																
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# ide (PACI stmisston of Trade Waste Bacilities agalitistic (P.Removal) epitoly control (Networks) Ecoglistica (P.Removal) Coggistica (P.Removal) Chemical (Cleaning in Membrane Sy Carbon Source for BNR iquid olid or liquid Coagulation, flocculation aid, sludge to pH correction pH correction, softening, neutralisation o membrane systems. Septicity control [No or liquid Sludge Tankering disposal (One-Waj kering - Sludge Quantity (wet tonnes)

Enter Oper

al Carbon - Activity Operational Carbon - Application (as appropriate)

Click to return to	Decision Coltras B	No. dealers and a		
Click to enter Emb				
Click to jump		rinz Module	_	
Operational Carbon				
Operational Carbon ation in rows 19-46. See Headi	ngs in row 48	for Sludge Tank	ering Module	
Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	2,943,360.00	624.96	
	Litres / year			
	Litres/year			
	Litres / year			
	m3 / year			
	kg / year			
	kg / year			
	kg/year			
	kg / year			
	kg/year			
	kg / year			
	kg/year			
Liquid	kg/year			
Solid or liquid	kg/year			
Liquid	kg/year kg/year			
Liquid				
Liquid	kg/year kg/year			
Liquid	kg/year			
Liquid	kg/year			
Solid or liquid	kg/year			
Liquid	kg/year			
Liquid	kg/year			
Sludge Tankering				
Sludge Tankering - Distance to disposal site	Period	Frequency	Sludge Tankering Carbon	Sludge Tankering - Comments
(One-Way, km)			(tCO2e / year)	
+				
+				

VERN ALTER Cobs	KCy User Selection / Input Information - No Input Required Calculation Note - Action Validation Note - Action Attack In	Severn Trent Water C Embodied - Gate 2, Option 1 Brief Description of works 20 are Free Entry. Please use dro		21-000. All screets can be remained if required.	Clickt	o return to Project Setup & o view inclusions & Exclusi Click to enter Operational Is	Navigation page	The embodied car undertaken for ea points and limits.	rbon calculations co ch item in a range c	onsider the materials o of sizes for primary an	Embodied Carbon Calculations see in each Item, applying factors from secondary metrics (where applicable)	- Source Methodolog n CESMM, Defra and the I. These are then regress	/ Bath inventory of i ed to the most app	Carbon and Energy propriate formula a	y. Calculations are ind tested for fit, turning		Severa Trent Water Carbon Calculator Operation - Gate 3, Option 1 Description of operational address / annual requirements 577MD +2007	d the year // 11 MID 50% of the year	Click to r Click to r
					Embodied Ca	irbon	_	Primary Metri				Secondary Metric					1		Operational Ca formation in rows 19-46. See I
ltem	Works	Stage	Process Click to view Asset Index	Asset Name		Unit of Quantity	Unit of measurement	Min	tale Max	Primary Measurement	Unit of measurement	Scale Min	Max N	Secondary Measurement	Embodied Carbon (tCD2e)	OpEx Catego	·	Operational Carbon - Application (as appropriate)	Operational Carbon (as appropriate
Asset 1 Asset 2	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3		iree Entry iree Entry	5,400.00	tCO2e/m3	N/A - Free N/A - Free		0.03	185.93	Power	Grid Electricity Diesel - Vehicles		
Asset 3									ree Entry			N/A - Free				3	Fuel Oil - Generator		
Asset 4									ree Entry			N/A - Free				-	Fuel Oil - Heating		
Asset 5 Asset 6									ree Entry			N/A - Free N/A - Free					Aluminium Sulphate		
Asset 7									ree Entry			N/A - Free					Chlorine Gas		
Asset 8 Asset 9									ree Entry			N/A - Free N/A - Free		_			Ferric Chloride Lime		
Asset 10									ree Entry			N/A - Free				ě.	Monosodium Phosphate (MSP)		
Asset 11									ree Entry			N/A - Free				icais - Wa	Orthophosphoric acid Polyaluminium Chloride (PACI)		
Asset 12 Asset 13									ree Entry			N/A - Free N/A - Free				E C	Polyelectrolytes (various)		
Asset 14								N/A - Fi	ree Entry			N/A - Free	Entry				Sodium Hydroxide (NaOH) Sodium Hypochlorite		4
Asset 15 Asset 16									iree Entry iree Entry			N/A - Free N/A - Free					Solium Hypochionte Sulphur Dioxide / Bisulphate		
Asset 17									ree Entry			N/A - Free					Sulphuric Acid		
Asset 18									ree Entry			N/A - Free					Acetic Acid Aluminium Sulphate	Optimisation of Trade Waste facilities Coagulation (P Removal)	Liquid Solid or liquid
Asset 19 Asset 20								N/A - Fi N/A - Fi	ree Entry ree Entry			N/A - Free N/A - Free					Calcium Nitrate	Septicity control (Networks)	Liquid
Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	0.2		112.00	Not Applicable	N/A	N/A		14.03	vater	Ferric Chloride	Coagulation (P Removal)	Liquid
Influent Pumping Station CoMag Mixing and Flocculation	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	. Waster	Ferric Sulphate Hydrochloric Acid	Coagulation (P Removal) Chemical Cleaning in Membrane Systems	Liquid
Tanks CoMag Ferric Storage and Dosing	Cross Functional Cross Functional	Site Wide	Concrete Tank Concrete Tank	Concrete Tank No M&E Concrete Tank No M&E	2.0	Number	Volume (m3) Volume (m3)	5.0	2,000.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		72.52 85.72	emicals -	Methanol	Carbon Source for BNR	Liquid
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	đ	Polyaluminium Chloride (PACI) Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Liquid Solid or liquid
BAC	Cross Functional Cross Functional	Site Wide	Building Concrete Tank	Building - Treatment Concrete Tank No M&E	6.0	Number	Area (m2) Volume (m3)	45.0	3,000.0		Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	808.18 93.89		Holyelectrolytes (vanous) Sodium Carbonate	pH correction	Liquid
	Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration	Biological Filter (Civil)	4.0	Number	T_Volume (m3)	25.0			Not Applicable	N/A	N/A		62.58		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning membrane systems. Septicity control (Networks)	
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		Not Applicable	N/A	N/A		27.69				Sludge Tankeri Sludge Tankering - Distan
	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC GAC	GAC Tank - GAC	4.0	Number	T_Flow (ML/day) Volume (m3)	2.5	100.0 300.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		440.33 93.92		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	disposal site (One-Way, km)
	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Flow Rate (ML/day)	1.0	100.0		Not Applicable	N/A	N/A		0.00				
Well) - Backwash Pumps	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank Building	Interstage Pumping Building - Control	3.0	Number	T_Power (KW) Area (m2)	0.5	1,000.0		Not Applicable Height(m)	N/A 2.0	N/A 15.0	5.00	68.69				
Interstage Pumping Station (Wet Well)	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0		Height(m)	2.0	15.0	12.00	301.71	la nkerin			
Chemical Building CoMag Magnetite Storage and	Cross Functional Cross Functional	Site Wide Site Wide	Building	Building - Treatment Tank - Chemical	10	Number	Area (m2)	45.0	3,000.0		Height(m)	2.0	15.0	12.00	57.87	Sudge .			
Dosing CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Volume (m3) Area (m2)	0.4	40.0	20.00	Not Applicable Height(m)	0.5	N/A 4.0	3.00	<u>8.41</u> 5.17				
CoMag Ferric Storage and Dosing		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 Ozone Contact Tanks	Cross Functional Water Treatment (Non-Infra)	Site Wide Chlorination	Tank Contact Tank	Tank - Chemical Contact Tank	10	Number	Volume (m3)	1.0	40.0	15.00	Not Applicable	N/A	N/A	_	8.81				
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Capacity (m3) Area (m2)	70.0	3,000.0	210.70 225.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	46.84				
BAC Air Scour Blowers	Sewage Treatment (Non-Infra) Water Treatment (Non-Infra)	Secondary Treatment Chlorination	Biological Aerated Flooded Filter Contact Tank	BAFF Plant Contact Tank	2.0	Number Number	PE	50.0			Not Applicable	N/A	N/A	_	168.61				
Ozone LOX GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Capacity (m3) Area (m2)	70.0	3,000.0	78.90	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	31.58				
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 AP SCOUT BIDWEIS	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0			Not Apolicable	N/A	N/A	12.00	168.61				
Backwash Storage Pipe Work Treatment	Cross Functional Cross Functional	Site Wide Site Wide	Building Pipework	Building - Control Pipework (Stainless Steel)	500.0	Length (m)	Area (m2) Diameter (mm)	10.0 50.0	1,000.0	100.00 300.00	Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	<u>89.79</u> 41.70				
Fencing	Cross Functional	Site Wide	Site Wide Roads and footpaths	Fending Footpath	1.0	Number	Length (m)			660.00	Not Applicable		N/A		20.27				
Access Road Site Returns Pumping Station		Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	Area (m2) T_Power (KW)	5.0		1,650.00	Not Applicable	N/A N/A	N/A N/A		62.32				
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0		36.000.00	Not Applicable		N/A		0.00				
														_					
Asset 55 Asset 56																			
Asset 57																			
Asset 58 Asset 59																			
Asset 60																			
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Asset 62 Asset 63																			
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Tick to return to	Project Setun &	Navigation nage	_	
		Navigation page		
	o to Sludge Tanki		=	
onal Carbon 6. See Headi	ngs in row 48	for Sludge Tanke	ering Module	
irbon - Type priate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	2692466.294	571.69	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	1.287.53	1.55	
	kg/year			
	kg/year	41,040.00	15.18	
	kg/year			
	kg/year	198260.8696	159.20	
	kg/year			
	kg/year	4651.2	3.78	
	kg/year			
Tankering	kg/year	273600	300.96	
- Distance to			Sludge Tankering	
l site y, km)	Period	Frequency	Carbon (tCO2e / year)	Sludge Tankering - Comments
	1			

	Key User Selection / Input Information - No Input Required Validation Note - Action Association	Severn Trent Water Ca Embodied - Gate 2, Option 2 Brief Description of works			Cicks Cick	to return to Project Setup & to view inclusions & Exclusi Elick to enter Operational is arbon	Navigation page ons for all assets nformation	The embodied ca undertaken for ea points and limits.	rbon calculations co ach item in a range o	nsider the materials of sizes for primary an	Embodied Carbon Calculations used in each item, applying factors fro d secondary metrics (where applicable	s - Source Methodok m CESMM, Defra and t e). These are then regre	<b>Ogy</b> the Bath Inventory of essed to the most app	Carbon and Ener propriate formula	gy Calculations are and tested for fit, turning		Severn Trent Water Carbon Calculator Operation: 642: 4 Option 2 Description of operational activities / Januar requirements 133 McD- 1010	of the year // 23 MLD 100x of the year	Cick tor Cick to a Cick The Cick
			1					Primary Metr				Secondary Metr					1	Enter Operational Carbon Info	
Item	Works	Stage	Process Click to view Asset Index	Asset Name	Quantity	Unit of Quantity	Unit of measurement		cale Max	Primary Measurement	Unit of measurement	Sca Min	sle Max <sup>1</sup>	Secondary Measurement	Embodied Carbon (tCD2e)	OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - T (as appropriate)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3		Free Entry	5,700.00	tCD2e/m3	N/A - Fri		0.03	196.26	Power	Grid Electricity Diesel - Vehicles		
Asset 2 Asset 3									Free Entry Free Entry			N/A - Fro N/A - Fro				-	Fuel OII - Generator		
Asset 4									Free Entry			N/A - Fri				E.	Fuel Oil - Heating		
Asset 5									Free Entry			N/A - Fro					Imported Natural Gas		
Asset 6									Free Entry			N/A - Fro					Aluminium Sulphate Chlorine Gas		
Asset 7 Asset 8									Free Entry Free Entry			N/A - Fro N/A - Fro					Ferric Chloride		
Asset 9									Free Entry			N/A - Fro					Lime		
Asset 10								N/A - F	Free Entry			N/A - Fro	ee Entry			Water	Monosodium Phosphate (MSP)		_
Asset 11									Free Entry			N/A - Fro				nicats -	Orthophosphoric acid Polyaluminium Chloride (PACI)		_
Asset 12 Asset 13									Free Entry Free Entry			N/A - Fro N/A - Fro				Ge	Polyelectrolytes (various)		
Asset 14								N/A - F	Free Entry			N/A - Fro	ee Entry				Sodium Hydroxide (NaOH)		_
Asset 15									Free Entry			N/A - Fro					Sodium Hypochlorite 		
Asset 16 Asset 17									Free Entry			N/A - Fro					Sulphuric Acid		_
Asset 17 Asset 18									Free Entry Free Entry			N/A - Fro N/A - Fro	ee Entry				Acetic Acid	Optimisation of Trade Waste facilities	Liquid
Asset 19									Free Entry	$\square$		N/A - Fro					Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid
Asset 20					4.0	Number			Free Entry			N/A - Fro					Calcium Nitrate Ferric Chloride	Septicity control (Networks) Coagulation (P Removal)	Liquid
Influent Pumping Station		Sewerage PS Site Wide	Sewerage PS Building	SPS Pump - 24 Hrs / Day Running Building - Control	1.0	Number	T_Power (KW) Area (m2)	0.2	3,000.0	336.00 374.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	55.39	stew ato	Ferric Sulphate	Coagulation (P Removal)	Liquid
CoMag Mixing and Flocculation Tanks	n Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0	2,000.0		Not Applicable	N/A	N/A		114.89	4 - Was	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid
Mag Ferric Storage and Dosin CoMag Settlement Tanks	ng 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	the mica	Methanol Boluzium Chinzida (BKCI)	Carbon Source for BNR	Liquid
(Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primary Tank (Civil)	2.0	Number	m2	9.0	419.8		Not Applicable	N/A	N/A		100.80	, in the second s	Polyaluminium Chloride (PACI) Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Liquid Solid or liquid
BAC	Cross Functional Cross Functional	Site Wide	Building Concrete Tank	Building - Treatment Concrete Tank No M&E	12.0	Number	Area (m2) Volume (m3)	45.0	3,000.0	1,443.00	Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	1491.31 187.77		Sodium Carbonate	pH correction	Liquid
BAC terstage Pumping Station (We	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		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	
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		Not Applicable	N/A	N/A		73.45				Sludge Tanker
GAC	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC	GAC Tank - GAC	6.0	Number	T_Flow (ML/day)	2.5	100.0	65.88 266.00	Not Applicable	N/A N/A	N/A N/A		440.33 173.29		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distan disposal site (One-Way, km)
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Volume (m3) Flow Rate (ML/day)	1.0	100.0	28.75	Not Applicable Not Applicable	N/A	N/A		0.00				
terstage Pumping Station (We Well) - Backwash Pumps	et Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	4.0	Number	T_Power (KW)	0.5	1,000.0		Not Applicable	N/A	N/A		97.72				
Site Returns Pumping Station Interstage Pumping Station (We		Site Wide	Building	Building - Control	1.0	Number Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41	kering			
Well) Chemical Building	Cross Functional Cross Functional	Site Wide Site Wide	Building Building	Building - Control Building - Treatment	10	Number	Area (m2) Area (m2)	45.0	1,000.0	512.00	Height(m) Height(m)	2.0	15.0	12.00	459.75	te Tank			
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	12.00	8.41	auc			
CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Klosks	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17				
Mag Ferric Storage and Dosin		Site Wide	Tank	Tank - Chemical Tank - Chemical	2.0	Number	Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		18.99				
Ozonw H2O2 Storage Ozone Contact Tanks	Cross Functional Water Treatment (Non-Infra)	Site Wide Chlorination	Contact Tank	Contact Tank	10	Number Number	Volume (m3)	1.0	40.0	20.00	Not Applicable	N/A	N/A		9.21				
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Capacity (m3) Area (m2)	70.0	3,000.0	422.10	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	61.90				
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		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 Ozone Building	Cross Functional Cross Functional	Site Wide	Building Building	Building - Treatment Building - Treatment	1.0	Number	Area (m2) Area (m2)	45.0	3,000.0	2,000.00	Height(m) Height(m)	2.0	15.0	12.00	2066.96 645.93				
GAC Air Scour Blowers	Courses Transforment (Mars. Index.)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0	393.700.0		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		Height(m)	2.0	15.0	12.00	157.14				
Pipe Work Treatment	Cross Functional	Site Wide	Pipework Site Wide	Pipework (Stainless Steel) Fending	700.0	Length (m) Number	Diameter (mm)	50.0	1,000.0	300.00	Not Applicable	N/A	N/A		58.38				
Fencing Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Length (m) Area (m2)	5.0		660.00 1,650.00	Not Applicable Not Applicable	N/A N/A	N/A N/A	_	20.27 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			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																			
Asset 59																			
Asset 60 Asset 61																			
Asset 62	1	1																	
Asset 63																			
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Asset 76 Asset 77 Asset 78 Asset 79 Asset 80 Asset 81 Asset 82 Asset 82																			

	Click to return to	Project Setup &	Navigation page		
	Click to return to	odied Carbon /	Asset Information		
	Click to jump	to Sludge Tanks	ring Module	_	
	Operational Carbon				
orma	tion in rows 19-46. See Headin	igs in row 48	for Sludge Tanke	ring Module	
	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
		kWh / year	4419025.397	938.29	
		Litres / year			
		Litres / year			
		Litres / year			
		m3 / year			
		kg/year	2.597.65	3.12	
		kg/year			
_		kg/year	82,800.00	30.64	
_		kg/year			
	Liquid Solid or liquid	kg/year kg/year			
	Liquid	kg/year			
	Liquid	kg/year			
	Liquid	kg/year	400,000.00	321.20	
_	Liquid	kg/year			
	Liquid	kg/year			
	Liquid	kg/year			
	Solid or liquid	kg/year			
	Liquid	kg/year	9,384.00	7.63	
	Liquid	kg/year			
	Sludge Tankering		552,000.00	607.20	
	Sludge Tankering - Distance to			Sludge Tankering	
	disposal site (One-Way, km)	Period	Frequency	Carbon (tCO2e / year)	Sludge Tankering - Comments

ATER ACODS	Key User Selection / Input Information - No Input Requiree Celevatem - NOCRED Multidiscon Retto, Action	Severn Trent Water Ci Embodied - Gate 2, Option 3 Brief Description of works	arbon Calculator TREAT172_STT115_GU	57	Cick:	o return to Project Setup & o view inclusions & Exclusio Stick to enter Operatory ()	Navigation page ons for all assets	The embodied ca undertaken for ea points and limits.	rbon calculations c ach item in a range	onsider the materials of sizes for primary an	Embodied Carbon Calculation used in each item, applying factors fr d secondary metrics (where applicabl			y of Carbon and Ener appropriate formula	rgy. Calculations are and tested for fit, turning		Severn Trent Water Carbon Calculator Operation - Gate 2, Option 3 Description of operational activities / annual requirements 172 McD-9% of the year //	60 MLD 17% of the year // 34 MLD 74% of the year	Click to re Click to re
	Validation Note - Action Assets 1-	20 are Free Entry. Please use dro	p-downs to enter information in each column for assets	23-200. All assets can be renamed if required.	Embodied Ca	irbon													Operational Ca
Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Unit of measurement		cale	Primary	Unit of measurement		etric Scale	Secondary Measurement	Embodied Carbon (tCO2e)	OpEx Categor	y Operational Carbon - Activity	Enter Operational Carbon In Operational Carbon - Application (as appropriate)	formation in rows 19-46. See H Operational Carbon - Ty (as appropriate)
Asset 1	Cross Functional	Site Wide	Click to view Asset Index	Gravel	1.0		m3	Min N/A - F	Max Free Entry	6,300.00	tCO2e/m3	Min N/A -	Max Free Entry	0.03	216.92	Power	Grid Electricity	(exeption arc)	(er appropriate)
Asset 2									Free Entry				Free Entry				Diesel - Vehicles Fuel Oil - Generator		
Asset 3 Asset 4									Free Entry Free Entry				Free Entry Free Entry			2	Fuel Oil - Heating		
Asset 5									Free Entry				Free Entry				Imported Natural Gas Aluminium Sulphate		_
Asset 6 Asset 7									Free Entry Free Entry				Free Entry Free Entry				Chlorine Gas		
Asset 8									Free Entry				Free Entry				Ferric Chloride		
Asset 9 Asset 10									Free Entry Free Entry				Free Entry			ě	Monosodium Phosphate (MSP)		
Asset 11									Free Entry				Free Entry			vicais - W	Orthophosphoric acid Polyaluminium Chloride (PACI)		
Asset 12 Asset 13									Free Entry Free Entry				Free Entry			ę	Polyelectrolytes (various)		
Asset 14									Free Entry				Free Entry				Sodium Hydroxide (NaOH) Sodium Hypochlorite		
Asset 15 Asset 16									Free Entry Free Entry				Free Entry				Sulphur Dioxide / Bisulphate		
Asset 17					-				Free Entry				Free Entry				Sulphuric Acid	Optimisation of Trade Waste facilities	Liquid
Asset 18 Asset 19									Free Entry Free Entry				Free Entry				Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid
Asset 20					5.0	Number		N/A - F	Free Entry			N/A -	Free Entry				Calcium Nitrate Ferric Chloride	Septicity control (Networks) Coagulation (P Removal)	Liquid
Influent Pumping Station		Sewerage PS Site Wide	Sewerage PS Building	SPS Pump - 24 Hrs / Day Running Building - Control	1.0	Number	T_Power (XW) Area (m2)	0.2	3,000.0	597.00 459.00	Not Applicable Height(m)	N/A 2.0		12.00	122.15 412.16	stew ate	Ferric Sulphate	Coagulation (P Removal)	Liquid
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	cals - Wa	Hydrochloric Acid Methanol	Chemical Cleaning in Membrane Systems Carbon Source for BNR	Liquid
CoMag Ferric Storage and Dosing CoMag Settlement Tanks (Clarifiers)	g Cross Functional Sewage Treatment (Non-Infra)	Site Wide Primary Treatment	Concrete Tank Settlement (Sewage)	Concrete Tank No M&E Primary Tank (Civil)	2.0	Number	Volume (m3) m2	5.0	2,000.0	1,341.40 314.16	Not Applicable	N/A N/A			221.71 155.39	Chem	Methanol Polyaluminium Chloride (PACI)		Liquid
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		Polyelectrolytes (various) Sodium Carbonate	Coagulation, flocculation aid, sludge thickening	Solid or liquid
BAC	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Concrete Tank Filtration	Concrete Tank No M&E Biological Filter (Civil)	18.0	Number Number	Volume (m3) T_Volume (m3)	5.0	2,000.0 8,000.0	100.00	Not Applicable	N/A N/A	N/A N/A		281.66 349.02		Sodium Carbonate Sodium Hydroxide (Caustic Soda)	pH correction pH correction, softening, neutralisation of waste from chemical cleaning membrane systems. Septicity control (Networks)	in Elquid
Interstage Pumping Station (Wet	t Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	5.0	Number	T_Power (XW)	0.5	1,000.0	597.00	Not Applicable	N/A			122.15				Sludge Tankeri
	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC GAC	GAC Tank - GAC	2.0	Number Number	T_Flow (ML/day) Volume (m3)	5.0	300.0	65.88 299.00	Not Applicable	N/A N/A	N/A N/A		440.33 251.95		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distan disposal site (One-Way, km)
	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				
Well) - Backwash Pumps Site Returns Pumping Station	Sewage Treatment (Non-Infra) Cross Functional	Storm Water Treatment	Storm Tank Building	Interstage Pumping Building - Control	4.0	Number Number	T_Power (KW) Area (m2)	0.5	1,000.0	746.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	5.00	121.68	2			
Interstage Pumping Station (Wet Well)	t Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (mZ)	10.0	1,000.0	576.00	Height(m)	2.0	15.0	12.00	517.22	Ta nkeri			
Chemical Building CoMag Magnetite Storage and Dosing		Site Wide	Building Tank	Building - Treatment Tank - Chemical	1.0	Number Number	Area (m2) Volume (m3)	45.0	3,000.0	298.50	Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	<u>308.49</u> 8.41	Budge			
CoMag Magnetite Transfer System		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 Ozonw H2O2 Storage	Cross Functional Cross Functional	Site Wide	Tank Tank	Tank - Chemical Tank - Chemical	3.0	Number	Volume (m3) Volume (m3)	1.0	40.0	23.33 25.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		28.45				
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				
	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	1.0	Number Number	Area (m2) PE	45.0		225.00	Height(m) Not Applicable	2.0 N/A		12.00	232.53				
	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	3.0	Number	Capacity (m3)	70.0	3,000.0		Not Applicable	N/A			95.18				
GAC Building Ozone Building	Cross Functional Cross Functional	Site Wide	Building Building	Building - Treatment Building - Treatment	1.0	Number	Area (m2) Area (m2)	45.0	3,000.0	2,500.00 750.00	Height(m) Height(m)	2.0		12.00	2583.70 775.11				
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number	PE	50.0			Not Applicable	N/A	N/A		168.61				
	Cross Functional Cross Functional	Site Wide Site Wide	Building Pipework	Building - Control Pipework (Stainless Steel)	900.0	Number Length (m)	Area (m2) Diameter (mm)	50.0	1,000.0		Height(m) Not Applicable	2.0 N/A		12.00	224.49				
Fencing	Cross Functional	Site Wide	Site Wide	Fending	1.0	Number	Length (m)			660.00	Not Applicable	N/A			20.27				
Access Road Site Returns Pumping Station	Cross Functional	Site Wide Sewerage PS	Roads and footpaths Sewerage PS	Footpath SPS Pump - 24 Hrs / Day Running	1.0	Number	Area (m2) T_Power (KW)	5.0			Not Applicable	N/A N/A			62.32				
	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)			42.000.00	Not Applicable	N/A			0.00				
Asset 54 Asset 55									<u> </u>										
Asset 56																			
Asset 57 Asset 58																			
Asset 59																			
Asset 60 Asset 61									<u> </u>										
Asset 62																			
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Asset 84										$\square$				$\square$					
Asset 85	1	+																	
Asset 86																			

	Project Setup &	Navigation page		
		Asset Information	_	
Click to jump	o to Sludge Tanka	ring Module		
nal Carbon				
	ngs in row 48	for Sludge Tanke		
rbon - Type priate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	6485419.405	1,377.05	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	4.246.59		
	kg/year			
	kg/year	135,360.00	50.08	
	kg/year			
	kg/year	653,913.05		
	kg/year			
	kg/year	15,340.80	12.47	
	kg/year	1.0.00		
	kg/year	902,400.02	992.64	
Tankering				
- Distance to site , km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
	1			
	1			

ATER		Severn Trent Water C Embodied - Gate 2, Option 4	arbon Calculator														Severn Trent Water Carbon Calculator Operation - Gate 2, Option 4 Description of operational activities / annual requirements	
cobs	Key	Brief Description of works	TREAT230_STT115_GU	UC115	Clicks	to return to Project Setup &	L Navigation page				Embodied Carbon Calculation	s - Source Method	ology				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% o
	User Selection / Input Information - No Input Required Calculation - LOCKED Validation Note - Action				Click	to view Inclusions & Exclusi Click to enter Operational I	ions for all assets	The embodied ca undertaken for e points and limits	arbon calculations o ach item in a range	onsider the materials of sizes for primary ar	used in each item, applying factors fro id secondary metrics (where applicabl			ry of Carbon and Ener t appropriate formula	gy. Calculations are and tested for fit, turning			
	Assets 1-2	0 are Free Entry. Please use dro	sp-downs to enter information in each column for asset	ts 21-200. All assets can be renamed if required.	Embodied C	arbon		Primary Met	e e			Secondary Me	atric					Enter Opera
Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Unit of measurement	s	icale	Primary Measurement	Unit of measurement	5	icale	Secondary Measurement	Embodied Carbon (tCO2e)	OpEx Catego	ory Operational Carbon - Activity	Operational Carbon - App (as appropriate)
Asset 1	Cross Functional	Site Wide	Click to view Asset Index	Gravel	1.0		m3	Min N/A -I	Max Free Entry	7,800.00	tCO2e/m3		Max Free Entry	0.03	268.57	Power	Grid Electricity	(as appropriate)
Asset 2									Free Entry				Free Entry				Diesel - Vehicles	
Asset 3					_				Free Entry				Free Entry			Ē	Fuel OII - Generator Fuel OII - Heating	
Asset 4 Asset 5									Free Entry Free Entry				Free Entry Free Entry				Imported Natural Gas	
Asset 6								N/A -	Free Entry			N/A -	Free Entry				Aluminium Sulphate Chlorine Gas	
Asset 7 Asset 8									Free Entry Free Entry				Free Entry Free Entry				Ferric Chloride	
Asset 9									Free Entry				Free Entry				Lime	
Asset 10									Free Entry				Free Entry			Water	Monosodium Phosphate (MSP) Orthophosphoric acid	
Asset 11 Asset 12									Free Entry Free Entry				Free Entry Free Entry			emicals -	Polyaluminium Chloride (PACI)	
Asset 13									Free Entry				Free Entry			6	Polyelectrolytes (various) Sodium Hydroxide (NaOH)	
Asset 14 Asset 15									Free Entry Free Entry				Free Entry Free Entry				Sodium Hypochlorite	
Asset 16									Free Entry				Free Entry				Sulphur Dioxide / Bisulphate	
Asset 17					_				Free Entry				Free Entry				Sulphuric Acid Acetic Acid	Optimisation of Trade Waste facilities
Asset 18 Asset 19									Free Entry Free Entry				Free Entry Free Entry				Aluminium Sulphate	Coagulation (P Removal)
Asset 20					6.0	Number		N/A -	Free Entry			N/A -	Free Entry				Calcium Nitrate Ferric Chloride	Septicity control (Networks) Coagulation (P Removal)
	Sewerage (Non-Infra) Cross Functional	Sewerage PS Site Wide	Sewerage PS Building	SPS Pump - 24 Hrs / Day Running Building - Control	1.0	Number	T_Power (KW) Area (m2)	0.2	3,000.0	745.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	488.48	few ater	Ferric Chloride Ferric Sulphate	Coagulation (P Removal) Coagulation (P Removal)
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0			Not Applicable	N/A	N/A		197.50	als - Was	Hydrochloric Acid	Chemical Cleaning in Membrane Systems
CoMag Ferric Storage and Dosin CoMag Settlement Tanks		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	Chemica	Methanol Polyaluminium Chloride (PACI)	Carbon Source for BNR
(Clarifiers) BAC	Sewage Treatment (Non-Infra) Cross Functional	Primary Treatment Site Wide	Settlement (Sewage) Building	Primary Tank (Civil) Building - Treatment	1.0	Number	m2 Area (m2)	9.0 45.0	419.8	415.50 2,760.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	203.00 2852.41		Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickeni
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		Sodium Carbonate	pH correction pH correction, softening, neutralisation of waste
BAC Interstage Pumping Station (We Well) - Conveyance Pumps	Sewage Treatment (Non-Infra) It Sewage Treatment (Non-Infra)	Secondary Treatment	Filtration Storm Tank	Biological Filter (Civil)	6.0	Number Number	T_Volume (m3) T_Power (XW)	25.0	8,000.0	1,685.00 746.00	Not Applicable	N/A N/A	N/A N/A		588.75		Sodium Hydroxide (Caustic Soda)	membrane systems. Septicity control (Networks)
GAC	Sewage Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC	Interstage Pumping GAC	2.0	Number	T_Power (KW) T_Flow (ML/day)	2.5	1,000.0	65.88	Not Applicable Not Applicable	N/A N/A	N/A N/A		440.33		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transp
GAC	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	10.0	Number Number	Volume (m3)	5.0	300.0	300.00	Not Applicable	N/A	N/A		315.73		(wet tonnes)	
UV Disinfection Interstage Pumping Station (We Well) - Backwash Pumps	Cross Functional tt Sewage Treatment (Non-Infra)	Site Wide Storm Water Treatment	UV - Reactors (M&E) Storm Tank	UV - Reactors (M&E) Interstage Pumping	5.0	Number	Flow Rate (ML/day) T_Power (KW)	1.0	100.0	46.00 746.00	Not Applicable	N/A N/A	N/A N/A		0.00			
Site Returns Pumping Station		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	Ĕ		
interstage Pumping Station (We Well)	Cross Functional Cross Functional	Site Wide Site Wide	Building Building	Building - Control Building - Treatment	1.0	Number Number	Area (m2)	10.0	1,000.0	750.00	Height(m)	2.0	15.0	12.00	673.46	je Tarrice		
Chemical Building CoMag Magnetite Storage and Dosing CoMag Magnetite Transfer		Site Wide	Tank	Tank - Chemical	1.0	Number	Area (m2) Volume (m3)	45.0	3,000.0	373.00	Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	<u>385.49</u> 8.41	Bud		
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 Dosin	Cross Functional Cross Functional	Site Wide	Tank 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 Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Volume (m3) Capacity (m3)	1.0	40.0	30.00 842.50	Not Applicable Not Applicable	N/A N/A	N/A N/A		81.68			
BAC Blower Building	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	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 Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	3.0	Number	PE Capacity (m3)	50.0	393,700.0 3,000.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		168.61			
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 Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	2.0	Number	Area (m2) PE	45.0		1,050.00	Height(m)	2.0 N/A	15.0 N/A	12.00	1085.16			
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0			Height(m)	2.0		12.00	269.38			
Pipe Work Treatment	Cross Functional	Site Wide	Pipework Site Wide	Pipework (Stainless Steel) Fencing	1,100.0	Length (m) Number	Diameter (mm)	50.0		300.00	Not Applicable	N/A	N/A		91.74			
Fencing Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Length (m) Area (m2)	5.0		660.00	Not Applicable Not Applicable	N/A N/A			20.27			
Site Returns Pumping Station		Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2			Not Applicable	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 Asset 58																		
Asset 59																		
Asset 60																		
Asset 61 Asset 62																		
Asset 63					_													
Asset 64																		
Asset 65 Asset 66																		
Asset 67										$\vdash$								
Asset 68 Asset 69																		
Asset 70					_													
Asset 71	-																	
Asset 72 Asset 73																		
Asset 74					_													
Asset 75 Asset 76																		
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Asset 78					_													
Asset 79 Asset 80	1																	
Asset 81																		
Asset 82					_													
Asset 83 Asset 84																		
Asset 85		<u> </u>																
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year	Click to return to	Project Setup &	Navigation page		
	Cirk to enter Feel	varied Carbon / J	Accest information	=	
	Click to return to Click to enter Emb Click to jump	to Floring Toolo		_	
		to stoge ranke	a nig moodle		
	Operational Carbon				
	tion in rows 19-46. See Headir	igs in row 48			
tion	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
		kWh / year	8675732.712	1,842.12	
		Litres / year			
		Litres / year			
		Litres / year			
		m3 / year			
		kg/year	6.416.47	7.70	
		kg/year			
		kg/year	204,525.00	75.67	
		kg/year			
	Liquid Solid or liquid	kg/year kg/year			
	Liquid				
	Liquid	kg/year kg/year			
	Liquid	kg/year	988,043.50	793.40	
	Liquid				
	Liquid	kg/year kg/year			
	Liquid	kg/year			
	Solid or liquid	kg/year			
	Liquid	kg/year	23,179.50	18.84	
hemical cleaning in	Liquid	kg/year			
	Sludge Tankering		1,363,500.03	1,499.85	
	Sludge Tankering - Distance to			Sludge Tankering	
ethod	disposal site (One-Way, km)	Period	Frequency	Carbon (tCO2e / year)	Sludge Tankering - Comments

INTERN RENT ATER CODS	Key User Selection / Input Information - No Input Required Control Control Con	Severn Trent Water Ca Embodied - Gate 2, Option 5 Brief Description of works	TREATS7_GUCS7		Click	o return to Project Setup & to view Inclusions & Excluse Cirkk to enter Operational In	Navigation page ons for all assets formation	The embodied ca undertaken for ea points and limits.	arbon calculations c ach item in a range	onsider the materials of sizes for primary an	Embodied Carbon Calculations and in each item, applying factors fron secondary metrics (where applicable			of Carbon and Ener opropriate formula	rgy. Calculations are a and tested for fit, turning		Severn Trent Water Carbon Calculator Operation - Gate 2, Option 5 Description of operational activities / annual requirements 57 MLD - 25% of the year //r	28.5 MLD 17% of the year // 14 MLD 38% of the year	Click to r Click to r Click
			p-downs to enter information in each column for asset	· · · · · · · · · · · · · · · · · · ·	Embodied C	arbon		Primary Metr				Secondary Metri						Enter Operational Carbon 1	Operational Car nformation in rows 19-46. See H
ltem	Works	Stage	Process Click to view Asset Index	Asset Name	Quantity	Unit of Quantity	Unit of measurement	Si Min	icale Max	Primary Measurement	Unit of measurement	Sca Min	de Max	Secondary Measurement	Embodied Carbon (tCD2e)	OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbon - Ty (as appropriate)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3		Free Entry	5,400.00	tCD2e/m3	N/A - Fro		0.03	185.93	Power	Grid Electricity Diesel - Vehicles		
Asset 2 Asset 3									Free Entry Free Entry			N/A - Fre				3	Fuel Oil - Generator		
Asset 4									Free Entry			N/A - Fro					Fuel Oil - Heating Imported Natural Gas		
Asset 5 Asset 6									Free Entry Free Entry			N/A - Fre					Aluminium Sulphate		
Asset 7									Free Entry			N/A - Fre					Chlorine Gas Ferric Chloride		
Asset 8 Asset 9									Free Entry Free Entry			N/A - Fre N/A - Fre					Lime		
Asset 10									Free Entry			N/A - Fre				Water	Monosodium Phosphate (MSP) Orthophosphoric acid		
Asset 11 Asset 12									Free Entry Free Entry			N/A - Fre N/A - Fre				emicals -	Polyaluminium Chloride (PACI)		
Asset 13									Free Entry			N/A - Fre				6	Polyelectrolytes (various) Sodium Hydroxide (NaOH)		
Asset 14 Asset 15									Free Entry Free Entry			N/A - Fre					Sodium Hypochlorite		_
Asset 16									Free Entry			N/A - Fre					Sulphur Dioxide / Bisulphate		
Asset 17 Asset 18									Free Entry Free Entry			N/A - Fre					Sulphuric Acid Acetic Acid	Optimisation of Trade Waste facilities	Liquid
Asset 19									Free Entry			N/A - Fro					Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid
Asset 20	Sewerage (Non-Jofes)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	3.0	Number	T_Power (KW)	N/A - F	Free Entry 3,000.0	112.00	Not Applicable	N/A - Fre			14.03	8	Calcium Nitrate Ferric Chloride	Septicity control (Networks) Coagulation (P Removal)	Liquid
Influent Pumping Station	Sewerage (Non-Infra) Cross Functional	Sewerage PS Site Wide	Sewerage PS Building	SPS Pump - 24 Hrs / Day Running Building - Control	1.0	Number	T_Power (KW) Area (m2)	0.2	1,000.0	112.00	Not Applicable Height(m)	2.0	N/A 15.0	12.00	143.67	astew at	Ferric Sulphate	Coagulation (P Removal)	Liquid
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number Number	Volume (m3)	5.0	2,000.0		Not Applicable	N/A	N/A		72.52	icais - W	Hydrochioric Acid Methanol	Chemical Cleaning in Membrane Systems Carbon Source for BNR	Liquid
CoMag Ferric Storage and Dosing CoMag Settlement Tanks (Clarifiers)	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Primary Treatment	Concrete Tank Settlement (Sewage)	Concrete Tank No M&E Primary Tank (Civil)	2.0	Number	Volume (m3) m2	5.0	2,000.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		85.72	Cher	Polyaluminium Chloride (PACI)		Liquid
BAC	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number Number	Area (m2)	45.0	3,000.0	782.00	Height(m)	2.0	15.0	12.00	<u>508.18</u>		Polyelectrolytes (various) Sodium Carbonate	Coagulation, flocculation aid, sludge thickening	Solid or liquid
BAC	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Concrete Tank Filtration	Concrete Tank No M&E Biological Filter (Civil)	4.0	Number	Volume (m3) T_Volume (m3)	5.0	2,000.0	421.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		93.89		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleanin membrane systems. Septicity control (Networks)	g in Liquid
Interstage Pumping Station (Wet	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank	Interstage Pumping	3.0	Number	T_Power (KW)	0.5	1,000.0		Not Applicable	N/A	N/A		27.69				Sludge Tankeri
	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC	GAC Tank - GAC	2.0	Number Number	T_Flow (ML/day) Volume (m3)	2.5	300.0	65.88 198.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		440.33 93.92		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distanc disposal site (One-Way, km)
	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				
Well) - Backwash Pumps Site Returns Pumping Station	Sewage Treatment (Non-Infra)	Storm Water Treatment	Storm Tank Building	Interstage Pumping Building - Control	3.0	Number Number	T_Power (KW) Area (m2)	0.5	1,000.0	559.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	5.00	<u>68.69</u> 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	Tankerin			
Chemical Building CoMag Magnetite Storage and	Cross Functional	Site Wide	Building	Building - Treatment Tank - Chemical	1.0	Number	Area (m2)	45.0	3,000.0	56.00	Height(m)	2.0	15.0	12.00	57.87	Sudge			
Dosing CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Volume (m3) Area (m2)	0.4	40.0	20.00	Not Applicable Height(m)	N/A 0.5	N/A 4.0	3.00	<u>8.41</u> 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 Ozone Contact Tanks	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	Volume (m3) Capacity (m3)	1.0	40.0	15.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		<u>8.81</u> 46.84				
BAC Blower Building	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	1.0	Number	Area (m2)	45.0	3,000.0		Height(m)	2.0	15.0	12.00	232.53				
BAC Air Scour Blowers Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	1.0	Number	PE Capacity (m3)	50.0	393,700.0 3,000.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		168.61 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 GAC Air Scour Blowers	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	2.0	Number	Area (m2) PE	45.0	3,000.0		Height(m) Not Apolicable	2.0 N/A	15.0 N/A	12.00	387.56				
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	1.0	Number	Area (m2)	10.0	1,000.0		Height(m)	2.0	15.0	12.00	89.79				
Pipe Work Treatment	Cross Functional	Site Wide	Pipework Site Wide	Pipework (Stainless Steel) Fencing	500.0	Length (m) Number	Diameter (mm) Length (m)	50.0	1,000.0	300.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		41.70 20.27				
Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Area (m2)	5.0			Not Applicable	N/A	N/A		62.32				
Site Returns Pumping Station	Sewerage (Non-Infra) Cross Functional	Sewerage PS Site Wide	Sewerage PS Site Clearance	SPS Pump - 24 Hrs / Day Running Site Clearance	1.0	Number Number	T_Power (KW)	0.2			Not Applicable	N/A	N/A		0.68				
Site Clearance Asset 54							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																			
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Asset 81 Asset 82 Asset 83																			
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Click to jump			_	
Operational Carbon				
n rows 19-46. See Headir	ngs in row 48	for Sludge Tanke	ering Module	
)perational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	5172369.459	1,098.25	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	2.313.53	2.78	
	kg/year kg/year			
	kg/year kg/year			
	kg/year			
	kg/year	73,743.75	27.29	
1	kg/year			
or liquid	kg/year			
1	kg/year			
1	kg/year	356250	286.07	
1	kg/year	530130		
1	kg/year			
1	kg/year			
1	kg/year			
or liquid	kg/year	8357.625	6.79	
1	kg/year			
1	kg/year	491625	540.79	
Sludge Tankering				
dge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
	1			

	Key User Selection / Input Information - No Input Required Catalusten - LDCCD	Severn Trent Water Ca Embodied - Gate 2, Option 6 Brief Description of works	rbon Calculator		Cicks Cicks	o return to Project Setup & to view inclusions & Exclusi	Navigation page	The embodied car undertaken for ea	rbon calculations c ach item in a range	onsider the materials of sizes for primary an	Embodied Carbon Calculation used in each item, applying factors fn d secondary metrics (where applicab			y of Carbon and Ener appropriate formula	rgy. Colculations are and tested for fit, turning		Severn Trent Water Carbon Calculator Operation - Gate 2, Option 6 bescription of operational activities / annual requirements 115 MLD - 25% of the year //	58 MLD 176 of the year // 29 MLD 586 of the year	Click to re Click to ent
	Validation Note - Action Assets 1-	20 are Free Entry. Please use dro	o-downs to enter information in each column for assets	21-200. All assets can be renamed if required.	Embodied Ci	Click to enter Operational Ir arbon	nform ation	points and limits.											Click to Operational Car
Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Unit of measurement		cale	Primary	Unit of measurement	Secondary Me	etric Scale	Secondary Measurement	Embodied Carbon (tCO2e)	OpEx Categor	y Operational Carbon - Activity	Operational Carbon - Application	formation in rows 19-46. See H Operational Carbon - Ty (as appropriate)
Asset 1	Cross Functional	Site Wide	Click to view Asset Index Landscaping	Gravel	1.0		m3	Min N/A - F	Max Free Entry	5,700.00	tC02e/m3	Min N/A -	- Free Entry	0.03	196.26	Power	Grid Electricity	(as appropriate)	(as appropriate)
Asset 2								N/A - F	Free Entry			N/A -	- Free Entry				Diesel - Vehicles Fuel Oli - Generator		
Asset 3 Asset 4									Free Entry Free Entry				- Free Entry - Free Entry			Fuel	Fuel Oil - Heating		
Asset 5									Free Entry				- Free Entry				Imported Natural Gas		
Asset 6 Asset 7									Free Entry Free Entry				- Free Entry - Free Entry				Chlorine Gas		
Asset 8									Free Entry			N/A -	- Free Entry				Ferric Chloride		
Asset 9 Asset 10									Free Entry Free Entry				- Free Entry - Free Entry			ž	Monosodium Phosphate (MSP)		
Asset 11									Free Entry				- Free Entry			cals - Wa	Orthophosphoric acid		
Asset 12 Asset 13									Free Entry				- Free Entry - Free Entry			Genic	Polyaluminium Chloride (PACI) Polyelectrolytes (various)		
Asset 14									Free Entry				- Free Entry				Sodium Hydroxide (NaOH)		
Asset 15									Free Entry				- Free Entry				Sodium Hypochlorite Sulphur Dioxide / Bisulphate		
Asset 16 Asset 17									Free Entry Free Entry				- Free Entry - Free Entry				Sulphuric Acid		
Asset 18									Free Entry				- Free Entry				Acetic Acid Aluminium Sulphate	Optimisation of Trade Waste facilities Coagulation (P Removal)	Liquid Solid or liquid
Asset 19 Asset 20								N/A - F	Free Entry Free Entry				- Free Entry - Free Entry				Calcium Nitrate	Septicity control (Networks)	Liquid
Influent Pumping Station		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			55.39	w ater	Ferric Chloride Ferric Sulphate	Coagulation (P Removal)	Liquid
Influent Pumping Station CoMag Mixing and Flocculation Tanks	Cross Functional Cross Functional	Site Wide	Building Concrete Tank	Building - Control Concrete Tank No M&E	4.0	Number	Area (m2) Volume (m3)	5.0	2,000.0	374.00	Height(m) Not Applicable	2.0 N/A		12.00	335.83	s - Waste	Hydrochloric Acid	Chaguration (P Kemovar) Chemical Cleaning in Membrane Systems	Liquid
CoMag Ferric Storage and Dosing CoMag Settlement Tanks	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	hemicalı	Methanol Polvaluminium Chloride (PACI)	Carbon Source for BNR	Liquid
(Clarifiers) BAC	Sewage Treatment (Non-Infra) Cross Functional	Primary Treatment Site Wide	Settlement (Sewage) Building	Primary Tank (Civil) Building - Treatment	1.0	Number	Area (m2)	9.0	419.8	201.06	Not Applicable Height(m)	N/A 2.0		12.00	100.80	Ŭ	Polyaluminium Chloride (PACI) Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid
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			187.77		Sodium Carbonate	pH correction	Liquid
Interstage Pumping Station (Wet	Sewage Treatment (Non-Infra) Sewage Treatment (Non-Infra)	Secondary Treatment Storm Water Treatment	Filtration Storm Tank	Biological Filter (Civil)	6.0	Number Number	T_Volume (m3) T_Power (KW)	25.0	8,000.0	844.00	Not Applicable	N/A N/A			176.62 73.45		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleaning membrane systems. Septicity control (Networks)	<sup>IN</sup> Liquid Sludge Tankeri
	Water Treatment (Non-Infra)	GAC	GAC.	Interstage Pumping GAC	2.0	Number	T_Flow (ML/day)	2.5	100.0	65.88	Not Applicable	N/A	N/A		440.33		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Distanc disposal site (One-Way, km)
	Water Treatment (Non-Infra)	GAC	GAC	Tank - GAC	6.0	Number	Volume (m3)	5.0		266.00	Not Applicable	N/A			173.29		(wet tonnes)		(One-Way, km)
Interstage Pumping Station (Wet	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Storm Water Treatment	UV - Reactors (M&E) Storm Tank	UV - Reactors (M&E) Interstage Pumping	4.0	Number	Flow Rate (ML/day) T_Power (KW)	0.5	100.0	28.75	Not Applicable Not Applicable	N/A N/A	N/A N/A		97.72				
Site Returns Pumping Station Interstage Pumping Station (Wet	:	Site Wide	Building	Building - Control	1.0	Number Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41	tering			
Well) Chemical Building	Cross Functional Cross Functional	Site Wide Site Wide	Building Building	Building - Control Building - Treatment	1.0	Number	Area (m2) Area (m2)	45.0	3,000.0	512.00	Height(m) Height(m)	2.0	15.0	12.00	459.75	dge Tan			
CoMag Magnetite Storage and Dosing CoMag Magnetite Transfer	Cross Functional 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	Ř			
System	Crean Frankland	Site Wide	Building Tank	Building - Klosks Tank - Chemical	2.0	Number	Area (m2) Volume (m3)	0.4	30.0	20.00	Height(m) Not Applicable	0.5 N/A	4.0 N/A	3.00	5.17				
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			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		12.00	61.90				
BAC Air Scour Blowers	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	2.0	Number	Area (m2) PE	45.0			Height(m) Not Applicable	2.0 N/A		1200	232.53				
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	2.0	Number	Capacity (m3)	70.0	3,000.0		Not Applicable	N/A			63.77				
GAC Building Ozone Building	Cross Functional Cross Functional	Site Wide Site Wide	Building Building	Building - Treatment Building - Treatment	1.0	Number	Area (m2) Area (m2)	45.0	3,000.0	2,000.00	Height(m) Height(m)	2.0		12.00	2066.96 645.93				
GAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant	2.0	Number Number	PE	50.0			Not Applicable	N/A			168.61				
	Cross Functional Cross Functional	Site Wide Site Wide	Building Pipework	Building - Control Pipework (Stainless Steel)	700.0	Length (m)	Area (m2) Diameter (mm)	10.0	1,000.0		Height(m) Not Applicable	2.0 N/A		12.00	157.14 58.38				
Fencing	Cross Functional	Site Wide	Site Wide	Fencing Footpath	1.0	Number	Length (m)			660.00	Not Applicable				20.27				
Access Road Site Returns Pumping Station	Cross Functional Sewerage (Non-Infra)	Site Wide Sewerage PS	Roads and footpaths Sewerage PS	Footpath SPS Pump - 24 Hrs / Day Running	1.0	Number	Area (m2) T_Power (KW)	5.0			Not Applicable	N/A N/A			<u>62.32</u> 1.59				
	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)			38.000.00	Not Applicable	N/A			0.00				
Asset 54 Asset 55								<u> </u>											
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Asset 85 Asset 86																			

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lick to enter Embr	odied Carbon / J	Asset Information		
			=	
onal Carbon				
	es in row 48	for Sludge Tanke	ering Module	
irbon - Type priate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	8489180.368	1,802.51	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	4668	5.60	
	kg/year			
	kg/year	148781	55.05	
	kg/year			
	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
	kg/year			
	kg/year	16,861.88		
	kg/year			
	kg/year	991875	1,091.05	
Tankering				
- Distance to I site	Period	Frequency	Sludge Tankering Carbon	Sludge Tankering - Comments
y, km)			(tCO2e / year)	

CODS	Key User Selection / Input Information - No Input Required Calculation - LOCID	Severn Trent Water Ca Embodied - Gate 2, Option 7 Brief Description of works	rbon Calculator	7	Gick	to return to Project Setup & i to view Inclusions & Exclusio	Navigation page	The embodied ca undertaken for a	arbon calculations o	onsider the materials	Embodied Carbon Calculations used in each item, applying factors fron d secondary metrics (where applicable)			rbon and Energy priate formula a	Calculations are id tested for fit, turning		Severn Trent Water Carbon Calculator Operation - Gate 2, Oplion 7 Description of operational artificities / annual requirement: 115 MLD - 9% of the year // 60 MLD 17% of	the year // 31 MLD 17K of the year // 23 MLD 57K of the year
	Validation Note - Action Assets 1-	20 are Free Entry. Please use droj	o-downs to enter information in each column for assets 2	1.200. All assets can be renamed if required.	Embodied C	Elick to enter Operational In arbon	formation	Primary Met	<u>.</u>	o stars for primary an		Secondary Metric		priate formora an	o teste ior in, tarning			Enter Operational C
ltem	Works	Stage	Process Click to view Asset Index	Asset Name	Quantity	Unit of Quantity	Unit of measurement	S	Scale Max	Primary Measurement	Unit of measurement	Scale		econdary asurement	Embodied Carbon (tCO2e)	OpEx Catego	cy Operational Carbon - Activity	Operational Carbon - Application (as appropriate)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3		Free Entry	5,700.00	tCD2e/m3	N/A - Free		0.03	196.26	Power	Grid Electricity	
Asset 2									Free Entry			N/A - Free					Diesel - Vehicles Fuel Oli - Generator	
Asset 3 Asset 4									Free Entry			N/A - Free N/A - Free				2	Fuel Oil - Heating	
Asset 5									Free Entry			N/A - Free					Imported Natural Gas	
Asset 6								N/A -	Free Entry			N/A - Free	Entry				Aluminium Sulphate Chlorine Gas	
Asset 7 Asset 8									Free Entry			N/A - Free N/A - Free					Ferric Chloride	
Asset 9									Free Entry			N/A - Free					Lime	
Asset 10									Free Entry			N/A - Free		_		Water	Monosodium Phosphate (MSP) Orthophosphoric acid	
Asset 11 Asset 12									Free Entry			N/A - Free N/A - Free				micats -	Polyaluminium Chloride (PACI)	
Asset 13									Free Entry			N/A - Free				ĕ	Polyelectrolytes (various)	
Asset 14									Free Entry			N/A - Free		_			Sodium Hydroxide (NaOH) Sodium Hypochlorite	
Asset 15 Asset 16									Free Entry			N/A - Free N/A - Free					Sulphur Dicxide / Bisulphate	
Asset 17									Free Entry			N/A - Free					Sulphuric Acid	
Asset 18									Free Entry			N/A - Free		_			Acetic Acid Aluminium Sulphate	Optimisation of Trade Waste facilities Coagulation (P Removal)
Asset 19 Asset 20									Free Entry			N/A - Free N/A - Free					Calcium Nitrate	Septicity control (Networks)
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	vater	Ferric Chloride	Coagulation (P Removal)
CoMag Mixing and Flocculation	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	.Waster	Ferric Sulphate Hydrochloric Acid	Coagulation (P Removal) Chemical Cleaning in Membrane Systems
Tanks CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank Concrete Tank	Concrete Tank No M&E Concrete Tank No M&E	2.0	Number	Volume (m3) Volume (m3)	5.0	2,000.0		Not Applicable Not Applicable	N/A N/A	N/A N/A		114.89	rmic als -	Methanol	Carbon Source for BNR
CoMag Settlement Tanks	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	đ	Polyaluminium Chloride (PACI)	
	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		Polyelectrolytes (various) Sodium Carbonate	Coagulation, flocculation aid, sludge thickening
BAC	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Concrete Tank Filtration	Concrete Tank No M&E Biological Filter (Civil)	6.0	Number	Volume (m3) T_Volume (m3)	5.0	2,000.0	100.00 844.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		187.77 176.62		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemica membrane systems. Septicity control (Networks)
Interstage Pumping Station (Wet	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			
	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC	GAC Tank - GAC	2.0	Number	T_Flow (ML/day)	2.5	300.0	65.88 266.00	Not Applicable	N/A N/A	N/A N/A		440.33		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method
UV Disinfection	Cross Functional	Site Wide	UV - Reactors (M&E)	UV - Reactors (M&E)	0.0	Number	Volume (m3) Flow Rate (ML/day)	1.0	100.0	28.00	Not Applicable 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 Interstage Pumping Station (Wet		Site Wide	Building	Building - Control	1.0	Number Number	Area (m2)	10.0	1,000.0	100.00	Height(m)	2.0	15.0	5.00	37.41	ntering		
Well) Chemical Building	Cross Functional Cross Functional	Site Wide Site Wide	Building Building	Building - Control Building - Treatment	1.0	Number	Area (m2) Area (m2)	45.0	3,000.0	512.00	Height(m) Height(m)	2.0	15.0	12.00	173.62	udge Ta		
CoMag Magnetite Storage and Dosing CoMag Magnetite Transfer	Cross Functional Cross Functional	Site Wide	Tank Building	Tank - Chemical Building - Klosks	1.0	Number	Volume (m3)	1.0	40.0	10.00	Not Applicable	N/A	N/A		8.41			
System	Come Exception of	Site Wide	Tank	Tank - Chemical	2.0	Number	Area (m2) Volume (m3)	0.4	30.0	20.00	Height(m) Not Applicable	0.5 N/A	4.0 N/A	3.00	5.17			
CoMag Ferric Storage and Dosing Ozonw H2O2 Storage	Cross Functional	Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0	23.50	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			
	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	2.0	Number	Area (m2) PE	45.0	3,000.0	225.00	Height(m) Not Applicable	2.0 N/A	15.0 N/A	12.00	232.53			
Ozone LOX	Water Treatment (Non-Infra)	Chlorination	Contact Tank	Contact Tank	2.0	Number	Capacity (m3)	70.0	3,000.0		Not Applicable	N/A	N/A		63.77			
	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0	2,000.00	Height(m)	2.0		12.00	2066.96			
	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Building Biological Aerated Flooded Filter	Building - Treatment BAFF Plant	2.0	Number	Area (m2) PE	45.0	3,000.0	625.00 292.800.00	Height(m) Not Apolicable	2.0 N/A	15.0 N/A	12.00	645.93 168.61			
Backwash Storage	Cross Functional	Site Wide	Building	Building - Control	10	Number	Area (m2)	10.0			Height(m)	2.0	15.0	12.00	157.14			
ripe new measures	Cross Functional	Site Wide	Pipework Site Wide	Pipework (Stainless Steel) Fencing	700.0	Length (m) Number	Diameter (mm)	50.0			Not Applicable	N/A	N/A		58.38			
Fencing	Cross Functional	Site Wide	Roads and footpaths	Footpath	1.0	Number	Length (m) Area (m2)	5.0		660.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		20.27			
Site Returns Pumping Station		Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	T_Power (KW)	0.2			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										$\square$								
Asset 57																		
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Asset 79 Asset 80																		
Asset 81			1	1														
Asset 82																		
Asset 82 Asset 83																		
Asset 82																		

tar	Click to return to	Project Setup &	Navigation page		
	Click to enter Emb	odied Carbon /	Asset Information	=	
	Click to jump			_	
	Operational Carbon				
al Carbon Informa	tion in rows 19-46. See Headir	igs in row 48	for Sludge Tanke	ering Module	
on	Operational Carbon - Type (as appropriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
		kWh / year	5020245.431	1,065.95	
		Litres / year			
		Litres / year			
		Litres / year			
		m3 / year			
		kg/year	3.223.06	3.87	
		kg/year kg/year			
		kg/year	102,735.00	38.01	
	Liquid	kg/year			
	Solid or liquid	kg/year			
	Liquid	kg/year			
	Liquid	kg/year			
	Liquid	kg/year	496,304.35	398.53	
	Liquid	kg/year			
	Liquid	kg/year			
	Liquid	kg/year			
	Solid or liquid	kg/year	11,643.30	9.47	
	Liquid	kg/year	1,1,1,1,1		
emical cleaning in	Liquid	kg/year	684,900.01	753.39	
	Sludge Tankering				
thod	Sludge Tankering - Distance to disposal site (One-Way, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments

	Key User Selection / Input Information - No Input Required Consumer ICCRID Validation Note - Action	Severn Trent Water Ca Embodied - Gate 2, Option 8 Brief Description of works	TREAT172_STT57_GUC1		Gick	o return to Project Setup & to view Inclusions & Excluse Click to enter Operational In	Navigation page one for all assets formation	The embodied car undertaken for ear points and limits.	bon calculations c ch item in a range	onsider the materials of sizes for primary an	Embodied Carbon Calculation and in each item, applying factors fro secondary metrics (where applicable			y of Carbon and Ener appropriate formula	rgy, Calculations are a and tested for fit, turning		Severn Trent Water Carbon Calculator Operation of Gate 2, Option 8 Develoption of operation Latitudies, Janual requirement 372 MLD - 9% of the year//118 MLD 1	ns Nr a' the year // 61 MLD 37K a' the year // 34 MLD 57K a' the year	Click ty
	Assets 1-	20 are Free Entry. Please use droj	p-downs to enter information in each column for assets a	21-200. All assets can be renamed if required.	Embodied C	arbon		Primary Metri	2			Secondary Me	atale					Enter Operational Codes	Operational Information in rows 19-46. Se
Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Unit of measurement	Sc	ale	Primary Measurement	Unit of measurement	2	icale	Secondary Measurement	Embodied Carbon (tCO2e)	OpEx Category	Operational Carbon - Activity	Operational Carbon - Application (as appropriate)	Operational Carbor (as appropriat
Asset 1	Cross Functional	Site Wide	Click to view Asset Index	Gravel	1.0		m3	Min N/A - Fr	Max ree Entry	6,300.00	tCO2e/m3	Min N/A -	Max Free Entry	0.03	216.92	Power	Grid Electricity		
Asset 2								N/A - Fr	ree Entry			N/A -	Free Entry				Diesel - Vehicles Fuel Dil - Generator		
Asset 3 Asset 4								N/A - Fr N/A - Fr	ree Entry				Free Entry Free Entry			Ē	Fuel Oil - Heating		
Asset 5								N/A - Fr					Free Entry				Imported Natural Gas		
Asset 6 Asset 7									ree Entry ree Entry				Free Entry Free Entry				Aluminium Sulphate Chlorine Gas		
Asset 8									ree Entry				Free Entry				Ferric Chioride		
Asset 9									ree Entry				Free Entry				Lime Monosodium Phosphate (MSP)		
Asset 10 Asset 11									ree Entry ree Entry				Free Entry Free Entry			as-was	Orthophosphoric acid		
Asset 12									ree Entry				Free Entry			C) em ka	Polyaluminium Chloride (PACI) Polyelectrolytes (various)		
Asset 13 Asset 14									ree Entry ree Entry				Free Entry Free Entry				Sodium Hydroxide (NaOH)		
Asset 15								N/A - Fr	ree Entry			N/A -	Free Entry				Sodium Hypochlorite Sulphur Dioxide / Bisulphate		
Asset 16 Asset 17									ree Entry				Free Entry Free Entry				Sulphuric Acid		
Asset 18									ree Entry				Free Entry				Acetic Acid	Optimisation of Trade Waste facilities	Liquid
Asset 19 Asset 20								N/A - Fr	ree Entry			N/A -	Free Entry				Aluminium Sulphate Calcium Nitrate	Coagulation (P Removal) Septicity control (Networks)	Solid or liquid
Asset 20	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 -			122.15	ator	Ferric Chloride	Coagulation (P Removal)	Liquid
CoMag Mixing and Flocculation		Site Wide	Building	Building - Control	1.0	Number Number	Area (m2)	10.0	1,000.0	459.00	Height(m)	2.0	15.0	12.00	412.16	W astew.	Ferric Sulphate Hydrochloric Acid	Coagulation (P Removal) Chemical Cleaning in Membrane Systems	Liquid
Tanks CoMag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E Concrete Tank No M&E	2.0	Number	Volume (m3) Volume (m3)	5.0	2,000.0	394.00 1,341.40	Not Applicable	N/A N/A	N/A N/A		<u>155.92</u> 221.71	mic ais -	Hydrochloric Acid Methanol	Chemical Cleaning in Membrane Systems Carbon Source for BNR	Liquid
CoMag Settlement Tanks	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	ç	Polyaluminium Chloride (PACI)		Liquid
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		Polyelectrolytes (various) Sodium Carbonate	Coagulation, flocculation aid, sludge thickening	Solid or liquid
BAC	Cross Functional Sewage Treatment (Non-Infra)	Site Wide Secondary Treatment	Concrete Tank Filtration	Concrete Tank No M&E Biological Filter (Civil)	8.0	Number	Volume (m3) T_Volume (m3)	5.0	2,000.0	100.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		281.66 349.02		Sodium Hydroxide (Caustic Soda)	pH correction, softening, neutralisation of waste from chemical cleanis membrane systems. Septicity control (Networks)	lg in Liquid
Interstage Pumping Station (Wet Well) - Conveyance Pumps	t 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				Sludge Tank Sludge Tankering - Dist
	Water Treatment (Non-Infra) Water Treatment (Non-Infra)	GAC	GAC	GAC Tank - GAC	2.0	Number Number	T_Flow (ML/day) Volume (m3)	2.5	100.0 300.0	65.88 299.00	Not Applicable Not Applicable	N/A N/A	N/A N/A		440.33 251.95		Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	disposal site (One-Way, km)
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				
	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 Interstage Pumping Station (Wet Well)	t Cross Functional	Site Wide Site Wide	Building Building	Building - Control Building - Control	1.0	Number	Area (m2) Area (m2)	10.0	1,000.0	150.00	Height(m) Height(m)	2.0	15.0	5.00	56.12	'a niterin			
Chemical Building CoMag Magnetite Storage and	Cross Functional	Site Wide	Building Tank	Building - Treatment Tank - Chemical	1.0	Number	Area (m2)	45.0	3,000.0	298.50	Height(m)	2.0	15.0	12.00	308.49	Sudge 1			
Dosing CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Volume (m3) Area (m2)	0.4	40.0	20.00	Not Applicable Height(m)	N/A 0.5	N/A 4.0	3.00	<u>8.41</u> 5.17				
CoMag Ferric Storage and Dosing		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 Ozone Contact Tanks	Cross Functional Water Treatment (Non-Infra)	Site Wide Chlorination	Tank Contact Tank	Tank - Chemical Contact Tank	1.0	Number	Volume (m3)	1.0	40.0		Not Applicable	N/A	N/A		9.62				
BAC Blower Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Capacity (m3) Area (m2)	70.0 45.0	3,000.0	629.70 225.00	Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	72.68				
BAC Air Scour Blowers	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter	BAFF Plant Contact Tank	2.0	Number	PE	50.0	393,700.0		Not Applicable	N/A	N/A		168.61				
Ozone LOX GAC Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Capacity (m3) Area (m2)	70.0 45.0	3,000.0		Not Applicable Height(m)	N/A 2.0	N/A 15.0	12.00	95.18				
Ozone Building	Cross Functional	Site Wide	Building	Building - Treatment	1.0	Number	Area (m2)	45.0	3,000.0		Height(m)	2.0		12.00	775.11				
GAC Air Scour Blowers Backwash Storage	Sewage Treatment (Non-Infra)	Secondary Treatment	Biological Aerated Flooded Filter Building	BAFF Plant Building - Control	2.0	Number	PE Area (m2)	50.0	393.700.0		Not Apolicable Height(m)	N/A		12.00	<u>168.61</u> 224.49				
	Cross Functional	Site Wide	Pipework	Pipework (Stainless Steel)	900.0	Length (m)	Diameter (mm)	10.0 50.0			Not Applicable	2.0 N/A		1200	75.06				
Fencing	Cross Functional Cross Functional	Site Wide Site Wide	Site Wide Roads and foctpaths	Fending Footpath	1.0	Number	Length (m)			660.00	Not Applicable				20.27				
Access Road Site Returns Pumping Station		Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	1.0	Number	Area (m2) T_Power (KW)	5.0		1,650.00 74.60	Not Applicable Not Applicable	N/A N/A			62.32				
Site Clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)			42.000.00	Not Apolicable		N/A		0.00				
Asset 54 Asset 55																			
Asset 56																			
Asset 57																			
Asset 58 Asset 59																			
Asset 60																			
Asset 61 Asset 62																			
Asset 63																			
Asset 64																			
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Asset 70																			
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Asset 74										⊢ –				$\left  - \right $					
Asset 75 Asset 76																			
Asset 76 Asset 77																			
Asset 78										$\vdash$									
Asset 79 Asset 80																			
Asset 81																			
Asset 82																			
Asset 83 Asset 84																			
Asset 85																			
Asset 86	1	1	1	1															

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k to enter Emb	edied Carbon / J	Asset information		
Click to jumo	to Shudge Tanks	Asset Information		
Char to port	to Sludge Tanke	ang maara		
al Carbon	n la com 42	for Sludge Tanke	- front to dula	
bon - Type iate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	7879575.369	1,673.07	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year			
	kg/year			
_	kg/year			
_	kg/year			
	kg/year			
	kg/year	5.433.88	6.52	
	kg/year			
	kg/year	173,205.00	64.09	
	kg/year			
	kg/year	835,739.14	671.90	Manually corrected values in the summary table. The spreadsheet does not consider the factor of 80 years for the calculation of chemicals
	kg/year			
	kg/year			
	kg/year			
_	kg/year			
	kg/year	19,629.90	15.96	
	kg/year			
	kg/year	1,154,700.01		
ankering				
Distance to ite km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments

	Key User Selection / Input Information - No Input Requiree Colorations - In OPERD	Severn Trent Water Ca Embodied - Gate 2, Option 9 Brief Description of works	arbon Calculator TREATS7.AUT_STT		Click to	o return to Project Setup & I	lavigation page	The embodied ca	rbon calculations o	consider the materials	Embodied Carbon Calculation used in each item, applying factors fro d secondary metrics (where applicabl			y of Carbon and Ene	rgy. Calculations are a and tested for fit success		Severn Trent Water Carbon Calculator Operation - Gate 2, Option 9 Description of operational activities / annual requireme \$7 MID - 1	nts DK of the year // 11 MLD 90% of the year	Click to m Click to en
	Calculation - LOCKED Validation Note - Action Assets 1	20 are Free Entry. Please use dro	p-downs to enter information in each column for assets	21-200. All assets can be renamed if required.	Embodied Ca	Click to enter Operational In	formation	undertaken for ex points and limits.	ach item in a range	e of sizes for primary ar	d secondary metrics (where applicabl	ie). These are then re	gressed to the most :	appropriate formula	a and tested for fit, turning				Click
								Primary Metr				Secondary Me		_			1	Enter Operational Carbon Inf	
ltem	Works	Stage	Process Click to view Asset Index	Asset Name		Unit of Quantity	Unit of measurement		cale Max	Primary Measurement	Unit of measurement		icale Max	Secondary Measurement	Embodied Carbon (tCD2e)	OpEx Categor		Operational Carbon - Application (as appropriate)	Operational Carbon - 1 (as appropriate)
Asset 1	Cross Functional	Site Wide	Landscaping	Gravel	1.0		m3		Free Entry	4,200.00	tCO2e/m3		Free Entry	0.03	144.51	Power	Grid Electricity Diesel - Vehicles		
Asset 2 Asset 3									Free Entry Free Entry				Free Entry Free Entry			3	Fuel Oil - Generator		
Asset 4									Free Entry				Free Entry			2	Fuel Oil - Heating		
Asset 5									Free Entry				Free Entry				Imported Natural Gas Aluminium Sulphate		
Asset 6 Asset 7									Free Entry Free Entry				Free Entry Free Entry				Chlorine Gas		
Asset 8									Free Entry				Free Entry				Ferric Chloride		
Asset 9									Free Entry				Free Entry			2	Lime Monosodium Phosphate (MSP)		
Asset 10 Asset 11									Free Entry Free Entry				Free Entry Free Entry			is - Wate	Orthophosphoric acid		
Asset 12								N/A -1	Free Entry			N/A -	Free Entry			D emica	Polyaluminium Chloride (PACI) Polyelectrolytes (various)		
Asset 13 Asset 14									Free Entry Free Entry				Free Entry Free Entry				Sodium Hydroxide (NaOH)		
Asset 15									Free Entry				Free Entry				Sodium Hypochlorite		
Asset 16									Free Entry				Free Entry				Sulphur Dioxide / Bisulphate		
Asset 17 Asset 18									Free Entry Free Entry				Free Entry Free Entry				Acetic Acid	Optimisation of Trade Waste facilities	Liquid
Asset 19									Free Entry				Free Entry				Aluminium Sulphate	Coagulation (P Removal)	Solid or liquid
Asset 20					3.0	Number			Free Entry				Free Entry				Calcium Nitrate Ferric Chloride	Septicity control (Networks) Coagulation (P Removal)	Liquid
Influent Pumping Station		Sewerage PS Site Wide	Sewerage PS Building	SPS Pump - 24 Hrs / Day Running Building - Control	1.0	Number	T_Power (KW) Area (m2)	0.2			Not Applicable Height(m)	N/A 2.0		12.00	14.03	stew ate	Ferric Sulphate	Coagulation (P Removal)	Liquid
CoMag Mixing and Flocculation Tanks	Cross Functional	Site Wide	Concrete Tank	Concrete Tank No M&E	4.0	Number	Volume (m3)	5.0			Not Applicable	N/A			72.52	de - Wa	Hydrochloric Acid	Chemical Cleaning in Membrane Systems	Liquid
CoMag Ferric Storage and Dosing CoMag Settlement Tanks		Site Wide	Concrete Tank	Concrete Tank No M&E	2.0	Number Number	Volume (m3)	5.0	2,000.0		Not Applicable	N/A	N/A		85.72	Chemica	Methanol Polyaluminium Chloride (PACI)	Carbon Source for BNR	Liquid
(Clarifiers)	Sewage Treatment (Non-Infra)	Primary Treatment	Settlement (Sewage)	Primany Tank (Civil)	-		m2	9.0	419.8	103.87	Not Applicable	N/A	N/A		52.68		Polyelectrolytes (various)	Coagulation, flocculation aid, sludge thickening	Solid or liquid
																	Sodium Carbonate	pH correction	Liquid
																	Sodium Hydroxide (Caustic Soda)	pH conrection, softening, neutralisation of waste from chemical cleaning in membrane systems. Septicity control (Networks)	Liquid Sludge Tanker
																	Sludge Tankering - Sludge Quantity	Sludge Tankering - Transport Method	Sludge Tankering - Distan disposal site (One-Way, km)
																_	(wet tonnes)		(One-Way, km)
								-				-							
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	ŝ			
	Cross Functional			Building - Treatment	1.0	Number										t Tanke			
Chemical Building CoMag Magnetite Storage and		Site Wide Site Wide	Building Tank	Building - Treatment Tank - Chemical	10	Number	Area (m2)	45.0			Height(m)	2.0		12.00	57.87	Sudge			
Dosing CoMag Magnetite Transfer System	Cross Functional	Site Wide	Building	Building - Kiosks	1.0	Number	Volume (m3) Area (m2)	0.4		20.00	Not Applicable Height(m)	N/A 0.5		3.00	<u>8.41</u> 5.17				
CoMag Ferric Storage and Dosing	R 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				
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				
Fencing	Cross Functional	Site Wide	Site Wide	Fencing	0.8	Number	Length (m)		10,000.0	660.00	Not Applicable		N/A		16.22				
	Cross Functional	Site Wide	Roads and footpaths	Footpath	0.8	Number	Area (m2)	5.0			Not Applicable	N/A			49.86				
Site Returns Pumping Station	Sewerage (Non-Intra) Cross Functional	Sewerage PS Site Wide	Sewerage PS Site Clearance	SPS Pump - 24 Hrs / Day Running Site Clearance	1.0	Number	T_Power (KW) Area (m2)		3,000.0	15.00 28.000.00	Not Applicable Not Applicable		N/A N/A		0.68				
Asset 54																			
Asset 55																			
Asset 56 Asset 57																			
Asset 58																			
Asset 59 Asset 60																			
Asset 61																			
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Asset 82																			
Asset 83																			
Asset 84 Asset 85																			
Asset 86																			

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Click to jumo	to Sludge Tanks	Asset information	_	
onal Carbon		for Sludge Tanke	ada a Mandada	
	igs in row 48			
rbon - Type priate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	1997505.602	424.13	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	198260.8696	159.20	
	kg/year			
	kg/year	4104	3.34	
	kg/year	1.04		
	kg/year	273600	300.96	
Tankering				
- Distance to site /, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments

Cobs	Key User Selection / Input Information - No Input Required Calculation - LOCKED (19) Validation Note - Action	Severn Trent Water C Embodied - Gate 2, Option 10 Brief Description of works	arbon Calculator o TREATLISALT_ST	т	Cick	to return to Project Setup & to view inclusions & Exclusion (Eick to enter Operational in	Navigation page Ins for all assets formation	The embodied cart undertaken for eac points and limity	bon calculations c th item in a range	onsider the materials	Embodied Carbon Calculations red in each item, applying factors from t secondary metrics (where applicable)	s - Source Methodo m CESMM, Defra an e). These are then rep	ology d the Bath Inventory gressed to the most :	r of Carbon and Ener appropriate formula	gy. Calculations are and tested for fit, turning		Severn Trent Water Carbon Calculator Operation - Gate 2. Option 10 Description of operational activities / annual requirement 115 McD - 307	Lof the year // 23 MLD 90% of the year	Cickto
	Assets 1-	20 are Free Entry. Please use dro	op-downs to enter information in each column for asset	s 21-200. All assets can be renamed if required.	Embodied C	arbon													Operational
Item	Works	Stage	Process	Asset Name	Quantity	Unit of Quantity	Unit of measurement	Primary Metri	ale	Primary Measurement	Unit of measurement	Secondary Me	tric cale	Secondary Measurement	Embodied Carbon	OpEx Catego	ry Operational Carbon - Activity	Enter Operational Carbon In Operational Carbon - Application (as appropriate)	Operational Carbon
Asset 1	Cross Functional	Site Wide	Click to view Asset Index		1.0		m3	Min	Max ee Entry	Measurement 4,800.00	tCO2e/m3	Min	Max Free Entry	0.03	(tCO2e) 165.27	Power		(as appropriate)	(as appropria
Asset 2	crossrunctional	Jace mide	Landscaping	Ciave				N/A - Fr			(COLUMN 2		Free Entry				Diesel - Vehicles		
Asset 3								N/A - Fr	ee Entry			N/A - F	Free Entry			2	Fuel Oil - Generator		
Asset 4 Asset 5								N/A - Fr N/A - Fr					Free Entry Free Entry				Fuel Oil - Heating Imported Natural Gas		_
Asset 6								N/A - Fr					Free Entry				Aluminium Sulphate		
Asset 7								N/A - Fr					Free Entry				Chlorine Gas Ferric Chloride		
Asset 8 Asset 9								N/A - Fr N/A - Fr					Free Entry Free Entry				Lime		
Asset 10									ee Entry				Free Entry			Water	Monosodium Phosphate (MSP)		
Asset 11								N/A - Fr					Free Entry			icals - W	Orthophosphoric acid Polyaluminium Chloride (PACI)		_
Asset 12 Asset 13									ee Entry ee Entry				Free Entry Free Entry			e E	Polyelectrolytes (various)		
Asset 14									ee Entry				Free Entry				Sodium Hydroxide (NaCH)		_
Asset 15									ee Entry				Free Entry				Sodium Hypochlorite Sulphur Dicaide / Bisulphate		
Asset 16 Asset 17									ee Entry ee Entry				Free Entry Free Entry				Sulphuric Acid		
Asset 18									ee Entry				Free Entry				Acetic Acid	Optimisation of Trade Waste facilities	Liquid
Asset 19 Asset 20						+		N/A - Fe	ee Entry				Free Entry Free Entry				Aluminium Sulphate Calcium Nitrate	Coagulation (P Removal) Septicity control (Networks)	Solid or liquid
Asset 20 Influent Pumping Station	Sewerage (Non-Infra)	Sewerage PS	Sewerage PS	SPS Pump - 24 Hrs / Day Running	4.0	Number	T_Power (XW)	0.2		336.00	Not Applicable	N/A - F	1		55.39	ater	Ferric Chloride	Coagulation (P Removal)	Liquid
Influent Pumping Station		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	N astew.	Ferric Sulphate Hydrochloric Acid	Coagulation (P Removal)	Liquid
Tanks Mag Ferric Storage and Dosing	Cross Functional	Site Wide	Concrete Tank Concrete Tank	Concrete Tank No M&E Concrete Tank No M&E	2.0	Number	Volume (m3) Volume (m3)	5.0	2,000.0		Not Applicable Not Applicable	N/A N/A			114.89	micads - V	Hydrochloric Acid Methanol	Chemical Cleaning in Membrane Systems Carbon Source for BNR	Liquid
CoMag Settlement Tanks		Site Wide Primary Treatment	Settlement (Sewage)	Concrete Lank No Mile Primary Tank (Civil)	2.0	Number	volume (m.s) m2	9.0		201.06	Not Applicable	N/A N/A			100.80	Che	Polyaluminium Chloride (PACI)		Liquid
																	Polyelectrolytes (various) Sodium Carbonate	Coagulation, flocculation aid, sludge thickening pH correction	Solid or liquid
																	Sodium Larbonate Sodium Hydroxide (Caustic Soda)	pH correction pH correction, softening, neutralisation of waste from chemical cleaning membrane systems. Septicity control (Networks)	in Liquid
																			Sludge Tan
																	Sludge Tankering - Sludge Quantity (wet tonnes)	Sludge Tankering - Transport Method	Sludge Tankering - Dis disposal site (One-Way, km
																			(One-way, kin
ite 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	kering			
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	dge Tan			
CoMag Magnetite Storage and Dosing CoMag Magnetite Transfer		Site Wide	Tank	Tank - Chemical	1.0	Number	Volume (m3)	1.0	40.0		Not Applicable	N/A			8.41	đ			
System	Cross Functional	Site Wide	Building	Building - Kiosks Tank - Chemical	1.0	Number	Area (m2)	0.4	30.0	20.00	Height(m)	0.5	4.0	3.00	5.17				_
Mag Ferric Storage and Dosing							Volume (m3)	1.0	40.0	23.50	Not Applicable	N/A	N/A		18.99				
					_														
The Work Treasment	Cross Functional	Site Wide	Pipework Site Wide	Pipework (Stainless Steel) Fencing	560.0	Length (m) Number	Diameter (mm)	50.0			Not Applicable	N/A			46.71				
Fencing Access Road	Cross Functional	Site Wide	Roads and footpaths	Footpath	0.8	Number	Length (m) Area (m2)	5.0		660.00	Not Applicable Not Applicable	N/A N/A			<u>15.22</u> 49.85				
Site Returns Pumping Station		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			1.59				
site clearance	Cross Functional	Site Wide	Site Clearance	Site Clearance	1.0	Number	Area (m2)	10.0	400.000.0	32.000.00	Not Apolicable	N/A	N/A		0.00				
Asset 54 Asset 55																			
Asset 56										$\vdash$				$\mid$					
Asset 57 Asset 58																			
Asset 58 Asset 59																			
Asset 60										$\square$				$\mid$					
Asset 61																			
Asset 62 Asset 63																			
Asset 64																			
Asset 65														$\vdash$					
Asset 66 Asset 67																			
Asset 68										$\vdash$				$\mid$					
Asset 69 Asset 70																			
Asset 70 Asset 71																			
Asset 72										$\vdash$				$\mid$					
Asset 73 Asset 74																			
Asset 74 Asset 75																			
Asset 76																			
Asset 76 Asset 77		-	1																
Asset 76								-											
Asset 76 Asset 77 Asset 78																			
Asset 76 Asset 77 Asset 78 Asset 79 Asset 80 Asset 81																			
Asset 76 Asset 77 Asset 78 Asset 79 Asset 80 Asset 81 Asset 82																			
Asset 76 Asset 77 Asset 78 Asset 79 Asset 80 Asset 81																			
Asset 75 Asset 77 Asset 73 Asset 79 Asset 80 Asset 81 Asset 81 Asset 82 Asset 83																			

lick to return to	Project Setup &	Navigation page		
ick to enter Emi	oodied Carbon /	Asset Information	_	
Click to jump	to Sludge Tanki	ering Module		
nal Carbon				
	ngs in row 48	for Sludge Tank		
rbon - Type oriate)	Unit	Quantity (annual)	Operational Carbon (tCO2e / year)	Operational Carbon - Comments
	kWh / year	3,007,895.36	638.67	
	Litres / year			
	Litres / year			
	Litres / year			
	m3 / year			
	kg/year	198,260.87	159.20	
	kg/year			
	kg/year	4,104.00	3.34	
	kg/year			
	kg/year	273,600.00	300.96	
Tankering				
- Distance to site 1, km)	Period	Frequency	Sludge Tankering Carbon (tCO2e / year)	Sludge Tankering - Comments
	1			
	1			
	-			



## A.8 Carbon Summary

A7W13155-GT-SPR-200029

Carbon Summary

1\A	В	C	D	E	F	G	
2	Step 1: set out emissions footprint	Footprint			Comments		
		Embodied Carbon tCO2e	Operational Carbon tCO2e (71 years)	Whole Life Carbon (80 years) tCO2e			
3	Gate 1 solution			(Embodied Carbon + Operational Carbon)			
	Minworth (Treatment and Conveyance)	22,625	235,152	2 257,78	1 Gate 1 Preliminary Feasibility Assessment: Table 10.1 ba	se on a Carbon Tool V.2009	
7	Cate 2 hearline (Ileritizated)						
8	Gate 2 baseline (Unmitigated)						
	STT115 TREAT115 - STT115	119,614 10,434					
14	INER 1112 - 211112	10,434	145,021				
21	PDD and when the second from the standard and Plan Plan	Decision of Contraction	2	Proventing and a second s			
22	CO2 reduction owner for Treatment and Pipeline	Designer/Contractor	Operations	Energy			
23		Designer/Contractor	Operations	Chemicals			
24 25		Designer/Contractor Designer/Contractor	Operations Operations	Materials Transport			
26				Tempore			
1	Step 2: how has the project designed down carbon and GHGs						
27	What policies, frameworks and approaches have been used to drive down whole life carbon in option choices and	Carbon Ambition 2030					
	within solution design?	ACWG					
•		PAS 2080 Carbon Management in Infrastructure STT Carbon Tool					
28							
29		Deale and and the lateration of		with the second of the Comparation of the design of the	Contract on the strength of the d	Andreas and antices. According to	W
			Are Scope 1, 2 or 3 emissions reduced? Scope 1: emissions from Operations	Which part of the STW Triple Pledge does this mitgation contribute to?	Carbon reduction - Embodied tCO2e	Carbon reduction - Operational tCO2e	tCO
			Scope 2: emissions from electricity Scope 3: indirect emissions in value chain	<ul><li>A. net zero carbon emissions;</li><li>B. generating 100% of our power from renewable</li></ul>			(En
		Build Efficiently		sources;			
30	The design shows multiple flow rates with different combinations that allow evaluating the electrical consumption	Build Clever	Scope 1	C. making our fleet of vehicles 100% electric A. net zero carbon emissions	-		46,274
	and the use of chemicals. For option TREAT115_STT115, there is an operational carbon saving compared to the unmitigated option.		Scope 2 Scope 3				
31							
	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	Build Clever	Scope 3	A. net zero carbon emissions	28,54		-
	construction.						
	There was carbon saving by building a more efficient treatment plant and changing the treatment processes to more				2,420		
33	sustainable options						
/		Build Clever	Scope 1	A. net zero carbon emissions	26,010		-
	Novel alternatives to steel reinforcement in reinforced concrete (e.g., fibre-reinforced polymer bars).		Scope 2 Scope 3	C. making our fleet of vehicles 100% electric			
	Reduce demolition trough trenchless techniques and avoid infrastructures such as railway lines, canals, motorways, highways, and urban areas.						
1	Re-use demolished material. Re-use existing available materials, e.g., processing, re-use of excavated material as fill. Sustainable construction materials.						
1	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						
34	Total mitigation reductions against baseline realised at G2				56,971	4	46,274
35							
36	Total remaining whole life carbon emissions for offsetting to UK Government target for Scope 1 , Scope 2 and				F35 = F31 + F32 + F33 + F34 73,078	<u>G35 = G31 + G32 + G33 + G34</u> 23	H3. 35,467
	Scope 3 being net zero by 2050				F37 = C10 + C14 - F35	G37 = D10 + D14 - G35	нз
	Total remaining whole life carbon emissions for offsetting to achieve Water Industry target for Scope 1 and 2 being net zero by 2030				a	23	35,467
40		I		l.	1		
41		011		A	• • • • • • • • • • • • • • • • • • •		
	Step 3: if there are still emissions after Step 2, explore offsetting opportunities in relation to Water Industry net zero targets eg:	Offsetting opportunities		Asset in use by 2030 - required offset (tCO2e) to achieve Water Industry target for Scope 1 and 2 being	Asset in use by 2050 - required offset (tCO2e) to achieve UK Government target for Scope 1 , Scope 2		
	Solar - 1 Ha (0.5MW) Ground mounted solar array generates a saving of 95tCO2e per year. Net saving (costs less			net zero Operational Carbon (Scope 1 &2) to be offset per year	and Scope 3 being net zero		
i	income) = £83,000/Ha/year (at July 2022 prices).			= 235,467 tCO2e / 71 years	Capital Carbon (Scope 3) to be offset = 73,078 tCO2e		
	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			Operational carbon Offset per year = 3,316 tCO2e/year			
	region of 1 tCO2e during its full lifetime. Onshore wind turbines - 1Ha has potential to generate 40GWh/year, highly dependent on location/planning,			E43 = G37 / 71	F43 = F37		
	however this represents a saving of 8,493 tCO2e per year.			3,31			
1		62m pressure available within the gravity pipeline which transferring 115Mld	discharges to the River Avon when the pipeline is	Carbon Offset is 156 tCO2e/year			
		······································		Remaining carbon (Scope 1 and 2) = 3,316 - 156 = 3,160			
44 45				tCO2e/year 3,160	-		
	Solar	There is approximately 57Ha of available land owned by possible size of land that could be used to install solar pa	STW adjacent to Minworth WwTW. This is the maximum nels to reduce the carbon impact of the scheme as well	Carbon Offset: 3,160tCO2e/ year	Years from 2050 to 2102 = 52 years. Carbon to be offset = 73,078 tCO2e.		
		as reduce operational cost through renewable energy. 1		Required Area = 3,160/95 = 33 Ha.	Annual amount = 73,078/52 = 1,405 tCO2e.		
46 47		saving of 95tCO2e per year.		33	Area of solar array required = 1405/95 = 14.8 Ha 14.8	-	
	Tree Planting	Trees are essential to maintaining our climate and biodiv improving air quality, conserving water, preserving soil a		Tree Planting = 235,467 trees	Embodied Carbon offset trees 73,078 tCO2e		
		mineroring an quanty, consciving water, preserving SOII d			consected carbon onsectives / 3,078 (CO2e		
		carbon as part of the process of photosynthesis, which e					
48					Remaining carbon (Scope 3) = 73,078 - 73,078 = 0 tCO2e/year		
49		carbon as part of the process of photosynthesis, which e dioxide is converted into stored carbon, and this is why t	rees are sometimes referred to as 'carbon sinks'	235,467 Carbon Offset: 3,160 tCO2e/ year	tCO2e/year	-	
49	Wind turbine	carbon as part of the process of photosynthesis, which e	rees are sometimes referred to as 'carbon sinks'	Carbon Offset: 3,160 tCO2e/ year	tCO2e/year		
49	Wind turbine	carbon as part of the process of photosynthesis, which e dioxide is converted into stored carbon, and this is why t All power to be renewable generated inhouse or sourcect	rees are sometimes referred to as 'carbon sinks'		tCO2e/year		

н	

Nole life carbon reduction	
mbodied Reduction + Operational	Reduction)
	46,274
	28,541
	2.420
	2,420
	26,010
	103,245
35 = H31 + H32 + H33 + H34	
55 - 1152 · 1152 · 1155 · 1154	308,545
37 = G37 + F37	