UUWR_11.2

PR24 Draft Determination: UUW Representation

Area of representation: Appendix - Eccles WwTW

August 2024

This document is a supporting appendix to accompany UUW DD representation document *UUWR_11 – Gated mechanisms* providing technical information on Eccles WwTW.

Reference to draft determination documents PR24 draft determination: Expenditure Allowances, section 4.7.3 Approach to large schemes, pages 177 - 184

United Utilities

Water for the North West

1. Key points

- **Negotiations with the Environment Agency have been complex, but now are clear:** We recognise that Environment Agency negotiations have been prolonged as we have optimised adaptive plans that deliver benefits for customers. Following agreement with the Environment Agency in March 2024 we have a clear need for Eccles WwTW and since business plan submission we have worked hard to optimise the scope, cost and delivery schedule. We now have an integrated solution that and avoids wasteful or abortive investments. We now have clarity and are ready to deliver at pace for customers and the environment based on the optimised plan.
- **UU is certain on the required solution and the associated cost to deliver to ensure all AMP8 regulatory drivers can be met at Eccles WwTW –** a considerable site re-build is necessary to meet the challenging AMP8 WINEP requirements for the technically achievable limits (TAL) for BOD and ammonia and this decision is reinforced following the addition of new phosphorus and cypermethrin drivers post business plan submission. The proposal for a biological P removal approach at Eccles, delivers the most resilient, sustainable and efficient solution for the future. However, in comparison to the more widely used chemical removal approach, it does not perform effectively through standard cost assessment models. In addition, significant site-specific construction costs have been identified through the detailed cost development process which we also consider will not be appropriately assessed through the standard modelling approach. We discuss further our observations on the cost assessment approach for phosphorus removal in UUWR_33_P Removal. In this appendix to UUWR_11 we present evidence for our cost assessment for Eccles WwTW.
- **Eccles has stringent drivers but we are confident in delivery -** Eccles WwTW is required to achieve TAL for BOD, ammonia and post business plan submission, new drivers for TAL for phosphorus and cypermethrin. The site's existing trickling filters cannot meet these standards and replacement of these filters with a new build activated sludge process with biological phosphorus removal is required.
- **We have applied adaptive planning principles for these sites:** with awareness of the long-term drivers in the Environment Act for some of these sites, we have included solutions for AMP8 that enable best overall value for customers and the environment considering the AMP8 and AMP9 drivers**.**
- **We have done a full bottom-up estimate assessing site specific risks -** we understand the construction challenge of the scheme and have estimated costs to resolve specific site constructability challenges such as use of temporary treatment to phase delivery of solution, demolition costs to maximise use of existing site footprint and mitigation measures – such as piling – required to build in challenging ground conditions. Therefore, we are confident in delivering the scheme to the regulatory date.

2. Introduction and Site Overview

This document is an appendix to UUWR_11_Gated mechanism. Here we describe the development of the Eccles scheme in detail and provide additional information around the solution development and the constructability assessment and specific challenges to Eccles. We consider that this early detail is key to understanding the delivery schedule as well as supporting a robust cost estimate.

Our PR24 submission included four large wastewater projects at some of our largest treatment works. This appendix relates to the scheme at Eccles WwTW. Due to the scale of investment and perceived uncertainty of scope and costs, Ofwat has placed Eccles WwTW into the newly proposed large scheme gated process for added scrutiny and customer protection.

The Eccles scheme is driven by improving the status of the Manchester Ship Canal as part of a long-term adaptive plan agreed with the EA. In addition, we have considered future requirements and long-term planning principles to ensure there is no abortive short-term investment for customers.

We have developed the best value solutions through an optioneering process, and we have challenged ourselves on the need and solution. Based on the knowledge and experience of our capable engineering team and those of our experienced supply chain partners we have proposed solutions that meet the requirements of the Environment Agency as set out in the WINEP, deliver the necessary significant environmental improvements and are best value for our customers.

Our proposal is to move the Eccles scheme to the enhanced engagement and cost sharing scheme as described in UUWR_11_Gated mechanism. On moving we recommend cost assessment is carried out as a deep dive cost assessment rather than through a modelled approach. The scheme for Eccles is part of an adaptive plan to deliver a biological phosphorus removal process with demonstrable constructability challenges that we expect to be viewed as an outlier against the model assessment. Our observations of the limitations of the phosphorus removal cost assessment models are discussed in detail in UUWR_33_Phosphorus Removal, with a summary of relevant areas as follows:

- Ofwat has developed four econometric models to assess phosphorus removal costs. Two of these models are backwards-looking, using data on the AMP7 phosphorus removal programme, while two are forward-looking, using data on companies' proposed phosphorus expenditure within AMP8. These models perform well in terms of statistical significance, though there is a noticeable deterioration in the model fit of the backward-looking AMP7 models. PR24 is the first time Ofwat has used a scheme-level econometric approach.
- Ofwat assesses outliers separately. It identifies outliers using the Cooks Distance statistic. Outliers are subject to a deep dive assessment. 'Efficient' outliers receive the business plan value rather than the (higher) modelled value. 'Inefficient' outliers receive the modelled value if insufficient evidence has been provided to support higher cost forecasts.
- Ofwat does not distinguish between chemical and biological solutions, because it considers that biological solutions will only be adopted at a small number of sites in AMP8.

The final point of not distinguishing between chemical and biological solutions being key to Eccles discussed, as biological phosphorus removal is the best value solution for this adaptive plan. We consider that large biological phosphorus removal solutions will not perform well through existing model assessments. In our solution development, we have considered chemical supply resilience, impact to customers from traffic movements from chemical tanker deliveries and whole life cost assessments that we propose are not considered in existing model assessments.

We are supportive of biological phosphorus removal techniques, along with the Environment Agency. However, if insufficient allowance to deliver biological phosphorus removal materialises, we may be guided towards the lowest capex solution and to what we consider to be a lower value and less resilient solution of chemical P removal and the disruption that the extensive tanker movements this will result in at these sites. Furthermore, we have carried out bottom-up estimates and considered the constructability challenges in detail. Further information on these issues is included in this appendix, but key to this scheme are issues such as confirmed contaminated land and constructing in extremely close proximity to the M60 motorway and Barton high level bridge. These are considerable challenges and we have assessed the impact on the costs for these issues which we consider would not be well represented through standard cost assessment modelling.

Following the October 2023 business plan submission we have used the time wisely and have continued to carry out a further review of the scope and costs for the Eccles project. This document provides information around the technical and constructability challenges and presents additional evidence to demonstrate that the solutions and costs UU submitted are accurate and efficient.

2.1 Overview - Site considerations

Stretching Permit Limits

The drivers for Eccles are documented in the WINEP and summarised in Table 2.

As indicated in the table these new permit levels are consistently at TALs for both AMP8 and AMP9 for Eccles. Stringent targets at significantly large WwTWs adds complexity and cost. We have applied adaptive planning principles to consider future drivers to minimise spend across AMPs and provide solutions that are resilient.

Our plans detail the best available technologies (BAT) for treating wastewater to low levels and how we arrived at our proposed solutions.

Table 1: Table showing red depicts new permit that will be at technically achievable limit

Site	AMP 8 new drivers				AMP9 new drivers			
	BOD	Ammonia	Phosphorus	Cypermethrin	BOD	Ammonia	Phosphorus	Cypermethrin
	mg/l 95%ile	mg/l 95%ie	Annual average	ug/l 99%ile	mg/l 95%ile	mg/l 95%ie	Annual average	ug/l 99%ile
Eccles	6	1	0.25	0.000186			0.1	

Source: UUW analysis

Table 2 shows where drivers include permit levels at the Technically Achievable Limit (TAL) for that driver. The term TAL is not an absolute number, but it is an indication of on average the minimum level for that driver. There will be examples of sites in the UK with permits lower than the TAL where companies have agreed to take on more onerous targets due to the nature of the assets on site or for use in a flexible permitting environment. However, the TAL limit indicates the minimum environmental standard expected for these determinands (BOD, ammonia etc).

As we are now clear on the long-term WINEP ambitions we have deployed adaptive planning principles and explored the potential for phased driver delivery that we considered we efficient and appropriate in seeking the lowest cost solution in AMP8 and for the whole life of the facility at Eccles.

Constructability challenges

As part of the company's approach to developing the submitted solutions for our major AMP8 projects we consulted with our external supply chain to ensure site specific constructability issues were identified and considered.

Two major constructability themes have been identified that apply to Eccles: constrained site conditions and the surrounding built environment. Adapting to and resolving these challenges has resulted in site specific cost increases when compared to a typical capital intervention. This may contribute to this project being viewed as an outlier.

Constrained Site Conditions

Eccles has already expanded to the site boundary in many areas. There are no substantial undeveloped areas for the construction of new build assets. This results in additional constructability requirements such as the need to demolish redundant assets, construct in challenging ground conditions (including building on brown field sites /

flood plains). This impacts programme sequencing and can necessitate temporary treatment to enable the continuity of existing treatment to be maintained during construction. Where construction within the site boundary is unachievable, we have identified the need to purchase land or rent land for the location of site compounds, plant storage and equipment laydown areas.

Surrounding Built Environment

Eccles WwTW is located within the highly urbanised city of Manchester and is significantly constrained by its surrounding geography and adjacent land use. These factors present several challenges that drive increased costs and prolong construction timescales at each site.

The presence of a high density of third-party assets, such as overhead and buried HV Power, Gas and Telecom infrastructure, requiring service diversions and / or protection works.

The choice and design of our solutions are influenced the need to give due consideration to limiting construction, noise, vibration and odour emissions that may impact the surrounding residential communities.

Construction activities and plant access is required near a number of strategic transport assets such as the Manchester Ship Canal, the M60 motorway and road bridges. There will be programme and cost impacts due the need to obtain specific permissions, such as National Highways Approval In Principle, (AIP), undertake monitoring works during construction and the need to employ specialist low impact construction techniques.

Eccles is located within a high density of sensitive residential properties and commercial premises immediately adjacent to the site boundaries and site access is though high traffic / congested areas. This requires the adoption of appropriate working practices, such as low noise and vibration techniques, dust and odour suppression measures and restricted working hours to ensure that disruption to customers is controlled to within acceptable levels.

Specific constructability requirements have been identified for each of the schemes discussed in this appendix, they significantly contribute to increased project costs.

3. The Need for the Project

The Eccles scheme is driven by improving the status of the Manchester Ship Canal as part of a long-term adaptive plan agreed with the Environment Agency. We have developed the best value solution for Eccles WwTW through an optioneering process. The drivers influencing the need for the significant rebuild of Eccles relate to low BOD and ammonia drivers. This decision for a substantial rebuild of Eccles has been validated following more recent additions of new phosphorus and cypermethrin drivers post October 2023.

The WINEP quality drivers for Eccles WwTW will make it the most tightly permitted site in the UU region and we believe one of the tightest in the UK. A comparison of existing permit and future drivers can be seen in Table 2. The drivers in the WINEP at the time of delivering our business plan were TAL for BOD and TAL for ammonia, along with a standstill limits for cypermethrin and nonylphenol. In combination with new stringent limits we need to continue to maintain the existing tight iron permit (relevant for discussions around the potential of chemical dosing solutions).

Following business plan submission there was a change to the drivers to include TAL for phosphorus (0.25mg/l) and a permitted value for cypermethrin which would be the lowest cypermethrin permit in UU.

In addition, Eccles was also given a driver to achieve 0.1mg/l P in early AMP9 (31st December 2032). The combination of these drivers into the AMP8 requirements and being aware of AMP9 future drivers allowed us to develop a no regrets solution, preventing abortive investment for customers.

Table 2: Summary of the existing permit and future quality drivers for Eccles WwTW

	Existing permit	AMP8 requirements 31st March 2027	AMP8 requirement 31st March 2030	Additional AMP8 requirements post October 2023 submission 31st March 2030	AMP9 31st March 2032
BOD mg/l 95%ile	20		6		
Ammonia mg/l 95%ile	8		1		
Phosphorus mg/l annual average	1.1			0.25	0.1
Cypermethrin ug/l 99%ile		0.0019205		0.000186 (0.000562 UTL)	
Nonylphenol ug/l 99%ile		1.5		0.82 (4.3 UTL)	
Iron mg/l 95%ile	2.75				

Source: UUW analysis from WINEP 5 July 2024

Eccles WwTW's existing treatment process comprises primary settlement, trickling filters and primary ferric dosing for P removal designed for 1.1mg/l P permit (Figure 1). This also utilises alkalinity correction in the form of caustic (sodium hydroxide) dosing. The site trickling filters were originally designed to meet a 30mg/l BOD permit and have since been optimised to achieve the current 20mg/l BOD permit.

Figure 1 below shows the existing site configuration and location identifying the immediate proximity of the M60 motorway, residential and commercial properties and the Manchester Ship Canal.

Figure 1: Eccles site layout showing proximity to neighbours, Manchester Ship Canal and the M60 motorway

Source: UUW analysis with Google Maps

4. Development of the technical solution

4.1 The proposed solution

We carried out an option appraisals process which looked at a do nothing, enhancement of existing assets and new build solutions. The do nothing and enhance existing assets approaches were not feasible as they would not achieve the BOD or ammonia drivers at the time of submission of the business plan, nor the additional phosphorus or cypermethrin drivers included after submission as evidenced in section 4.2 below. The existing process of tricking filters is not capable of meeting the new drivers for any of the determinands. We therefore need to deliver a solution best available technology (BAT), that will deliver environmental improvement for Eccles WwTW to the regulatory date and the best value solution for customers. As a result, a new secondary treatment process was selected as the only suitable option.

Our proposed solution to meet the drivers set out in Section 3 is a new biological P removal activated sludge process (Bio P ASP) (Figure 6). To achieve the additional driver of 0.25mg/l P added after business plan submission we would not normally propose a tertiary solids removal process when constructing a new build bio P ASP however considering Eccles' tight iron permit of 2.75mg/l (usual permits at 4mg/l) our engineering team have determined the need for tertiary solids removal here. These are no regrets interventions for AMP8 drivers and complementary to the AMP9 0.1mg/l P driver where additional intervention is expected. However, there will be no abortive cost and as such supports our adaptive plan to achieving the future stringent phosphorus permit as well as the overall plan to improve the quality of the Manchester Ship Canal.

The following sections will describe in more detail why we are confident this is the only solution for Eccles WwTW to meet the AMP8 drivers, maintain our excellent environmental performance and deliver best value for customers.

4.2 Challenging permit conditions compared to the existing asset base

As discussed, the AMP8 WINEP drivers for Eccles WwTW will be amongst the most stringent in England and Wales. Our engineering teams have verified that the existing site assets will be incapable of meeting the new permit requirements, for BOD and ammonia, and for the new phosphorus and tighter cypermethrin drivers that have been included in the WINEP since the submission of our business plan in October 2023.

6mg/l BOD driver – beyond the capability of the existing assets

The driver for 6mg/l BOD is a significant challenge to deliver at any wastewater treatment works, being the current TAL. We challenged ourselves to incorporate the use of the existing assets; we assessed the current performance, the optimisation potential and the potential to add on tertiary treatment to meet the requirement for 6mg/l BOD.

Achieving 6mg/l BOD permits with a fixed film trickling filter process is highly challenging and is widely considered impractical due to several inherent limitations of the technology:

- **Diffusion Limitation**: The biology attached to trickling filter media is often referred to as a fixed film or biofilm. Performance of biofilm processes is diffusion-limited, i.e. pollutant mass must travel across a concentration gradient from the bulk to the biofilm where the mass is metabolised by the biology/microorganisms. However, the rate at which these pollutants diffuse into the biofilm can be limited by a number of factors including biofilm thickness, oxygen gradient and available substrate. Trickling filters therefore have limited BOD treatment performance of up to 90% BOD removal (Metcalf and Eddy 2002, Table 9-1, p. 893).
- **Oxygen Limitation**: Oxygen is required for all aerobic treatment processes, including trickling filters, which employ natural ventilation. The rate of airflow is a function of the temperature difference between the ambient air and the air inside the pores, which is approximately at sewage temperature. During some periods of the year no nett air flow occurs through the trickling filters because temperature differential is negligible

(Metcalf and Eddy 2002, Figure 9-6, p. 902). This limits the biological process and reduces the effectiveness of the treatment process.

- **Low Hydraulic Retention Time:** The hydraulic retention time of effluent while it is being treated in trickling filters is short, therefore the effective contact time needed for thorough BOD removal, such as that to 6mg/l BOD and beyond, is not sufficient.
- **Lack of Process Control:** Trickling filters offer limited process control opportunities, which makes it hard to optimise the process for low BOD levels. The fixed media bed restricts adjustments to biofilm thickness and hydraulic loading in real-time. Ensuring adequate oxygen transfer, especially in deeper biofilm layers, is also problematic. So, optimisation of Trickling Filters to achieve low BOD drivers is seldom possible.

BOD is the sum of the particulate BOD and the soluble filtered BOD. Total BOD can be reduced by the addition of tertiary solids removal downstream of trickling filters; however the soluble filtered fraction would not be improved by this process.

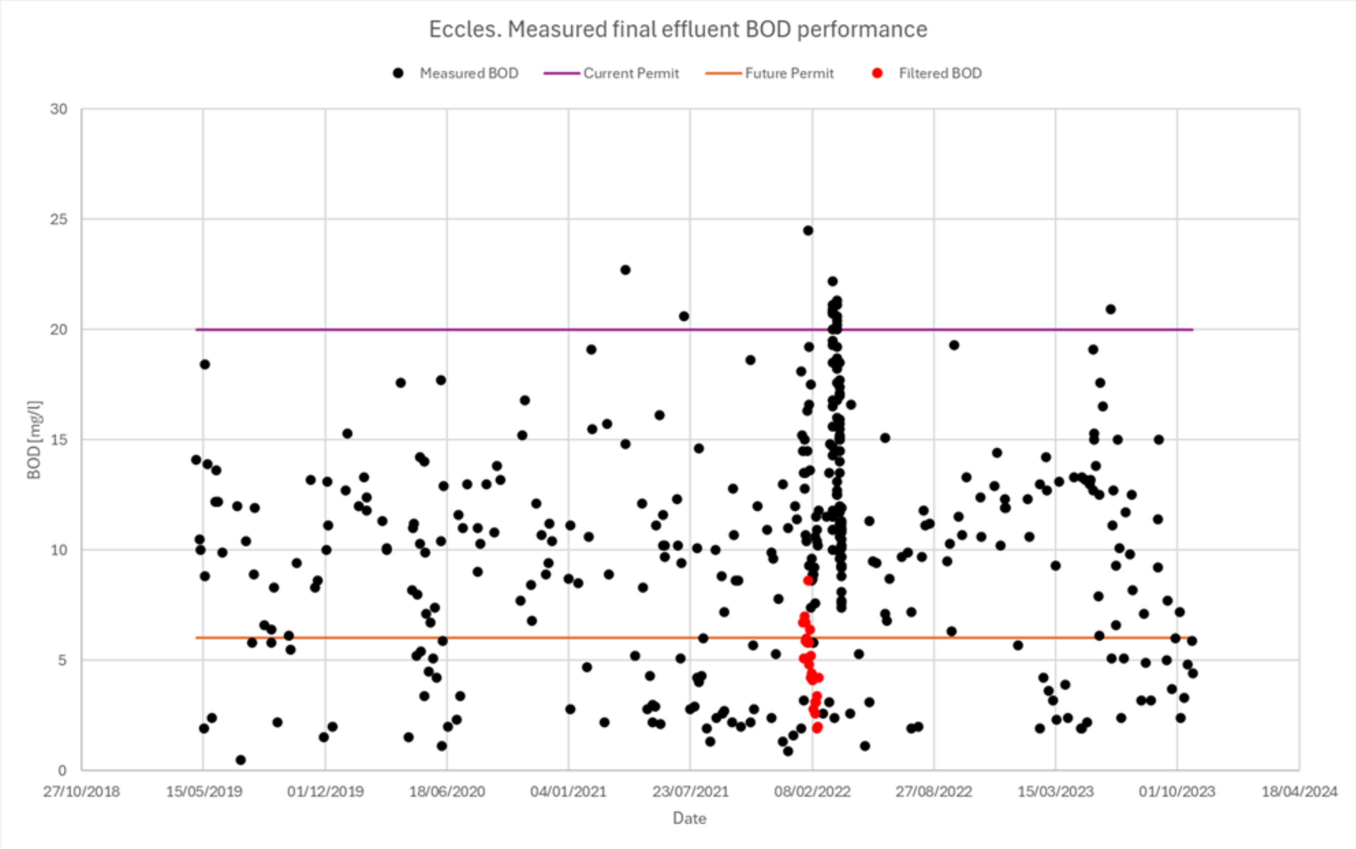
Trickling filters designed for maximum BOD removal capability will be sized for both BOD and ammonia removal. The effluent quality that can be achieved is 10 mg/l BOD and 3 mg/l ammonia (Metcalf and Eddy 2002, Table 9-5, p. 909). Consequently, the industry view on designing trickling filter performance for a technically achievable limit of 6 mg/l BOD is not possible.

BOD Performance at Eccles WwTW

The conclusion drawn from the technical theory of the treatment capability of trickling filters is that they are unable to achieve 6mg/l BOD performance. However, we also reviewed the performance data of the assets at Eccles to identify any opportunities to retain them in our solution for the AMP8 WINEP drivers.

Figure 2 below shows all the final effluent data for Eccles and demonstrates that it is not capable of achieving the 6mg/l BOD driver, indicated by the red horizontal line. A small subset of soluble filtered BOD (labelled filtered BOD) indicates that even if particulate BOD was removed effectively by tertiary solids removal the filtered soluble BOD would be higher than 6mg/l.

Figure 2: Eccles WwTW Measured BOD and Filtered BOD (red) data from existing site



Source: UUW analysis

1mg/l Ammonia driver– a challenge for the existing assets

Meeting a stringent 1mg/l ammonia permit with trickling filters poses significant challenges:

- **Biological nitrification inefficiency**: trickling filters primarily focus on organic carbon removal and can nitrify ammonia to nitrate under certain conditions. However, they often lack the consistent nitrification efficiency needed to achieve ammonia levels as low as 1mg/l, especially under varying loading conditions
- **Temperature sensitivity**: biological nitrification in trickling filters is highly temperature dependent. At lower temperatures, the activity of nitrifying bacteria diminishes, making it difficult to maintain low ammonia concentrations year-round
- **Hydraulic Loading Rates**: High hydraulic loading rates can lead to insufficient contact time between the wastewater and the biofilm, reducing nitrification efficiency. Trickling filters may struggle to balance high hydraulic loads with the need for thorough nitrification.

As stated above in section 4.2.1, trickling filters are designed for maximum BOD removal capability will be sized for both BOD and ammonia removal. The effluent quality that can be achieved is 10 mg/l BOD and 3 mg/l ammonia (Metcalf and Eddy, Table 9-5, p. 909).

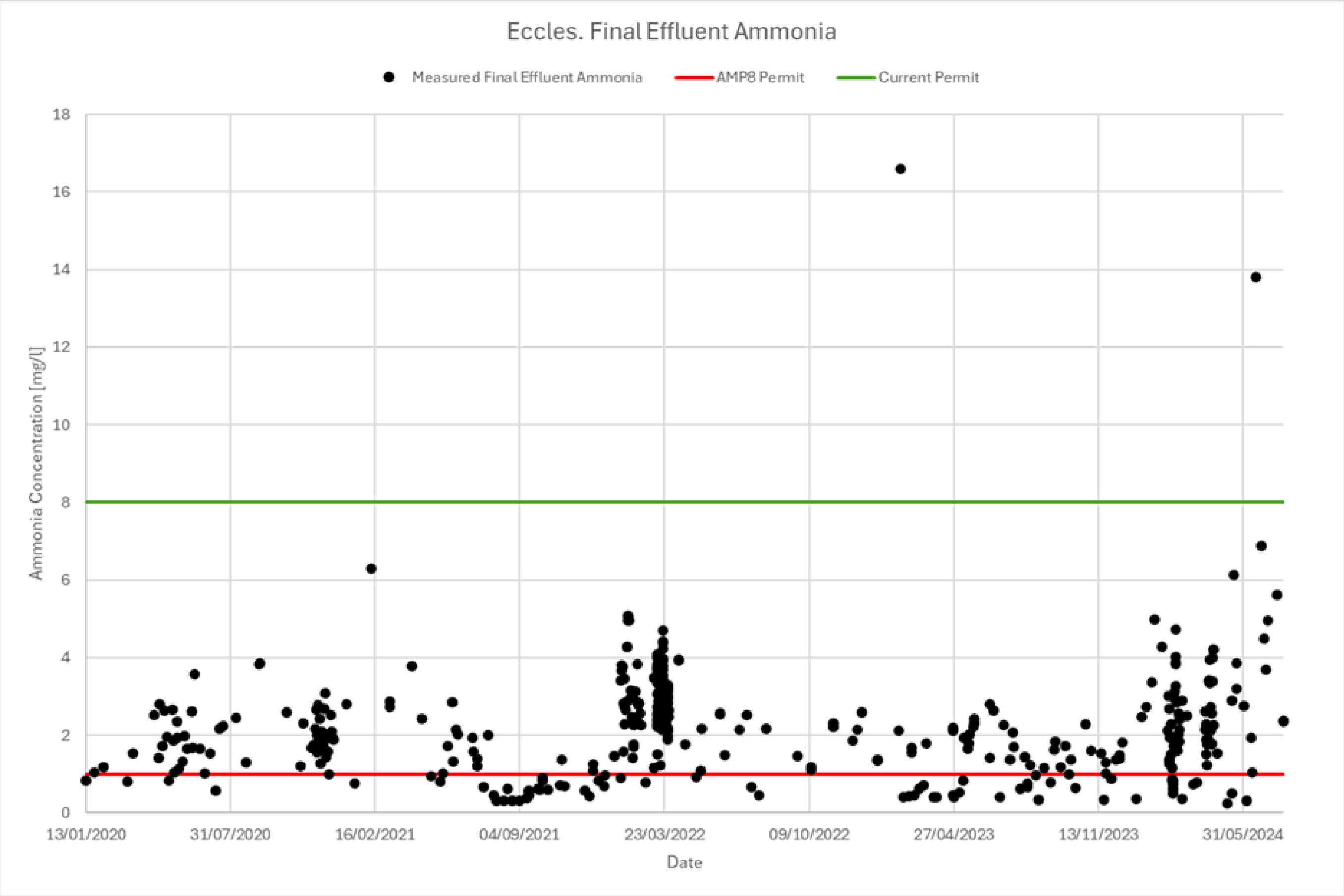
It is possible to install tertiary treatment downstream of trickling filters to achieve more stringent ammonia drivers, but this is not possible for BOD, as discussed in section 4.2.1. Our view for Eccles was that an add on tertiary ammonia solution would only achieve a single WINEP driver, and therefore does not represent the best value solution at Eccles.

Ammonia Performance at Eccles WwTW

As with the BOD driver, the conclusion drawn from the technical theory of the treatment capability of trickling filters is that they are also unable to achieve 1mg/l ammonia performance. However, we again reviewed the performance data of the assets at Eccles to identify any opportunities to retain them in our solution for the AMP8 WINEP drivers.

Figure 3 shows all the final effluent data for Eccles and demonstrates that it is not capable of achieving the 1mg/l Ammonia, indicated by the red horizontal line.

Figure 3: Eccles WwTW Measured Ammonia data from existing site



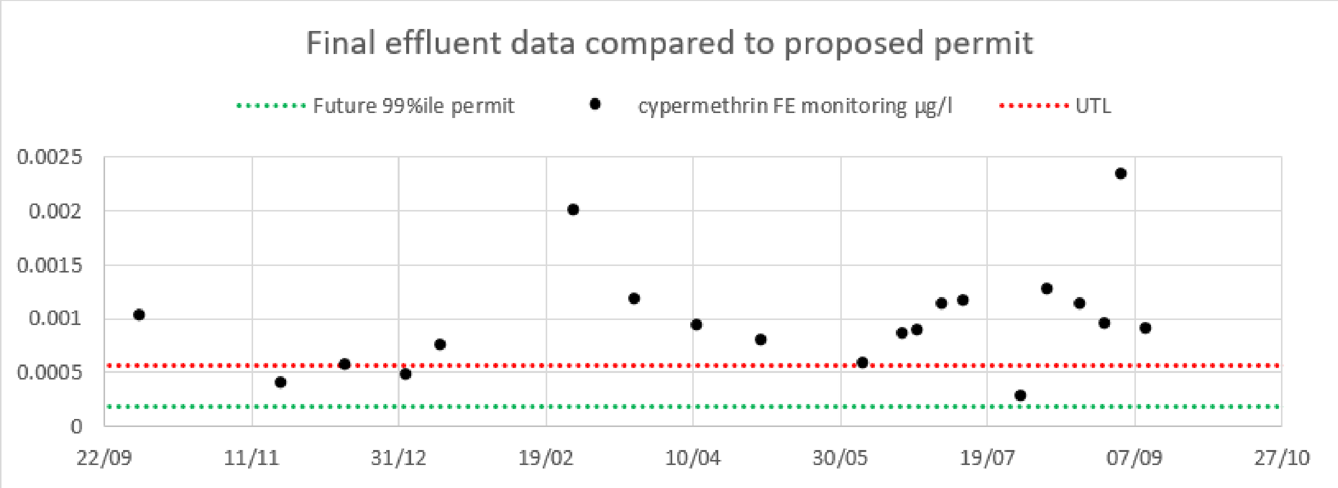
Source: UUW analysis

4.3 Our region's tightest Cypermethrin permit

The revised cypermethrin permit for Eccles WwTW is significantly lower than that proposed for other sites as it is based on the River Needs values. This is not possible to achieve with a trickling filter process, even with additional new treatment processes. Cypermethrin removal at the treatment works is primarily associated with adsorption onto organic matter and removal in the sludge.

Figure 4 shows the current performance data for Cypermethrin at Eccles, which demonstrates the existing trickling filter process is incapable of meeting the future permit.

Figure 4: Eccles WwTW - measured Cypermethrin removal from existing process

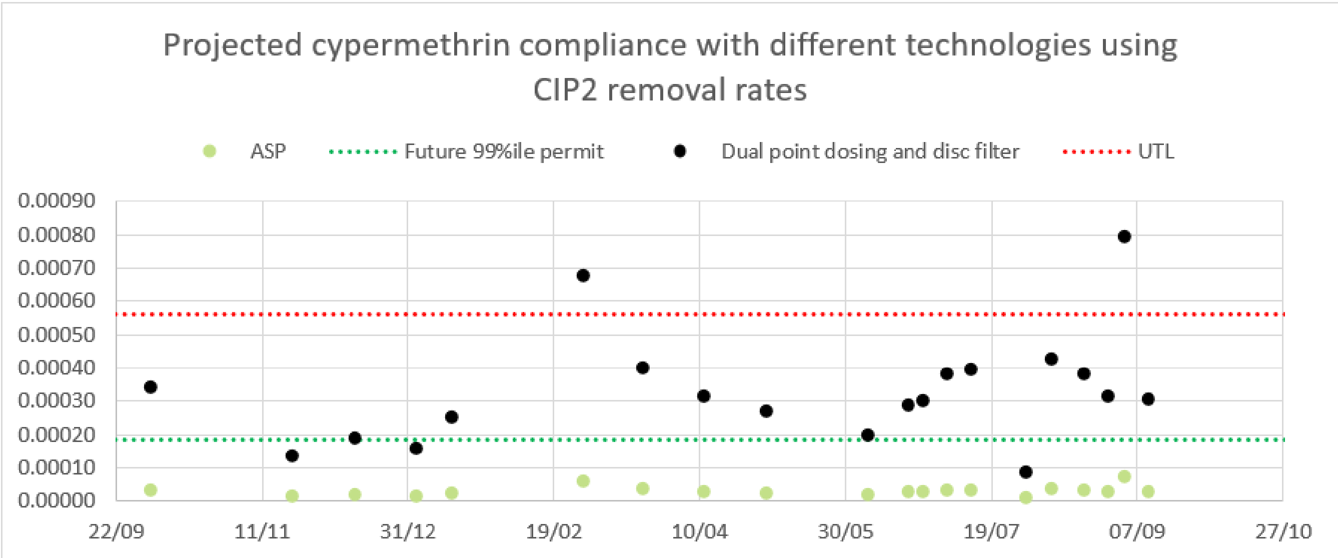


Source: UUW analysis

This conclusion is also supported by the Chemical Investigations Programme 2 (CIP2). CIP2 extensively studied various wastewater treatment processes and their efficacy in removing micropollutants, including cypermethrin. Conclusions drawn from assessment of different treatment processes in CIP2 show that of all the technologies considered activated sludge-based treatment processes consistently remove the most cypermethrin. Activated sludge systems, which are a type of suspended growth process, promote microbial degradation and adsorption due to their longer sludge retention times and higher biomass concentrations (UK Water Industry Research [UKWIR], 2014. This is thought to be the reason that activated sludge-based processes achieve higher removal rates of Cypermethrin compared to fixed film processes (such as trickling filters).

Trickling filters, which were not specifically assessed for cypermethrin removal in CIP2, generally demonstrate lower removal efficiencies for hydrophobic organic compounds like cypermethrin. This is due to their reliance on biofilms with lower biomass concentrations and shorter hydraulic retention times, which are less effective at adsorbing and degrading such pollutants (Metcalf & Eddy, 2002).

Figure 5: Projected cypermethrin compliance with different technologies using CIP2 removal rates



Source: UUW analysis

We did consider other tertiary treatment processes based on the data provided from CIP2, but there was no evidence that any would consistently achieve the challenging cypermethrin driver. In conclusion, to meet the stringent cypermethrin permit requirements based on River Needs values, implementing a suspended growth (e.g. activated sludge-based) treatment process is the only viable solution.

4.4 Creating a sustainable adaptive plan which represents best value for customers

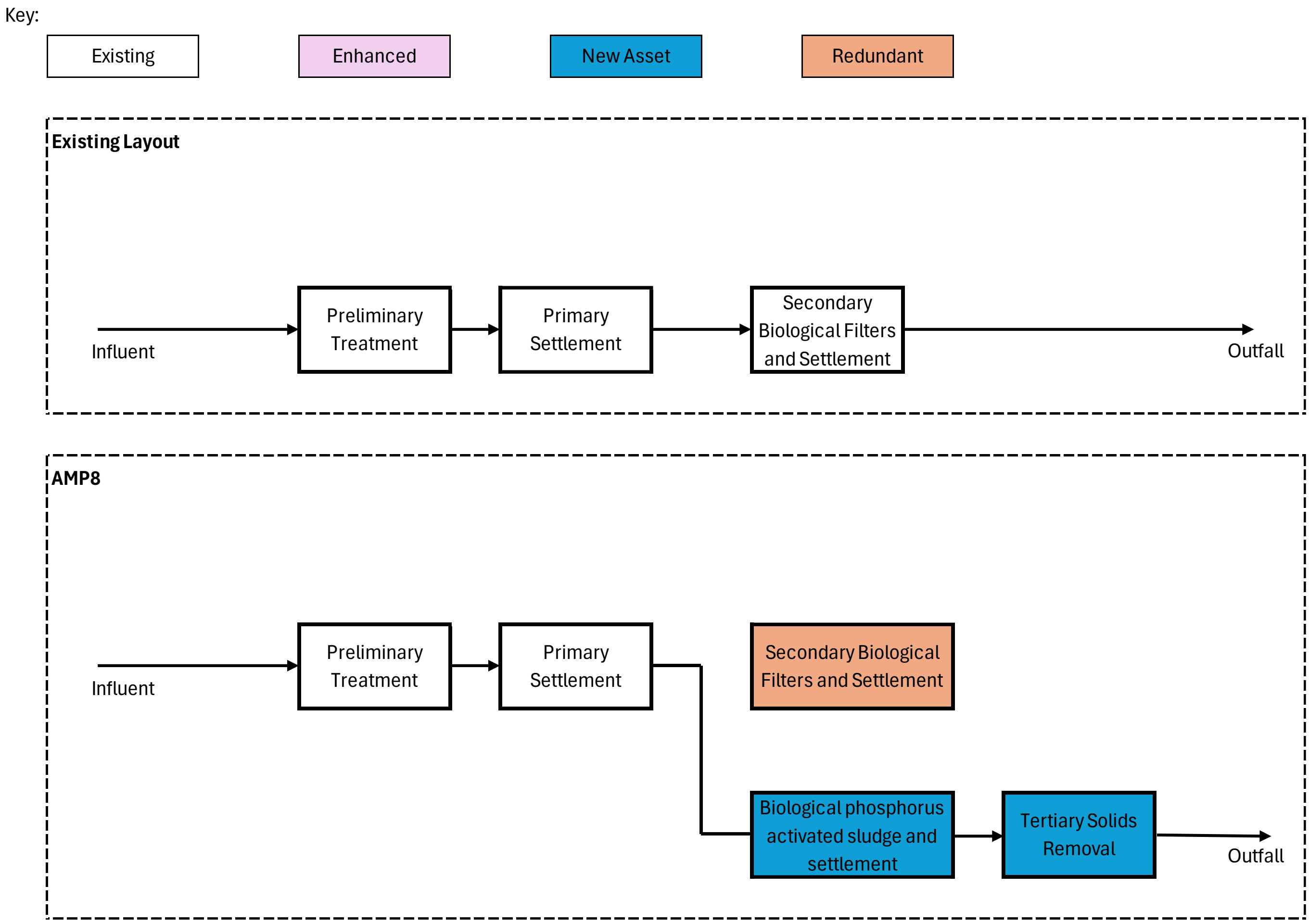
We have demonstrated above based on technical theory and on performance data from the existing assets at Eccles, that the TAL AMP8 WINEP drivers of 6mg/l BOD, 1mg/l Ammonia and 0.000186ug/l cypermethrin, are not possible to achieve with the existing secondary treatment trickling filters. We have also discussed that although it would be possible to achieve the 1mg/l ammonia driver with a bolt-on tertiary treatment process downstream of the trickling Filters, the 6mg/l BOD and tight cypermethrin drivers would not be met by such a solution.

We therefore concluded that our best value option to meet the AMP8 WINEP drivers at Eccles was to replace the existing trickling filters with a modern activated sludge based process, which will meet all 3 drivers (BOD, ammonia and cypermethrin), and will be designed for the 2050 design horizon. Activated sludge based technology is the best available technique (BAT) for achieving the stringent drivers described above.

While we were developing the solution for Eccles for submission of our Business Plan in October 2023, we knew that the site would have a future tightening of the phosphorus permit to 0.25mg/l from the Environment Act in AMP9. As discussed in our representation for our phosphorus programme (UUWR_33_Phosphorus removal), when a new suspended growth (e.g. ASP) secondary treatment process is part of solution for sanitary drivers, the best value sustainable solution is to deliver biological phosphorus removal at the same time where there are phosphorus drivers. We therefore developed an adaptive plan to deliver biological phosphorus removal as part of the AMP8 solution in anticipation of the future driver, therefore ensuring no abortive investment for AMP9. It should also be noted that Eccles already has a tight iron permit (2.75mg/l) which would make it difficult to achieve tight phosphorus drivers utilising a full chemical dosing solution, whilst remaining within acceptable iron limits.

This decision was further validated by the acceleration of the 0.25mg/l phosphorus permit into the AMP8 WINEP and included in the drivers. We also now know that the phosphorus permit will be further tightened to 0.1mg/l in early AMP9, reinforcing the drivers for Eccles being amongst the most stringent in England and Wales and requiring modern ASP technology with biological phosphorus removal and utilisation of tertiary solids removal to maintain compliance with the existing iron permit but also providing a no regrets solution for AMP9 0.1mg/l P. The process flow below shows the existing process stages and what is proposed for delivery in AMP8.

Figure 6: Process Flow Diagram showing existing treatment process stages and proposed AMP8 solution



Source: UUW analysis

5. How additional requirements have influenced cost

From the submission in October 2023 the entire project cost of £177m was attributed to the sanitary drivers for BOD and ammonia for the ASP solution described above.

Since then, a permitted cypermethrin driver has been confirmed which can be delivered within the sanitary scheme and further confirms the need to move to the ASP solution.

The new 0.25mg/l P driver could not be delivered within the costs of the October submission and requires additional investment of £21.408m associated with that driver.

Table 3: Impact of drivers on total project cost for Eccles WwTWs

Drivers		Cost
WINEP Sanitary	6mg/l BOD 1mg/l ammonia	£177m
WINEP P (confirmed March 2024)	0.25mg/l P 0.1mg/l P	£21.4m

Source: UUW analysis

6. Constructability challenges and influence on cost

Our review of the construction plan for the Eccles WwTW AMP8 solution identified several areas of site-specific challenges which may not be considered through a standard model assessment of cost (Table 4). These have led to an impact on the total project cost for the scheme.

The footprint of Eccles WwTW is near capacity. The site is bounded by the M60 motorway, woodland and residential housing and commercial properties. As a result, there are no substantial undeveloped areas for the construction of new assets. Eccles has already expanded to the site boundary in many areas. There are no substantial undeveloped areas for the construction of new build assets. This results in additional constructability requirements such as the need to demolish redundant assets, construct in challenging ground conditions (including building on brown field sites / flood plains). This impacts programme sequencing and can necessitate temporary treatment to enable the continuity of existing treatment to be maintained during construction. Where construction within the site boundary is unachievable, we have identified the need to purchase land or rent land for the location of site compounds, plant storage and equipment laydown areas.

This results in constructability requirements including demolition of redundant assets, ground conditions (including building on brown field sites / flood plains), impacts programme sequencing and necessitates temporary treatment to enable continuity of existing treatment processes.

Table 4: Eccles WwTW – Key Site Constructability Challenges

Specific site constructability challenges	Total Capex (£m)
Temporary treatment	13.0
Demolition of trickling filters	11.7
Ground conditions (including piling)	14.3
New site roads	4.8
Landscaping	2.2
New site access	0.8
Total	46.8

Source: UUW analysis

Figure 7: Eccles WwTW overview site plan

Source: UUW analysis

6.1 Demolition

Demolition of the existing north bank of six trickling filters will be required to free land for the construction of new assets and will incur additional cost (Figure 7). Demolition includes the need to remediate the existing trickling filter media, dispose and then demolish the remaining structure (180 metres by 100 metres) including all associated mechanical and electrical equipment.

6.2 Ground conditions

Historic ground investigation records (United Utilities, 2024) show that ground conditions are poor and that areas of contaminated ground will be encountered that will require mitigation.

Investigation data shows that the load bearing capacity of the ground is inadequate, and that piling will be required to support all the new structures.

The presence of a high groundwater table will require temporary works dewatering during construction activities. The need to excavate and dewater close to existing structures will require monitoring works to ensure potential settlement does not damage these structures.

6.3 Land and planning constraints

The existing power supply at Eccles WwTW is insufficient to meet the demands of the new assets. The site's current Authorised Supply Capacity (ASC) is 700kVA and the power demand of the new proposed assets is expected to be 2,089 kVA. As a result, new electricity substation will be required at the site and enhancement of the local power network required.

The available undeveloped land within the site boundary at Eccles is insufficient for the scale of the new assets required to meet the AMP8 drivers. United Utilities land ownership extends to area to the north of the existing boundary, which is currently tenanted by an international archery club and close to residential properties. Expert advice provided by our framework environmental planning consultants, WSP, concludes that the construction of new assets in this area would trigger the need for an Environmental Impact Assessment (EIA). Completion of an

EIA would add 2 years to the overall project programme, thereby rendering the project undeliverable by the regulatory date of 31/03/2030.

The proposed solution has thus been designed to avoid the requirement for an EIA and necessitates construction over existing assets in a phased approach. Whilst this will enable the project to meet the regulatory date, it does in comparison to a “green field” build cause prolongation of the programme and incurs additional costs.

6.4 Programme sequencing

The new activated sludge plant and four new final settlement tanks will be constructed over the top of the existing trickling filters.

- Significant temporary treatment assets will be required to maintain compliance with the existing consent whilst the existing assets are decommissioned, demolished and new assets constructed.
- The temporary treatment assets will need to the established prior to start of construction and construction of the new process will need to be phased in two halves to minimise risk to the existing consent.
- This approach will cause prolongation of the programme and incur additional capex and operational costs.

6.5 Surrounding built environment

The M60 Barton High Level Bridge (BHLB) is a critical asset for National Highways and runs along the western boundary of Eccles WwTW (Figure 7). Working close to the BHLB will require an Approval In Principle (AIP) from National Highways and will constrain the design and construction methods to minimise any potential effect on the bridge. Ongoing monitoring of the bridge will also be required.

7. Challenging our own costs

Following the development of the solutions to meet the original AMP8 drivers we internally challenged ourselves, to ensure we were submitting efficient solutions. In the case of Eccles efficiencies were adopted, including removal of the tertiary solids removal process (which had been included to ensure robust delivery of the 6mg/l BOD driver) and rationalisation of sludge handling equipment.

This challenge generated circa £39m efficiency for the Eccles scheme, which was removed from our submitted costs in our business plan. We endeavoured to absorb the additional risk this poses to operational performance, however with the addition of low P in AMP8 and an additional stretch to 0.1mg/l in AMP9 and more importantly combined with a lower than usual existing iron permit, the need for the tertiary solids removal process was reintroduced.

The additional solids removal process is required when addressing the low BOD with the low P standards and low iron standards, combined there is an intolerable risk to the discharge permit.

7.1 Efficiencies identified since submission

Following our business plan submission in October 2023, we have continued to develop the Eccles solution through our Transitional Investment funding. We appointed Jacobs as our Strategic Solution Partner in February 2024, and since then we have been working with their global experts to leverage efficiencies in our solution for Eccles. We have subsequently challenged the tertiary solids removal solution with suppliers, along with the cost, and are pleased to have identified an efficiency of £18m against the £39m initial estimate.

8. Conclusion

The extremely stringent drivers for BOD, ammonia, P and cypermethrin that we are obligated to deliver at Eccles WwTW are impossible to meet with the existing assets.

Eccles is a constrained site, with the M60 and the Manchester ship canal running alongside two sides of the site. While the stringent limits and the size of Eccles make this a large project, we have carried out a detailed solution identification process and this has been estimated in detail as part of a bottom up estimating approach whilst considering the site-specific constraints.

As we understand the infrastructure at Eccles in detail and have robustly explored the challenges, we are confident in the deliverability, scope and costs.

Our solution secures a central part of our adaptive plan that is key to the wider Manchester Ship Canal strategy. With awareness of the long-term drivers we have been able to include solutions for AMP8 that enable best overall value for customers and the environment considering both the AMP8 and AMP9 drivers, minimising abortive investment.

Therefore, we consider Eccles to be clear and ready for delivery, as such inappropriate for inclusion in the large scheme gated process and appropriate for the enhanced engagement process.

9. References

- Metcalf & Eddy, Inc. (2002). Wastewater engineering : treatment and reuse. Boston : McGraw-Hill
- UK Water Industry Research [UKWIR] (2014) CIP2 Programme Report
- United Utilities (2024) Eccles WwTW – Geotechnical and Geoenvironmental Desk Study Report, February 2024