

Bury Wastewater Treatment Works – Flood Risk Assessment

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Bury Wastewater Treatment Works – Phase 1 Flood Risk Assessment

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Executive Summary

United Utilities commissioned Jacobs to prepare a Flood Risk Assessment (FRA) for an Electrical Control Building at Bury Wastewater Treatment Works (WwTW). The Electrical Control Building is part of a larger storm tanks scheme, although it is the only element of the scheme requiring planning permission and therefore the only part necessitating a FRA as the remaining works are undertaken as permitted development. The works would be integrated within the existing WwTW. The Electrical Control Building will be located in an area located within the existing Environment Agency's (EA) Flood Zone 2, as shown on the existing EA flood maps a FRA is required to support the planning application.

For the purposes of this assessment the 'Proposed Works' refers to the Electrical Control Building and the 'Wider Site' refers to United Utilities land ownership boundary as shown in Figure 1.1.

The Proposed Works will be constructed on a raised platform, and will be raised above ground level by 1.2m.

The main findings of this assessment are:

- Hydraulic modelling indicates that the Proposed Works are located outside, but on the edge, of the 1% (1 in 100) AEP event (with 46% climate change) extent. The Proposed Works will be constructed 1.23m above the 1% (1 in 100) AEP event (with 46% climate change) and 0.85m above the 0.1% AEP event peak water levels. The Proposed Works would therefore not be expected to flood during these events.
- The modelling also demonstrates that the Proposed Works are not located within the 3.3% (1 in 30) AEP extent and is therefore outside Flood Zone 3b/ functional floodplain.
- Groundwater is anticipated to be shallow, however there will be no deep excavations as part of the Proposed Works and therefore risk of groundwater flooding is anticipated to be low.
- All other sources of flood risk (surface water, sewers and reservoirs) are considered to be low.
- The impact of the development on flood risk as a result of the Proposed Works is also considered to be low.

As set out by the National Planning Policy Framework (NPPF), developments in Flood Zones 2 and 3a will have to pass the Sequential Test and Exception Test.

The Proposed Works pass the Sequential Test as the Electrical Control Building is required to be sited in close proximity to the new storm tanks and existing electrical connections within the site, in order to operate the equipment. There are no suitable areas of land for the new storm tanks within the Wider Site that are outside of the flood zone.

The Proposed Works pass the Exception Test as the platform that will hold the Electrical Control Building is raised 1.23m above the 1% (1 in 100) AEP event (with 46% climate change) and 0.85m above the 0.1% (1 in 1000) AEP event and will therefore remain dry. Other sources of flood risk are deemed to be low. Therefore, the Proposed Works will be designed so that it is safe for its lifetime.

Given the Proposed Works area is located on the edge of the 1% (1 in 100) AEP event with 46% climate change, the impact of the proposed works on flood risk elsewhere is deemed to be negligible. For the 0.1% (1 in 1000) AEP event this impact would be localised and restricted to the Wider Site (UU's ownership) due to size of the Proposed Works area.

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1. Introduction

1.1 Purpose

Jacobs have been commissioned to undertake a Flood Risk Assessment (FRA) to support a planning application by United Utilities to construct an Electrical Control Building as part of a wider storm tanks development within the Bury Wastewater Treatment Works (WwTW), Greater Manchester. The 'Proposed Works' involves the construction an Electric Control Building which will house the Motor Control Centre to operate equipment at the facility. The proposed building will be 10m long x 4m wide x 3m high, and raised on a 1.2m high steel platform. The remainder of the storm tanks development falls under permitted development rights under Part 13, Class B and Part 4, Class A of the General Permitted Development (England) Order 2015 (GDPO), and therefore will not be considered within this FRA.

For the purposes of this assessment, the 'Wider Site' refers to United Utilities land ownership boundary as shown in Figure 1-1. The Proposed Works are located within Flood Zone 2, and therefore require a FRA (see Section 2.2.1).

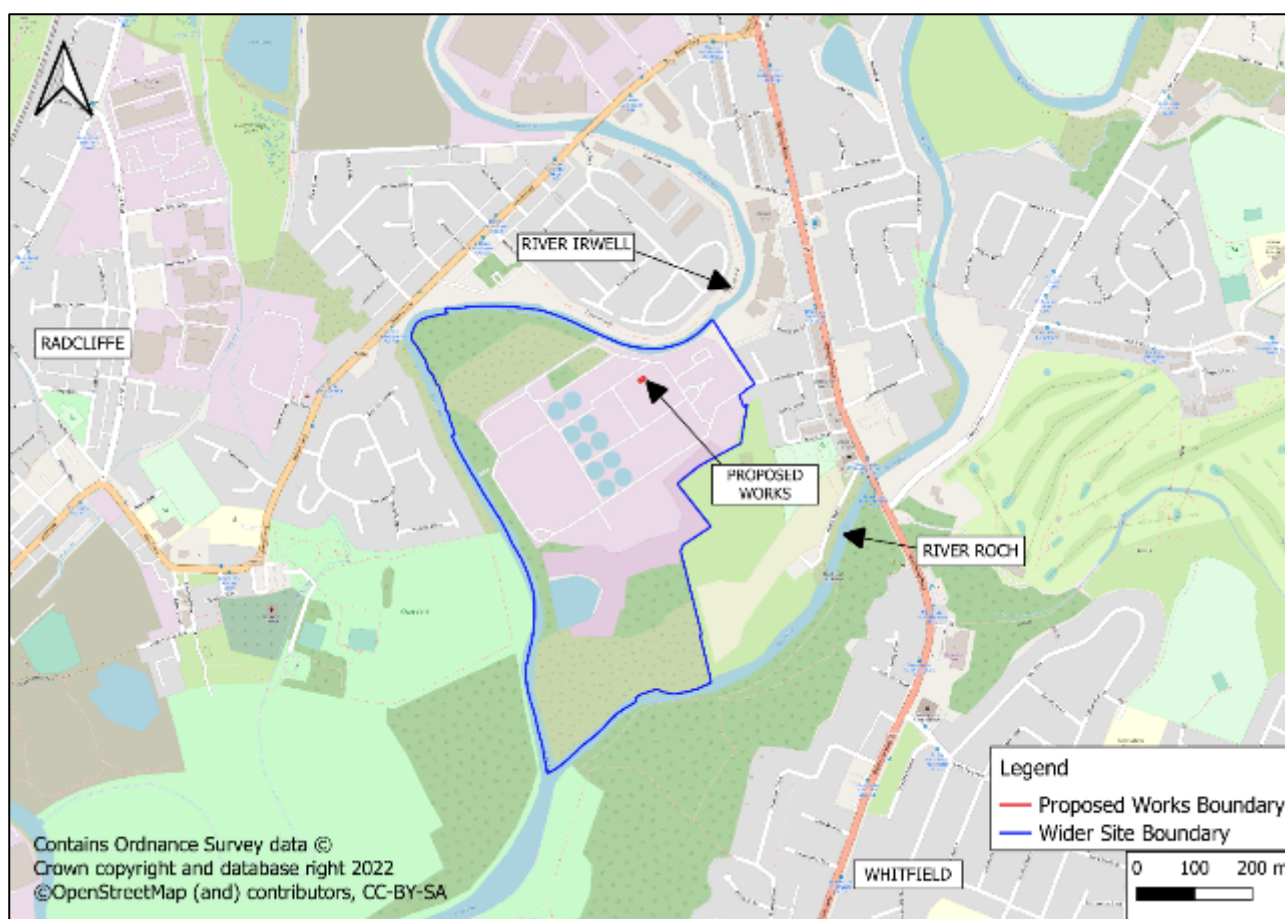


Figure 1-1 – Site location

This FRA has been prepared in accordance with the requirements of the National Planning Policy Framework (NPPF)¹ and technical guidance to the NPPF published by the Department for Communities and Local Government. The Proposed Works are located within the Bury Metropolitan Borough Council area and the relevant policy and guidance documents for the Borough have been utilised in the preparation of this FRA and are referenced in this report.

¹ NPPF accessed online (June, 2023)

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf

1.2 Objectives

The purpose of this report is to present a site-specific assessment of flood risk and to demonstrate the impact of the Proposed Works to flood risk based on currently available information and demonstrate compliance with national and local flood risk spatial planning policy.

This FRA demonstrates how the Proposed Works complies with national and local planning policy by:

- Including an assessment of flood risk to the Proposed Works from all sources;
- Demonstrating that the Proposed Works will not increase flood risk elsewhere;
- Demonstrating the Proposed Works will be safe for users for its lifetime, taking the predicted impact of climate change into account;
- Ensure flood risk to and from Proposed Works is minimised, and where possible achieves an overall reduction in flood risk; and,
- Providing evidence to demonstrate how the Proposed Works is considered to pass the Sequential and Exception Tests.

1.3 Proposed Works

The Proposed Works comprise an Electrical Control Building, which will house a Motor Control Centre to operate the equipment within the Bury WwTW. The platform that will hold the Electrical Control Building will be raised above ground level by 1.2m and set at a level of approximately 68.3m AOD.

The Proposed Works form part of a wider storm tank development which aims to increase storage capacity and reduce the spill volume from the existing storm tanks to achieve compliance with Water Framework Directive (WFD) standards. It will contribute towards an improvement of water quality in the River Irwell to 'good' status by September 2026. The storm tanks development consists of two new storm tanks and associated pipework and is primarily classed as Permitted Development under provisions of the GPDO. The Proposed Works (Electrical Control Building) is not covered under Permitted Development and therefore planning permission for this element is required.

The Proposed Works are considered to be 'essential utility infrastructure', and have consequently been classified as Essential Infrastructure in accordance with Annex 3 of the NPPF. The design life of the Proposed Works is 100 years, construction is due to commence in 2024. This FRA is for the Electrical Control Building as the only element requiring planning permission.

1.4 Approach

The following tasks have been undertaken as part of this FRA:

- A review of local and national flood risk management policy in relation to the Works land use;
- Review of flood risk datasets including national flood risk mapping, and fluvial hydraulic modelling exercise (Appendix A) undertaken to inform this FRA, to determine the flood risk baseline;
- An assessment of the potential flood risk to the Proposed Works from all types of flooding;
- A review of the potential impacts of the Proposed Works on flood risk elsewhere, including from the fluvial hydraulic modelling exercise; and
- Recommendations providing guidance on Proposed Works location and mitigation measures.

2. Flood Risk Policy and Guidance

An evaluation of relevant national and local development policies has been undertaken to inform the flood risk and planning context that should be considered as part of the Proposed Works as summarised in the following sections.

2.1 National Legislation

The Department of the Environment, Food and Rural Affairs (DEFRA) is responsible for all aspects of water policy in England. The key current legislation relating to flood risk is:

- Floods Directive (2007/60/EC): Established a framework for the assessment and management of flood risk to reduce the negative consequences of flooding on human health, economic activities, the environment and cultural heritage.
- Reservoirs Act (1975): Provides regulation for assessing risk of escape of water and ensuring that reservoirs are regularly monitored and their asset status (integrity) is regularly assessed. this is enforced by the Environment Agency in England.
- Land Drainage Act (1991): Empowering Drainage Authorities to regulate works to ordinary watercourses (non-main rivers);
- Water Resources Act (1991): Consolidation of previous legislation including water resource management, water quality standards and empowering the Environment Agency to regulate and manage works affecting designated Main Rivers and create Byelaws;
- Environment Act (1995): Creating several new agencies (including the Environment Agency) and setting new standards for environmental management;
- Water Act (2003): extending the provisions of the Water Resources Act (1991) and the Environment Act (1995) for abstractions and discharges, water conservation and pollution control.
- Flood and Water Management Act (2010): Designating Lead Local Authorities and empowering them to identify and manage flood risks from surface water runoff, groundwater and ordinary watercourses; and
- Flood Risk (England and Wales) Regulations 2016: The Flood Risk Regulations transposed the EU Floods Directive into law in England and Wales. The EU Floods Directive aims to provide a consistent approach to flood risk management across Europe.

2.2 National Planning Policy

The NPPF (Ministry of Housing, Community and Local Government, 2021) sets out the planning policies for England. It sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. Section 14 of the NPPF: 'Meeting the challenge of climate change, flooding and coastal change' is relevant to the water environment and considers the impact of climate change to flood risk. Paragraphs 159 to 169 set out flood risk policies to be followed by all proposed developments. These policies set strict tests to protect people and property from flooding. Where these tests are not met, national policy is clear that new development should not be allowed. The main steps are designed to ensure that if there are better sites in terms of flood risk, or a proposed development cannot be made safe for its lifetime, ensuring flood risk is not increased elsewhere, it should not be permitted.

2.2.1 Need for Site-Specific Flood Risk Assessment

Footnote 55 in the NPPF states that a site-specific FRA is required for proposals of 1 hectare or greater in Flood Zone 1; all proposals for new development (including minor development and change of use) in Flood Zones 2 and 3, or in an area within Flood Zone 1 which has critical drainage problems (as notified to the local planning authority by the Environment Agency); and where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

Additionally, the FRA should demonstrate to the decision-maker how flood risk will be managed now and over the development's lifetime, taking climate change into account, and with regard to the vulnerability of its users. The guidance to the NPPF states that the FRA should establish:

- whether a proposed development is likely to be affected by current or future flooding from any source;
- whether it will increase flood risk elsewhere;
- whether the measures proposed to deal with these effects and risks are appropriate;
- the evidence for the local planning authority to apply (if necessary) the Sequential Test; and

- whether the development will be safe and pass the Exception Test, if applicable.

2.2.2 The Sequential Test

The aim of the Sequential Test is to ensure the safety and sustainability of new developments and provide guidance for developers. The Sequential Test ensures that a sequential approach is applied steering developments to areas of low probability of flooding. The Flood Zones are defined by the Environment Agency Flood Map for Planning and in the local planning authorities' SFRA. The aim is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding).

If this is not possible, local planning authorities in their decision-making should consider the flood risk vulnerability of land uses. Therefore, they should consider reasonably available sites in Flood Zone 2 (areas with a medium probability of river or sea flooding), applying the Exception Test if required. Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in Flood Zone 3 (areas with a high probability of river or sea flooding) be considered. However, it should consider the flood risk vulnerability of land uses and apply the Exception Test if required.

Paragraph 019 of National Planning Policy Guidance (NPPG) states that within the flood zones other sources of flooding need to be considered. Therefore, a sequential approach should be applied to determine the location of the new development.

The Proposed Works compliance with the Sequential Test is detailed in Section 6.

2.2.3 The Exception Test

The appliance of the Exception Test depends on the location of the Proposed Works and its flood risk vulnerability classification as shown in Table 2-1. The Exception Test is used to demonstrate and ensure that flood risk to people and property will be managed properly, whilst allowing the Proposed Works to progress in situations where suitable sites at lower risk of flooding are not available.

Table 2-1 Summary of conditions required for the application of the Exception Test (source: Planning Practice Guidance Table 2)

Flood Zone	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
1	Development is appropriate				
2	Development is appropriate	Exception Test required	Development is appropriate		
3a	Exception Test required	Development should not be permitted	Exception Test required	Development is appropriate	
3b	Exception Test required	Development should not be permitted			Development is appropriate

As detailed in paragraph 160 of the NPPF, there are two sections of the Exception Test that the applicant needs to demonstrate:

- The Proposed Works provides wider sustainability benefits to the community that outweigh the risk of flooding; and
- The Proposed Works will be safe for its lifetime, without increasing flood risk elsewhere, and, where possible reduce flood risk overall.

The Proposed Works compliance with the Exception Test is detailed in Section 6.

2.3 Local Flood Risk Policy Guidance

The Proposed Works fall within the administrative area of Bury Metropolitan Borough Council, who are the Lead Local Flood Authority (LLFA). Local policies related to the Proposed Works and flood risk are listed below.

2.3.1 Bury Local Plan

In Bury, the Local Plan will form part of the Borough's overall development plan alongside other strategic Greater Manchester plans, namely the Greater Manchester Spatial Framework (GMSF) and the Greater Manchester Minerals and Waste plans. The GMSF and the Bury Local Plan contain the strategic and non-strategic planning policies that will manage the growth and development of the Borough up to 2037. This includes the allocation of sites that will provide new housing and employment opportunities, alongside the delivery of supporting infrastructure.

The Flood Risk policy is covered by Policy GM-S 5 of GMSF: Flood Risk and the Water Environment, which adheres to the national guidance laid out by the NPPF, 2021 and states:

An integrated catchment-based approach will be taken to protect the quantity and quality of water bodies and managing flood risk, by:

- *Returning rivers to a more natural state, where practicable, in line with the North West River Basin Management Plan.*
- *Working with natural processes and adopting a natural flood management approach to slow the speed of water drainage and intercept water pollutants.*
- *Locating and designing development to minimise the impacts of current and future flood risk, including retrofitting or relocating existing developments, infrastructure and places to increase resilience to flooding.*
- *Expecting developments to manage surface water runoff through sustainable drainage systems and as close to source as possible (unless demonstrably inappropriate) to not exceed greenfield run-off rates or alternative rates specified in district local plans.*
- *Ensuring that sustainable drainage systems:*
 - *Are designed to provide multifunctional benefits wherever possible, including for water quality, nature conservation and recreation.*
 - *Avoid adverse impacts on water quality and any possibility of discharging hazardous substances to ground*
 - *Are delivered in a holistic and integrated manner, including on larger sites split into different phases; and*
 - *Are managed and maintained appropriately to ensure their proper functioning over the lifetime of the development*
- *Securing the remediation of contaminated land and the careful design of developments to minimise the potential for urban diffuse pollution to affect the water environment; and*
- *Securing further investment in wastewater treatment to reduce the frequency of intermittent discharges of storm sewage.*

2.3.2 Greater Manchester Strategic Flood Risk Assessment (SFRA)

Greater Manchester Combined Authority (GMCA) commissioned the Level 1 Strategic Flood Risk Assessment for Greater Manchester (2019) and Level 2 Hybrid Strategic Flood Risk Assessment (2020a) to support the GMSF in achieving sustainable development across Greater Manchester. The SFRA provides an overview of all sources of flood risk and provides the basis for applying the Sequential Test. The information in this SFRA has informed the assessment of flood risk in this FRA.

2.3.3 Greater Manchester Surface Water Management Plan (SWMP)

The Greater Manchester Surface Water Management Plan (SWMP) is split into two stages, providing a strategic overview of surface water flood risk in Greater Manchester. Stage one (2012) considered Greater Manchester as a whole and Stage two (2013) is comprised of area specific SWMPs.

2.3.4 Bury Preliminary Flood Risk Assessment (PFRA)

A Preliminary Flood Risk Assessment (PFRA) report was prepared for Bury Council as LLFA, to manage flood risk. Historic and potential flood risk data from surface water, groundwater, ordinary watercourses and canals is considered in the report issued in 2011 which was then updated in 2017 with additional relevant flood risk data and information.

2.3.5 Bury Local Flood Risk Management Strategy

The Bury Local Flood Risk Management Strategy (LRFMS) (2018) sets out what the council intends to do, working with organisations, businesses and communities, to manage the risk of flooding within the country. The objectives relate to all aspects of flood risk management – preparing for, protecting against, preventing and recovering from flooding. The objective relevant to this document is:

- Objective 4 – To ensure new development reduces rather than increases flood risk.

2.3.6 Irwell Catchment Flood Management Plan

The Catchment Flood Management Plan (CFMP) (2009) was developed by the EA to provide an overview of flood risk within the catchment, as well as policies for long-term management of flood risk that consider the likely impacts of climate change, effects of land use and land management, and how delivering multiple benefits can be conducted and contribute towards sustainable development. The Works is located within the Bury, Bolton and Ramsbottom sub-area which is identified as a 'Policy Option 4' policy unit, which is areas of low, moderate or high flood risk where flood risk is being managed effectively but where further actions is required to keep pace with climate change.

2.3.7 Non-Statutory Technical Standards for Sustainable Drainage Systems

The ministerial statement on Sustainable Drainage Systems (SuDS, 2015) details that as of the 6 April 2015 all major developments should include provision of SuDS for management of runoff. Design criteria for these SuDS are also proposed.

2.4 Climate Change

As required by national planning policy this FRA considers the predicted impact of climate change on flood risk for the design life of the Proposed Works. The assessment incorporates the guidance provided by the EA as to how the predicted impacts of climate change on flood risk are to be addressed by new development. The allowances to be applied are dependent on the location of the Proposed Works (river basin district), flood zone, design life and vulnerability classification.

2.4.1 Peak River Flow

The peak river flow allowance stipulated by the EA to assess the predicted impact of climate change on peak river flow is determined by the location of the site in relation to the identified river basin districts. The Proposed Works is located within the North West river basin district. The climate change allowances for peak river flow within this river basin district are included in Table 2-2. The Proposed Works has been assessed as Essential Infrastructure (see Section 1.3) and consequently the higher and central allowances are to be considered.

Table 2-2 Recommended North West Catchment peak river flow allowances (EA, 2022)

Epoch	Central	Higher	Upper
'2020s' (2015 to 2039)	12%	15%	24%
'2050s' (2040 to 2069)	19%	26%	43%
'2080s' (2070 to 2115)	35%	46%	75%

2.4.2 Peak Rainfall Intensity

EA guidance also states the potential increase in rainfall intensity due to climate change that should be considered within an FRA for rainfall intensity (primarily to inform surface water drainage design). Given the design life for the project extends beyond the year 2100 the EA's guidance requires application of the Upper End allowances to ensure the development does not increase flood risk elsewhere and is safe from surface water flooding.

Table 2-3 sets out the allowances to be adopted for the development location based on the EA's Peak Rainfall Allowances Map².

Table 2-3 Irwell Management Catchment Peak Rainfall Allowances (EA, 2022)

Total potential change anticipated for	'2050s' (2040 to 2060)	'2070s' (2061 to 2125)
Upper End	35%	40%
Central	25%	30%

² <https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall>

3. Existing Site Description

3.1 Location and Existing Site Description

The Proposed Works are located on a rectangular plot of land within the existing Bury WwTW. The land is primarily grassed. The extent of the WwTW is referred to in this report as the 'Wider Site' which is owned by United Utilities and comprises existing local road networks, tanks and apparatus associated with the treatment works.

The Proposed Works are located at grid reference SD 8035 0798, with the closest postcode being M26 2AD. The Proposed Works are surrounded by the Wider Site. The location of the Proposed Works is shown on Figure 1.1.

3.2 Topography

Existing ground levels at the location of the proposed Electrical Control Building are approximately 67.14m AOD.

3.3 Surface water features

The River Irwell is in close proximity to the Proposed Works, with it looping around the western and northern boundaries of the Wider Site, and at its closest, is 40m away from the Proposed Works. It flows in a southerly direction until it merges with the River Mersey at Irlam (16.5 km to the south west).

The River Roch, a tributary of the River Irwell, is located along the southern boundary of the Wider Site, and its confluence with the River Irwell is at the south western boundary of the Wider Site. At its closest point, it is 420.1m from the Proposed Works.

3.4 Existing flood defences

The EA Spatial flood defences map (Figure 3-1) shows flood defences currently owned, managed or inspected by the EA. Both man-made and natural, a defence is any asset that provides flood defence or coastal protection. The EA Reduction in Risk of Flooding from Rivers and Sea due to Defences is a map that indicates where areas have reduced flood risk from rivers and sea due to the presence of flood defences. Figure 3-1 shows that the Proposed Works do not benefit from the presence of flood defences. It is likely that these defences provide more protection during lower severity flood events.

According to Bury Council, Environment Agency owned flood defences on Close Park and Dumers Lane, both west of the Wider Site, were completed in Autumn 2020. This was Phase 1 of a 2 Phase project named The Radcliffe and Redvales Flood Risk Management Scheme, which plans to reduce flood risk to 873 properties that are located within Flood Zone 2 areas. These flood defences were included within the hydraulic modelling.

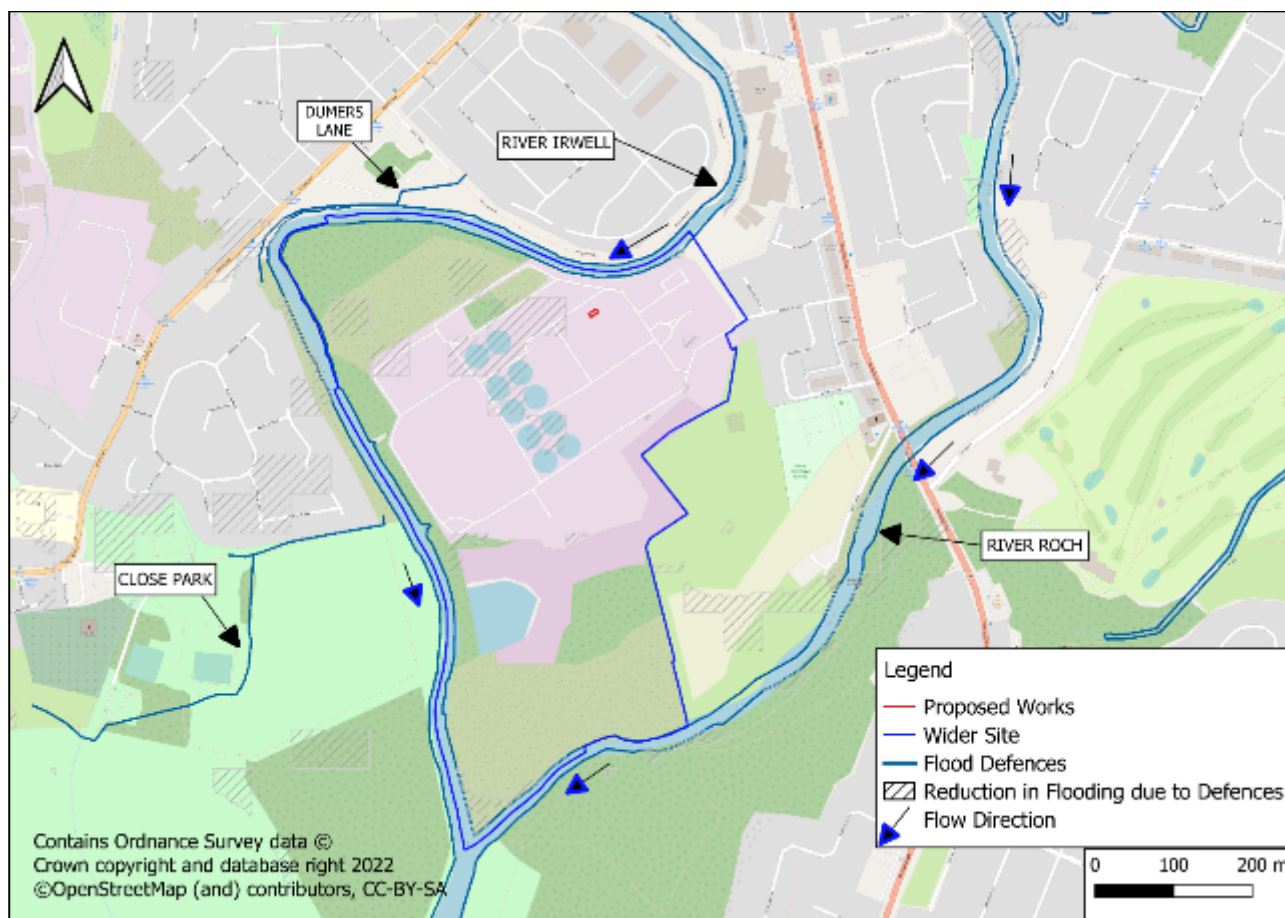


Figure 3-1 - Spatial flood defences surrounding the Wider Site (includes EA data, 2023)

3.5 Local Geology

Published geology maps available from the British Geological Survey (BGS) indicate that the bedrock underlying the Proposed Works and Wider Site is Pennine Middle Coal Measures Formation – Mudstone, Siltstone and Sandstone.

The British Geological Survey (BGS) Geology of Britain Viewer indicates that the superficial deposits underlying the Proposed Works are Alluvium – Clay, Silt, Sand and Gravel.

A ground investigation was undertaken in September 2022 by Allied Exploration and Geotechnics Ltd to provide information on the subsurface ground and groundwater conditions for the area surrounding the Proposed Works. Within all the borehole records, the same strata sequence was encountered, just at slightly different depths. This included, made ground (depths ranging between 0 – 7.6 metres below ground level (m bgl)), boulder clay (depths ranging between 4.5 - 12.5 m bgl), mudstone (depths ranging between 8.34 – 16.40 mbgl) and sandstone (depths ranging between 11.50 and 30m bgl (end of boreholes)).

3.5.1 Groundwater

Borehole records from British Geological Survey (BGS) (Ref: SD80NW502) encountered groundwater seepage 7.5m bgl. Borehole data (Ref SD80NW497) approximately 80m north west of SD80NW502 encountered the presence of groundwater 2.95m bgl.

During the ground investigation (Allied Exploration and Geotechnics Ltd., 2022) ground water monitoring was undertaken within the area surrounding the Proposed Works. This encountered groundwater at approximately 0.5 m below ground level at its shallowest depth.

4. Assessment of Flood Risk

This section of the report considers the potential risks posed to the Proposed Works from all sources of flooding and determines those that should be assessed in further detail as part of this FRA. It also considers the risk of the Proposed Works increasing flood risk elsewhere.

4.1 Tidal Flood Risk

The Proposed Works are not located within an area that is at risk of tidal flooding and therefore this risk has been screened out of further assessment.

4.2 Fluvial Flood Risk

Fluvial flooding refers to flooding from rivers, streams and other inland watercourses. It is usually caused by prolonged or intense rainfall, generating high rates of runoff, which overwhelm the capacity of the receiving river or channel. When this occurs, excess water spills onto low-lying areas of land adjacent to the channel.

Figure 4-1 shows the Environment Agency Flood Zones (based on the EA Flood Map for Planning). The figure also shows that the Proposed Works are located in Flood Zone 2, and in close proximity to Flood Zone 3. Flood Zone 2 means that the land has between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1% AEP).

Neither flood zone classification includes any allowance for climate change.

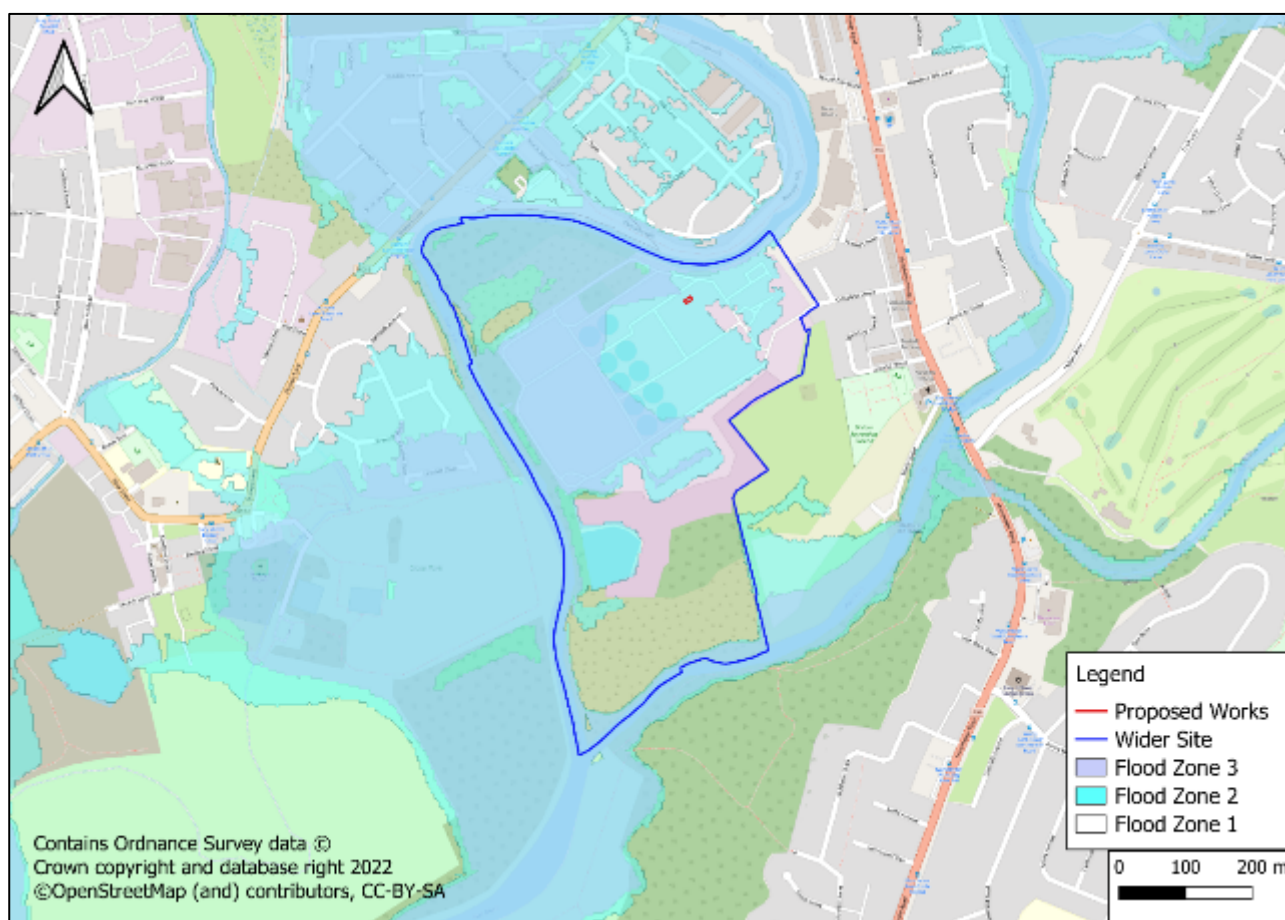


Figure 4-1 Fluvial flood risk from rivers (includes EA data, 2023)

A hydraulic modelling exercise was undertaken to assess flood risk for the wider storm tank proposals (which include the Proposed Works) with an allowance for climate change. A number of different hydrological events

were simulated, including allowances for climate change. This included the 3.3% (1 in 30), 1% (1 in 100) AEP, 0.1% (1 in 1000) AEP, and 1% (1 in 100) AEP event (with 46% climate change).

The existing Radcliffe and Redvales 1D-2D (Flood Modeller – TUFLOW) linked hydraulic model (JBA, 2017) was obtained from the EA in November 2022. The model was reviewed and updated to the included the following:

- Updated with latest 1m EA LiDAR DTM (2020);
- Included site-specific topographical survey to enforce ground levels for the Wider Site;
- Included linear defences at Close Park and Dumers Lane (as shown on Figure 3-1), with defence crest levels taken from the AIMS Spatial Flood Defences dataset;
- Timestep was adapted to reduce modelling times and update to current standard practice; and
- The climate change run was updated to the latest for the North-West River basin district allowances. As the Proposed Works is deemed Essential Infrastructure and its design life assumed as 100 years the higher allowance for the 2080s Epoch (46%) was adopted.

The results of the hydraulic modelling demonstrate that the Proposed Works are not located within the 3.3% (1 in 30) AEP extent and is therefore not located within Flood Zone 3b/ functional floodplain extent (see Figure 4-2).

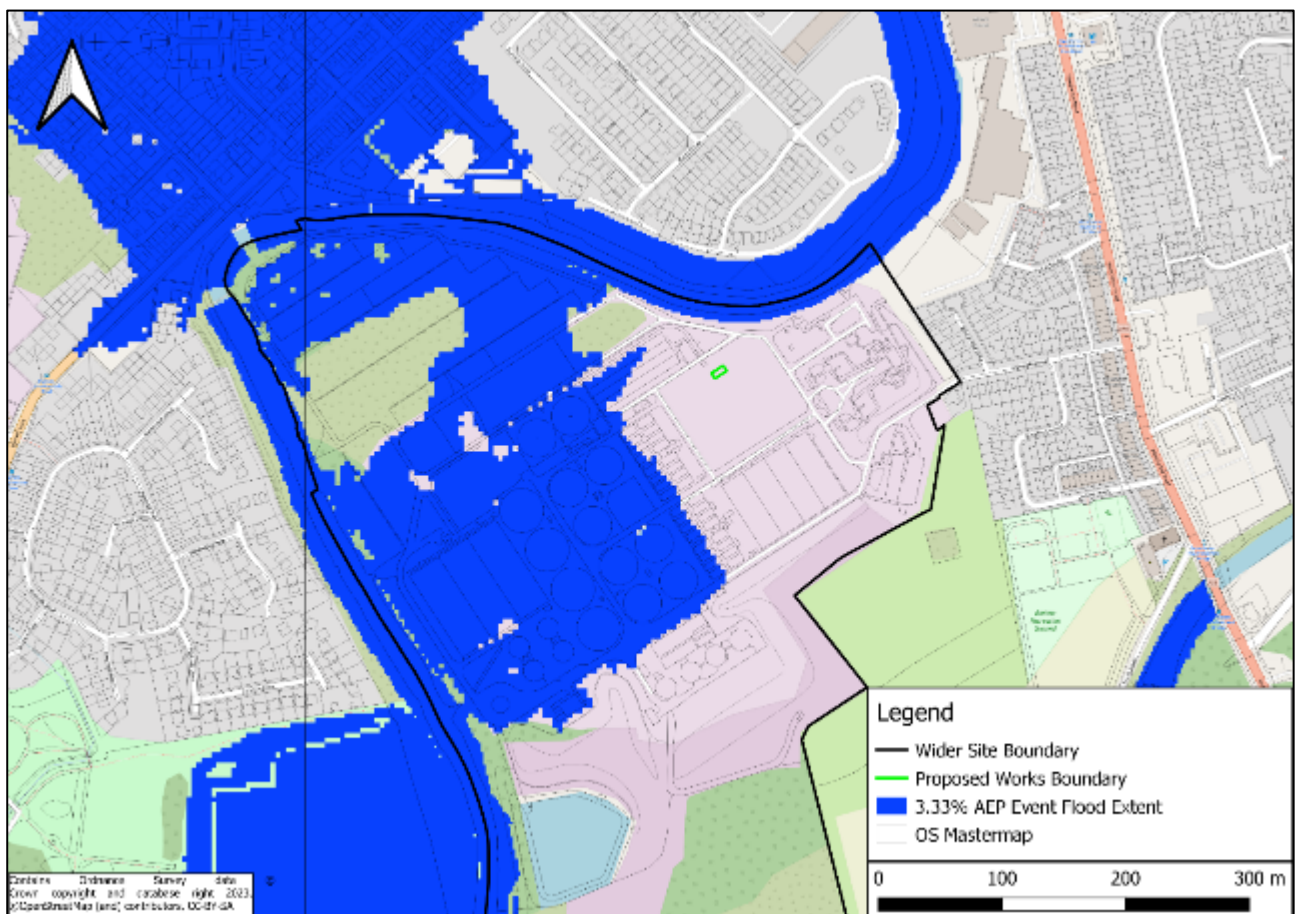


Figure 4-2 3.3% AEP Event Flood Extent

The results of the modelling demonstrate that the Proposed Works is located outside, but on the edge, of the 1% (1 in 100) AEP event with 46% climate change extent (Figure 4-2). Peak water levels for the modelled flood event in the proximity of the Proposed Works are 67.07 mAOD. However, the Electrical Control Building will be raised to a level of approximately 68.3m AOD (1.2m above ground level) which is 1.23 m above the 1% (1 in 100) AEP event with 46% climate change.

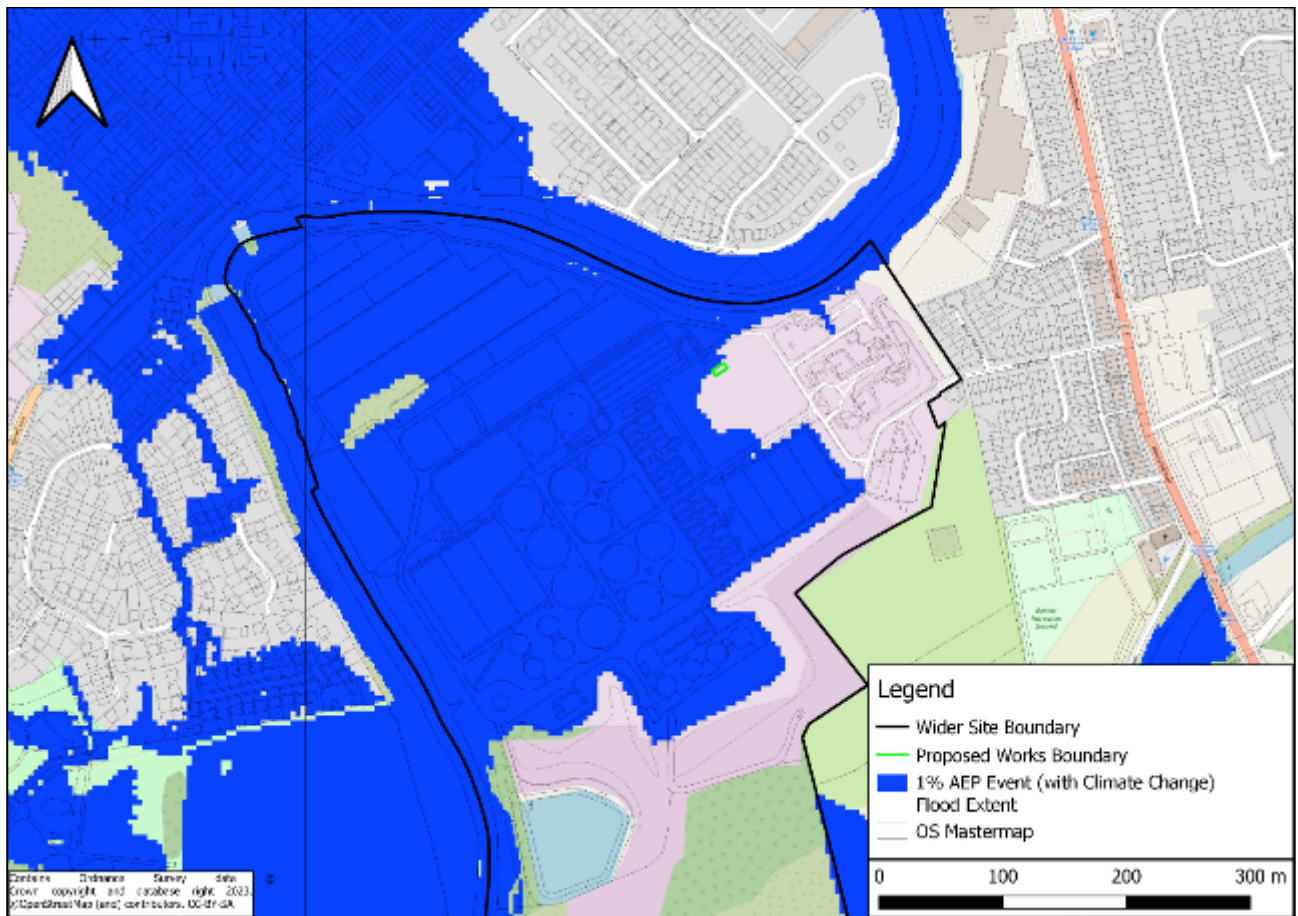


Figure 4-2 1% AEP Event (with Climate Change) Flood Extent

The results of the modelling demonstrate that the Proposed Works is located within the 0.1% (1 in 1000) AEP event (Figure 4-3). Peak water levels for the modelled flood event in the proximity of the Proposed Works are 67.45 mAOD. The Electrical Control Building will be raised 0.85 m above the 0.1% (1 in 1000) AEP event.

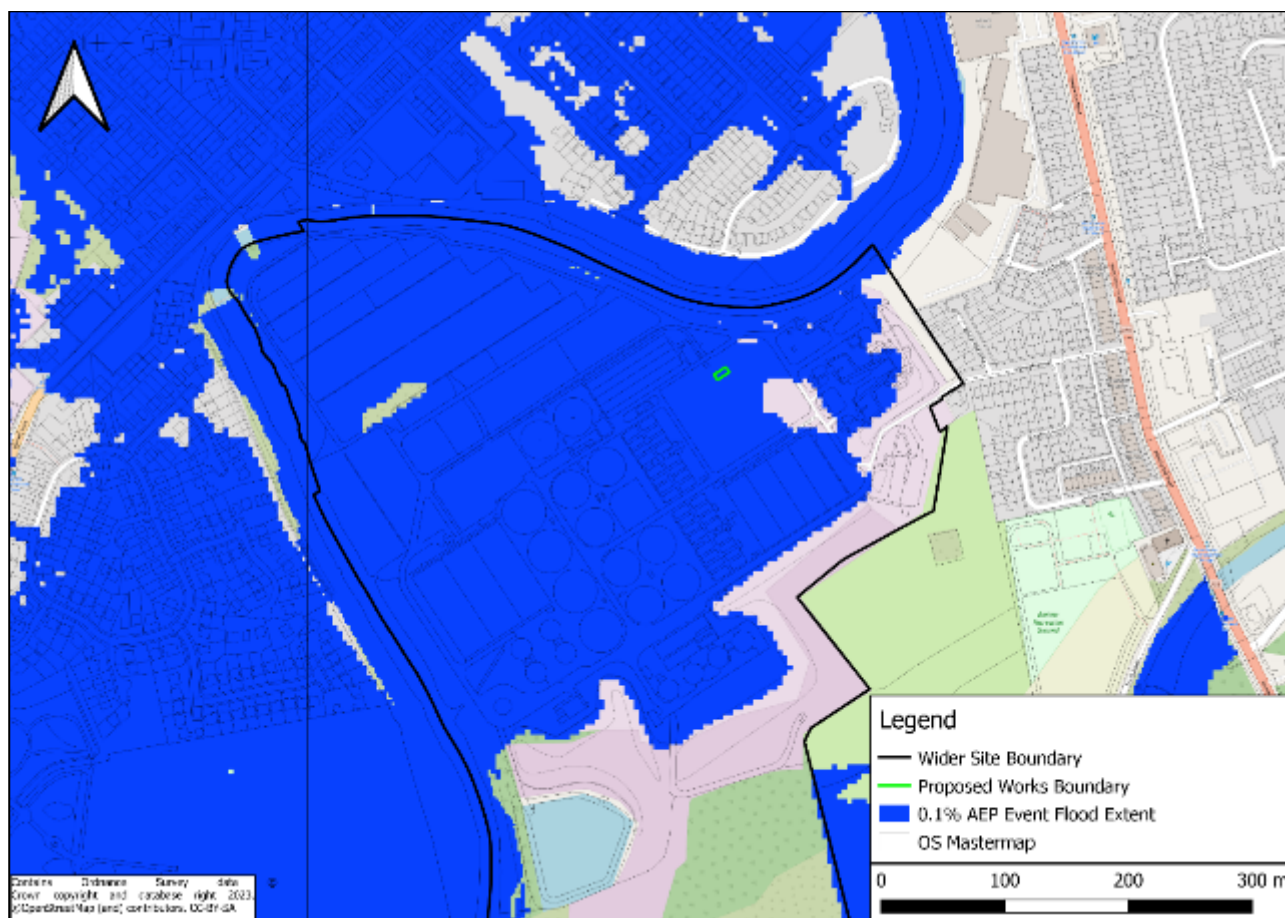


Figure 4-3 0.1% AEP Event Flood Extent

Given the Proposed Works area is located outside, but on the edge, of the 1% (1 in 100) AEP event with 46% climate change the impact of the proposed works on flood risk elsewhere is deemed to be negligible. For the 0.1% (1 in 1000) AEP event this impact would be localised and restricted to the Wider Site (UU's ownership) due to size of the Proposed Works area.

4.3 Risk of Flood Defence Failure

The Radcliffe and Redvales Flood Risk Management Scheme (which include the defences along the Irwell and the River Roch) has been designed with a 100-year design life and therefore the risk of flood defences failing is low. Additionally, due to the height of these defences they do not provide a significant amount of protection during the design flood event and given the nature of the Proposed Works (a raised platform that will hold the Electrical Control Building) the risk is deemed to be low. It is likely that these defences provide more protection during the smaller return period events. This risk is considered to be residual.

Additionally, the Close Park and Durers Lane defences built in 2020 do not provide any direct protection to the Proposed Works and therefore the risk from failure of these defences is also negligible.

4.4 Surface Water Flood Risk

Pluvial flooding is water flowing over the ground or ponded as surface water, that has not yet or is unable to enter a watercourse, drainage channel or similar. It usually occurs as a result of an intense period of rainfall, which exceeds infiltration capacity of the ground or capacity of the drainage network. Typically, pluvial flows occur on sloping land and where the ground surface is relatively impermeable or saturated. The ground can be impermeable either naturally through the soil type or geology, or due to development which places areas of impervious material over the ground surface (i.e., paving and roads).

The EA Risk of Flooding from Surface Water (RoFSW) map (Figure 4-4) has been used to assess the baseline surface water flood risk to the Proposed Works. This map is a national data set and does not specifically consider road or the existing site drainage, therefore this data needs to be interpreted with caution.

The Proposed Works are shown to be at a very low risk of flooding, with none of it being covered by any RoFSW flood extents of any severity.

This could increase due to climate change. Peak rainfall intensity could potentially increase by 20-45% over the next 100 years. Therefore, due to this increase in rainfall intensity, the total volume of surface runoff is likely to increase, however it is predicted that the overall risk of pluvial flooding including climate change would be still be low to the Proposed Works.

Given the very low flood risk category the likelihood that the Proposed Works will increase surface water flood risk offsite is also very low.

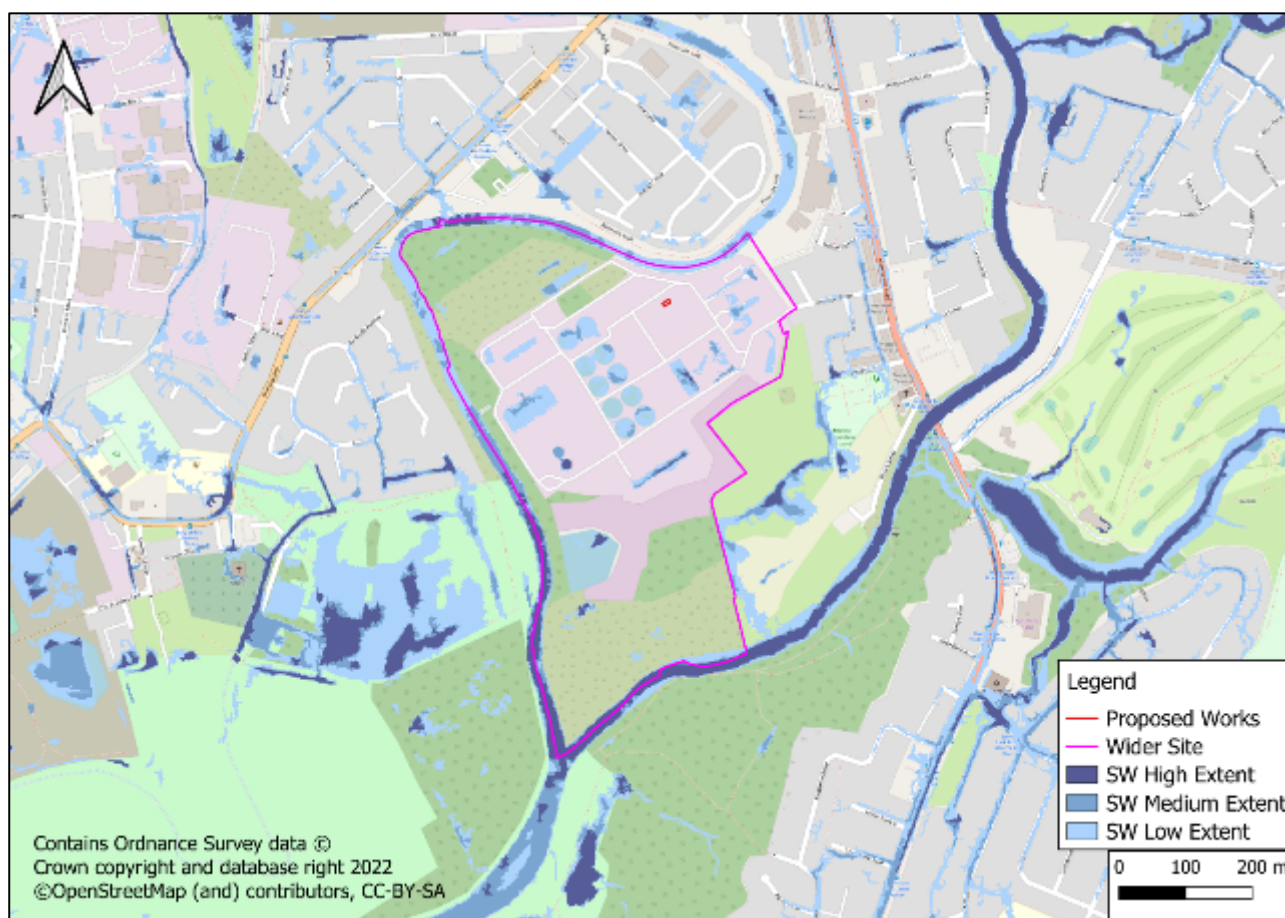


Figure 4-4 - Risk of Flooding from Surface water (includes EA data, 2023)

4.5 Flooding from Sewers

Flooding can occur when sewer systems become overwhelmed with surface water runoff from heavy and intense rainfall. Flooding is common where the drainage system is in poor condition, is blocked or requires maintenance. Where this source of flooding occurs, flood water can be contaminated with sewage waste (if the system is a combined system) which can pollute watercourses and create a health hazard.

United Utilities is responsible for the public sewer networks in the area. While the Proposed Works will be nearby foul sewer drainage in the area due to its purpose as a treatment plant, given the nature of the Proposed Works, the risk to these structures is deemed to be low and is not considered further within this report.

4.6 Water mains

Flooding can be caused by burst water mains, of primary concern in this assessment are distribution and transmission (bulk water) mains.

Although there is always potential for a burst or damaged water main to cause flooding, given the nature of the Proposed Works (raised Electrical Control Building), flood risk from this source is deemed to be low and is not considered further within this report.

4.7 Groundwater Flooding

Groundwater flooding refers to flooding caused by the emergence of water from beneath the ground surface, when the natural level of the water table rises above ground level. This can result in flooding of prolonged duration in low lying areas or below ground infrastructure.

The Proposed Works lie over an aquifer with geology consisting of Pennine Middle Coal Measures Formation bedrock and Alluvium deposits. During the ground investigation (Allied Exploration and Geotechnics Ltd., 2022) ground water monitoring was undertaken within the Proposed Works and surrounding areas, which encountered groundwater at approximately 0.5m below ground level at its shallowest depth. Given that the Proposed Works will not involve deep excavations, there will be limited groundwater flood risk to or from the Proposed Works.

4.8 Flooding from Artificial Sources

Failure of water mains, reservoirs and canal embankments have the potential to result in the rapid onset of localised flooding.

According to the Environment Agency Risk of Flooding from Reservoirs mapping shown in Figure 4-5, the Proposed Works would be at risk of flooding in the event of reservoir failure, when there is also flooding from rivers. The EA maps represent a worst-case scenario, and reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925 and all large reservoirs must be inspected and supervised by reservoir panel engineers. Therefore, the flood risk from reservoir flooding is considered to be very low.

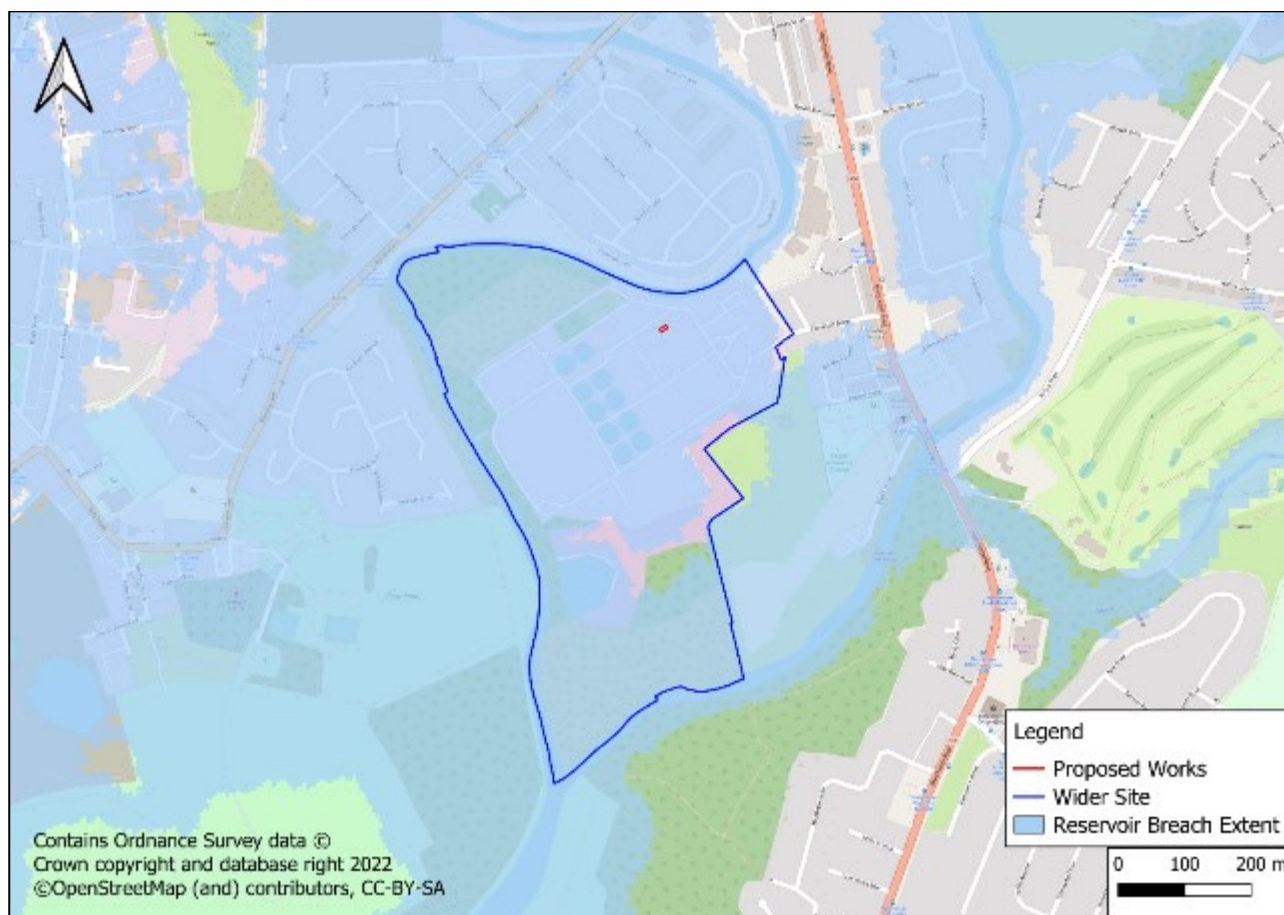


Figure 4-5 - Maximum extent of flooding from reservoirs (includes EA data, 2023)

4.9 History of Flooding

The EA's Historic Flood Map shows that parts of the Wider Site were flooded on the 26 December 2015 from the River Irwell, as seen in figure 4-6, however the flood extent does not cover the Proposed Works.

The combination of prolonged above average rainfall, saturated catchments, rapidly responding rivers and heavy showers resulted in an extremely rapid onset of flooding. The Boxing Day 2015 event resulted in flood damage to over 700 residential buildings, multiple commercial properties and critical infrastructure including Bury WwTW and electricity substations.

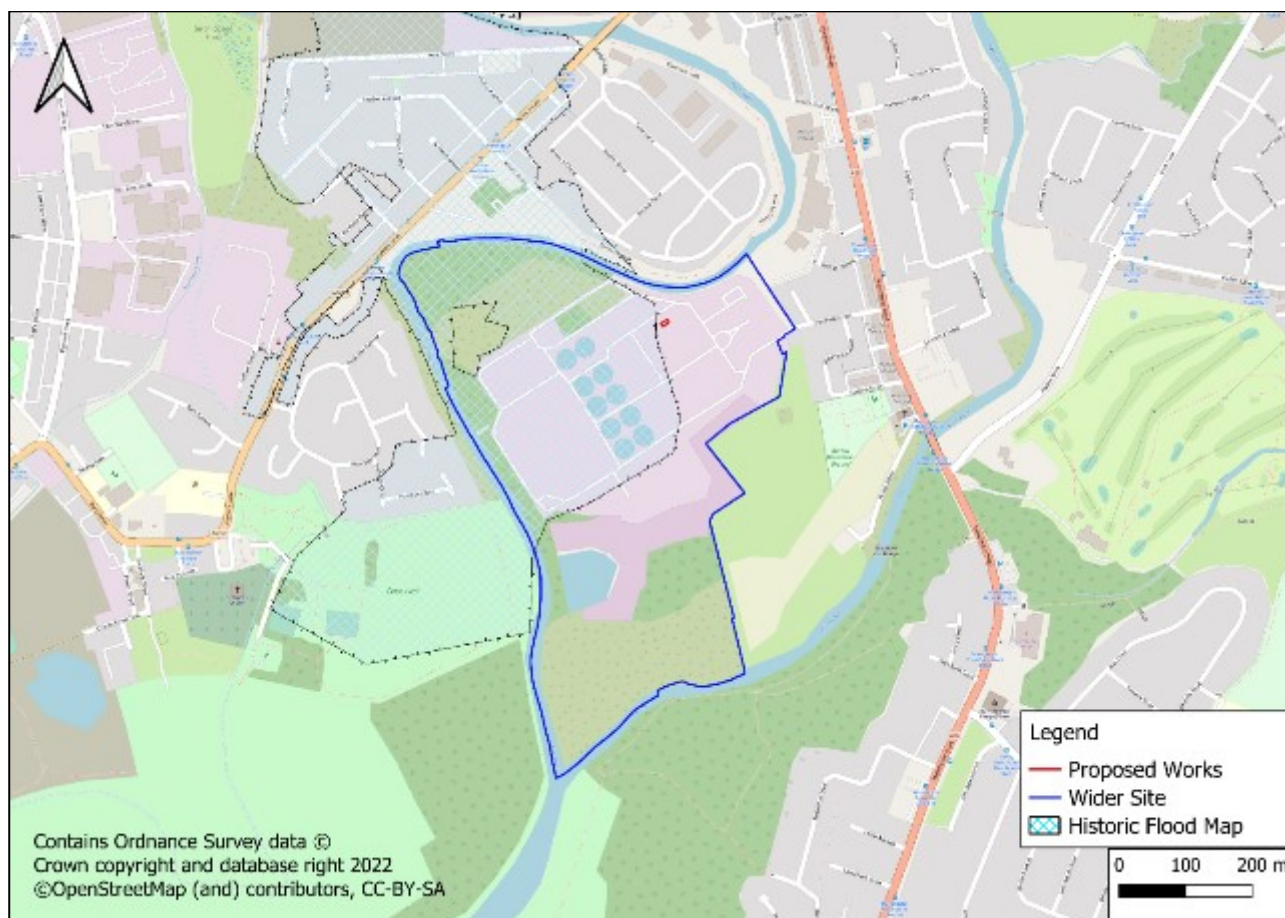


Figure 4-6 - Historic flood map (includes EA data, 2023)

The SFRA's, SWMP and PFRA for the area do not make reference to any other historical flooding that has affected the area where the Proposed Works are located. The document refers to the 2015 flood event however it does not provide any further information about the impact to the area where the Proposed Works are located.

4.10 Summary of Flood Risk

The primary source of flood risk to the Proposed Works is fluvial flooding from the River Irwell which loops around the western and northern boundaries of the Wider Site. The area lies outside, but on the edge of the extent of the 1% (1 in 100) AEP plus 46% climate change event. However, the Proposed Works will be raised sufficiently above the flood level to ensure that the development is not impacted by flooding.

Flood risk from all other sources is deemed to be low. Recommended mitigation measures and residual risks are detailed in Section 7.

5. Surface Water and Foul Water Drainage

5.1.1 Surface Water Drainage

The current Proposed Works primarily comprises a grassed undeveloped plot of land, with tanks and infrastructure associated with the WWTW to the southern of the area. It is assumed that rainwater currently either infiltrates into the ground or runoff enters drains within the WwTW.

After construction of the Proposed Works surface water will runoff the raised area into the surrounding grassed areas similar to existing. The Proposed Works form part of the part of a wider storm tank development which will provide flood risk and water quality benefits in the form of 6,000m³ of additional storage volume, which will be significantly greater than the increase in impermeable area from the Proposed Works (40m²).

5.1.2 Foul Water Drainage

There are currently no foul flows exiting the Proposed Works other than from the existing tanks. This will be retained as existing. The new tanks will connect into the existing WwTW infrastructure and will be used to retain stormwater.

6. Compliance with the Sequential and Exception Tests

6.1 Sequential Test

The Proposed Works lie within Flood Zone 2 and the edge of the 1% (1 in 100) AEP event (with 46% climate change) extent therefore with reference to Table 2 of the Planning Practice Guidance³ an assessment of compliance with the Sequential Test and application of the Exception Test are required.

In order to meet the requirements for the new storm tanks as defined by WFD standards, they are required to be sited within Bury WwTW, on United Utilities operational land. During an optioneering phase to assess available land within the Wider Site that could accommodate the required infrastructure, another location to the north east was considered for the siting of the new storm tanks, however this was within Flood Zone 3. The proposed location was selected due to operational requirements and constructability considerations, but is sited within an area which would experience lower depths of fluvial flooding than other areas within the site (Flood Zone 2). The Electrical Control Building is required to be sited in close proximity to the new storm tanks and existing electrical connections within the Wider Site, in order to operate the relevant equipment. There are no suitable areas of land across the Wider Site that are outside of the flood zone, and therefore the Proposed Works is considered to pass the Sequential Test.

6.2 Exception Test

As detailed in paragraph 160 of the NPPF, there are two elements of the Exception Test that the applicant needs to demonstrate:

- a) The Proposed Works provides wider sustainability benefits to the community that outweigh the risk of flooding; and
- b) The Proposed Works will be safe for its lifetime, without increasing flood risk elsewhere, and, where possible reduce flood risk overall.

In terms of the Proposed Works, it can be concluded that the Exception Test should be passed due to the following:

- a) The platform that will hold the Electrical Control Building is raised 1.23m above the 1% (1 in 100) AEP event (with 46% climate change) and 0.85m above the 0.1% (1 in 1000) AEP event and will therefore remain dry. Other sources of flood risk are deemed to be low. Therefore, the Proposed Works is designed so it is safe for its lifetime.
- b) Given the Proposed Works area is located on the edge of the 1% (1 in 100) AEP event with 46% climate change the impact of the proposed works on flood risk elsewhere is deemed to be negligible. For the 0.1% (1 in 1000) AEP event this impact would be localised and restricted to the Wider Site (UU's ownership) due to size of the Proposed Works area.
- c) Therefore, it can be concluded that the Proposed Works will be safe for its lifetime, without increasing flood risk elsewhere, and is part of a wider scheme that will reduce flood risk overall;
- d) The Proposed Works will also be designed to remain operational and safe during a flood event as per the Exception Test requirement for Essential Infrastructure located within Flood Zone 3a.

Consequently, it is considered that the development passes the Exception Test.

³ Table 2 Planning Practice Guidance accessed online (July, 2023)
<https://www.gov.uk/guidance/flood-risk-and-coastal-change#table2>

7. Mitigation Measures and Residual Risks

7.1 Mitigation Measures

Flood mitigation measures are presented in Table 7.1.

Table 7.1 Flood mitigation measures and residual flood risk

Flood Source	Risk	Mitigation
Fluvial	Flooding from overtopping of the River Irwell flood defences	The Electrical Control Building will be raised sufficiently above the design flood event.

7.2 Residual Risks

A number of residual risks have been identified associated with breach in flood defences, breach in reservoir, and intense rainfall.

However, providing the defences and reservoirs are regularly inspected by the Environment Agency and United Utilities respectively, and given the Proposed Works would be raised above ground level, the residual risk will be reduced to an acceptable level.

8. Conclusions

This FRA has been produced to support the planning application for an Electrical Control Building (Proposed Works) for Bury WwTW, which United Utilities intend to integrate within the existing works.

The principal findings of this assessment are:

- Hydraulic modelling indicates that the Proposed Works are located outside, but on the edge, of the 1% (1 in 100) AEP event (with 46% climate change) extent. The Proposed Works will be constructed 1.23m above the 1% (1 in 100) AEP event (with 46% climate change) and 0.85 m above the 0.1% AEP event peak water levels. The Proposed Works will therefore remain dry during these flood events.
- The modelling also demonstrates that the Proposed Works are not located within the 3.3% (1 in 30) AEP extent and is therefore outside Flood Zone 3b/ functional floodplain.
- Groundwater is anticipated to be shallow, however there will be no deep excavations as part of the Proposed Works and therefore risk of groundwater flooding is anticipated to be low.
- All other sources of flood risk (surface water, sewers and reservoirs) are considered to be low.
- The impact of the development on flood risk as a result of the Proposed Works is also considered to be low.

As set out by the National Planning Policy Framework (NPPF), developments in Flood Zones 2 and 3a will have to pass the Sequential Test and Exception Test.

The Proposed Works pass the Sequential Test as the Electrical Control Building is required to be sited in close proximity to the new storm tanks and existing electrical connections within the site, in order to operate the equipment. There are no suitable areas of land for the new storm tanks within the Wider Site that are outside of the flood zone.

The Proposed Works pass the Exception Test as the platform that will hold the Electrical Control Building is raised 1.23m above the 1% (1 in 100) AEP event (with 46% climate change) and 0.85m above the 0.1% (1 in 1000) AEP event and will therefore remain dry. Other sources of flood risk are deemed to be low. Therefore, the Proposed Works will be designed so that it is safe for its lifetime.

Given the Proposed Works area is located outside, but on the edge of the 1% (1 in 100) AEP event with 46% climate change the impact of the proposed works on flood risk elsewhere is deemed to be negligible. For the 0.1% (1 in 1000) AEP event this impact would be localised and restricted to the Wider Site (UU's ownership) due to size of the Proposed Works area.

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Appendix A – Planning Drawings