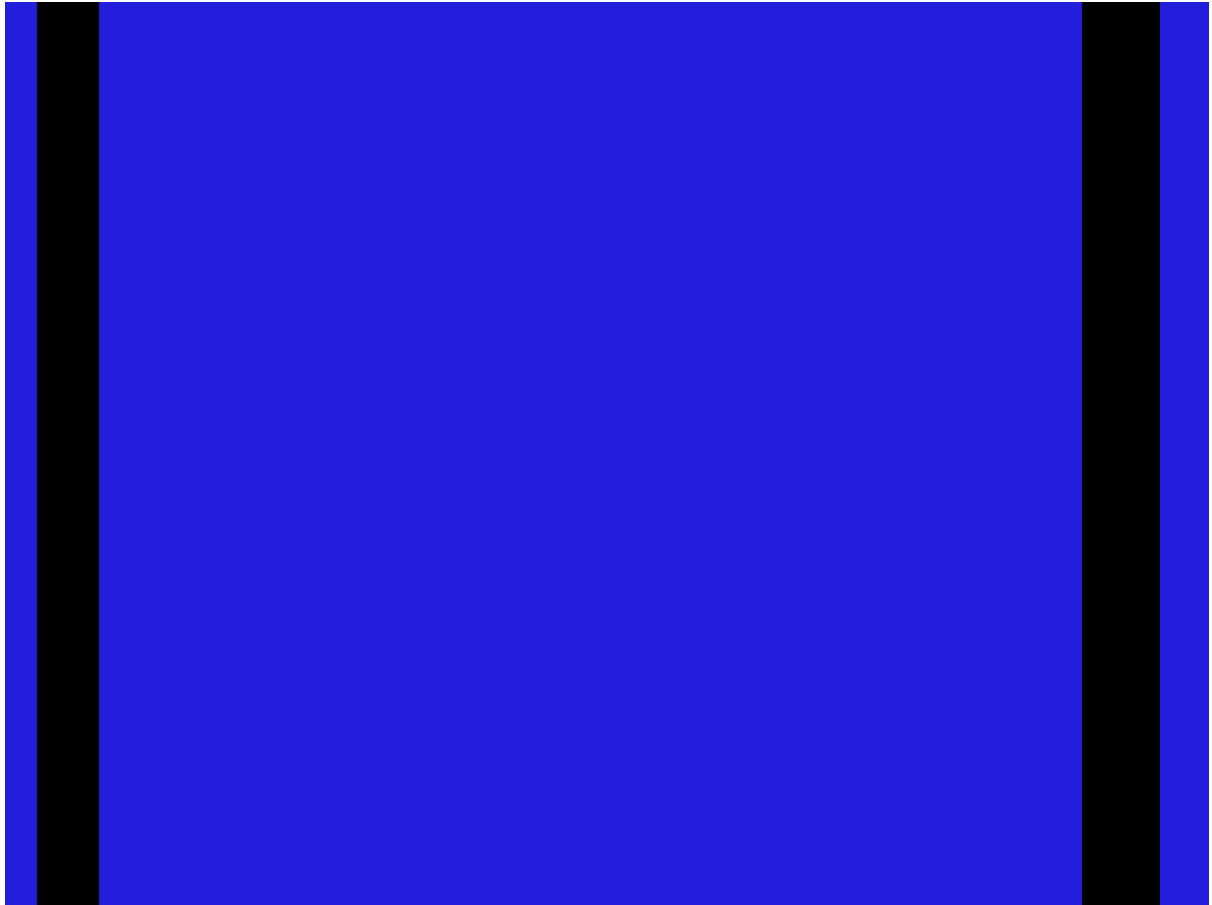


Boothroyden Road Flood Risk Assessment

Document no: UU-80065519-JAC-ZZ-00-AS-Z-0001
Version: P02

United Utilities
UU.80065519

Boothroyden Road
2 April 2024



Boothroyden Road Flood Risk Assessment

Client name:	United Utilities		
Project name:	Boothroyden Road		
Client reference:	UU.80065519	Project no:	B27070GJ
Document no:	UU-80065519-JAC-ZZ-00-AS-Z-0001	Project manager:	Andrea Wilson
Version:	P02	Prepared by:	Ellie Rigby
Date:	2 April 2024	File name:	UU-80065519-JAC-ZZ-00-AS-Z-0001

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
P01	28/03/2024	First issue	ER	DS	DS	PM
P02	02/04/2024	Update following Client comment	ER	DS	DS	PM

Distribution of copies

Version	Issue approved	Date issued	Issued to	Comments
P01	PM	28/03/2024	S. Jakubiak	
P02	PM	02/04/2024	S. Yasmin	

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Executive summary

Jacobs UK Ltd has been commissioned by United Utilities (UU) to undertake a Flood Risk Assessment (FRA) to support a planning application and Flood Risk Activity Permit (FRAP) application for the proposed improvement works to Boothroyden Road Combined Sewer Overflow (CSO). The proposed works would involve the construction of a below-ground storm water detention tank, with a capacity of 2,000m³, to increase the sewer network capacity and reduce the frequency of combined sewage overflow spills into the River Irk. Temporary works during the 11-month construction period would involve installation of a temporary bridge across the river, and temporary ground level raising of an access track and compound area, to facilitate access to the site.

The site is within Flood Zone 3 and therefore the works fall under the National Planning Policy Framework (NPPF) requirements for an FRA. The site is currently at medium to high risk of fluvial flooding due to its proximity to the River Irk, a statutory Main River. The proposed permanent works (detention tank and associated kiosk and pressure relief column) would be at least eight metres away from the riverbank and are not expected to impact fluvial flood risk to the site or elsewhere. Some of the proposed temporary works (bridge abutments and ground level raising of the access track) would be in closer proximity to the riverbank and could temporarily reduce floodplain storage capacity by approximately 42.5m³. Based on model data available, it is not possible to prove whether this reduction in floodplain capacity is within Flood Zone 3b (functional floodplain) or not. However, the Environment Agency's (EA) Risk of Flooding from Rivers and Sea data suggests the land is at risk during 1% - 0.1% Annual Exceedance Probability (AEP) flood events, so is likely outside of Flood Zone 3b (Figure 2). The impact of this small loss is likely to be a temporary increase in flood risk to the open space around the site, should flooding occur during the 11-month construction period.

Access to the site would be restricted during a 1% AEP fluvial event as some of the site would be expected to flood. However, this is unlikely to impact the construction or operation of the site as the detention tank would still be expected to function and access is not expected to be required during times of flooding.

The site is at high risk of surface water flooding on the north bank. The proposed temporary compound and access track could increase the impermeable area by up to 1,015m². Any change in surface water risk around the compound is expected to be mitigated through temporary drainage; the access track is already at low risk, but any overland flow would be directed towards the river, where the track leads to.

The risk of sewer flooding to the site itself is not expected to change, but will remain a low risk due to the presence of sewer infrastructure and a residual risk of failure. However, the proposed works are expected to reduce the risk of sewer flooding to surrounding properties and infrastructure as the storm water detention tank will improve the sewer network capacity.

The risk of flooding from groundwater and other sources (tidal and canals) is considered unlikely and the proposed development is not expected to impact these sources of flood risks to the site or elsewhere. Groundwater ingress during excavation would be addressed by de-watering.

Similarly, the risk of flooding from an uncontrolled release of water from reservoirs is considered unlikely. However, if this risk did occur during construction when river levels were also high, the risk to the site and surrounding land may be increased due to the temporary reduction in floodplain capacity as a result of the temporary ground raising. However, this is very unlikely to occur during the 11-month construction.

During the 50-year lifespan of the development, climate change is likely to increase the frequency and severity of rainfall events. Therefore, the risk of flooding to the site from fluvial and surface water sources will likely increase over time which could mean the site is more regularly inaccessible due to being flooded. The proposed development is water compatible and automatically operated though, so access during a flood is not expected to be necessary.

As discussed in Section 2.1.2, according to the NPPF, essential infrastructure or water-compatible infrastructure within Flood Zone 3b (functional floodplain) should be design and structured to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage; and
- not impede water flows and not increase flood risk elsewhere.

Although based on available data (Appendix H) it is not possible to prove whether the proposed development is within Flood Zone 3b or not, taking a conservative approach and assuming it is within the functional floodplain, this FRA has concluded that:

- The proposed development would remain operational in times of flood. Access would likely be restricted during 1% AEP fluvial events (or surface water flood events during construction) due to part of the site being flooded. However access is not necessary during a flood and operational measures will be used to reduce the risk of maintenance staff being on site during a flood event;
- The proposed permanent works are not expected to notably impact floodplain storage capacity. Temporary works, including ground level raising to facilitate the access bridge abutments and access track, would likely temporarily reduce floodplain storage by around 42.5m³. However, this land is likely outside of Flood Zone 3b and the loss would be for a maximum 11-month construction period, so given the small volume of loss and relative levels, would likely have minor impact to flood levels in open areas rather than impact properties or infrastructure in the unlikely event of a major flood; and
- The proposed permanent works are not expected to impede water flows or increase flood risk elsewhere. Temporary works, including the bridge, access track, and compound, may increase flood risk to the site and immediate surrounding area, therefore temporary drainage would be provided to reduce this increased risk.

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Acronyms and abbreviations

AEP	Annual Exceedance Probability
BGS	British Geological Survey
CC	Climate Change
CSO	Combined Sewer Overflow
EA	Environment Agency
FMfP	Flood Map for Planning
FRAP	Flood Risk Activity Permit
FRA	Flood Risk Assessment
GMCA	Greater Manchester Combined Authority
NPPF	National Planning Policy Framework
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
RBC	Rochdale Metropolitan Borough Council
SFRA	Strategic Flood Risk Assessment
UU	United Utilities

1. Introduction

1.1 Background

Jacobs UK Ltd has been commissioned by United Utilities (UU) to undertake a Flood Risk Assessment (FRA) to support a planning application and Flood Risk Activity Permit (FRAP) application for the proposed improvement works to Boothroyden Road Combined Sewer Overflow (CSO). The works are being carried out with the aim of reducing the overflow spills into the River Irk and therefore improving the water quality of the watercourse and reducing the risk of sewer flooding to properties and infrastructure. UU has a responsibility under the Flood and Water Management Act 2010 for managing the risk of flooding from foul or combined sewer systems within its ownership. The works would enable UU to comply with the Environment Agency's (EA) requirements to reduce storm overflow spills so that they do not discharge above an average of ten rainfall events per year. The project is therefore being carried out as part of UU's Better Rivers scheme to improve the water quality of watercourses.

The aim of this FRA is to assess flood risk to, and arising from, the proposed CSO works, hereafter referred to as the proposed development, and the measures for managing any risks. The FRA will consider the proposed development with regard to National Planning Policy Framework (NPPF) and Planning Practice Guidance (PPG). Flood risk from a variety of sources including rivers, surface water, sewers, groundwater, reservoirs, and other sources (tidal and canals) will be assessed.

1.2 Existing Site

Boothroyden Road CSO, hereafter referred to as the site, is located on the River Irk in Middleton, Manchester (Figure 1). The River Irk is a statutory Main River which flows from east to west across the site and eventually joins the River Irwell near Manchester Victoria railway station. Storm water from combined sewer pipes is released into an existing underground CSO chamber, from which it is then released via overflow pipes into the River Irk via an outfall.

During heavy rainfall events, the capacity of the existing combined sewer network is sometimes exceeded, so to prevent people's homes, roads and open spaces from being inundated with a mix of rainwater and foul water from the network backing up, the CSO allows the combined sewer system to outfall into the watercourse and therefore help reduce the risk of sewage flooding homes and businesses. The existing CSO outfalls on the left (south) bank of the River Irk at National Grid Reference: SD8498004970.

There is also an existing footbridge adjacent to the site, upstream of the CSO. The bridge provides pedestrian access across the River Irk from Boothroyden Road to the open space south of the river. According to topographic survey data (Appendix F), the bridge has a soffit of 68.63mAOD. No works or alterations are proposed to this existing bridge.

On the left and right bank of the River Irk at the site, there is uninhabited vegetated land between the river and residential properties to the north, and the M60 to the south. There are footpaths on the south bank alongside the route of the river, and from the bridge across the river between Boothroyden Road and the M60. The proposed works will be carried out within this vegetated land.

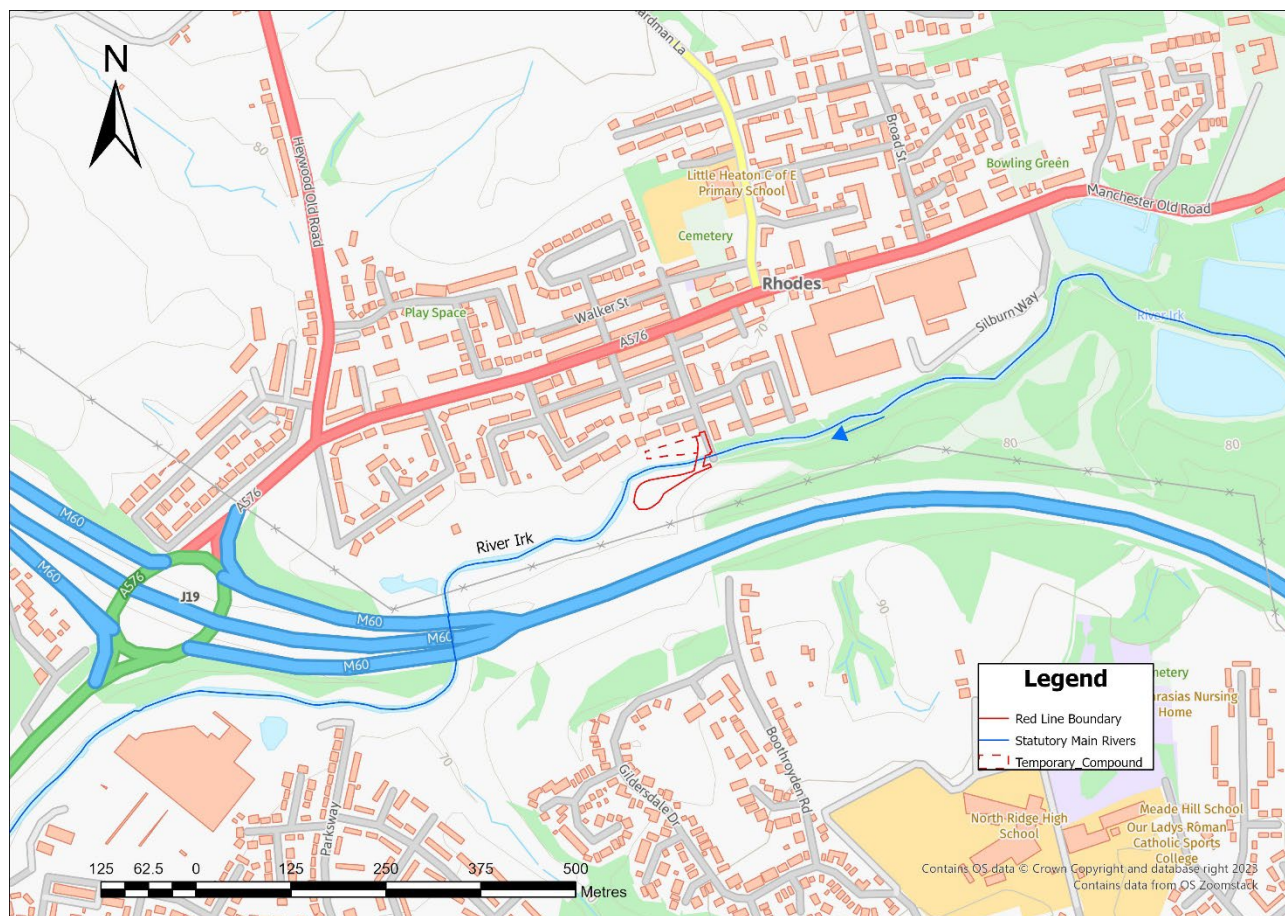


Figure 1 Site Location

1.3 Description of the Proposed Scheme

To reduce the frequency of CSO spills into the watercourse, the sewer network capacity must be increased to allow a greater volume of storm water to be attenuated within the system. It should be noted that the proposed works are not expected to completely prevent CSO spills, however the frequency of spills would be reduced.

The proposed works assessed as part of this FRA are shown in drawings included within Appendix B to Appendix F and include:

Permanent Works

- Installation of new underground storm water detention tank, with a volume of 2,000m³
- Associated new manhole, valve chamber, kiosk, and security fencing around the detention tank

Temporary works

- Construction of a temporary bridge across the River Irk for construction traffic, to be removed once remaining construction works are complete. The bridge would be in situ for approximately 11 months. The proposed temporary bridge would have a soffit no lower than the existing bridge immediately upstream (68.63mAOD)

- Construction of a temporary works compound on the north bank of the river, including car parking area, stores, welfare unit, and vehicle turning point
- Temporary raising of ground levels by 150mm to accommodate the temporary compound on the north bank (Appendix F). It is expected that ground levels would be raised for approximately 11 months during construction and then re-instated to original levels
- Temporary raising of ground levels by 150mm to accommodate the access track on the south bank to facilitate vehicular access to the detention tank (Appendix F). It is expected that ground levels would be raised for approximately 11 months during construction and then re-instated to original levels
- Temporary raising of ground levels by an estimated maximum of 630mm to accommodate the temporary bridge abutments and to infill from the road level to temporary bridge level (Appendix E). It is expected that ground levels would be raised for approximately 11 months during construction and then re-instated to original levels
- Vegetation clearance, including tree removal, to enable access to the working area

Construction is currently proposed to begin in Autumn 2024. All works, apart from the temporary access bridge, are understood to be located at least eight metres away from the bank of the Main River. Construction is expected to take 11 months.

It is understood that the existing CSO outfall is being retained, i.e. no additional outfall is being constructed and no permanent in-channel works are planned.

1.4 Limitations and Assumptions

The FRA was undertaken with the following limitations and assumptions:

- The study was desk-based and no site visit was undertaken to verify the state of the watercourse, riverbanks or flood defences nearby and vulnerability of nearby properties or infrastructure to flooding
- No hydraulic modelling has been undertaken as part of this assessment so the FRA has based the assessment of fluvial flood risk on model data provided by the EA
- The study was based on the design drawings available at the time of writing
- No groundwater monitoring has been undertaken so the groundwater flood risk assessment is based on British Geological Survey mapping only
- It is assumed that the proposed works will be undertaken using best practise techniques and appropriate safe systems of works will be in place to help mitigate any potential flood risk impacts from the scheme

2. Planning Policy

The aim of this section of the report is to introduce the main aspects of the national and local planning policies that are relevant to the proposed development in terms of flood risk.

2.1 National Planning Policy Framework

In England, development and flood risk is guided by the National Planning Policy Framework (NPPF). The principal aim of the NPPF is to avoid inappropriate development in areas at risk of flooding by directing development away from areas at highest risk and where development is necessary, making it safe without increasing flood risk elsewhere.

2.1.1 Assessment of Flood Risk

As part of the FRA, the NPPF requires that developers consider not just the flood risk to the development but also the impact that the proposed development might have on flood risk elsewhere. All sources of flood risk should be assessed, including fluvial, coastal, surface water, groundwater, and artificial drainage systems, and infrastructure failure.

The flood risk from Main Rivers and the sea is assessed using the Environment Agency National Fluvial and Coastal Flood Map, also called the Flood Map for Planning (FMfP). This map has three main zones of risk:

- **Zone 1 'Low probability of flooding'** – This zone comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1 %) in any year
- **Zone 2 'Medium probability of flooding'** – This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1 % – 0.1 %), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5 % – 0.1 %) in any year
- **Zone 3 'High probability of flooding'** – This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1 %), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5 %) in any year
- **Flood Zone 3b 'The Functional Floodplain'** – A sub-part of Zone 3, this zone comprises land where water has to flow or be stored in times of flood. This zone is not normally included within the national FMfP and is calculated where necessary using detailed hydraulic modelling and is typically defined as: areas having a 1 in 30 or greater annual probability of flooding ($\geq 3.3\%$ AEP); or land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

The National Planning Policy Framework (NPPF) (DLUHC, 2023) requires an FRA to be produced where development sites are:

- located in Flood Zone 1 with critical drainage problems (as notified to the local planning authority by the Environment Agency) or are greater than one hectare in size;
- all proposals for new development (including minor development and change of use) in Flood Zone 2 and 3;
- on land identified in a strategic flood risk assessment as being at increased flood risk in future; or
- where proposed development or a change of use to a more vulnerable class may be subject to other sources of flooding.

According to the Environment Agency's FMfP (Appendix A), the proposed development site is within Flood Zone 3 and therefore the falls under the NPPF requirements for an FRA.

2.1.2 The Sequential Test

A primary aim of the NPPF is that areas at little or no risk of flooding from any source are developed in preference to areas at higher risk. This is achieved through applying the Sequential Test to the location of proposed development site. The NPPF states that:

'The aim [of the Sequential Test] is to steer new development to Flood Zone 1 (areas with a low probability of river or sea flooding).

'Where there are no reasonably available sites in Flood Zone 1, local planning authorities in their decision making should take into account the flood risk vulnerability of land uses and 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, taking into account the flood risk vulnerability of land uses and applying the Exception Test if required.'

The proposed development (permanent works) involves improvement works to an existing structure (Boothroyden Road CSO) and therefore its location is already prescribed. The proposed detention tank needs to be connected to the existing CSO chamber. Other alternative locations for the detention tank have been studied, such as the north area of the riverbank (River Irk), but due to the volume required to be attenuated (2000m³), construction on the north bank would not be achievable due to lack of available space. Similarly, locating the tank further back from the south area of the riverbank would not be feasible as space is limited by the M60 motorway and associated embankments. East or west of the existing CSO chamber are not appropriate locations for the proposed tank either because of pipe connections with the existing infrastructure and/or lack of available area. The temporary bridge cannot be located in an area of lower flood risk as it needs to provide vehicular access across the river to the CSO.

The table below illustrates the flood risk vulnerability categories and flood zone compatibility matrix for the UK. The proposed development, including storm water detention and associated temporary works are classed as water-compatible and therefore appropriate in Flood Zone 3. An exception test is not required to demonstrate that the water-compatible development should be permitted in Flood Zone 3. However, the following advice is given;

*In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test and water-compatible uses, should be design and structured to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage; and
- not impede water flows and not increase flood risk elsewhere.

Table 1 Flood risk vulnerability and flood zone compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water-compatible
Zone 1	✓	☐	☐	☐	☐
Zone 2	☐	Exception Test required	☐	☐	☐

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water-compatible
Zone 3a	Exception Test required	X	Exception Test required	☐	☐
Zone 3b	Exception Test required	☐	☐	☐	☐ *

2.1.3 Climate Change

The NPPF requires new development to consider the effect of climate change on long term flood risk to developments.

Within the UK, climate change is expected to increase the frequency of short-duration, high-intensity rainfall events, as well as long-duration rainfall events. These changes, which are already being observed, will have an impact on flood risk.

Current Environment Agency climate change allowance guidance suggests the central peak river flow allowance should be used for water compatible development within Flood Zone 3 (EA, 2022). For the Irwell catchment, this means an uplift of 19% for development with a lifespan up to the 2050s and a 35% allowance for development with a lifespan up to the 2080s. The proposed detention tank would have a design life of 50 years, so the 2080s climate change epoch should be considered.

No hydraulic modelling has been carried out as part of this FRA, however fluvial flood levels have been provided by the Environment Agency from their 'Irk, Moston and Whit Brook 2007' model and these include a 20% climate change allowance. It is noted that the 20% allowance was based on the climate change guidance available in 2007.

2.2 Local Planning Policy

National planning policy is supplemented at a local level by additional plans and policies set out in local planning documents (Unitary Development Plans, Local Development Frameworks, Local Plans etc.), supported by Strategic Flood Risk Assessments and Supplementary Planning Documents.

Locally set flood risk policies relate to specific, local issues such as drainage requirements for development within critical drainage areas, restrictions on infill development or minimum threshold levels for properties within the floodplain. Details of key points from relevant policy documents have been identified and presented below.

Rochdale Borough Council (RBC) is the Lead Local Flood Authority (LLFA) for the area in which the proposed development is located and is responsible for the publication of local flood risk strategies.

2.2.1 Strategic Flood Risk Assessment, 2019

The Level 1 Strategic Flood Risk Assessment (SFRA) for Greater Manchester - Update (JBA, 2019) is a key document outlining the local flood risk from all sources and acts as an evidence base for flood risk policies, and to identify suitable areas for future development. The SFRA quotes the PPG advice that site-specific FRAs assessments 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 SFRA also states that site-specific FRAs should demonstrate:

- Whether the development 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.

The proposed development also supports the Greater Manchester Spatial Framework (GMCA, 2019) (which is informed by the SFRA), in particular Policy GM-S 5 for the “investment in wastewater treatment to reduce the frequency of intermittent discharges of storm sewage.

2.2.2 Rochdale Core Strategy, Adopted 2016

Rochdale Core Strategy (RBC, 2016) is a planning policy document which sets out the strategic framework and policies to guide developments within Rochdale. Policy SO4 G8 outlines the requirements for developments to follow in relation to managing water resources and flood risk. The proposed development complies with this policy; in particular, the proposed CSO improvements works would “contribute where possible to alleviate existing flood risk” and “incorporate measures to improve water quality”.

2.2.3 Preliminary Flood Risk Assessment, 2011 (updated 2017)

Rochdale Preliminary Flood Risk Assessment (PFRA) (RBC, 2011) provides a high-level overview of flood risk from various flood sources. The PFRA addendum (RBC, 2017) states that there are no significant ‘Flood Risk Areas’ as defined by the Environment Agency within Rochdale.

2.2.4 Local Flood Risk Management Strategy 2014 – 2024

Rochdale Flood Risk Management Strategy (RBC, 2014) outlines the Council’s objectives for flood risk management. The strategy provides the guiding principles, delivery plan and approach which should be taken during the planning process. The strategy also discusses UU’s investment in improving its sewerage infrastructure to reduce the risk of flooding to properties. The proposed development supports the council’s objectives, in particular, to “ensure that development and land management do not increase flood risks and contribute to...the reduction of flood risk”.

3. Assessment of Flood Risk to the Existing Site

3.1 Fluvial

Fluvial flooding occurs when a watercourse exceeds its capacity and the water breaches its banks, overflowing onto neighbouring land.

The proposed development is adjacent to the River Irk, a designated Main River, which flows from east to west across the site and eventually joins the River Irwell near Manchester Victoria railway station. 'Ordinary watercourses' include all watercourses that are not designated as 'Main Rivers', such as brooks, streams, drains, ditches, and becks. The nearest ordinary watercourse appears to originate from North Manchester Golf Club and joins the River Irk approximately 600m upstream of the site.

The EA's FMfP (Appendix A) shows the site is partly located within Flood Zone 3, an area with a high probability of flooding from rivers or the sea. This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding ($>1\%$), or a 1 in 200 or greater annual probability of flooding from the sea ($>0.5\%$) in any year. The EA risk of flooding from rivers and the sea data shows the detention tank would be situated in land at high risk (to the south of the river), whereas the proposed temporary works compound would be situated in land at medium risk of flooding (north of the river) (Figure 2). Flood Zones 2 and 3 (medium to high risk) appear to generally be confined to the river corridor immediately surrounding the proposed development, however upstream of the site the fluvial Flood Zones encroach onto residential properties and industrial buildings on the right bank around Cotton Lane and Silburn Way. The site is serviced by the EA's 'Lower River Irwell' Flood Alert Area, although only land upstream of the site is serviced by the 'River Irk at Rhodes and Middleton' Flood Warning Area (EA, 2023g & EA, 2023h).

The EA's FMfP (Appendix A) also shows that there is a flood defence approximately 200m upstream from the site, on the right bank parallel to Silburn Way. This corresponds with the EA's data showing the industrial area of land around Silburn Way to be benefitting from a reduction in risk of flooding due to defences (Figure 2). However, analysis of the EA's Asset Information Management System (AIMS) data does not provide details about what the defence is, as the only defences nearby are categorised as natural high ground (EA, 2020). From a review of freely available photography, there appear to be sections of engineered banks around the site (possibly concrete bagwork or masonry walls). Two weirs are visible on United Utilities maps (Appendix G) nearby the development site, one is approximately 15m upstream of the CSO outfall and the second is approximately 300m downstream of the CSO outfall. There do not appear to be any water storage areas nearby (Appendix A).

There are no recorded flood outlines or historic flood map records within 1km of the site (EA, 2023b & EA, 2023b); this supports the PFRA which states there have been no past flood events considered to have had 'significant harmful consequences' within the area (JBA, 2011 & RBC, 2017). The SFRA's LLFA historic flood incidents map also indicates no records of flooding from any sources within 2km of the site (JBA, 2019). An internet search also found no records of Section 19 reports for flooding incidents nearby the site (the nearest was Rochdale town centre).

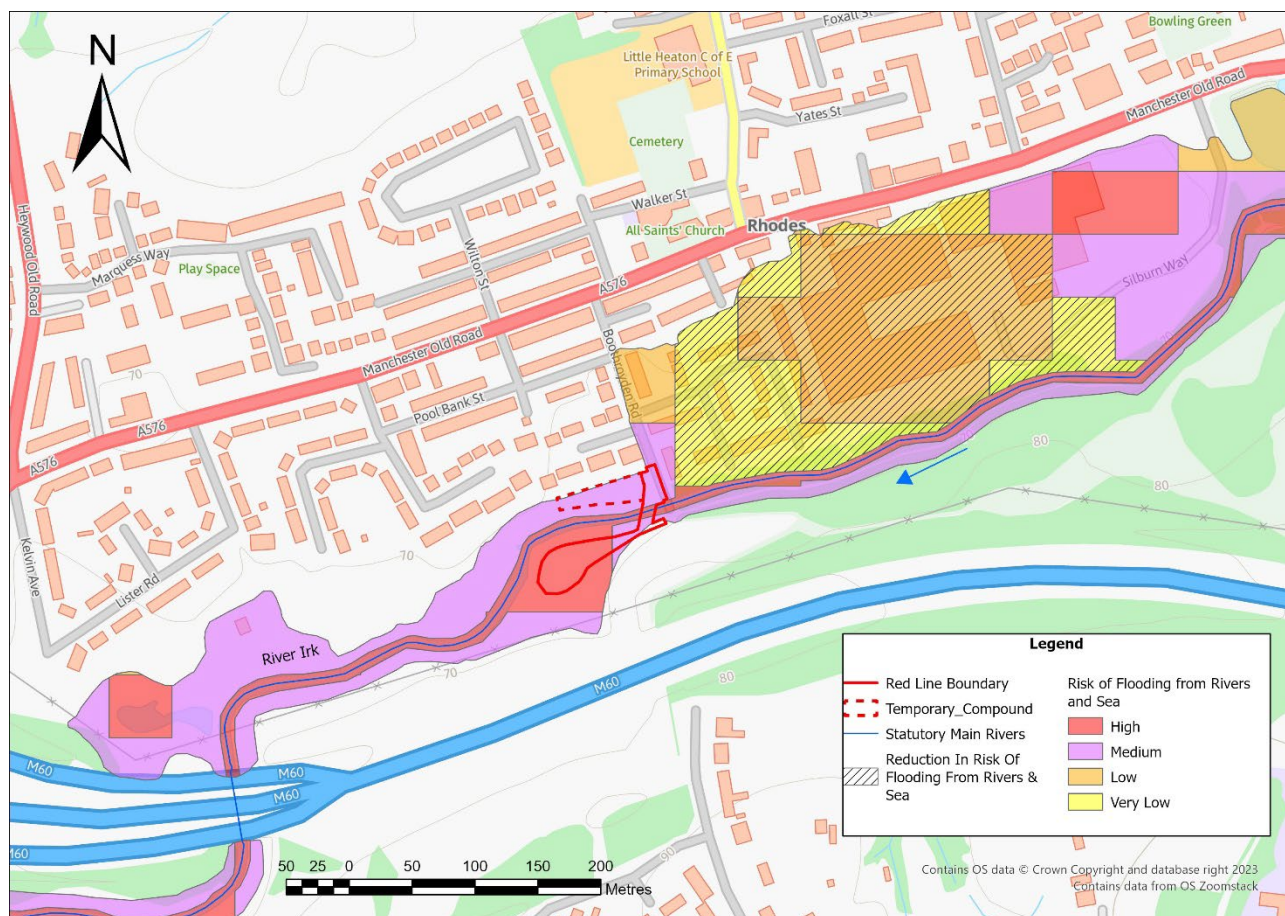


Figure 2 Fluvial flood risk surrounding the site

As part of this FRA, a data request was submitted to the EA for their Product 4 data, including hydraulic model data available. Information was received in relation to this request on 28/02/2024 and is included in Appendix H. No 2D flood levels were available but the EA did provide in-channel modelled water levels and flow measurements taken from the Irk, Moston and Whit Brook 2007 model. Data from the two closest model nodes to the development site are presented in Table 2 below. The two nodes are roughly equal distance apart (upstream and downstream) from the existing bridge, so an average has been taken between the two nodes, assuming levels and flow would be equally distributed between the nodes, to provide a slightly more accurate indication of levels and flow at the existing bridge (and adjacent proposed temporary access bridge and works area). It should be noted that it is not clear if the western (downstream) node is on the upstream or downstream side of the weir that appears to be at the same location. For the purposes of this assessment, it has been assumed to be on the upstream side of the weir.

The defended scenario, where existing flood defences are taken into account within the model, presents higher in-channel water levels and flows compared to the undefended scenario (where no flood defences are taken into account). No climate change allowance has been provided within the defended scenarios. For the defended 0.1% AEP flood event, the peak water level is 70.55mAOD upstream of the site and 68.07mAOD downstream, whilst the in-channel flow is 98.25m³/s upstream and 97.45m³/s downstream.

Based on a comparison between the peak water levels (Table 2) and the topographic survey (Appendix F), the lowest levels around the proposed development site are approximately 68.05mAOD (around the site boundary on the south bank), which means this area may experience flood depths of up to 0.83m during a 1% AEP event (based on an estimated 69.31 level at the site).

On the north bank, the temporary compound area appears to be a minimum of 68.77mAOD, so could experience up to 0.11mm of flooding during a 1% AEP event in a discrete low spot; most of the temporary compound area is above the 68.88mAOD peak flood level for the middle node so not expected to flood during a 1% AEP event. The temporary compound is expected to be in place for up to 11 months so comparison with the 1% AEP flood event level is considered conservative given low probability of such an event during the construction period.

No model information is available about water levels in events more frequent than a 1% AEP. Based on the EA's Risk of Flooding from Rivers and Sea data (Figure 2), the north bank where the temporary compound is located is at medium risk of flooding, so could flood during events with probabilities between 1 % – 0.1 % AEP. The western half of the red line boundary area (on the south bank) is at high risk, so could flood during events with probabilities >1% AEP.

Table 2 Modelled water level and flow upstream and downstream of the development site

Node	Measurement	Undefended		Defended	
		1 % AEP	1 % AEP + 20% climate change allowance	0.1% AEP	1% AEP
Upstream (No.3)	Water level (mAOD)	69.89	70.11	70.55	69.97
	Flow (m ³ /s)	53.50	60.90	98.25	55.69
*Middle (existing bridge location)	Water level (mAOD)	68.83	68.97	69.31	68.88
	Flow (m ³ /s)	53.45	60.70	97.87	55.64
Downstream (No.4)	Water level (mAOD)	67.76	67.82	68.07	67.78
	Flow (m ³ /s)	53.40	60.50	97.48	55.58

**Value estimated from an average of upstream and downstream node values*

The existing footbridge at the upstream end of the development site boundary provides pedestrian access across the River Irk from Boothroyden Road to the open space south of the river. The existing footbridge is not part of the proposed development (i.e. no changes or alterations are proposed) but the soffit level is relevant to assess as the bridge could potentially impact flows and is in proximity to (just upstream of) the proposed temporary bridge. According to topographic survey data (Appendix F), the existing bridge has a soffit level of 68.63mAOD. The existing bridge is therefore below the peak water level for the middle node for all scenarios/return periods (Table 2) so would be surcharged. The deck level on the upstream side of the bridge is 69.93mAOD (higher than the peak water level for the middle node for all return periods) so the bridge would not be expected to overtop.

The risk of flooding to the site from fluvial sources is considered **high**.

3.2 Surface Water

Surface water flooding refers to surface water runoff (pluvial flooding), usually a result of short-duration intense rainfall events where the water cannot infiltrate into the ground quick enough. This is more common in urban areas where there are more impermeable surfaces and when the urban drainage network cannot cope with the intensity of the rainfall runoff.

Surface water risk in Rochdale is often closely aligned with fluvial flood risk from rivers or topographical depressions where ponding can occur (RBC, 2016). The EA's surface water flood map (Figure 3) indicates that the proposed development site is partly within the 3.33% AEP surface water flood extent (on the north bank along Boothroyden Road) so is considered to be at high risk of surface water flooding. Here, flood depths of up to 0.60m and velocities up to 0.50m/s could be experienced during a 3.33% AEP event (EA, 2015). Similarly, during a 1% AEP event, the same area could experience flood depths of up to 0.60m and velocities up to 0.50m/s.

On the south bank, the site is partly within the 0.1% AEP surface water event and is therefore considered to be at low risk. On the south bank, EA data suggests depths of up to 0.30m could be experienced within the site boundary during a 0.1% AEP surface water flood event, whereas depths could reach 0.60m on the north bank (on Boothroyden Road) (EA, 2015). Velocities of up to 0.50m/s are expected on the south bank during this event, whereas velocities up to 1.00m/s could be experienced on the north bank.

Surrounding the site, the surface water extent follows the route of the River Irk and also encroaches onto Boothroyden Road and residential properties to the north of the site, as well as Silburn Way and industrial buildings to the east of the site. Boothroyden Road, immediately adjacent to the site on the north bank, is within the 3.33% AEP flood extent and is therefore considered to be at high risk of surface water flooding. There appears to be a surface water overland flow route originating north of West Green, which flows south via residential properties, down Wilson Street, across A576 Manchester Old Road, down Blackley Street, west across Pool Bank Street, where the flow routes splits, with some surface water flowing via residential properties off Boothroyden Road and into the River Irk, whilst other surface water flows down Boothroyden Road towards the bridge across the river, where it flows into the River Irk.

The risk of flooding to the site from surface water is considered **high**.

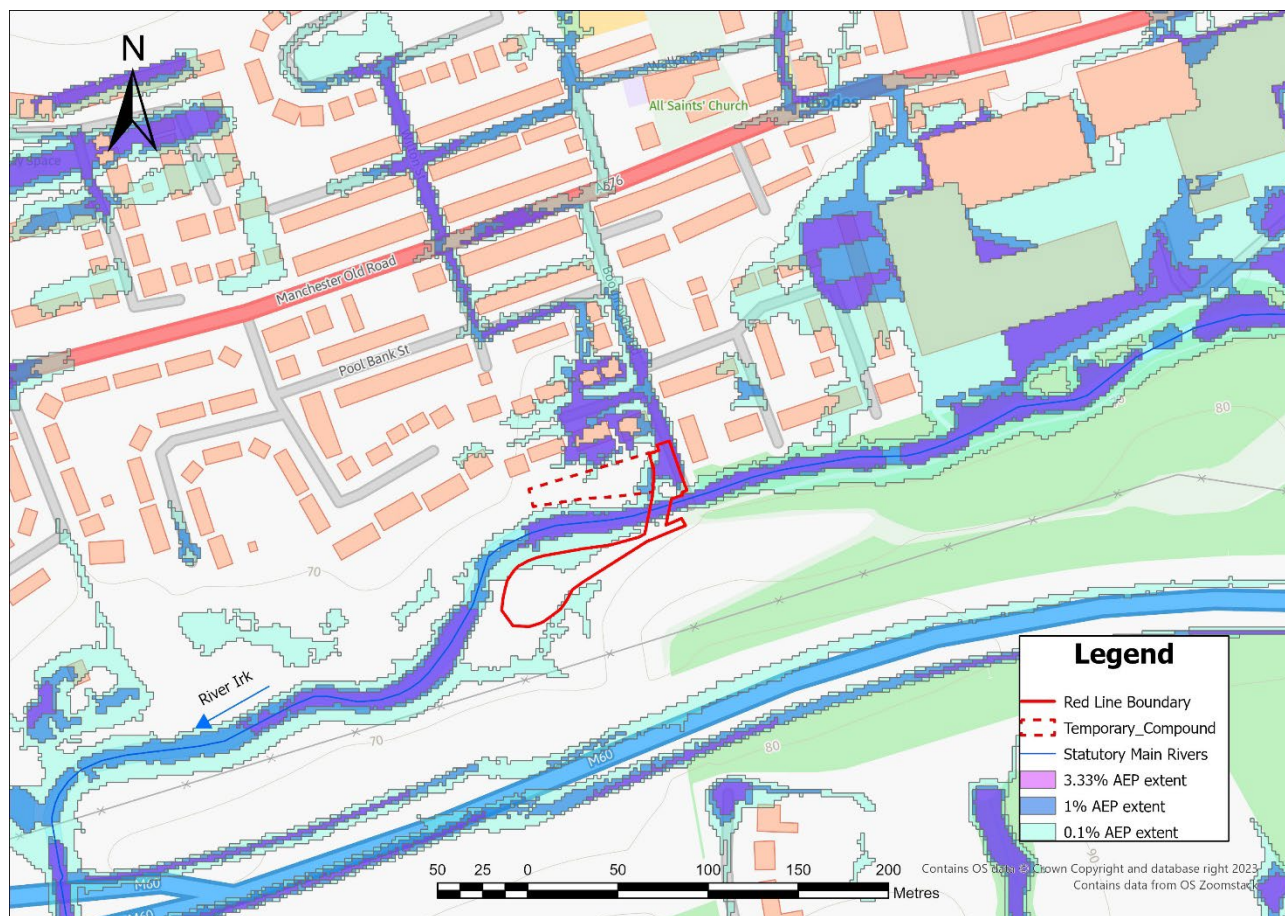


Figure 3 Risk of flooding from surface water at the site

3.3 Sewer

Sewer flooding usually occurs when the flow of water (usually rainfall runoff) entering the sewer system exceeds the discharge capacity of the system. This can be a result of a blockage in the sewer system or when surface water sewers are unable to discharge due to high water levels in the receiving watercourse. Water then surcharges the sewer network emerging at ground levels through manholes and gullies. Flood water containing foul sewage presents a significant health hazard.

Across Manchester, localised sewer flood risk is associated with aging drainage infrastructure which cannot cope with the capacity requirements of today, as well as the presence of blockages within the network (JBA 2019 & RBC, 2016). The SFRA identifies Rochdale as being within an 'opportunity area for further critical drainage management' (JBA, 2019). The SFRA's UU historic sewer flooding incidents and hotspots map indicates one sewer flooding incident to the south of the M60 near the site (date unknown). The map also shows 'hotspots', where modelled flood hazard, and local critical and vulnerable receptors have been identified, within 2km to the east of the site towards Chadderton.

UU infrastructure maps (Appendix G) display the location of the existing CSO on the south bank at the site, where the CSO outfalls on the south bank approximately 20m downstream of a weir. The map also shows combined sewer pipes flowing underground from east to west towards the CSO site; there does not appear to be connectivity to the site from the sewer system north of the river. There are also some abandoned sewers located within the site boundary on the south bank, along with clean water pipes along Boothroyden Road on the north bank.

The risk of flooding to the site from sewers would usually be low, as a build-up of sewerage in the system would discharge into the River Irk. However, if river levels were also high and the CSO outfall could not discharge (due to being river locked), the risk of sewer flooding could become **medium**.

3.4 Groundwater

Groundwater flooding occurs when water emerges from beneath the ground when the water table rises above ground level. This type of flooding usually has a slower onset compared to fluvial and pluvial flooding so the risk to life is lower, but groundwater flooding can be much longer lasting. There are several factors which can increase the likelihood of groundwater flooding including the local geology, prolonged rainfall, artificial structures, or high in-channel river levels.

The British Geological Survey (BGS) mapping identifies the site bedrock geology as Pennine Lower Coal Measures Formation of mudstone, siltstone and sandstone (BGS GeoIndex). Superficial deposits along the route of the watercourse are made up of alluvium – clay, silt, sand, and gravel. Along both riverbanks at the site, glaciofluvial sheet deposits made of sand and gravel are present (BGS Geology Viewer). The site has freely draining soils to the north of the river and slowly permeable seasonally wet soils with impeded drainage to the south (Defra Magic Maps).

The alluvium underlying the site is classified as a Secondary A aquifer typically with intergranular flow with varying permeability. The extent and thickness of these deposits limit the available groundwater yield contained within the more productive sand and gravel horizons. The unit may contain multiple perched water tables if discontinuous clay/peat lenses are present.

A review of groundwater data shows that the groundwater level varies between 0.8 and 7.8m below surface level, however the most recent data collected suggests that the groundwater level is currently 0.8 - 2 mbgl.

Geosmart (2024) groundwater flood risk mapping obtained for this study classifies the entire site and the majority of the area around it as at negligible risk of groundwater flooding. To the west of the wider study area there is a small area of both low and moderate risk. This area of increased flood risk correlates with a change in bedrock geology to the Chester Formation.

However, due to the proximity of the site to the River Irk and the relatively shallow groundwater at the site, flooding may be possible during intense, long-duration rainfall events, when river levels are high and the ground becomes saturated.

Furthermore, many issues, drain and sinks are present in the wider area, which are likely fed by perched water units in the alluvium and glaciofluvial sheet deposits. Historical mapping (1892-1914) show that the drains and issues to the east of the site used to be a spring before it was built over. These features may contribute to surface water or fluvial flooding risk during intense or long duration and recharge events.

However, based on the risk mapping for the area, the overall risk of flooding to the site from groundwater is considered **low** although it is likely that groundwater will be encountered during shallow excavation at the site which may need to be controlled and managed.

Groundwater also has the potential to impact any drainage or sewage infrastructure if ingress occurs through cracks, joints or defects in the infrastructure which may reduce efficiency and storage potential at periods of high groundwater levels.

3.5 Reservoirs

Reservoirs are defined as artificial structures used to store water, including for water supply purposes, recreation, or flood storage. Similar to the risk of flooding from canals, flood risk associated with reservoirs is residual and usually occurs as a result of a breach of the embankments or outfall. Reservoir flooding can pose a danger to life due to the sudden onset and large volumes of water that can travel at high velocity. However, all large, raised reservoirs (currently defined as those with a capacity of 25,000m³ and above), fall under the

Reservoirs Act 1975 and as such are regularly inspected and supervised by panel engineers. Therefore, the risk of reservoir failure is generally low.

The site appears to be at risk of flooding from an uncontrolled release of water from reservoirs (Figure 4). The reservoir flood extent generally follows the route of the River Irk and associated fluvial flood extent, although the reservoir extents, for both a 'dry day' and 'wet day' (when river levels are also high), are smaller than the Flood Zone 3 extent. According to the EA's long term flood risk map, the reservoir risk at the site is associated with 'Rhodes Lodge – Big Pond', approximately 600m upstream, which is owned by Rochdale Borough Council.

The risk of flooding to the site from reservoirs is considered **low**.

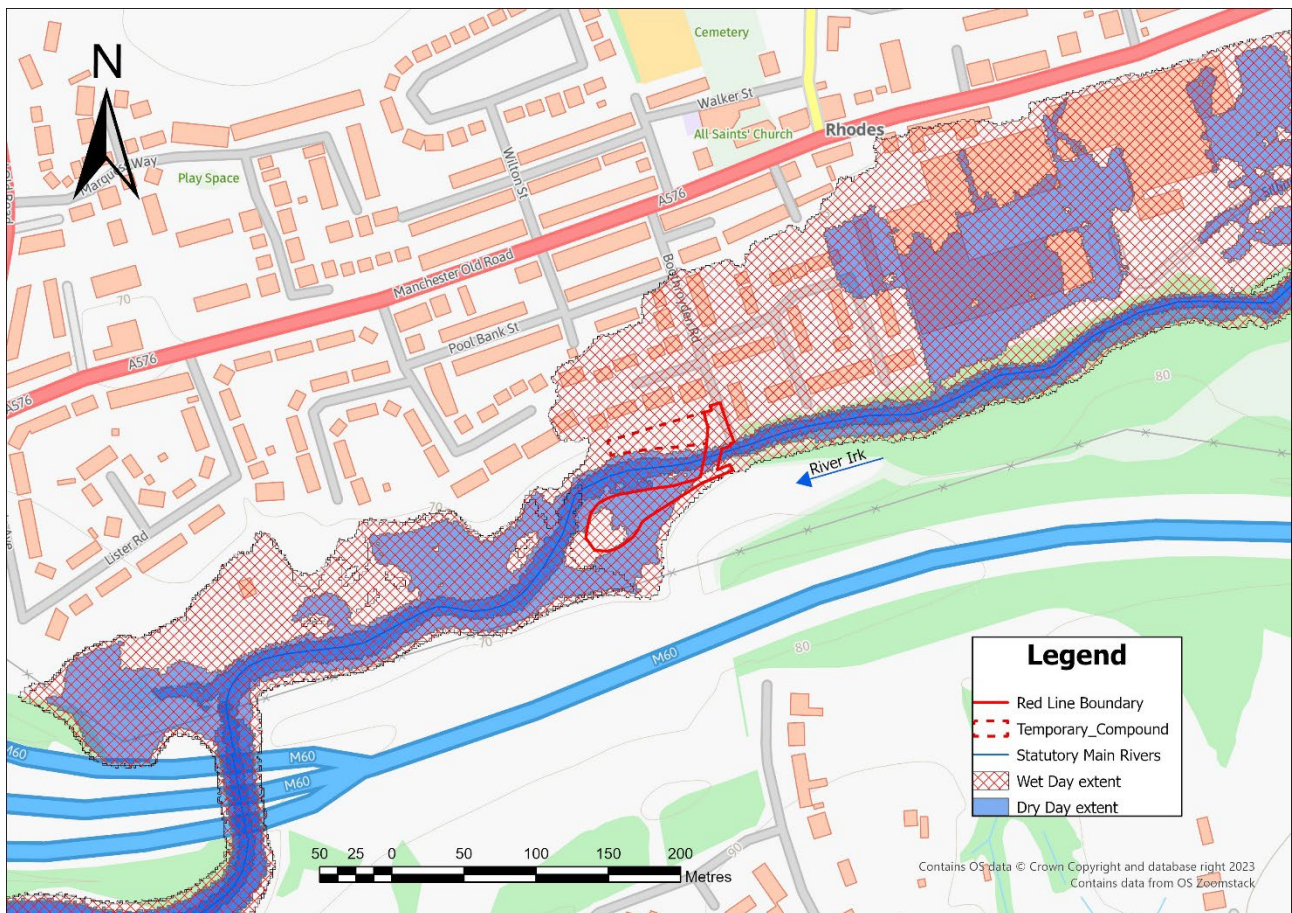


Figure 4 Risk of flooding from reservoirs at the site

3.6 Other (tidal, canals)

There are no canals nearby the site; the closest is Rochdale canal, approximately 3.9km away. The Rochdale canal is a controlled waterbody and as such the overtopping risk is low (JBA, 2019). The development is therefore considered to be at very low risk of flooding from canals.

Similarly, the development site is not at risk of tidal flooding based on its elevation and distance from the coast.

The risk of flooding to the site from other (tidal or canal) sources is considered **low**.

3.7 Summary of Flood Risk to the Site

The primary source of flood risk to the site is from the River Irk (fluvial), which flows from east to west through the site. According to the Environment Agency FMfP, the site is largely within Flood Zone 3 and at high risk of flooding from fluvial sources. Comparison of the 1% AEP peak flood levels with a topographic survey shows flood depths of up to 0.83m would be expected within low spots on site during this event on the south bank. However, much of the proposed work area on the south bank is above the 1% AEP flood level, suggesting it is largely outside of the floodplain. No flooding would be expected on the north bank during the 0.1% AEP event. The site is also partly at high risk of surface water flooding, with the north bank within the 3.33% AEP surface water flood extent (high risk). Depths of up to 0.60m and velocities up to 0.50m/s could be experienced during a 1% AEP surface water flood event on the north bank within the site boundary. The site on the right bank is at low risk of surface water flooding so would not be expected to flood during a 1% AEP surface water event. The site is located at the existing Boothroyden Road CSO and as such there is combined sewer infrastructure underground within the site boundary, so sewer flooding is possible. Based on publicly available data, groundwater flooding is unlikely in the general area, although due to the proximity of the site to the River Irk, groundwater flooding may be possible during intense, prolonged rainfall events, when river levels are high, and the ground becomes saturated. Additionally, the site is at risk of flooding from an uncontrolled release of water from a reservoir upstream of the site, however this risk is considered very low. Other sources (including tidal and canals) have been assessed and the risk is considered very low due to the site's elevation and distance from those sources.

4. Assessment of Flood Risk as a Result of the Proposed Development

4.1 Fluvial

The proposed detention tank would be a minimum of 9.5m away from the riverbank, providing a sufficient buffer for access and maintenance of the banks and channel, and minimising the risk of impacting the structural integrity of the banks. The tank would be underground so would not be expected to negatively impact fluvial flood risk. The operation of the proposed detention tank would reduce the frequency of overflow spills from the CSO into the River Irk, potentially having a positive impact on the river's capacity and surrounding flood risk, although the impact of reduced overflow spills would likely only be notable in low magnitude fluvial flood events.

Situated above the tank, the proposed kiosk and pressure relief column would be above ground. Comparison of the topographic survey with the flood levels for the land where the kiosk and pressure relief column are proposed, suggests this section of land sits at a minimum of 68.21mAOD, which is 0.67m below the 1% AEP peak flood level of 68.88mAOD (middle node in Table 2), so within Flood Zone 3. The tank lid and kiosk would be watertight, and the pressure relief column raised above predicted flood levels to avoid any floodwater from entering the structures. If floodwater entered the tank, it would fill up earlier than expected and reduce the existing sewer network capacity. If floodwater were to enter the pressure relief column, it would compromise the venting process of the tank and its pressure. It is recommended that the kiosk ventilation louvre is built no lower than 69.18mAOD, to provide a 300mm freeboard above the 1% AEP flood level; this will help prevent the kiosk from flooding via the ventilation louvre. If floodwater were to enter the kiosk, it would compromise the control panel, telemetry and electric instruments, and therefore the function of the existing CSO and proposed tank. Over the 50-year design life of the proposed development, climate change may increase the frequency and intensity of flood events so the area could flood in lower magnitude events, more regularly restricting access to the proposed development during heavy rainfall events. However, the site will be operated automatically and only need to be accessed for maintenance, so access should not be required during flood events.

The total volume of space taken up by the kiosk and pressure relief column within the floodplain is approximately 4m³, calculated using a height of 0.67m (the 1% AEP flood depth) x width x length of the structures as per Appendix D. This area is assumed to be outside of Flood Zone 3b (functional floodplain) due to being back from the riverbank and the volume is likely to have very minimal impact on floodplain capacity, so any minor increase in risk would impact the immediate surrounding open space rather than properties or infrastructure, and therefore would not increase flood risk elsewhere.

The proposed temporary bridge (and eastern end of the temporarily raised access track leading to the bridge), would be located within 8m of the channel, as the bridge would cross the River Irk. It is assumed that construction would be carried out in an appropriate way to minimise any risk of affecting the structural integrity of the riverbank and access to the adjacent riverbank would be maintained during construction. The proposed temporary compound would be a minimum 8m away from the riverbank.

The proposed temporary bridge soffit would be built no lower than 68.63mAOD. Although this level is below the 68.88mAOD peak flood level for the 1% AEP event (middle node in Table 2), it means the proposed bridge would be built no lower than the existing bridge just upstream, so would be anticipated to have a negligible impact on flows. During a 1% AEP event, the proposed bridge would likely be surcharged although assuming the deck level is no lower than the adjacent existing bridge, the proposed temporary bridge would not be expected to overtop during a 1% AEP event. However, it is assumed works would cease in such flood conditions so access to the site (including use of the temporary bridge) would not be necessary. As the proposed bridge would be a temporary structure only present during the construction period (11 months), it is not considered appropriate to assess the impact of climate change. Comparison to the 1% AEP peak flood level is considered conservative but no lower magnitude return period flood data is available.

The proposed temporary bridge abutments would be located within Flood Zone 3 so there could be a temporary reduction in floodplain storage capacity during the 11-month construction period. Based on data available (Table 2) it is not possible to prove whether the proposed development falls within Flood Zone 3b or not (functional floodplain). However, based on the EA's Risk of Flooding from Rivers and Sea data (Figure 2), the abutments would be located in land at medium risk of flooding, which has between a 1 % – 0.1 % AEP of river flooding and is therefore likely outside of Flood Zone 3b. Furthermore, topographic data suggests the road levels, above which material will be infilled to the temporary bridge level, are approximately 69.3mAOD, which is above the 1% AEP flood level of 68.88mAOD (middle node Table 2). Calculations have been undertaken based on the following design assumptions for the two abutments and temporary ground level raising around both ends of the proposed bridge: 6.5m width x 4.5 length x 0.5 depth. These suggest approximately 29m³ of reduced floodplain storage during construction. Considering the small volume and given that the abutments are likely outside of Flood Zone 3b, the impact of this is likely to be localised and very small and could result in increased flood risk to the adjacent open space land during the 1% AEP event; no increase in flood risk to properties or infrastructure is expected from this, so temporary floodplain storage compensation is not considered proportionate.

Where ground levels are proposed to be raised by 150mm to accommodate the compound, the land is above the 68.88mAOD 1% AEP peak flood level (compared to the middle node in Table 2) so would not be expected to flood during this return period, apart from a discrete low spot on the boundary. The compound is therefore not expected to have an impact on fluvial flood risk to the site or elsewhere.

The current levels along the access track are a minimum of 68.38mAOD, so if levels were temporarily raised by 150mm to a minimum of 68.53mAOD (as per the current design), the access track could experience flood depths of 0.35m during a 1% AEP event and 0.78m during a 0.1% AEP event (compared to the middle node in Table 2). Approximately half of the access track (the eastern end) is currently above the 1% AEP peak flood level (without ground raising). An estimate of floodplain loss has been undertaken based on the following design assumptions for the ground level raising along the section of access track within the 1% AEP flood extent: 30m length x 3m width x 0.15m depth. This suggests a maximum 13.5m³ of reduced floodplain storage during construction. This temporary loss of floodplain storage capacity could increase flood risk to the site and adjacent open space land during the 1% AEP event, but would not be expected to impact residential properties or infrastructure further away and at higher levels.

Vegetation clearance, including tree removal, as part of the enabling works to gain access to the working area, could reduce the stability of the riverbanks and increase the rate of erosion. It is assumed that the vegetation clearance would be carried out under supervision of a suitably qualified ecologist and in a carefully controlled manner to minimise any impact on the riverbanks. Further recommendations to minimise residual risks are discussed further in Section 5.

The existing risk of flooding from fluvial sources to the site during construction is **high**. The proposed temporary and permanent works are expected to have minimal impact on fluvial flood risk on the site or elsewhere. The risk to the proposed development during operation will therefore also remain **high**, although this is not expected to impact the operation of the site as it would be water-compatible. Recommendations to mitigate the residual risk are discussed in Section 5.

4.2 Surface Water

The site is at high risk of surface water flooding on the north bank, where the temporary compound and north abutment to the temporary bridge would be accessed from off Boothroyden Road. Elsewhere, the site is at low risk of surface water flooding. There is the potential for the proposed vegetation clearance, temporary compound, temporary bridge, access track, kiosk and pressure relief column to increase the impermeable surface area within the site. The temporary access track would cover an area of approximately 241m², although the track already exists but is being raised and slightly widened during construction, so some of this area is likely already impermeable. The temporary compound would temporarily increase the impermeable area by approximately 774m². This would increase surface water runoff and therefore could increase the risk

of surface water flooding on site without mitigation. Assuming works are carried out appropriately, including temporary drainage incorporated into the detailed design of the temporary works and implemented during construction, it is unlikely that there would be any increase in surface water flood risk. The kiosk and pressure relief column would increase the impermeable surface area on site by approximately 4.5m², so would likely have minimal impact on surface water flood risk to the site or elsewhere.

Raising of ground levels to accommodate for the proposed temporary compound and access track could interfere with overland flow routes and increase surrounding flood risk. As surface water flows from north to south towards the proposed compound, if the compound is raised, surface water may pond more at the properties to the north of the compound off Boothroyden Road if left unmitigated, however this risk will be avoided through the implementation of temporary drainage (as discussed in Section 5). Impacts of ground raising on the proposed access track are likely to be minimal as this area is currently at very low risk, the ground raising would be relatively shallow (150mm) and the track is not currently within an overflow flow route. The track already leads towards the River Irk so any overland flow during construction would be directed towards the river, and there are no properties nearby the track so this would not be expected to increase flood risk elsewhere.

No changes to surface water drainage, such as implementation of Sustainable Drainage Systems (SuDS), are proposed. It is expected that the runoff from the site, including the proposed bridge, will continue to naturally discharge into the River Irk.

Climate change is likely to increase the frequency and intensity of flash flooding events, so where the proposed permanent works are currently at low risk of surface water flooding, this area could become at a greater risk over the 50-year design life of the development, meaning higher flood depths and velocities would be experienced. However, the site will be operated automatically and only need to be accessed for maintenance, so access should not be required during flood events. Further recommendations to minimise the residual risk of surface water flooding are discussed further in Section 5.

The existing risk of flooding from surface water to the site during construction is **high** on the north bank, although most of the site is at low risk. The proposed temporary works could increase surface water risk, although this is expected to be avoided through the implementation of temporary drainage and so is not expected to impact risk elsewhere. The proposed permanent works are expected to have minimal impact on surface water risk and therefore the risk of flooding from surface water as a result of the proposed development is likely to remain **high**, although this is not expected to impact the operation of the site as it would be water-compatible. Recommendations to mitigate the residual risk are discussed in Section 5.

4.3 Sewer

The proposed development involves construction of an underground storm water detention tank with a capacity of 2,000m³ to increase the sewer network capacity. The risk of sewer flooding to properties and infrastructure is therefore expected to decrease as a result of the scheme.

The works will be carried out in proximity to existing sewer infrastructure, including combined sewers, and as such it is expected that safe systems of work will be in place, particularly for excavation works, to ensure the existing sewer infrastructure is not damaged.

The existing risk of flooding from sewers to the site during construction would generally be low, but could become **medium** if river levels were high so the CSO could not discharge and become overwhelmed. The proposed temporary works are not expected to impact the risk of sewer flooding on site or elsewhere. The permanent works would decrease the risk of flooding from sewers elsewhere. However, the risk to the site would likely remain **medium** due to the residual risk of the CSO becoming river locked and not being able to discharge, although this is unlikely and would not impact the operation of the site as it is water-compatible.

4.4 Groundwater

Groundwater risk mapping suggests that groundwater flooding is unlikely within the site but could be possible during intense, long-duration rainfall events when river levels are also high. The proposed detention tank will be below ground level so is the structure most likely to be at risk from the shallow groundwater levels recorded at the site. The risk of groundwater flooding during construction of the proposed tank is expected to be addressed by de-watering. It is understood that the tank would be designed to resist flotation when empty and with a groundwater level coincident with ground level or at the identified flood level for the site, whichever is highest. Any groundwater flooding to the site would likely drain back into the River Irk rather than towards receptors.

Checks have also been undertaken during the design to ensure the temporary stability of the shaft against flotation during construction. Construction works are proposed to commence in Autumn 2024 and would take approximately 11 months, so would include works over winter (generally wetter months). Further recommendations to minimise the residual risk of groundwater flooding are discussed further in Section 5.

It should be noted that shallow groundwater has the potential to impact any drainage or sewage infrastructure if ingress occurs through cracks, joints or defects in the infrastructure which may reduce the efficiency or and storage capacity at periods of high groundwater levels. It is assumed infrastructure will be design to be resilient to this risk of ingress.

The existing risk of flooding from groundwater to the site is **low**. To mitigate the risk of groundwater ingress during excavation for the proposed tank, de-watering will likely be required. The proposed development is not expected to impact the risk of flooding from groundwater on site or elsewhere, so the risk is likely to remain **low**.

4.5 Reservoirs

The nearest reservoir is approximately 600m to the east of the site, so the proposed works are not expected to damage the reservoir or increase the risk of an uncontrolled release of water from reservoirs. However, the extent of flooding from reservoirs at the site is linked to the fluvial flood extent, as an uncontrolled release of water is expected to flow towards the site via the River Irk. The proposed permanent works are not expected to increase fluvial flood risk and so the reservoir flood risk extent is also not expected to change on site as a result of the development. The temporary ground level raising for the access track, bridge abutments and compound may temporarily reduce the floodplain storage capacity, which could temporarily increase fluvial flood risk to the immediate surrounding area (Section 4.1). This means on a wet day (when river levels are also high) the reservoir flood extent, depths and velocities could be greater, although it is highly unlikely there would be a breach in a reservoir during the 11-month construction period. The volume of floodplain lost is also very small and therefore unlikely to make a significant difference in the context of a significant reservoir breach.

The existing risk of flooding from reservoirs to the site is **low**. The proposed development is not expected to impact the impact the risk of flooding from reservoirs on site or elsewhere, so the risk is likely to remain **low**.

4.6 Other (tidal, canals)

The site is not currently at risk of flooding from the tide or canals due to the distance from these flood sources. The proposed development is not expected to have an impact on tidal or canal flood risk to the site or elsewhere.

The existing risk of flooding from other (tidal and canal) sources is low. The proposed development is not expected to impact the risk of flooding from other (tidal and canal) sources on site or elsewhere, so the risk is likely to remain **low**.

4.7 Summary of Flood Risk as a Result of the Development

This section reviews the ongoing risk to the site, the risk due to the construction and any change in risk due to the proposed permanent works, and is summarised in Table 3.

The primary source of flooding to the site is fluvial, due to the site's proximity to the River Irk. The permanent works are not expected to have an impact on fluvial flood risk (apart from a minor positive impact from reduced overflows from the CSO into the river). The temporary ground level raising to facilitate the temporary bridge abutments and access track, would likely temporarily reduce floodplain storage capacity by up to approximately 42.5m³. Based on model data available (Table 2 Modelled water level and flow upstream and downstream of the development site, it is not possible to prove whether this reduction in floodplain capacity is within Flood Zone 3b (functional floodplain) or not, although EA data suggests the area is only at risk of flooding during events with between 1 % – 0.1 % AEP; so the area is likely outside of Flood Zone 3b. The impact of this temporary reduction in floodplain capacity is likely to be a minimal increase in flood risk, for example flood depths, surrounding the open space around the site rather than elsewhere, as the water would be displaced. The kiosk and pressure relief column could reduce floodplain capacity by around 4m³, which is considered negligible, and this area is also likely outside of Flood Zone 3b. Access to the site would be restricted during the 1% AEP fluvial event as some of the site would be expected to flood. However, this is unlikely to impact the construction or operation of the site as the detention tank would still be expected to function and access is not expected to be required during times of flooding.

The site is at high risk of surface water flooding on the north bank and if ground levels are temporarily raised there to accommodate a compound, surface water could be displaced and pond around the properties to the north of the compound off Boothroyden Road if left unmitigated, however this risk will be avoided through the implementation of temporary drainage. The proposed temporary compound and access track could increase the impermeable area by up to 1,015m². Any change in surface water risk around the compound is expected to be mitigated through temporary drainage; the access track is already at low risk, but any overland flow would be directed towards the river, where the track leads to. The kiosk and pressure relief column would increase the impermeable surface area on site by approximately 4.5m², so would likely have very minimal impact on surface water flood risk to the site or elsewhere. If a combined fluvial and surface water flood event occurred simultaneously during construction, the increase in flood risk within the site boundary could be significant, although it is expected that works would cease during a flood event so access to the site would not be necessary.

The risk of sewer flooding to the site itself is not expected to change and will still be possible due to the presence of sewer infrastructure and potential for failure. However, the proposed works are expected to reduce the risk of sewer flooding to surrounding properties and infrastructure as the storm water detention tank will improve the sewer network capacity. It is assumed that development would be designed in a way to minimise any risk of sewer flooding to the site so additional mitigation would not be necessary.

Groundwater flooding is considered unlikely and the proposed development is not expected to impact the risk of groundwater flooding, to the site or elsewhere. Groundwater ingress during excavation would be addressed by de-watering.

Similarly, the risk of flooding from an uncontrolled release of water from reservoirs is considered unlikely. If this risk did occur during construction when river levels were also high, the risk to the site and surrounding land may be slightly increased due to the temporary reduction in floodplain capacity as a result of the temporary ground raising. However, this is very unlikely to occur during the 11-month construction.

During the 50-year lifespan of the development, climate change is likely to increase the frequency and severity of rainfall events. Therefore, the risk of flooding to the site from fluvial and surface water sources will likely increase over time which could mean the site is more regularly inaccessible due to being flooded. The proposed development is water compatible and automatically operated though, so access during a flood is not expected to be necessary.

Recommendations to help mitigate the residual risks to and from the proposed development are detailed in Section 5.

Table 3 Summary of Flood Risk

Flood Source & Phase of Development	Existing Risk to the Site	Future Risk to Development	Mitigation Measures Required
Fluvial – Construction	High	High	Yes
Fluvial – Operation	High	High	Yes
Surface – Construction	High	High	Yes
Surface – Operation	High	High	Yes
Sewer – Construction	Medium	Medium	No
Sewer – Operation	Medium	Medium	No
Groundwater – Construction	Low	Low	No
Groundwater – Operation	Low	Low	No
Reservoir – Construction	Low	Low	No
Reservoir - Operation	Low	Low	No
Other Sources: Tidal & Canals - Construction	Low	Low	No
Other Sources: Tidal & Canals - Operation	Low	Low	No

5. Conclusions and Recommendations

5.1 Conclusions

As discussed in Section 2.1.2, according to the NPPF, essential infrastructure or water-compatible infrastructure within Flood Zone 3b (functional floodplain) should be designed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage; and
- not impede water flows and not increase flood risk elsewhere.

Although based on available data (Appendix H) it is not possible to prove whether the proposed development is within Flood Zone 3b or not, taking a conservative approach and assuming it is within the functional floodplain, this FRA has concluded that:

- The proposed development would remain operational in times of flood. Access would likely be restricted during 1% AEP fluvial events (or surface water flood events during construction) due to part of the site being flooded. However access is not necessary during a flood and operational measures will be used to reduce the risk of maintenance staff being on site during a flood event;
- The proposed permanent works are not expected to notably impact floodplain storage capacity. Temporary works, including ground level raising to facilitate the access bridge abutments and access track, would likely temporarily reduce floodplain storage by approximately 42.5m³. However, this land is likely outside of Flood Zone 3b and the loss would be for a maximum 11-month construction period, so given the small volume of loss and relative levels, would likely have minor impact to flood levels in open areas rather than impact properties or infrastructure; and
- The proposed permanent works are not expected to impede water flows or increase flood risk elsewhere. Temporary works, including the bridge, access track, and compound, may temporarily increase flood risk to the site and immediate surrounding area, although steps can be taken to mitigate any increase in risk, as detailed below.

5.2 Recommendations

In order to ensure that the proposed temporary works do not negatively impact flood risk on site or elsewhere, the following actions are recommended:

- Weather forecast monitoring and subscription to the Environment Agency's Flood Warning Service. In the event of a Flood Alert or Flood Warning, work should cease where possible, with materials, equipment and people removed from the floodplain. Any materials left should be secured in order to reduce the risk of being washed downstream.
- Temporary surface water drainage around the proposed compound, particularly to prevent runoff from flowing towards the properties at the back of Boothroyden Road.
- Detailed design should minimise any temporary reduction in floodplain storage e.g. through minimising the surface area of ground level raising to accommodate the temporary bridge abutments (as much as feasible whilst prioritising structural stability of the bridge)
- Riverbanks and associated flood defences in the vicinity of the site should be regularly monitored, and any defects reported to the Environment Agency. Natural banks should be safeguarded and reinforced (with relevant permissions) where necessary to maintain its stability. Banks should be reinstated to their previous condition (as a minimum) after the works are completed, including re-seeding banks where necessary to provide erosion protection.

- Although mapping indicates the groundwater flood risk to be negligible there is likely to be shallow perched groundwater bodies in the alluvium and glaciofluvial sheet deposits. Groundwater management may be required during construction of the CSO due to potential shallow groundwater levels recorded in the area. If dewatering is required this will need to consider discharge to the river and stability of any flood defences at the site.
- Where temporary works are being carried out, e.g. temporary compound and vegetation clearance, after works are completed, the area should be re-instated to its original condition (or improved as appropriate), for example through re-seeding.
- Safe Systems of Work (SSoW) and appropriate Risk Assessment and Method Statement should be produced in advance of the works. These documents should reflect the risk and provide mitigation for working nearby to a CSO and existing bridge, and above sewer network infrastructure, to reduce the risk of infrastructure damage.

Additionally, to ensure the site will remain operational and safe for users in times of flood, the following actions are recommended:

- Prior to attending site, staff should check the EA's Flood Warning Service for any Flood Alerts or Warnings issued to ensure staff do not try and attempt to access the site when it could be flooded.
- The ventilation louvre on the kiosk should be built no lower than 69.18mAOD, to provide a 300mm freeboard above the 1% AEP flood level to help prevent floodwater from entering the kiosk.
- Permanent site drainage could be considered during detailed design to prevent any localised mounding of surface water or groundwater.

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Appendix A. Flood Map for Planning

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
385035/405006

Created
18 Mar 2024 16:08

Your selected location is in flood zone 3, an area with a high probability of flooding.

This means:

- you must complete a flood risk assessment for development in this area
- you should follow the Environment Agency's standing advice for carrying out a flood risk assessment (see www.gov.uk/guidance/flood-risk-assessment-standing-advice)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence which sets out the terms and conditions for using government data. <https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

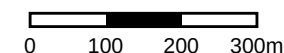
Your reference
<Unspecified>

Location (easting/northing)
385035/405006

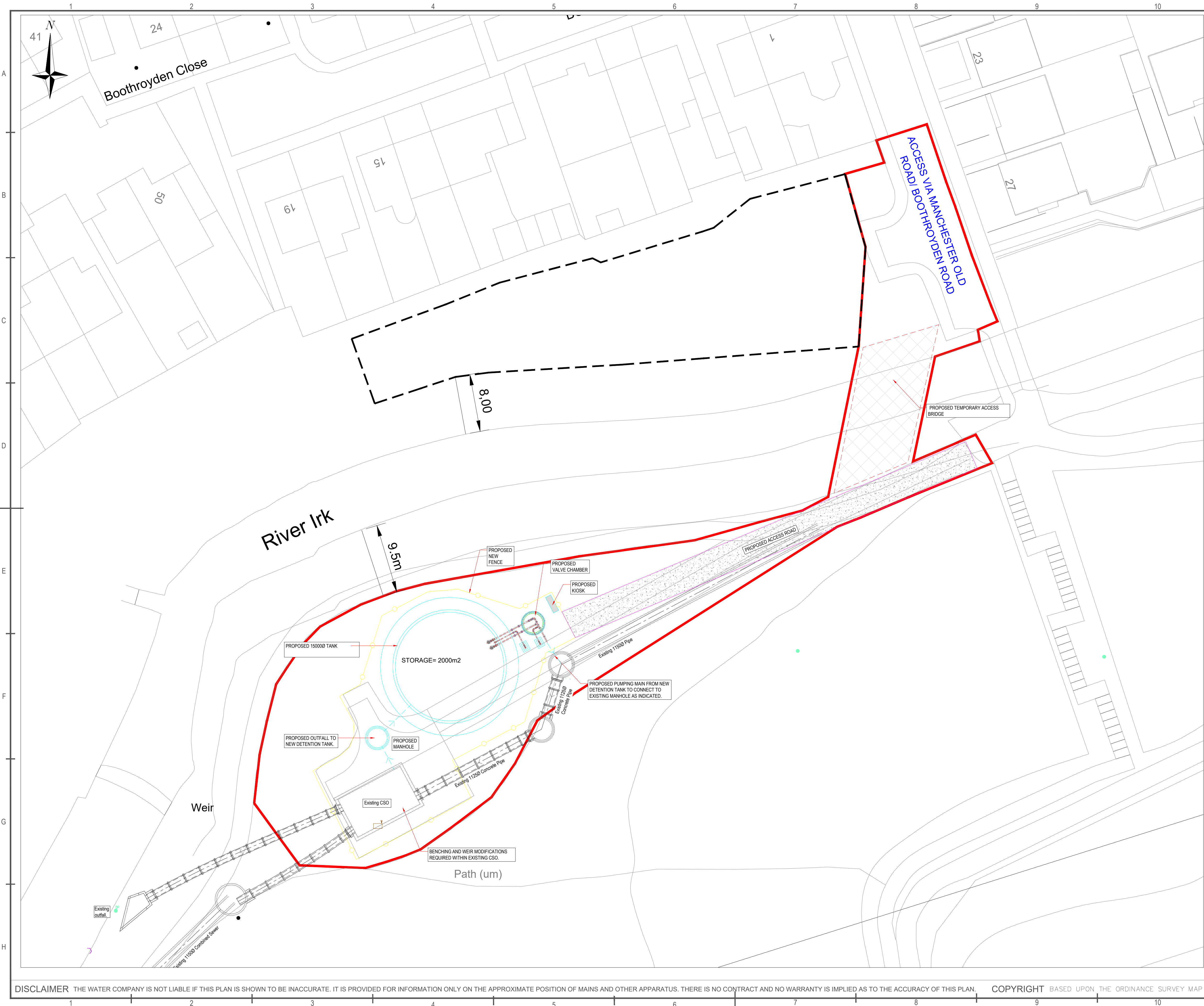
Scale
1:10000

Created
18 Mar 2024 16:08

-  Selected area
-  Flood zone 3
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Water storage area



Appendix B. Site Plan



- Proposed temporary bridge area
- Proposed new access road to UU CSO and detention tank. It will be temporary access to the working area CSO
- Proposed new fence area (extension of existing)
- Red boundary Planning
- Compound area

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Client:



helping life flow smoothly

SITE LAYOUT

PROJECT: BOOTHROYDEN RD CSO

TITLE: 1 Boothroyden Cl
Middleton
Manchester
M24 4RW

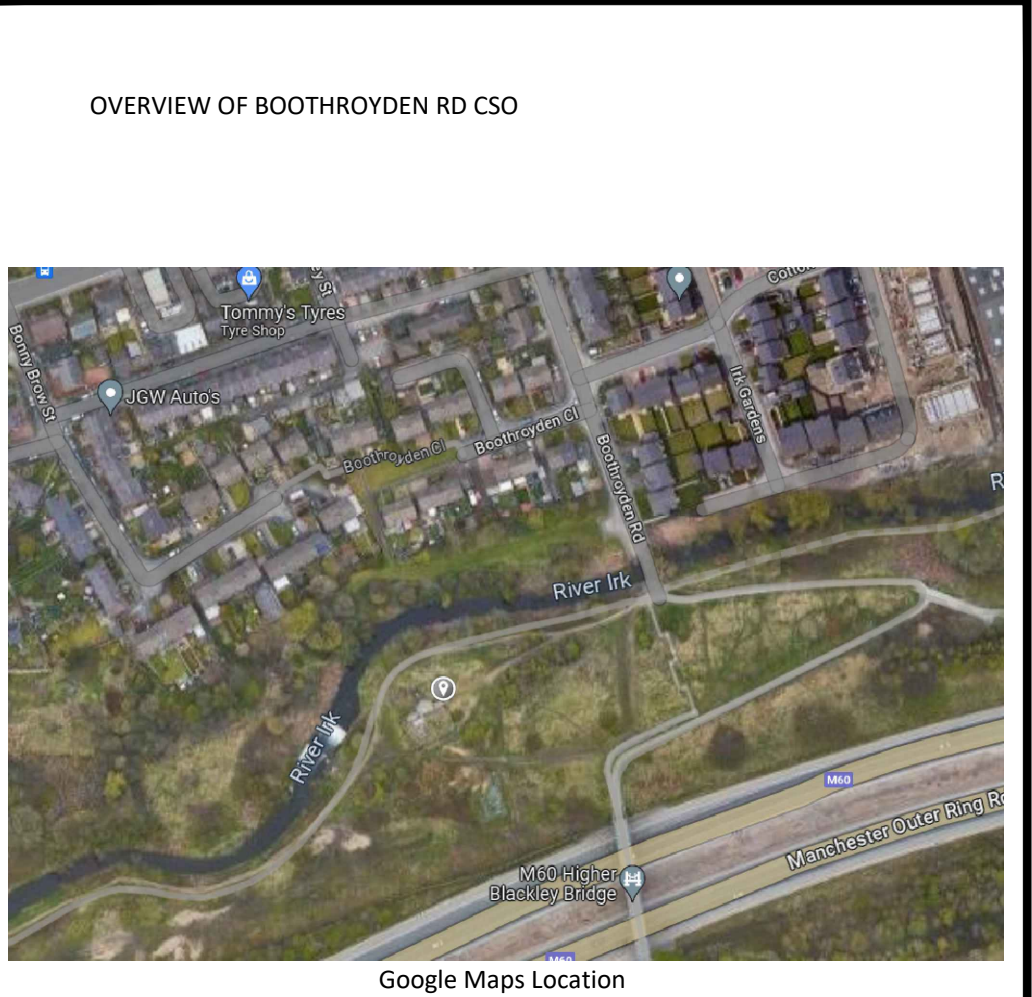
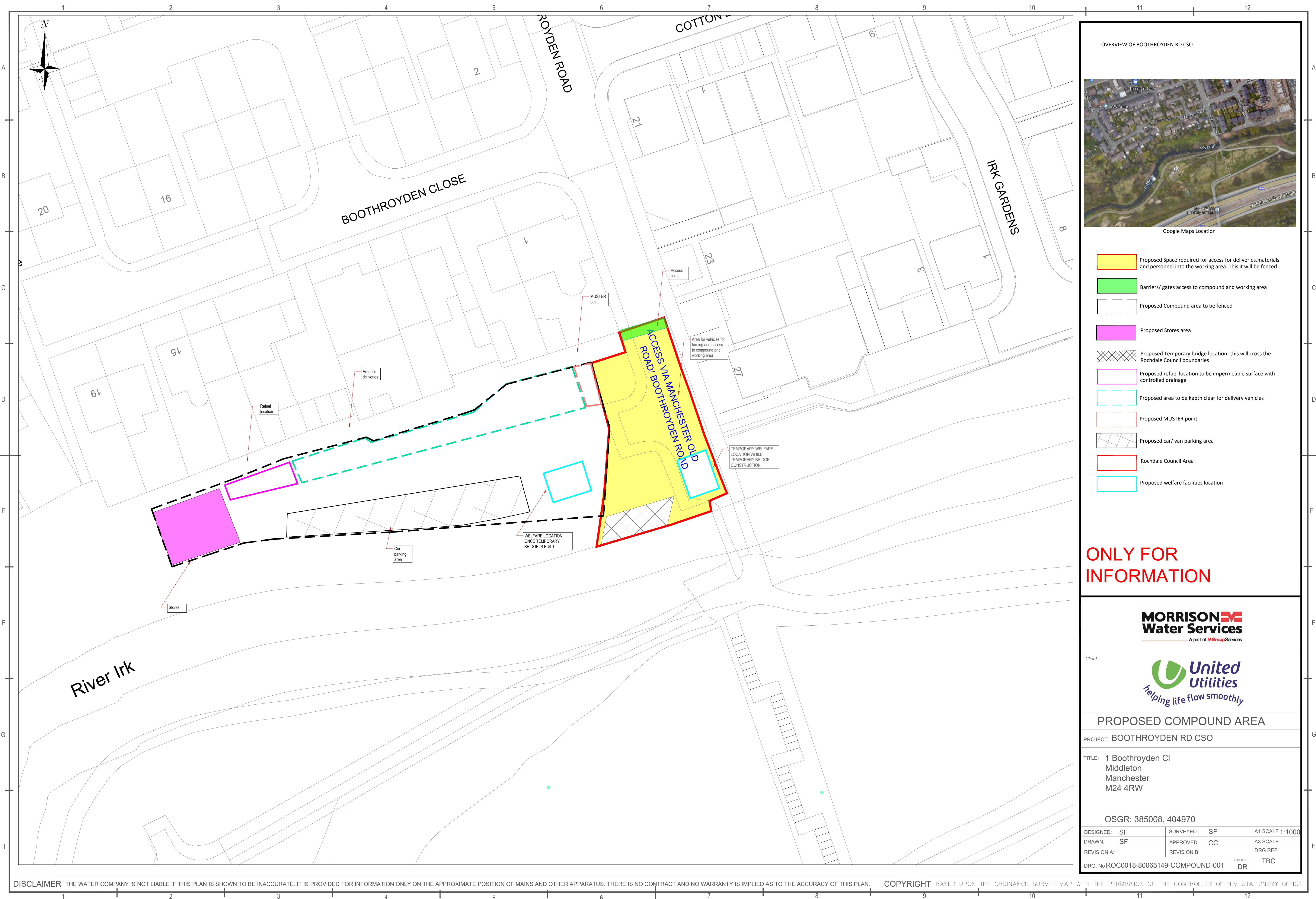
OSGR: 385008, 404970

DESIGNED: SF	SURVEYED: SF	A1 SCALE 1:250
DRAWN: SF	APPROVED: CC	A3 SCALE
REVISION A:	REVISION B:	DRG REF.
DRG. No ROC0018-80065149-SITELAYOUT-001		TBC

STATUS

DR

Appendix C. Proposed Compound Area



- Proposed Space required for access for deliveries, materials and personnel into the working area. This it will be fenced
- Barriers/ gates access to compound and working area
- Proposed Compound area to be fenced
- Proposed Stores area
- Proposed Temporary bridge location- this will cross the Rochdale Council boundaries
- Proposed refuel location to be impermeable surface with controlled drainage
- Proposed area to be kept clear for delivery vehicles
- Proposed MUSTER point
- Proposed car/ van parking area
- Rochdale Council Area
- Proposed welfare facilities location

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PROPOSED COMPOUND AREA

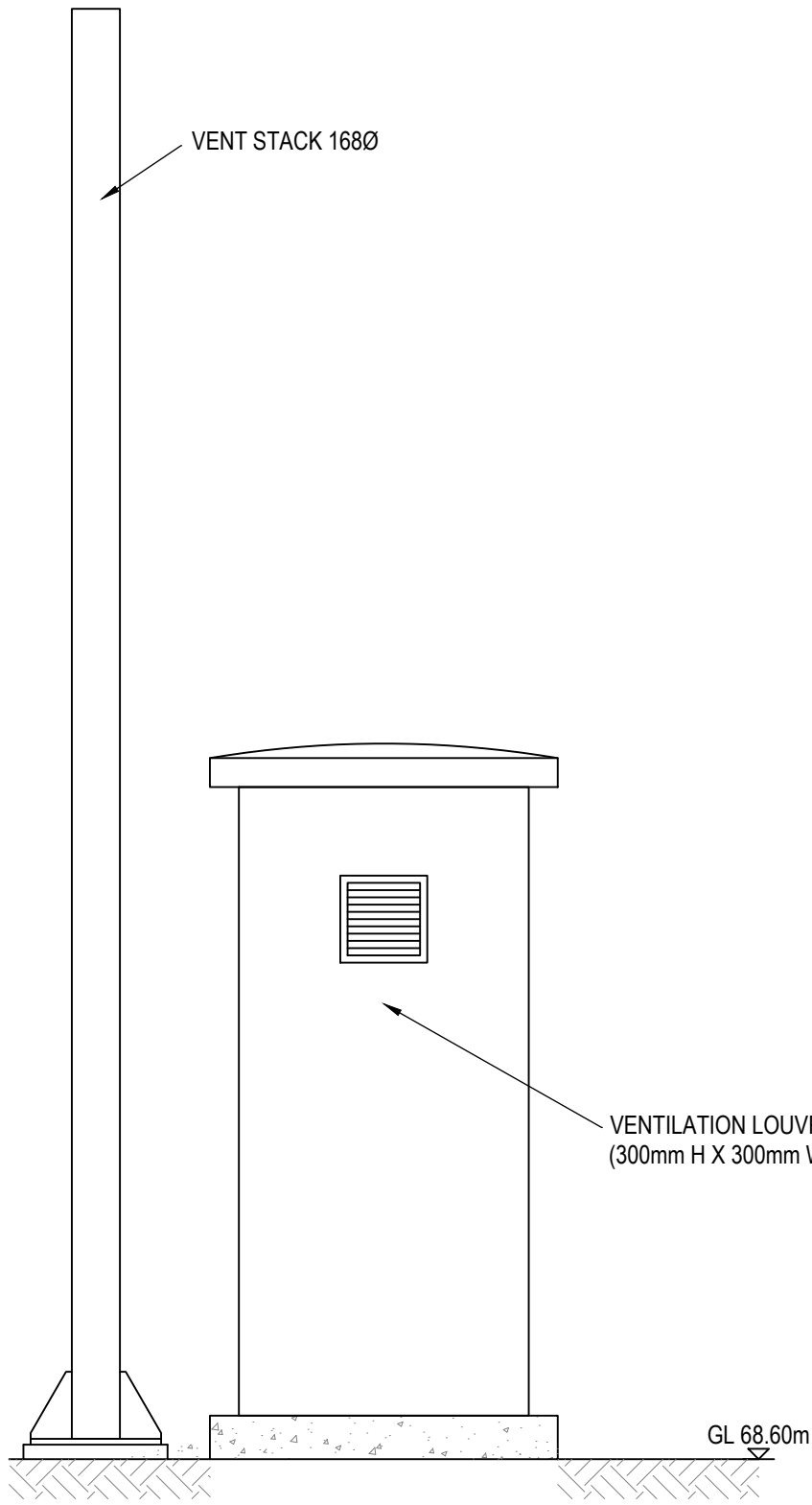
PROJECT: BOOTHROYDEN RD CSO

TITLE: 1 Boothroyden Cl
Middleton
Manchester
M24 4RW

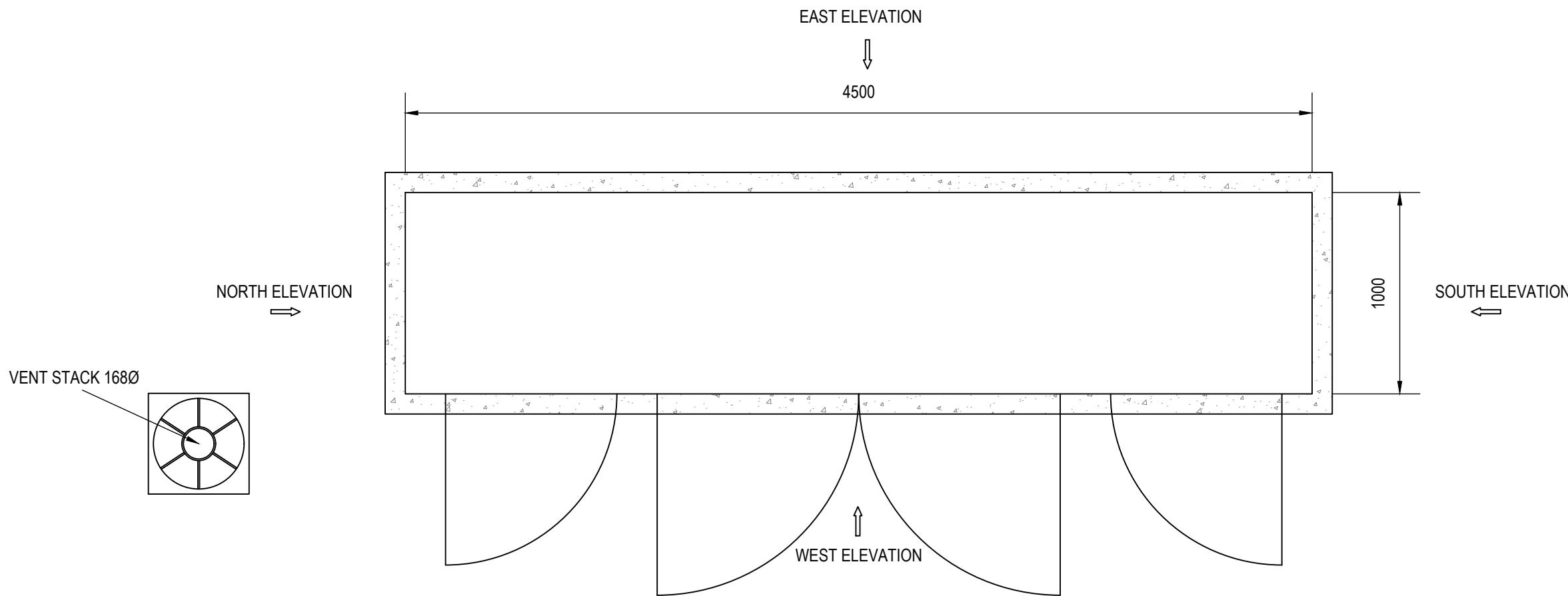
OSGR: 385008, 404970

DESIGNED: SF	SURVEYED: SF	A1 SCALE 1:1000
DRAWN: SF	APPROVED: CC	A3 SCALE
REVISION A:	REVISION B:	DRG REF.
DRG. No ROC0018-80065149-COMPOUND-001		STATUS DR TBC

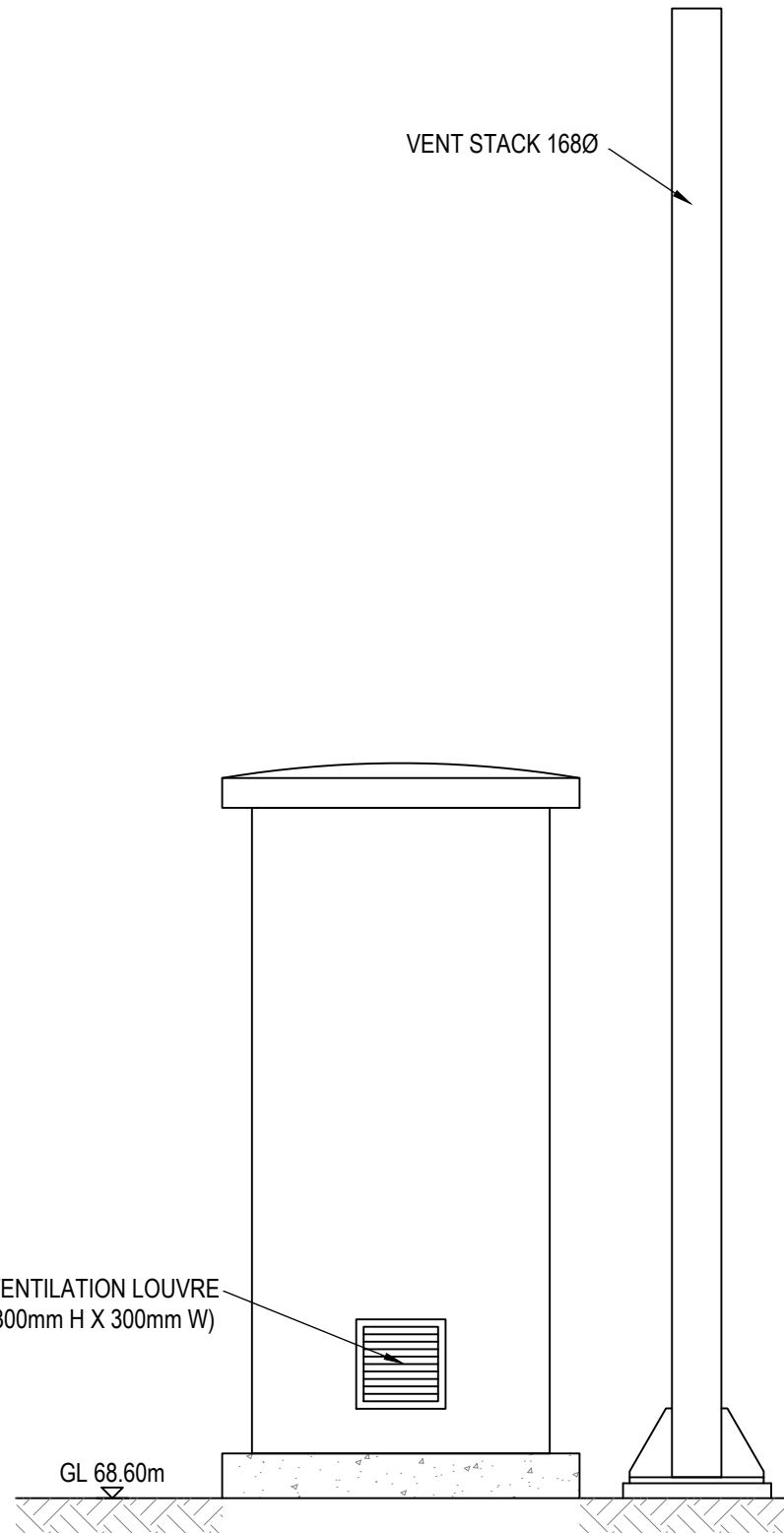
Appendix D. Proposed Kiosk and Pressure Relief Column Plan and Elevations



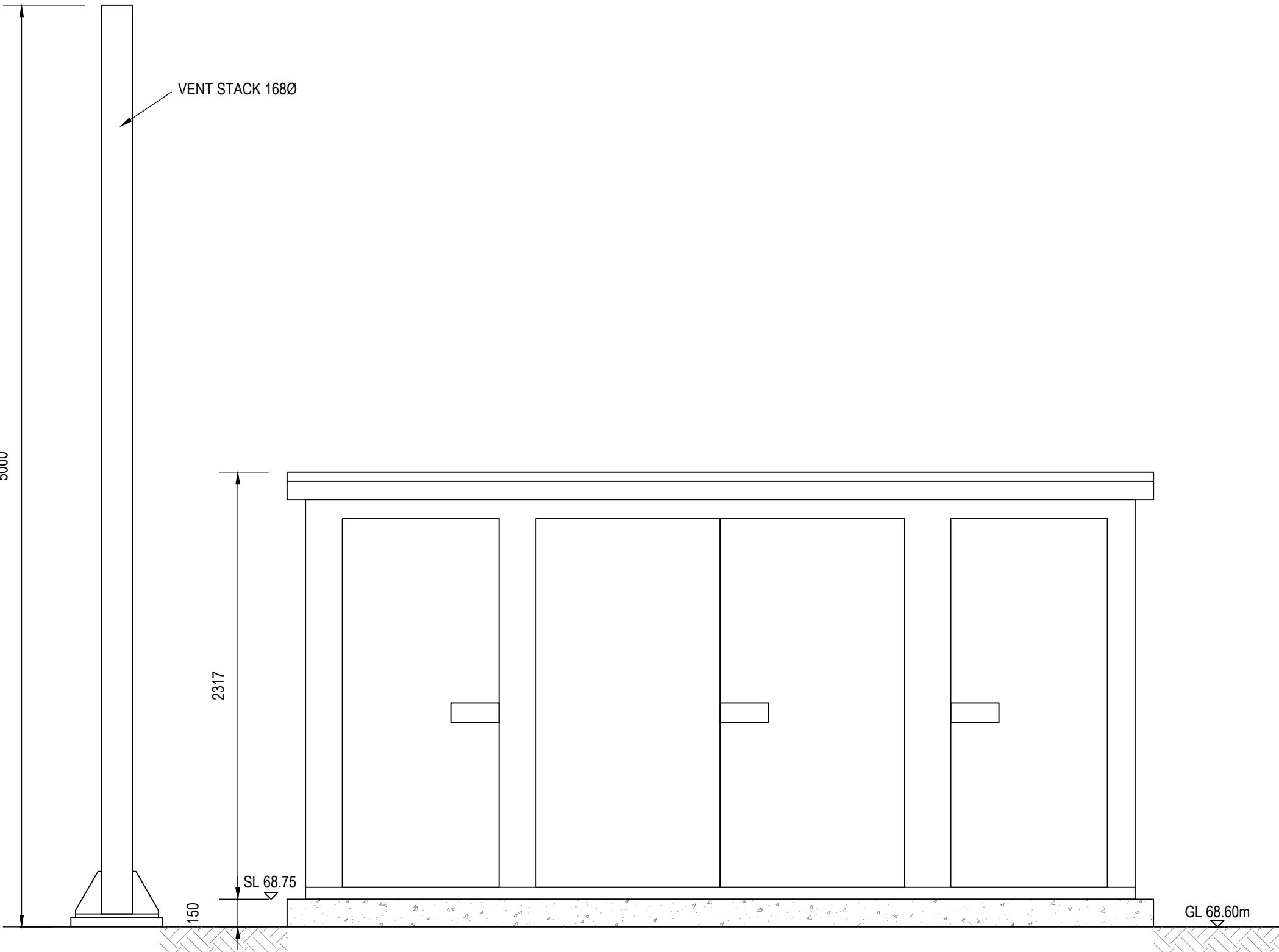
SOUTH ELEVATION



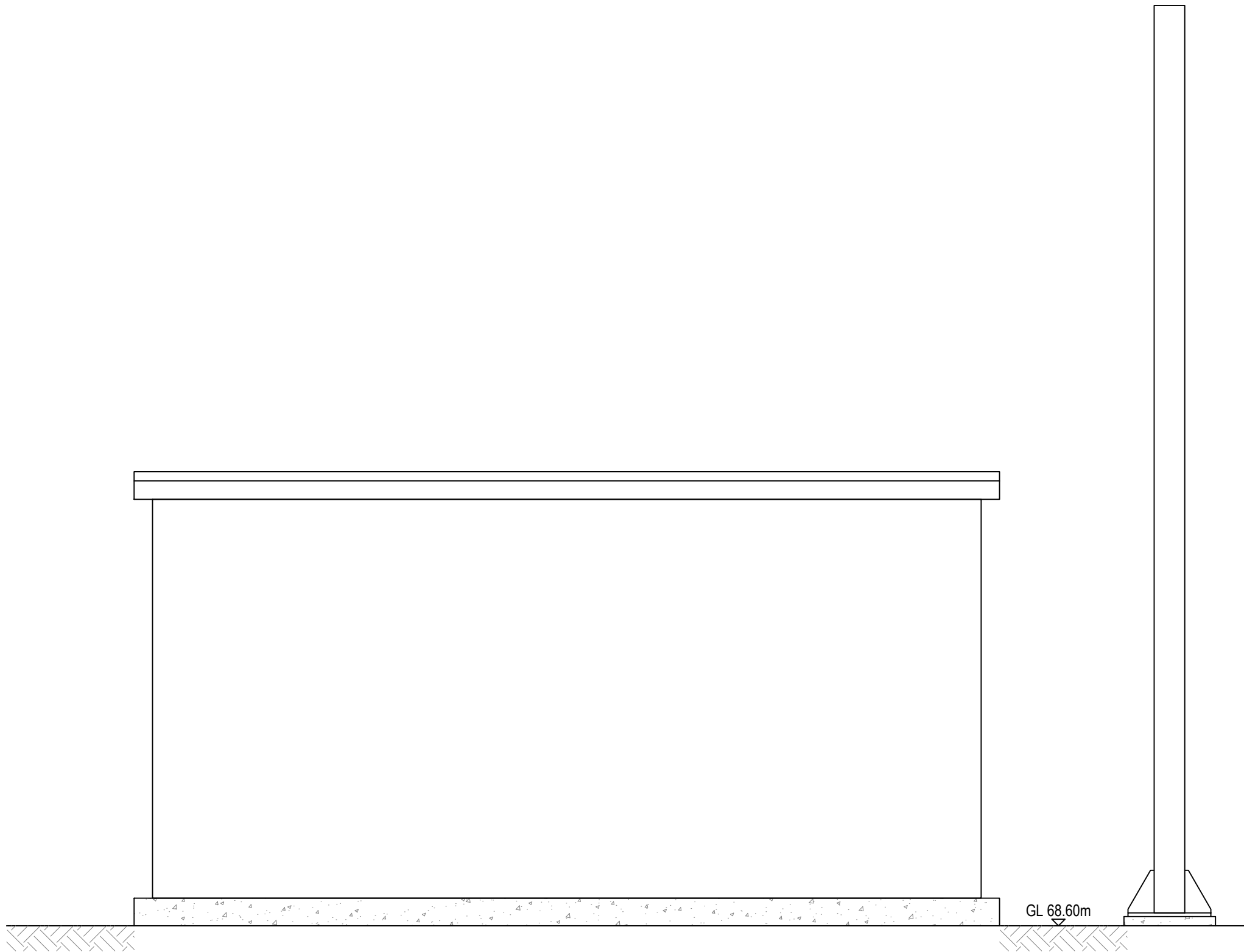
PLAN



NORTH ELEVATION



WEST ELEVATION



EAST ELEVATION

NOTES:

- This drawing is to be read in conjunction with other Eastwood Consulting Engineers drawings prefixed 48304.
- All dimensions are in millimetres unless indicated otherwise. Dimensions shown are the external dimensions to the MCC kiosk.
- Louvres to be colour matched to kiosk.

PROPOSED MATERIAL:

MCC Kiosk - Glass reinforced plastic
Colour - 14 C 39 Holly Green (BS4800)
Base Construction - Reinforced concrete

Vent Stack - Powder coated steel
Colour - Grey (Matt finish) RAL7047

P02	Size of kiosk updated	DW	VS	19.03.2024
P01	First issue.	DW	VS	06.03.2024
REV	DESCRIPTION	SIG	CHK	DATE

MORRISON
Water Services
A part of **MGroup**Services

United
Utilities
helping life flow smoothly

BOOTHROYDEN RD CSO

PROPOSED MCC KIOSK AND VENT
STACK PLAN AND ELEVATIONS

Eastwood
CONSULTING ENGINEERS

St Andrew's House
23 Kingfield Road
Sheffield, S11 9AS

T: 0114 255 4554
E: mail@eastwoodce.com
eastwoodce.com

ECE PROJECT No	SCALE AT A1	STATUS	SUITABLE FOR	REV
48304	1:25	S0	Initial	
DRAWING NUMBER				REV
48304	- ECE - XX - XX - DR - C - 0106	P02		
Project	Originator	Zone	Level	Type
				Role
				Number

Appendix E. Proposed Temporary Site Access Bridge

Appendix F. Proposed Ground Level Raised

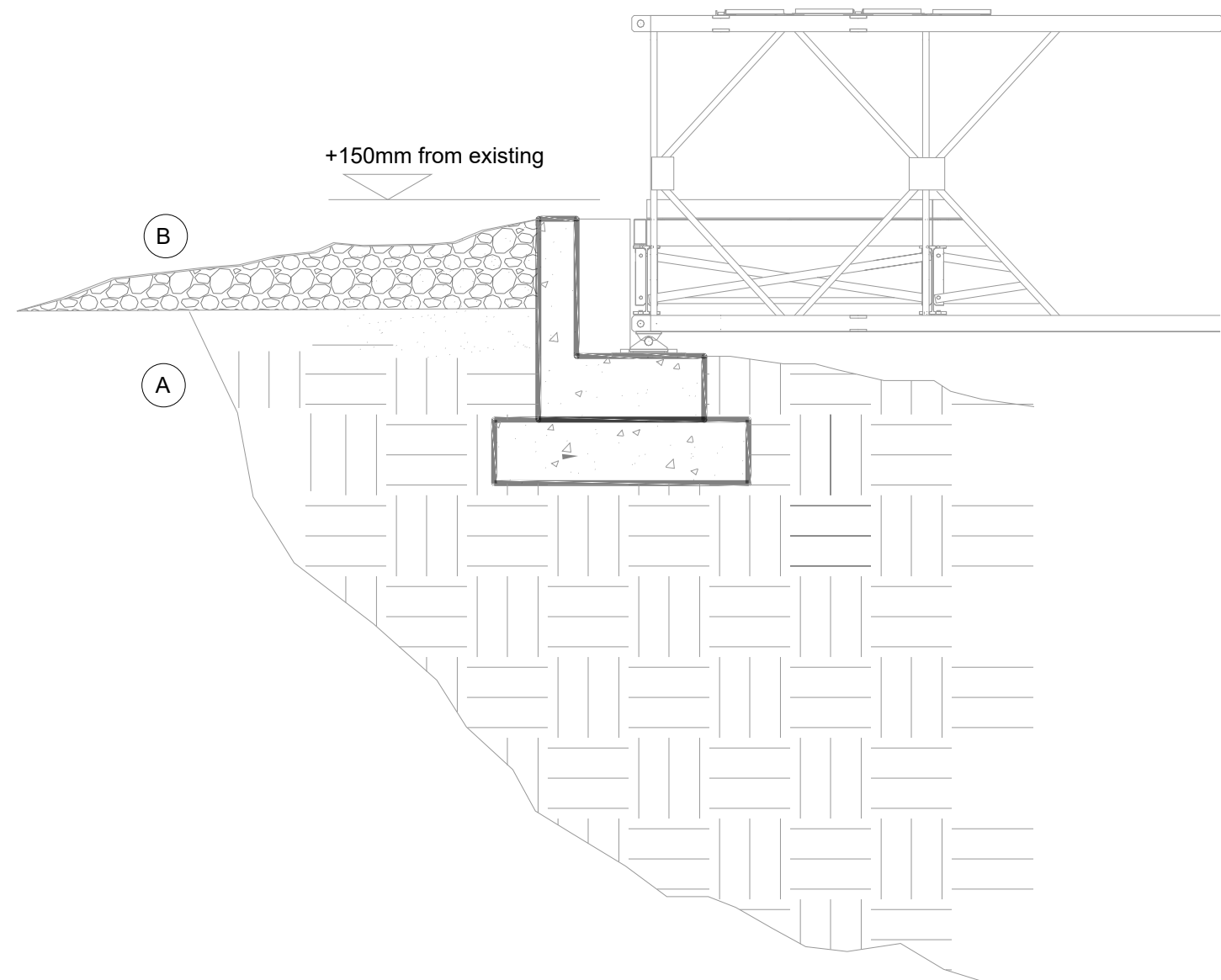


COMPOUND AREA & ACCESS ROAD

A- Well compacted natural ground
To remove 300mm of natural ground top soil
B- Type 1 MOT
To fill removed top soil area and raise ground level. Fill 450mm of Type 1 MOT

Ground raised for existing levels 150mm approx.
Existing levels shown on main drawing

After works, remove Type 1 MOT and reinstate as per original levels and standard

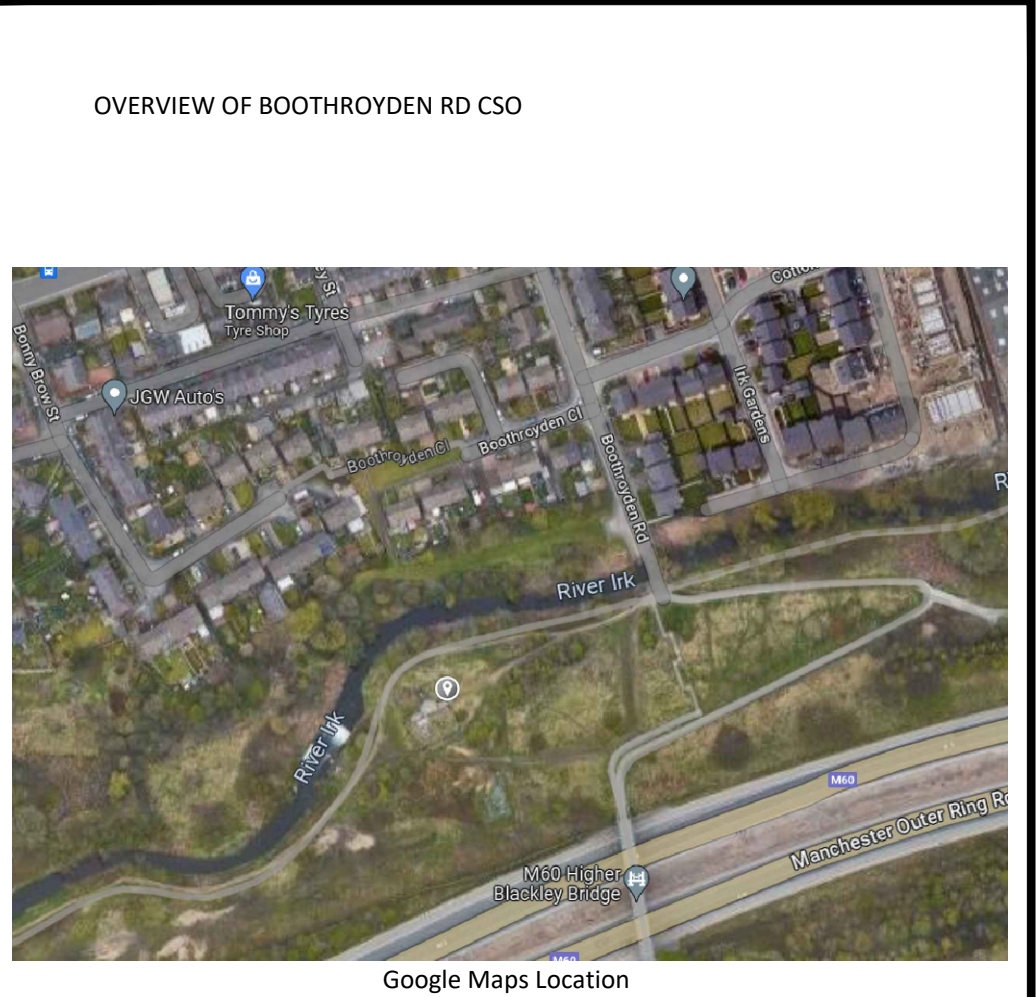


TEMPORARY BRIDGE

A- Well compacted natural ground
To remove 300mm of natural ground top soil
B- Type 1 MOT
To fill removed top soil and raise ground level. Fill 450mm of Type 1 MOT to allow level with temporary bridge level

Ground raised for existing levels 150mm approx.
Existing levels shown on main drawing

After works, remove Type 1 MOT and reinstate as per original levels and standard



- Legend**
- Proposed Temporary bridge location- abutments location and where to raise the ground level for construction traffic
 - Proposed compound area where to raise the ground level

Notes

- Do not scale this drawing
- Dimensions shown in mm unless estate otherwise
- This drawing is based on topographical survey by Morris Infrastructure Group UK Surveying & Engineering Division numbered MIG_715_3DT dated 01.12.2023

ONLY FOR INFORMATION



PROPOSED GROUND LEVEL RAISED

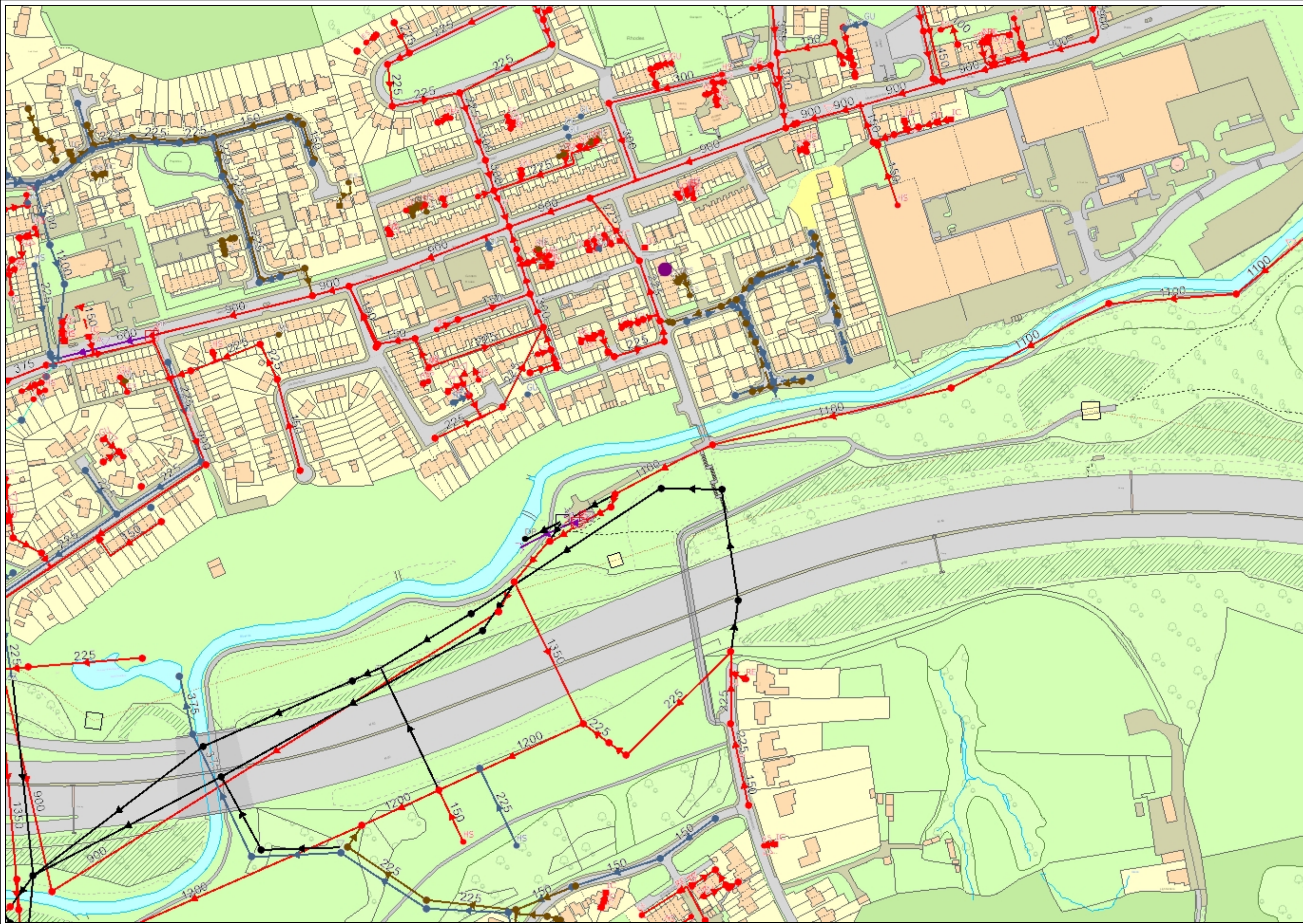
PROJECT: BOOTHROYDEN RD CSO

TITLE: 1 Boothroyden Cl
Middleton
Manchester
M24 4RW

OSGR: 385008, 404970

DESIGNED: SF	SURVEYED: SF	A1 SCALE 1:500
DRAWN: SF	APPROVED: CC	A3 SCALE
REVISION A:	REVISION B:	DRG REF.
DRG. No ROC0018-80065149-LEVEL-001	STATUS DR	TBC

Appendix G. United Utilities Sewer Infrastructure



United Utilities Maps
for SafeDig

Date :	08/03/2024 13:36:21
Centre X:	385062
Centre Y:	405011
Scale :	2500
UserName:	M3NR95

Extract from maps of United Utilities'
Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

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United Utilities SafeDig Website

Wastewater Symbolology

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

All point assets follow the standard colour convention: **red** – combined **brown** - foul
blue – surface water **purple** - overflow

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	
Drop Shaft	Change of Characteristic
Orifice Plate	

Appendix H. Environment Agency River Level and Flow Data

From: [GMMC Info Requests](#)
To: [REDACTED]
Subject: [EXTERNAL] GMMC349307SW Response attached from the Environment Agency
Date: 28 February 2024 15:52:07
Attachments: [image004.png](#)
[GMMC349307SW_DFM.pdf](#)
[GMMC349307SW_Table.pdf](#)

Dear Ellie,

Thank you for your enquiry which was received on 27/02/24.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

I enclose the data requested.

We have no records of flooding affecting the site.

However, this does not mean flooding has not occurred in the past or that it will not flood in future.

We recommend that you also contact United Utilities and Manchester and Rochdale Councils

Who may hold additional information (the former especially in relation to sewer flooding).

There are no flood defences in the vicinity of the site.

There are no 2D levels available for this site.

Manchester and Rochdale Councils is responsible for issues relating to surface water and hold information on surface water flooding.

Please be aware you can check your risk of flooding on our external website <https://flood-warning-information.service.gov.uk/long-term-flood-risk/>

Here are some useful links below:

<https://www.gov.uk/guidance/flood-risk-assessment-local-planning-authorities>

<https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>

Please refer to the [Open Government Licence](#) which explains the permitted use of this information.

Please get in touch if you have any further queries or contact us within two months if you'd like us to review the information we have sent.

Kind regards,

Sarah Walters

Customer and Engagement Officer

Greater Manchester, Merseyside and Cheshire

Email: inforequests.gmmc@environment-agency.gov.uk

Office address: Richard Fairclough House, Knutsford Road, Latchford, Warrington, WA14 4UW

From: Rigby, Ellie [REDACTED]
Sent: Tuesday, February 27, 2024 2:55 PM
To: Enquiries, Unit <enquiries@environment-agency.gov.uk>
Subject: 240228/ER01 FRA product 4 data request: River Irk, Manchester

You don't often get email from [REDACTED] [Learn why this is important](#)

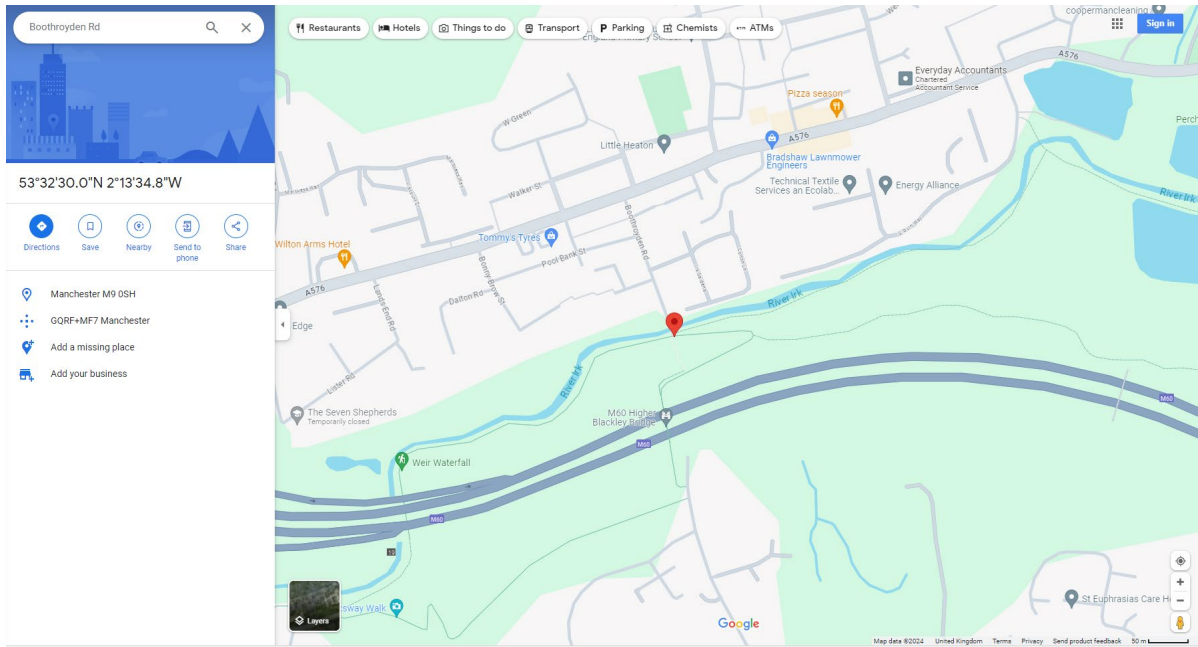
Good afternoon,

We are carrying out a Flood Risk Assessment (FRA) for works near the River Irk, Manchester, M9 OSH.

Please can you provide the standard [Product 4 data](#):

Detailed Flood Risk Assessment Map, including flood zones, defences and storage areas, areas benefiting from defences, statutory main river designations, historic flood event outlines and more detailed information from your computer river models (including model extent, information on one or more specific points, flood levels, flood flows).

Location: River Irk, Boothroyden Rd, Manchester, [M9 OSH](#), E: 680100 N: 680100.



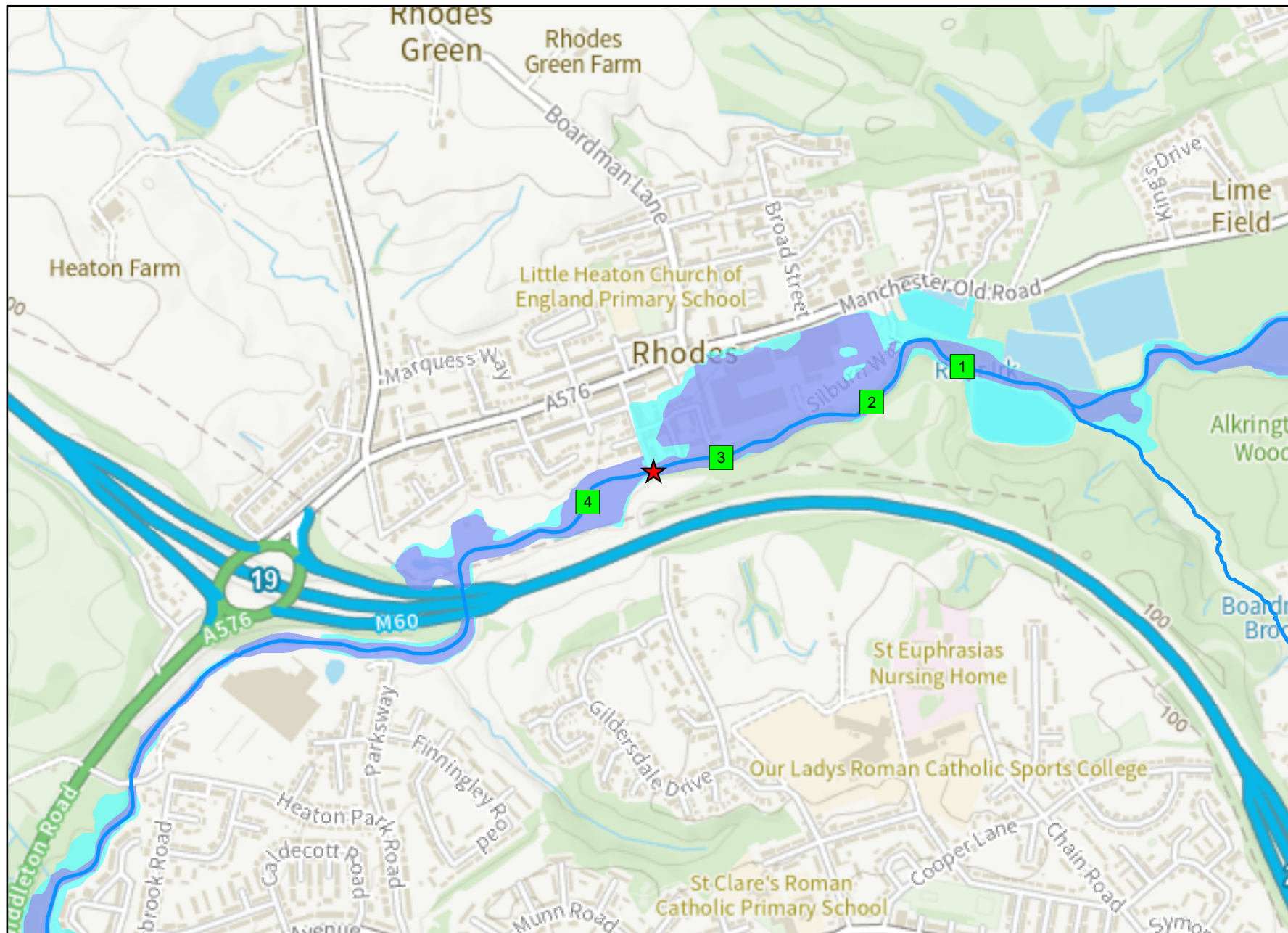
Many thanks
Ellie

Ellie Rigby

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Information in this message may be confidential and may be legally privileged. If you have received this message by mistake, please notify the sender immediately, delete it and do not copy it to anyone else. We have checked this email and its attachments for viruses. But you should still check any attachment before opening it. We may have to make this message and any reply to it public if asked to under the Freedom of Information Act, Data Protection Act or for litigation. Email messages and attachments sent to or from any Environment Agency address may also be accessed by someone other than the sender or recipient, for business purposes.

Detailed Flood Map Centred on Boothroyden Road, Manchester, M9 0SH. Created 28/02/2024 [GMMC349307SW]



1:10,001



Legend

- ★ Site Location
- Model Measurements
- Main River
- Flood Zone 3
- Flood Zone 2

					Undefended			Defended
Map Reference	Model Node Reference	Easting	Northing	Data	1 % AEP (1 in 100 year)	1 % AEP (1 in 100 year) + Climate Change*	0.1 % AEP (1 in 1000 year)	1 % AEP (1 in 100 year)
1	ea013_0287_IRKR03_0825	385653	405218	Modelled Water Level (m aodN)	71.03	71.23	71.95	71.18
				Modelled Flow (cumecs)	55.71	62.40	101.49	55.59
2	ea013_0287_IRKR03_0576B	385487	405170	Modelled Water Level (m aodN)	70.01	70.19	70.64	70.42
				Modelled Flow (cumecs)	55.95	62.90	123.20	55.71
3	ea013_0287_IRKR03_0271	385213	405067	Modelled Water Level (m aodN)	69.89	70.11	70.55	69.97
				Modelled Flow (cumecs)	53.50	60.90	98.25	55.69
4	ea013_0287_IRKR02_5845H	384971	404988	Modelled Water Level (m aodN)	67.76	67.82	68.07	67.78
				Modelled Flow (cumecs)	53.40	60.50	97.48	55.58

Model data taken from Irk, Moston, and Whit Brook 2007

AEP - Annual Exceedence Probability

m aodN - metres above ordnance datum Newlyn

cumecs - cubic metres per second

Notes:

*Climate Change Scenario - We only hold climate change measurements based on the previous climate change guidance (20% increase in flow). The new climate change guidance is available at <https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances>. The location of the site and the type (vulnerability) of development determine the climate change allowances to consider in any flood risk assessment.