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Corporation Street Manchester. Flood Mitigation Report

Final Report for:



June 2023

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1.0 INTRODUCTION

1.1 Overview

- 1.1.1 This Flood Risk Mitigation Statement provides information on the existing flood risk category of the site and the suitability of the development for inclusion within the identified zone.
- 1.1.2 The proposal includes the construction of a new substation along Corporation Street, Manchester and the refurbishment of a number of units within the arches beneath an existing Network Rail Asset.
- 1.1.3 This report has been based on the information previously submitted as part of the planning application reference 135342/FO/2022, and the drawing package produced by SGP Architects and Masterplanners.
- 1.1.4 Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, we reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations.

1.2 Scope of Strategy

- 1.2.1 The following information details the measures that the developer will take to ensure the substation development proposed satisfies the EA requirements for developments that are in Flood Zone 3 with the refurbished arch units falling within an area identified as flood zone 1.
- 1.2.2 The content of the flood risk assessment will be delivered in line with the objectives contained within paragraph 20 of the Flood risk and coastal change guidance which indicates:
 - 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.
- 1.2.3 Although a flood risk assessment is necessary, following the guidance within Paragraph 21 of the Flood risk and coastal change guidance (Extract below):

A flood risk assessment needs to be appropriate to the scale, nature and location of the development. For example, where the development is an extension to an existing house (for which an application for planning permission is required) which would not significantly increase the number of people present in an area at risk of flooding, the local planning authority would generally need a less detailed assessment to be able to reach an informed decision on the planning application.

- 1.2.4 Given the minor scale of the development and considering that none of the proposals will materially increase the number of people present in the area the document has been produced accordingly.

1.3 LLFA's Consultation Comments

- 1.3.1 Comments were received for the planning application. A summary is provided with response added from the design team.

The submitted FRA does not comply with the requirements for site-specific flood risk assessments, as set out in paragraphs 20 to 21 of the Flood Risk and Coastal Change section of the planning practice guidance.

- 1.3.2 All the stated requirements have been raised in the revised document and addressed accordingly.

The FRA does not therefore adequately assess the flood risks posed by the development. In particular, the FRA fails to:

- *consider how people will be kept safe from the identified flood hazards.*

- 1.3.3 The existing retail units are located within an area classified as at the lowest risk of flooding with very little surface water flooding being identified, given the extremely low levels of flooding from both river and surface water flood maps there would appear to be an extremely limited risk to the current operational use of the premises, the above has been indicated in the attached document.

- 1.3.4 The substation is located within an area designated as flood zone 3, however, the risk to people will be severely restricted for the following reasons:

1. The substation will not be used as a permanent residence.
2. The substation will not be frequented by members of the general public.
3. The substation will only require infrequent visits from specialist maintenance teams.
4. Prior to attendance flood warnings can be checked and attendance adjusted accordingly.
5. An emergency escape route has been identified should a maintenance engineer already be at the substation when an event is anticipated.

- *consider how a range of flooding events (including extreme events) will affect people and property.*

- 1.3.5 The development proposal is to construct a new substation and not a property as such the risk to people is extremely low with this in mind The 1 in 100-year flooding event provided by the Environment Agency has been deemed sufficient to inform the proposed FRA to adhere to the contents of Paragraph 21 of the Coastal Change section of the planning practice guidance the FRA must be commensurate with the scale of development.

- *consider the requirement for flood emergency planning including flood warning and evacuation of people for a range of flooding events up to and including the extreme event.*

- 1.3.6 A flood emergency plan has been provided.

- *take the impacts of climate change into account.*

1.3.7 The level of climate change has been identified.

- *There is no assessment of the impact of climate change using appropriate.*

1.3.8 Climate change is discussed within Paragraph 4.3 of this report.

We have reviewed the FRA by Cora IHT (ref: 16-2162/T001/Issue: 1). The FRA only references the proposed substation although the existing arch units also immediately adjoin the River Irk channel. The viaduct structure and culvert will generally contain the fluvial flood extents associated with the river. However, we note from the proposed plans that there appears to be rear doors within the units that open onto the river channel. The floor levels also appear to be considerably lower than Corporation Street/Dantzic Street levels. We recommend that the flood levels at this location are compared against the floor levels of the units to identify any potential risks and mitigation measures required. The assessment of fluvial flood levels in the FRA is simplistic and not necessarily an accurate representation of the risk levels associated with the River Irk. The design flood has not been determined. The EA has modelled levels for the River Irk which can be requested via inforequests.gmmc@environment-agency.gov.uk.

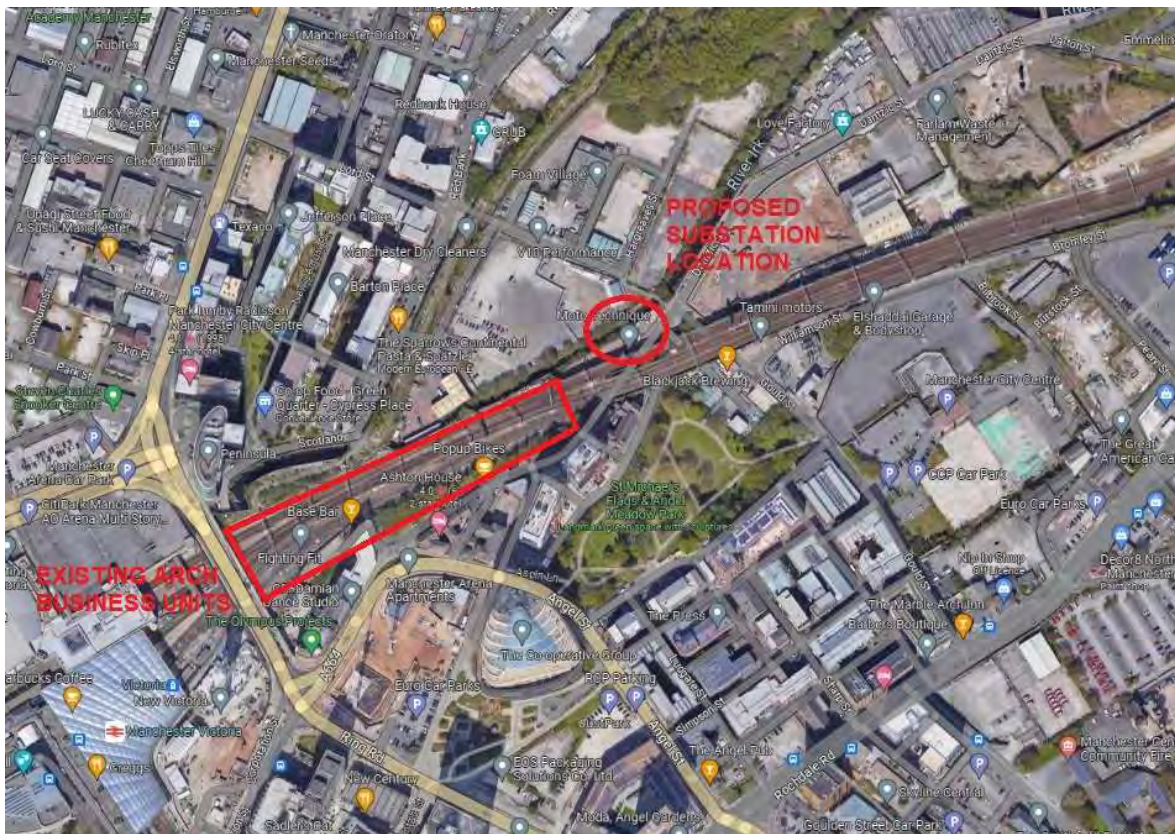
1.3.9 Product 4 information provided upon request by the Environment Agency the node points have been generated from LIDAR data to inform the anticipated flood levels through the study area, which has been understood and proven to be extremely high level in nature, with this in mind and as a monitoring station is located within the vicinity of the site, the information provided from the monitoring station provides are far more comprehensive and conclusive guide to the actual water levels experienced in the area.

2.0 SITE DESCRIPTION

2.1 Existing Site

- 2.1.1 The substation provision is proposed to be located between the River Irk and Dantzic Street approximately 845m to the north of Arndale Centre, Manchester, at Ordnance Survey grid reference 384434 , 399319, the arch units are located beneath the railway structure fronting onto Corporation Street.
- 2.1.2 Historically, the area used for the proposed substation has been used for various material storage and vehicle cleaning services. The existing arch business units are already in use and have been trading for a number of years with a variety of uses, the wider area has been subject to a significant amount of redevelopment for residential uses. **Figure 2.1** show the site location.

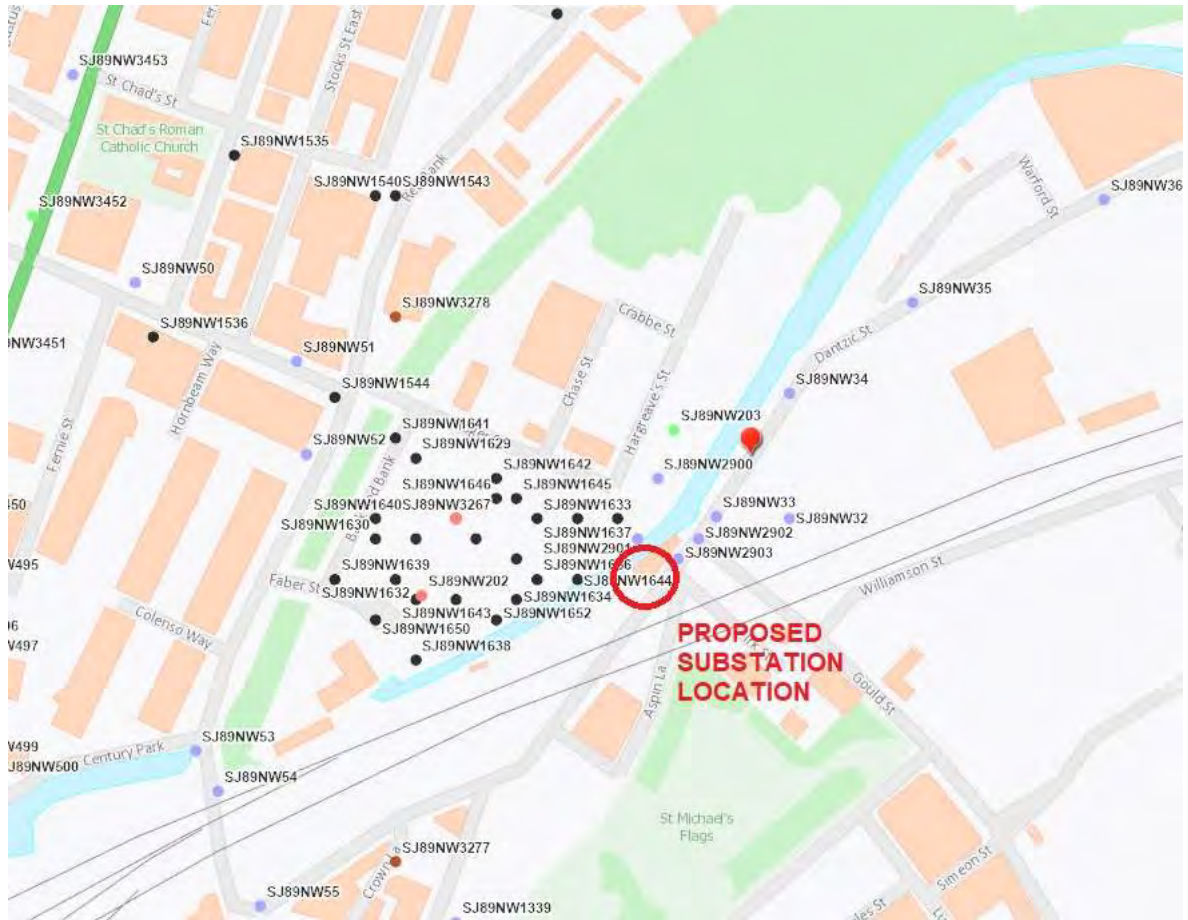
Figure 2.1: Aerial Photograph



2.2 Geology

- 2.2.1 British Geological Survey (BGS) 1:50 000 scale bedrock geology description: Chester Formation - Sandstone. Sedimentary bedrock formed between 250 and 247.1 million years ago during the Triassic period.
- 2.2.2 An historic BGS borehole log is located adjacent to the proposed site referenced as SJ89NW2903 shown in **Figure 2.2**, Borehole log included within **Appendix A**.

Figure 2.2: Borehole Location Plan



2.3 Flood Risk Guidance

- 2.3.1 In March 2012 and further updated in 2018 the Department of Communities and Local Government published National Planning Policy framework document (NPPF) which provides technical guidance on how flood risk should be assessed during the planning and development process.
- 2.3.2 To assess the NPPF flood risk classification for the site the first step was to inspect the Environment Agency web-based flood mapping data for flooding from rivers and seas, surface water and reservoirs. The rivers and sea flood map is used to inform planning of a sites flood zone(s), however the surface water and reservoir flood maps should also be used to identify other flood risks.
- 2.3.3 The Flooding to the site from rivers and seas is shown in **Figure 2.3** and it can be seen that the proposed substation site area is located wholly within Flood Zone 3 however the existing arch business premises are wholly located within an area designated as flood zone 1 with areas of flood zone 2 bordering the units.

Figure 2.3 - Environment Agency Flood Map (Rivers and Sea)



2.3.4 From the Environment Agency flooding from rivers and seas map:

- *Locations in flood zone 3 have a high probability of flooding. This means in any year land has a 1% or more chance of flooding from rivers, or a 0.5% or more chance of flooding from the sea.*
- *Locations in flood zone 1 have a low probability of flooding this means any Land within zone 1 has a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)*

2.3.5 Flood zone 3 developments need to submit a flood risk assessment as part of their planning application.

2.3.6 Table 2 within the National Planning Policy Framework Technical Guidance (NPPF) indicates that the proposed substation is designated as Essential Infrastructure, with the existing arch business premises being designated as less vulnerable see **Figure 2.4**.

- 2.3.7 Table 3 of the NPPF indicates that all less vulnerable uses are acceptable within an area designated as Flood Zone 1 with Essential Infrastructure also being identified as acceptable for areas designated as Flood Zone 3 following the inclusion of an exception test.

Figure 2.4 – NPPF TABLE 2

Table 2: Flood risk vulnerability classification

Essential infrastructure • Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk. • Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood. • Wind turbines.
Highly vulnerable • Police stations, ambulance stations and fire stations and command centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use³. • Installations requiring hazardous substances consent⁴. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as "essential infrastructure")⁵.
More vulnerable • Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste⁶. • Sites used for holiday or short-let caravans and camping, <i>subject to a specific warning and evacuation plan</i>.⁷
Less vulnerable • Police, ambulance and fire stations which are <i>not</i> required to be operational during flooding. • Buildings used for shops, financial, professional and other services.

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	×	×	×

Key: ✓ Development is appropriate.
 × Development should not be permitted.

Notes to table 3:

This table does not show:

- the application of the Sequential Test which guides development to Flood Zone 1 first, then Zone 2, and then Zone 3;
- flood risk assessment requirements; or
- the policy aims for each flood zone.

- 2.3.8 The Archway business premises are located directly beneath the existing Network Rail asset, as such they are not considered to generate any surface water flows either in their current condition or when the refurbishment has been completed.
- 2.3.9 Given the surface water flows are currently accommodated by Network Rail, it is not possible to amend the current drainage methodology.
- 2.3.10 When you also consider that the units are also wholly located within an area designated as flood zone 1 lowest chance of flooding and are only intended to be refurbished internally, the units have been excluded from the drainage strategy.
- 2.3.11 The proposed sub station is to be located within an area designated as flood zone 3 both an exception and sequential test must be applied.
- 2.3.12 Prior to completing an Exception Test it is first required to complete a sequential test, which aims to steer development to the lowest category of flooding as possible.

2.3.13 The proposed site could be designated as “**minor development**” which under the current guidance indicates that a sequential test is not applicable.

2.3.14 Although a sequential test is not strictly necessary, for completeness a sequential test has been applied to the site, unfortunately due the requirement to locate the substation within a set distance from the end user to avoid voltage drop through the network and the density of new residential development in the surrounding area, there are no viable alternatives in a lower category of flooding, as such current guidance dictates that

If your sequential test shows that it isn't possible to use an alternative site you'll need to do another test called the exception test if your development is:

2.3.15 The Exception Test requires two additional elements to be satisfied (as set out in paragraph 164 of the National Planning Policy Framework) before allowing development to be allocated or permitted in situations where suitable sites at lower risk of flooding are not available following application of the sequential test.

It should be demonstrated that:

- *development that has to be in a flood risk area will provide wider sustainability benefits to the community that outweigh flood risk; and*
- *the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.*

The above criteria have been satisfied by the evidence below:

Sustainable Benefit

- The existing site has historically been used for the storage of various construction materials together with business premises that have formally been used for Vehicle cleaning and maintenance. Given the flood risk status of the site in combination with the above uses has previously presented the significant opportunity for the various detergents and chemicals used during the cleaning process to potentially enter the River Irk.

The proposed development removes the potential for these liquids to enter the which presents a much wider sustainability benefit to the community which outweighs the flood risk for the site.

Lifetime Safety

- Following installation, the substation will only ever need to be accessed by specialist maintenance engineers, as such the flood risk to its users would be considered extremely low due to the anticipated infrequent nature of ongoing servicing.

Should attendance be required, The Environment Agency are responsible for issuing flood warnings throughout England and Wales, prior to attendance the flood warning service for the next 5 days should be interrogated so safe access can be effectively achieved.

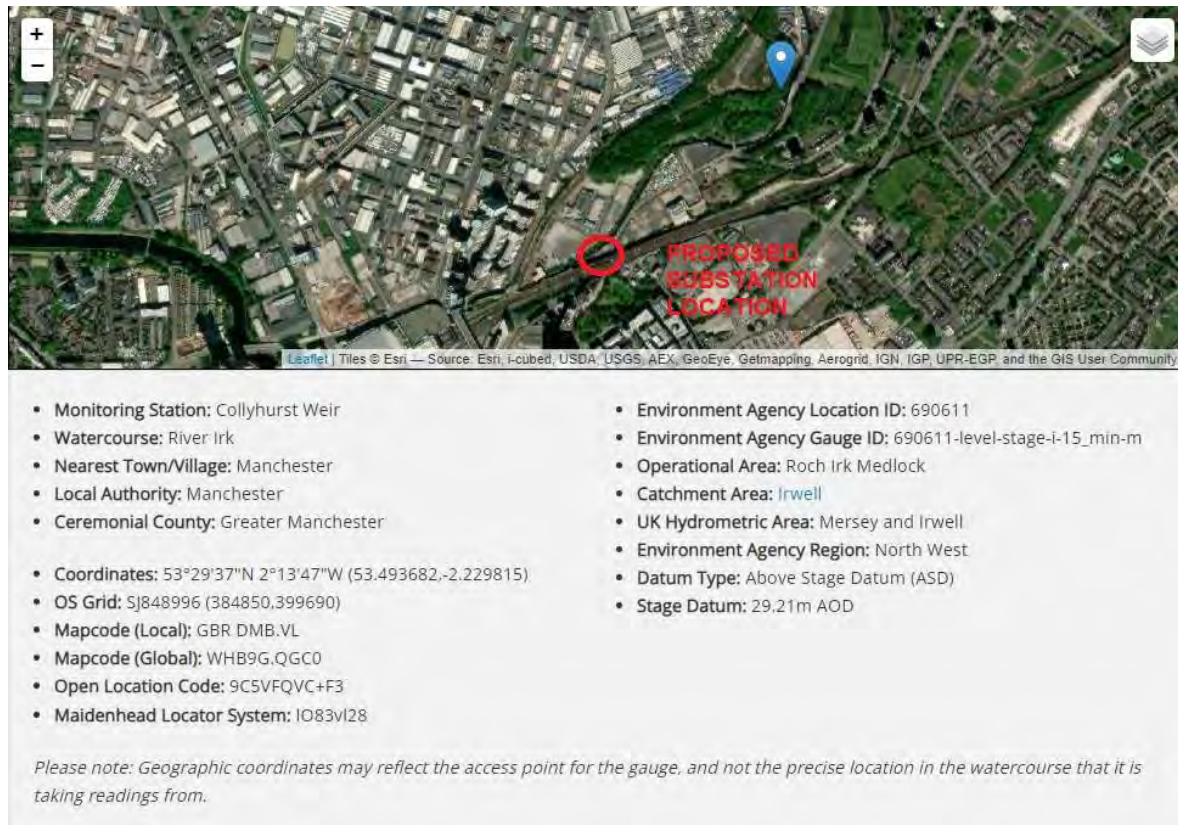
The substation must also will also be constructed with flood resilience guidance provided by the utility operator to protect the internal equipment during times of flood.

3.0 FLOOD MITIGATION

3.1 Anticipated Water Levels

- 3.1.1 In order to establish the maximum water level to be experienced at the proposed substation position from the adjacent watercourse, the information obtained from the Collyhurst Weir Monitoring station, ID number 5034 has been used. The Location is shown in **Figure 3.1**.

Figure 3.1 – Monitoring Station Position



- 3.1.2 The current water level was identified as 0.15 shown in **Figure 3.2**, however, the top of the normal range was recorded as 0.80m, with the maximum water level ever recorded at the station shown as 1.43m recorded on the 16th March 2019.
- 3.1.3 The level at which property flooding could be realised has been identified as 1.36m.

Figure 3.2 – Monitoring Station River Irk Level at Collyhurst Weir

River Irk level at Collyhurst Weir

[View map](#) [Nearby levels](#)

Latest at 11:00pm on 2 May ⓘ

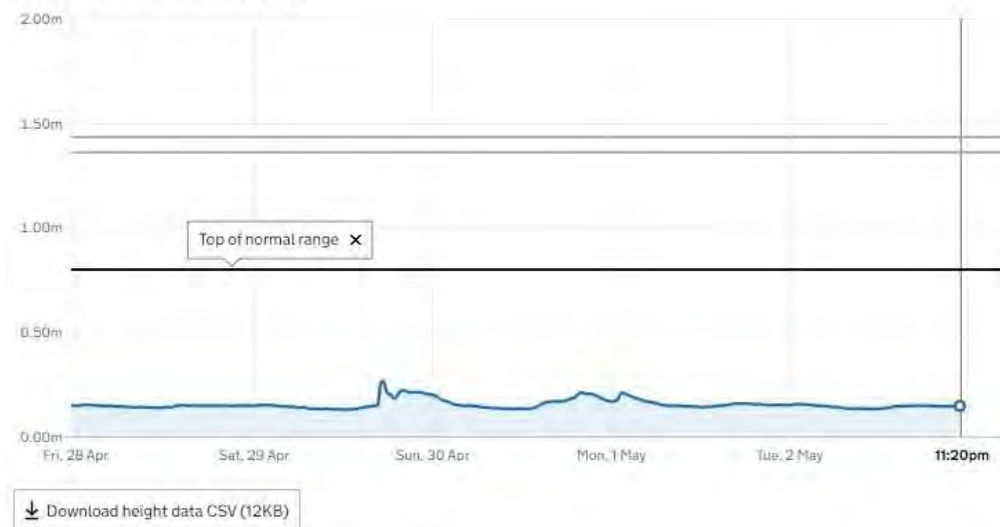
Height
0.15m ⓘ

Trend
Steady ⓘ

State
Normal ⓘ

Normal range 0.12m to 0.80m

Height over the last 5 days



How levels here could affect nearby areas

1.43m	Water reaches the highest level recorded at this measuring station (recorded on 16 March 2019)	Show on chart
1.36m	Property flooding is possible above this level. One or more flood warnings may be issued	Show on chart
0.80m	This is the top of the normal range	Show on chart
0.15m	Latest level	

No two flood events are the same. Flooding might not happen again at the same historical levels if, for example, flood defences are now in place.

- 3.1.4 The monitoring station is set at a datum of 29.21 AOD shown in **Figure 3.3** which would indicate top of water levels in the current, top of normal range and maximum recorded levels:

Figure 3.3 – Monitoring Station Technical Information

Current Water Level – 29.36

Top of Normal Range – 30.01

Max Recorded Level – 30.64

▼ [View technical information for this measuring station](#)

Site datum	29.21m (Above Ordnance Datum)
Station name	Collyhurst Weir
Normal range	0.12m to 0.80m
Station ID	5034

- 3.1.5 Due to the infrequent nature of the storm experienced during 2019 which has not been experienced again since, the maximum recorded flood level of 1.43m has been excluded from the study, with the top of normal range of 0.8m used to inform the current proposal.
- 3.1.6 The current level of the site shown on SGP drawing reference 19-259-014 included within the Appendix B has been identified as 29.60 with the elevation of the River Irk to the rear of the site estimated at a minimum of 1.5m below at 28.10.
- 3.1.7 Using the estimated level of the River Irk and applying the top of normal range value of 0.80m the top water level to be applied to the site is identified as 28.90.
- 3.1.8 Taking into consideration the anticipated top of normal range water level within the River Irk and the proposed site level, during this event the proposed site level remains 700mm higher which is in excess of the requisite freeboard allowances anticipated as 500mm above the top water level

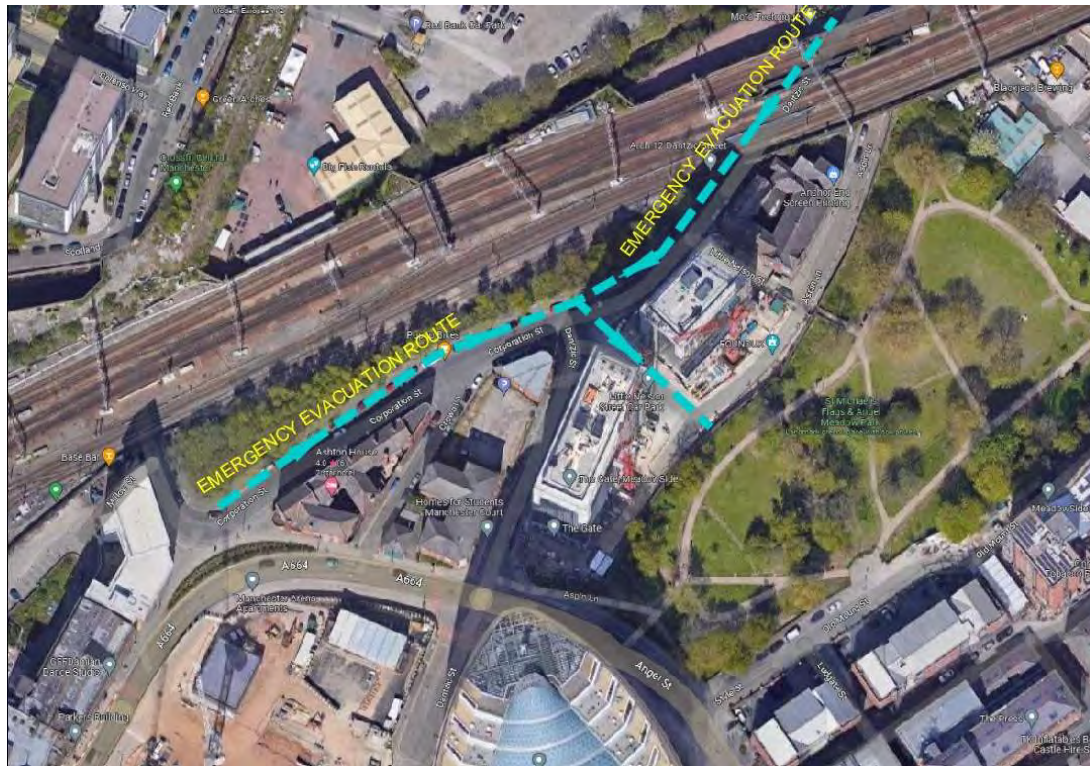
3.2 Flood Mitigation Proposals

- 3.2.1 Although the proposed site level is anticipated to exceed the top of normal range level, the inclusion of flood resilient measures in line with the guidance provided should be employed.
- 3.2.2 The use of flood gates to the substation should be considered as an additional level of flood protection as long as this doesn't prevent level access for servicing and maintenance.
- 3.2.3 Following installation, the substation will only ever need to be accessed by specialist maintenance engineers, as such the flood risk to its users would be considered extremely low due to the anticipated infrequent nature of ongoing servicing.
- 3.2.4 The Environment Agency are responsible for issuing flood warnings throughout England and Wales, prior to attendance the flood warning service for the next 5 days should be interrogated so safe access can be effectively achieved.
- 3.2.5 Regardless of the anticipated minimal level of attendance and the ability to identify potential flood events prior to attendance following the Environment Agency Alert system, an emergency escape

plan is to be provided to all engineers when visiting the site to indicate that in the event of a flood warning any engineer onsite must make their way along Corporation Street to the existing flood zone 1 area as shown in **Figure 3.4**.

- 3.2.6 The substation must also will also be constructed with flood resilience guidance provided by the utility operator to protect the internal equipment during times of flood.

Figure 3.4 – Emergency Escape Route



4.0 MANAGING SURFACE WATER

4.1 Brief

- 4.1.1 In accordance with the NPPF and SFRA, consideration should be given to natural water flows at the site. The development should not adversely affect flow or increase flood risk elsewhere, including increasing run-off rates. The disposal of surface water should be dealt with in a sustainable way and climate change should also be accounted for. The site drainage strategy is discussed in Section 5.

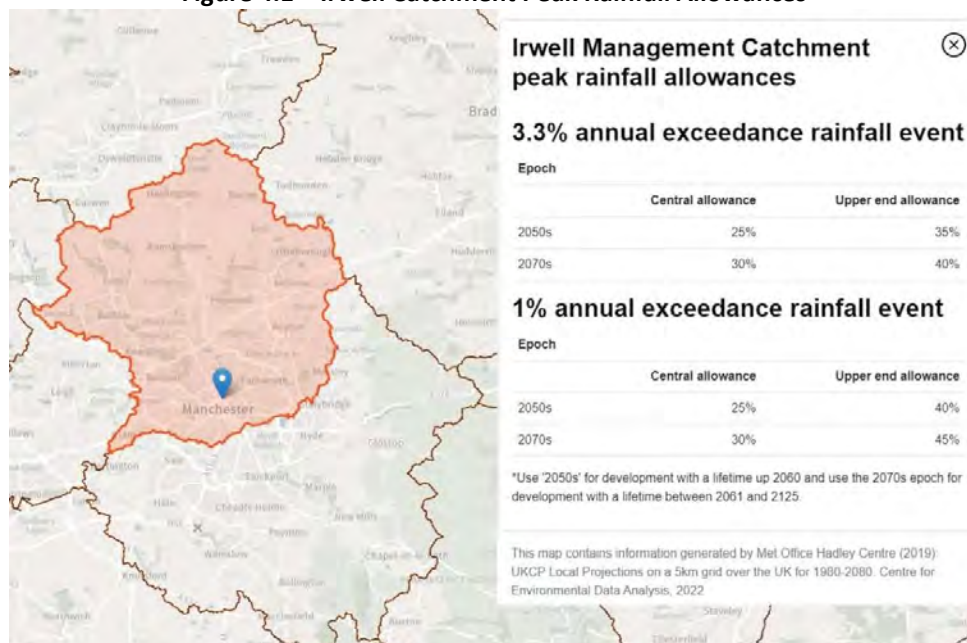
4.2 Previous Situation and Development Proposals

- 4.2.1 The area of land for the proposed substation has previously been used for various material storage and vehicle cleaning services. The existing arch business units are already in use and have been trading for a number of years with a variety of uses, the wider area has been subject to a significant amount of redevelopment for residential uses.
- 4.2.2 The introduction of the substation does not alter the current level of impermeable area with arch business premises being located directly beneath a network rail asset, as such it is considered that surface water flows in relation to the business units will be intercepted by the network rail structure with the arches having no impact on the current flows. The proposed drainage strategy is included Section 5.

4.3 Climate Change

- 4.3.1 There is evidence to suggest that the climate is changing with sea levels predicted to continue to rise along with more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall. The NPPF recommends that the effects of climate change be accounted for in FRA, with consideration of the EA flood maps and local authority SFRA.

Figure 4.1 – Irwell Catchment Peak Rainfall Allowances



- 4.3.2 Increased rainfall or higher intensity short-duration rainfall may increase as a result of climate change. Following assessment of the peak rainfall allowances for the Irwell Management catchment a climate change increase of 45% is identified for the upper allowance 1 in 100-year event. Climate change may also lead to variations in groundwater level which will also be considered during the drainage design.

4.4 Sustainable Drainage Systems (SUDS)

- 4.4.1 SUDS are a desirable way to manage surface water disposal within new developments and SUDS methods for surface water drainage management are discussed further within the SUDS Manual. When designing surface water drainage strategies priority should be given to disposal of surface water via infiltration drainage systems over (first) discharge to watercourses (second) prior to identifying a possible discharge to sewers.

SuDS hierarchy

- Into the ground (infiltration)
 - To a surface water body (rivers, watercourses, lakes, ponds, canals etc.)
 - Into a surface water sewer, highway drain, or another drainage system
 - Into a combined sewer
- 4.4.2 Considering the proximity of the substation to the network rail asset and the potential for contamination to be present within the ground, infiltration will not be possible as part of the proposed drainage strategy. With this in mind given the sites location to the River Irwell discharge from the proposed structure will use the current discharge position directly to the river.

5.0 DRAINAGE STRATEGY

5.1 Surface Water Drainage Strategy

5.1.1 The proposed site is currently classified as brownfield and has an approximate area of 90m² (0.009 hectares), and is understood to currently discharge to the River Irwell at an unrestricted rate. As we have an understanding of the current discharge methodology the most accurate way to understand pre development discharge rates from the existing site, is to produce a hydraulic model usually referred to as a 2-pipe system.

5.1.2 The result of the above Brownfield calculation for a range of critical storm return periods is shown in **Appendix C**, with the flow for the 1 in 100-year critical storm being established as 3.4 l/s

5.1.3 Notwithstanding the above brownfield flows, the non-statutory technical standards for sustainable drainage systems (March 2015) states that:

S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100-year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

5.1.4 With the above in mind there are two methods for calculating the greenfield run-off rates the IH124 method and the ICP method. The IH124 method calculates the peak Greenfield run-off flow rates by correlation of the Soil Index Value, the Average Annual Rainfall and the Site Area (SOIL, SAAR and AREA). The IH124 Method should be used for sites in excess of 50 hectares and the resulting discharge is linearly interpolated for the required area. The ICP method uses the IH124 method and automatically interpolates the discharge for sites less than 50 hectares and therefore this is the method that has been used extract shown in **Figure 5.1**.

Figure 5.1 – Rural Runoff Calculation

ICP SUDS

ICP SUDS Input (FSR Method)

Return Period (Years)

Area (ha)

SAAR (mm)

Soil

Growth Curve

Partly Urbanised Catchment (QBAR)

Urban

Region

Results

QBAR rural (l/s)

0.1

QBAR urban (l/s)

0.1

Return Period Flood

Region	QBAR (l/s)	Q (100yrs) (l/s)	Q (1 yrs) (l/s)	Q (30 yrs) (l/s)	Q (100 yrs) (l/s)
Region 1	0.1	0.1	0.0	0.1	0.1
Region 2	0.1	0.1	0.0	0.1	0.1
Region 3	0.1	0.1	0.0	0.1	0.1
Region 4	0.1	0.1	0.0	0.1	0.1
Region 5	0.1	0.2	0.0	0.1	0.2
Region 6/Region 7	0.1	0.2	0.0	0.1	0.2
Region 8	0.1	0.1	0.0	0.1	0.1
Region 9	0.1	0.1	0.0	0.1	0.1
Region 10	0.1	0.1	0.0	0.1	0.1

OK Cancel Help

Enter Return Period between 1 and 1000

- 5.1.5 The mean annual greenfield run off rate for the site has been calculated as 0.1 l/s for the 1 in 100-year storm 0.1 l/s for the 1 in 30-year storm and 0.0/s for the 1 in 1-year storm event.
- 5.1.6 Flows of the above values are not currently possible to be realised with modern flow control devices as such given that the area of impermeable surface is not being increased the proposed flows from the site will be maintained at the current unrestricted discharge rate of 3.4 l/s.
- 5.1.7 Flows generated by the proposed structure will be discharged via a rainwater pipe which will immediately communicate with the existing discharge position to the River Irwell.

6.0 Conclusions

6.1 Conclusion

- 3.1.1 The proposed substation is Wholly contained within in Environment Agency (EA) Flood Zone 3 Reference to NPPF Table 3 shows that an Exception Test should be applied however as the site could well be considered “minor development” the additional tests are necessarily applicable
- 3.1.2 Notwithstanding the above for completeness both an exception and sequential test has been applied.
- 3.1.3 The existing arch units are wholly contained within in Environment Agency (EA) Flood Zone 1 . As buildings used for shops are classified as less vulnerable all uses are acceptable.
- 3.1.4 The surface water drainage related to the arches is within the ownership of Network Rail as such the current methodology cannot be amended.
- 3.1.5 As the level of impermeable area is not being affected and given the extremely small footprint of the substation site, post development the flows generated will be equivalent to the current brownfield discharge rate of 3.4l/s as such no restrictions will be necessary.
- 3.1.6 The site is considered to be at very low / low overall risk of flooding, provided that surface water flooding risks are appropriately managed during the development. EA mapping indicates that sections of Dantzic Street beyond the proposed development may currently experience a greater level of surface water flooding potential due to the existing topography. It is recommended that finished floor levels at the substation are set at least 150mm above external ground levels to protect against localised pooling of surface water during heavy prolonged rainfall.
- 3.1.7 The risk of flooding elsewhere should not be increased as a result of the development.
- 3.1.8 The nearest surface watercourse is The River Irwell, into which it is proposed to discharge surface water flows in line with the current methodology.
- 3.1.9 The potential for pollution of controlled waters is considered to be low provided best practice procedures are following during construction. Drainage systems should be maintained to ensure that they do not become blocked and unable to discharge.

APPENDICES

APPENDIX A – BOREHOLE LOGS



GROUND TESTS LIMITED										GROUND LEVEL		SITE		REFERENCE														
-BOREHOLE RECORD-										WATER OBSERVED AT		JOB REF		BOREHOLE NO.														
										STANDING WATER LEVEL		DATE																
DESCRIPTION OF STRATA										Type & Size of Hole	Depth m	Core Recovery %	SAMPLES	SYMBOLS	LEVEL	SPT N VALUE	Uncorrected Compressive Strength kN/m ²	Penetration test result kN/m ²	Notes on Characteristics of Drilling Water, Air, Etc.	Depth of Corrosion kN/m ²	Angle of Friction (°)	Soil Density kg/m ³	Moisture Content %					
0-0.18 m Road setts with tarmac surfacing										S152 mm						29.37												
0.18-1.37 m Clay, stone, cinder, ash and brick rubble FILL											1					26.18												
1.37-2.74 m Soft/loose principally clay FILL with occasional pieces of stone											1.91					4												
											2																	
2.74-3.50 m Moist to wet silty brown sand FILL with traces of cinder and brick rubble											3					26.81												
3.50-4.06 m Dense to very dense reddish brown silty fine to medium grained partially cemented sand (Bunter Sandstone)											3.85					26.06	80 blows for 0.20 m penetration											
4.06-7.75 m Very dense partially cemented sand (Bunter Sandstone)											4.06					25.49	80 blows for 0.06 m penetration											
											5																	
											5.59					60 blows for 0.05 m penetration												
											6																	
										7.09					80 blows for 0.06 m penetration													
										7.70					21.80	85 blows for 0.05 m penetration												
Hole terminated at 7.75 m										8																		
										9																		
										10																		

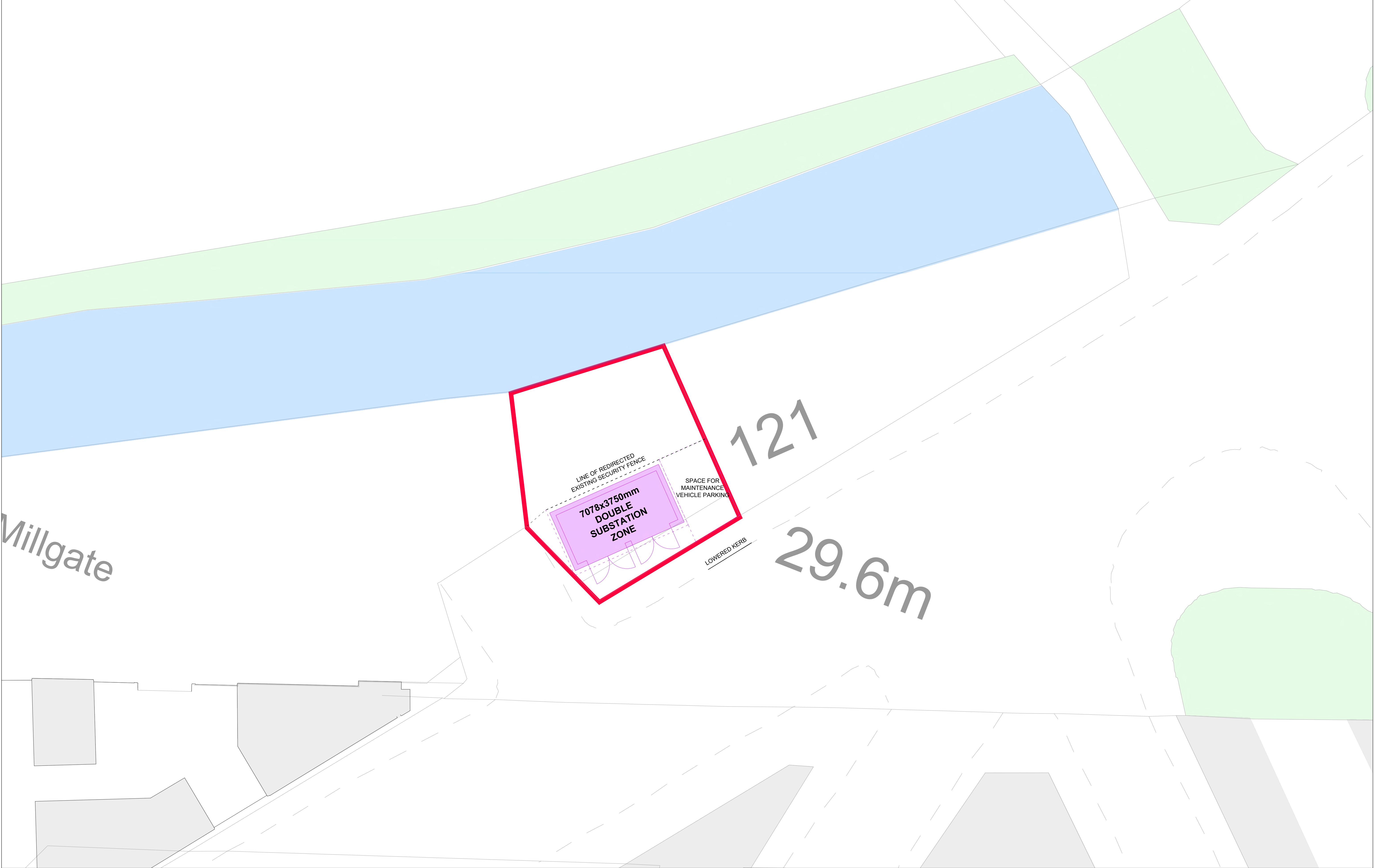
NOTE: With casing in hole to 4.11 m, highest standing water level measured was 1.88 m

Chisel used in fill for 1 hr. Drilling in very dense partially cemented sand 12 hrs.

Legend:
S - Shovel and Auger
H - Hand Auger
C - Cased Hole
A - Open Hole Air
W - Open Hole Water
Undisturbed Sample Obtained
Undisturbed Sample Attempted No Recovery
Disturbed or Water Sample Taken
B - Bulk Sample

APPENDIX B – PLANNING DRAWINGS





APPENDIX C – BROWNFIELD FLOW CALCULATION

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Innovyze	Network 2020.1.3	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coefficient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	0	Number of Storage Structures	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.359
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Water Level
1.000	Ex site 1	15 Winter	100	+0%				28.159
1.001	Ex site 2	15 Winter	100	+0%				28.139

PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap. (l/s)	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Level Exceeded
1.000	Ex site 1	-0.091	0.000	0.32			3.4	OK
1.001	Ex site 2	-0.091	0.000	0.32			3.4	OK

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