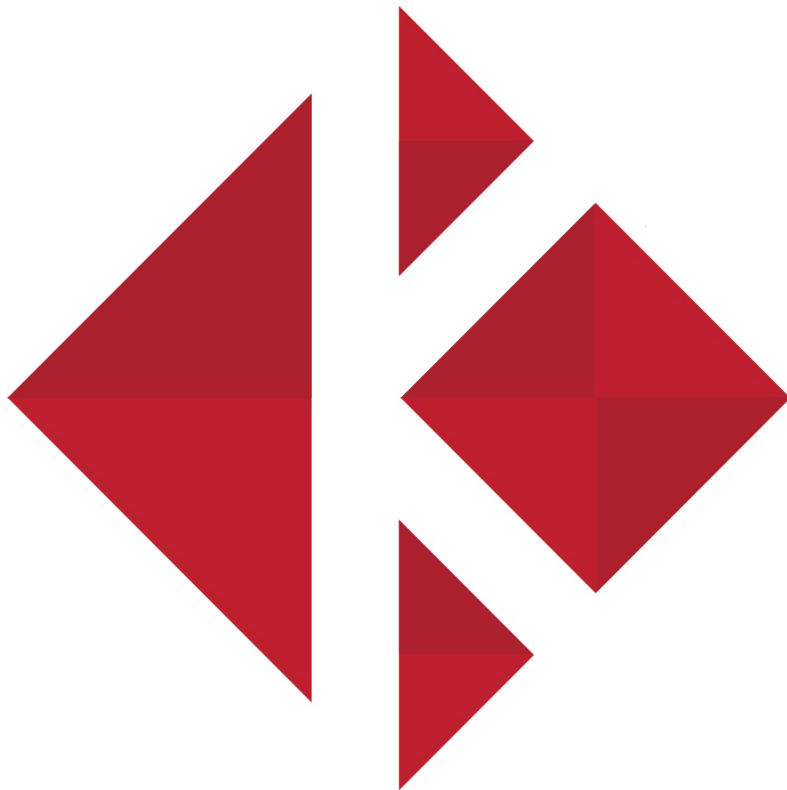




Flood Risk Assessment & Drainage Strategy

JD Sports Campus, Bury

Client: JD Sports PLC Date: 19/12/2025

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1 Document History and Validation

1.1 Revision History

Revision	Issue Date	Reason for Issue
Rev A	27 May 2022	First Issue
Rev B	19 December 2025	Updated Site Layout and Proposals

1.2 Document Validation (Latest Issue)



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2 Executive Summary

This Flood Risk Assessment (FRA) has been prepared for JD Sports PLC to inform the proposed development of their Proposed Campus Hub building. In addition to the Hub building, the site comprises of staff/visitor parking and soft landscaped gardens and recreational space.

This report has been written to meet the requirements of a site-specific FRA in accordance with the National Planning Policy Framework (NPPF) and its associated Planning Practice Guidance (PPG).

The development site lies adjacent to Pilsworth Road and directly west of Hollins Brook Way, Bury, BL9 8RR

The development will see the construction of a single storey Hub building for JD Sports. A central feature of the development will be sports pitches.

A review of the flood risk in the area has been carried out. It has been found that the development site is located within a Flood Zone 1 area.

This FRA has identified that the overall flood risk from all sources is low.

As with every development there are residual risks of flooding. With prudent design and construction and by enacting regular inspection and maintenance of infrastructure, these risks can be minimised. As it is proposed to restrict surface water flows off-site and attenuate flows on-site, the probability of flooding, both on site and downstream of the site will be reduced as a result of the proposed development.

Under these conditions, the flood risk posed to the development is deemed to be acceptable.

The surface water outfall for the site has been constructed as part of the Phase 1 works, the outfall was determined following a review of the drainage hierarchy. Phase 2 of the development has a restricted surface water discharge rate of 9 l/s. To achieve this whilst ensuring no flooding during a 1 in 30 year + CC event and limited flooding in a 1 in 100 year + CC event attenuation will be provided by a below ground attenuation tank, porous paving and rain gardens.

Foul flows will discharge to the adjacent United Utilities sewers.

The proposed drainage systems will be subject to a maintenance plan which should be carried out by an appointed management company. This will ensure adequate maintenance of the infrastructure in the future.

3 Introduction

3.1 Reason for Report

This Flood Risk Assessment (FRA) has been prepared for JD Sports PLC to inform the development of their Proposed Campus Hub. In addition to the Hub building, the site comprises of staff/visitor parking and soft landscaped gardens and recreational space.

This report has been produced to establish the risk of flooding to the proposed development location. It will also identify aspects requiring further study, if any.

3.2 Scope of Report

This report has been written to meet the requirements of a site-specific FRA in accordance with the NPPF paragraphs 170-182, and its associated Planning Practice Guidance (PPG) and includes the following:

- An appraisal of the availability and adequacy of existing information on flood risk.
- An appraisal of the flood risk posed to the site, and potential impact of the development on flood risk elsewhere.
- An appraisal of the scope of possible measures to reduce the flood risk to acceptable levels, if necessary.

3.3 Policy Review

3.3.1 National Planning Policy Framework (NPPF)

The government's national policy on development and flood risk is covered by the NPPF and the associated Planning Practice Guidance (PPG). The principal aim of the NPPF for flood risk is that:

"Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere." (Department for Communities and Local Government, 2012).

3.3.2 Development vulnerability classification

Table 2 of the PPG, enclosed in Appendix A (Department for Communities and Local Government, 2014), identifies the development vulnerability classification for various development types. The primary purpose of the development is to construct new building housing a restaurant and gym which, under Table 2 is classified as '*less vulnerable development*'.

3.3.3 Sequential test

The sequential test aims to steer new development towards areas with the lowest probability of flooding. The sequential test matrix, enclosed in Appendix A (Department for Communities and Local Government, 2014), indicates '*less vulnerable*' developments are appropriate in Flood Zones 1 and 2.

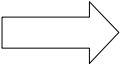
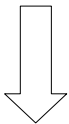
The development fulfils the sequential test, as the area considered for development lies within a Flood Zone 1.

3.3.4 Exception test

An exception test is carried out where a development does not meet the sequential test categories, requiring a demonstration that the benefits of the development outweigh the flood risk. An exception test is not required for this development as it is located within Flood Zone 1 and therefore fulfils the requirements of the Sequential test (refer to Table 3 enclosed in Appendix A).

3.4 Significance criteria

Risk is defined as the combination of the impact and probability of a flood event. The following significance criteria has been used in this report to quantify the severity of flood risk. If any sources of flooding are deemed to pose anything above a low risk to the site, the location and severity of the potential flooding will be examined in more detail to determine whether this is an acceptable risk or whether mitigation measures will be required to ensure that the risk is reduced.

RISK ASSESSMENT MATRIX				
	Impact			
Probability of Event 		Low	Medium	High
	Low	Low	Medium-Low	Medium
	Medium	Medium-Low	Medium	Medium-High
	High	Medium	Medium-High	High

3.5 Local Literature

3.5.1 Bury Council Preliminary Flood Risk Assessment, May 2011

In May 2011, JBA Consulting produced a Preliminary Flood Risk Assessment (PFRA) on behalf of Bury Council. The report was produced to meet the council's duties, as a Lead Local Flood Authority (LLFA) in accordance with the NPPF, using the most up to date flood risk information and planning policy.

The document provides an overview of the historical flood data collated, as well as how existing and potential future flood risk has been assessed. This PFRA has been reviewed to identify key points relevant to the area local to the JD Sports site (PFRA 1km² tile location reference X381 Y408).

- Bury Council is the lead local flood authority for the site. United Utilities are the Statutory Sewers Undertaker.

- The PFRA applies the Defra and WAG pre-determined thresholds criteria for human health and economic activity impacted by future flooding as follows:
 - 200 people at risk
 - 20 businesses at risk, or
 - 1 critical service at risk
- The site is located within an area whereby the above pre-determined thresholds have been exceeded; therefore, the development is classed as lying in a Flood Risk Area. The following exceedances have been recorded against the pre-determined threshold data:
 - Number of people at risk – 5 (205)
 - Number of Non-Residential Properties (businesses) at risk – 30 (50)
 - Number of critical services at risk - 0 (0)
- Flood risk maps contained within the PFRA indicate that the development area is in a Flood Zone 1.
- No United Utilities Sewer Incident Recording System (S.I.R.S) or Wastewater Incident Register System (W.I.R.S) records have been identified in the area.
- 1 No United Utilities External DG5 property is recorded approximately 900m south of the development location.
- The Environment Agency identifies 49 No areas of record flood events within the wider Bury Council. 2 No of these incidents were attributed to flooding of drainage networks with the remainder being from Main Rivers or incidents with an unknown source.
- The Environment Agency, National Dataset, Areas Susceptible to Groundwater flooding (AStGWF) indicates the area is at the lowest risk of groundwater flooding (<25% Risk).
- United Utilities modelling data indicates the sewer discharge volume for a 30yr rainfall event within the developments 1km grid square is 5,297m³, representing a midrange volume within the dataset.
- The development site lies approximately 250m north of the east/west flowing Hollins Brook and approximately 400m east of the north/south flowing River Roch (each classed as Main Rivers).
- Hollins Brook and the River Roch converge approximately 800m west-west-south of the development. East of the River Roch, this convergence forms a localised Flood Zone 2 and 3 area remote of the development. This is the closest flood zone 2/3 to the development area.
- By the 2080s, it is plausible that the amount of rain in extreme storms (with a 1 in 5 annual chance, or rarer) could increase locally by 40%.

3.5.2 Bury Local Plan, Topic Paper 6, Flood Risk, October 2018

The Bury Topic Paper 6 document sets out key policies, plans and strategies relating to flood risk that form the framework for the development of the Local Plan current at the time of publication.

The intention of the Topic Paper is that it can be maintained as a live document that can be updated, if necessary to reflect the most up-to-date circumstances. It should be noted that the document contains more recent updates suggesting that the accuracy of information is being maintained.

The Topic Paper has been reviewed to identify key points applicable to the development site. These are summarised as follows:

- The Greater Manchester Surface Water Management Plan (SWMP), 2012 identified 37 hotspot areas in Bury, representing 8% of the Greater Manchester total. None of these hotspot locations are within the proximity of the development site.
- The Boxing Day 2015 severe flooding event did not affect any area within close proximity of the development site.
- The River Roch is one of two major watercourses in the borough.
- Many sewers discharge directly into open watercourses prone to flooding and in general there is insufficient capacity in the sewers and drainage network to accommodate increasing amounts of surface water. This is largely due to the hilly topology of Bury.

3.5.3 Bury, Rochdale and Oldham Strategic Flood Risk Assessment Volume II – Level 1 SFRA, November 2009

In November 2009, JBA Consulting produced a Level 1 Strategic Flood Risk Assessment (SFRA) for key urban areas within the Bury, Rochdale and Oldham.

The Level 1 SFRA has been reviewed to identify key points applicable to the development site. These are summarised as follows:

- According to the Greater Manchester sub-regional SFRA, the principal source of flood risk across the region is from fluvial flooding.
- Hollins Brook is identified as a smaller watercourse, but this is not discussed in greater detail in terms of flood risk.
- The development site is not within close proximity to the two main areas considered at risk from flooding as a result of the River Roch and associated tributaries catchment area.

3.5.4 Bury, Rochdale and Oldham Strategic Flood Risk Assessment Volume III – Level 2 SFRA, November 2009

In November 2009, JBA Consulting produced a Level 2 Strategic Flood Risk Assessment (SFRA) for key urban areas within the Bury, Rochdale and Oldham.

Following a review of this Level 2 SFRA, there is no information relating to the local area of the development site.

3.6 Correspondence with Local Authorities

At this time, no local authorities have been contacted.

3.7 Site Overview

3.7.1 Existing Site

The development site lies adjacent to Pilsworth Road and directly west of Hollins Brook Way, Bury, BL9 8RR.

A portion of the development site has been constructed, it comprises of landscape, access road and car park areas (herein referred to as 'Phase 1'). The development portion being proposed for construction comprises of the main building, further parking allocation, sports pitches and landscaping (herein referred to as 'Phase 2'). A satellite image showing the site location can be found enclosed in Appendix B.

The site has an area of approximately 1.672ha, of which Phase 2 is approximately 0.90ha. This is made up of approximately 0.87ha of hardstanding.

3.7.2 Surrounding Area

The site is bounded by Pilsworth Road to the north and Hollins Brook Way to the east. A small residential development lies adjacent to the site in the west and to the south lies Hollins Vale Local Nature Reserve.

Vehicular access is from Hollins Brook Way.

3.7.3 Topography

The topographical survey can be found enclosed in Appendix C.

The site falls generally from northeast to southwest with an approximate maximum level of 89.98m AOD along the northeast boundary and a minimum level of 87.45m AOD in the southwest corner.

3.7.4 Hydrogeology

There are no watercourses on site or directly adjacent to the development.

The closest river is the Hollins Brook located approximately 250m to the south.

A man-made lagoon/SuDS pond lies within the Hollins Vale Local Nature Reserve between Hollins Brook and the site in the north.

3.7.5 Geology

Phase 2 site investigation data issued in December 2021 by RoC Consulting for the proposed road widening of Hollins Brook Way suggests that the site comprises of a mean 0.75m thickness of made ground from former development.

Underlying the made ground are glacial deposits of sands and sandy/gravelly clays. No sources of ground contamination were encountered during the investigation.

No ground water was encountered during the investigation which involved drilling works to a maximum depth of 5.45m BGL.

A more comprehensive site investigation was undertaken in March 2022 by Groundtech Consulting Ltd which found that the made ground across the wider site was encountered generally to the same depths as previously reported, but in some areas, this was as deep as 1.8m BGL.

Natural superficial deposits in the form of soft to firm sandy clays and silty clayey sands were encountered below the made ground up to depths of between 15.5m BGL and 17.0m BGL. Below this, firm to stiff sandy slightly gravelly clay was encountered.

Sandstone bedrock was present at depths ranging between 23.5m and 27.3m BGL.

Unlike the initial RoC site investigation, groundwater was encountered by Groundtech at depths ranging between 1.6m and 6.5m BGL.

The Groundtech report concluded that the risk to controlled waters from the site was considered to be low and initial infiltration testing was carried out within the natural sands in accordance with BRE 365, which found infiltration rates ranging between 2.17×10^{-5} and 4.37×10^{-5} m/s which are considered good drainage conditions for the promotion of SuDS solutions.

3.7.6 Existing Drainage

The existing drainage on site has been constructed as part of the Phase 1 works. A drawing showing Phase 1 drainage and a copy of the United Utilities Sewer Records can be found enclosed in Appendix D. The recently constructed drainage includes an outfall on to the public surface water sewer. A Hydrobrake at this outfall restricts discharge from the site to 25 l/s.

3.7.7 Proposed Development

The development proposals can be found enclosed in Appendix E.

The development will see the construction of a new single storey building for JD Sports. The proposed building will house a café, canteen and gym for company staff.

Externally, the development shall comprise of a series of pedestrian footpaths, internal circulation and parking provision. Access to the proposed site will be from both Hollins Brook Way in the east and Pilsworth Road in the north.

A central feature of the development will be sports pitches.

The development will not affect the total site area.

4 Flood Risk Assessment

4.1 Tidal & Fluvial

The EA Flood maps characterise the risk of flooding due to tidal and fluvial sources as follows:

- Flood Zone 1 – Land having less than 1 in 1,000 annual probability of river or sea flooding (low risk)
- Flood Zone 2 – Land having between a 1 in 100 and 1 in 1000 annual probability of river flooding, or, land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding (medium risk)
- Flood Zone 3 – Land having a 1 in 100 or greater annual probability of river flooding, or land having a 1 in 200 or greater annual probability of sea flooding (High risk)

Due to the Site location, there is no risk of tidal flooding.

The flood maps, enclosed in Appendix F, shows that the entire development site is located in a Flood Zone 1.

The closest flood zone 2 and 3 areas are shown approximately 0.8km to the west-south-west of the site where the Hollins Brook and River Roch converge.

Due to the distance from the development location and the local topography, the risk of fluvial flooding is considered low.

Assessment of Impact: LOW

Assessment of Probability: LOW

The overall risk posed due to tidal and fluvial flooding is therefore considered **low**.

4.2 Surface water

The GOV.UK Long Term Flood website map, enclosed in Appendix F, shows that the existing site is susceptible to minor, localised surface water flooding along the southern boundary of the site. In the existing case, this is most likely due to insufficient private drainage infrastructure along the low point of the site. Through the development of detailed design, any risk of surface water flooding will be mitigated by developing a levels strategy to ensure positive discharge of all surface water and a means of draining low points. Based on the small degree of localised flooding indicated, and considering that the site topology will be fully remodelled, the risk of surface water flooding is considered low.

Assessment of Impact: LOW

Assessment of Probability: LOW

The overall flood risk due to surface water is therefore considered **low**.

4.3 Groundwater

Groundwater flooding occurs when water levels in the ground rise above surface elevations. Groundwater flooding does not generally pose a significant risk to life due to the slow rate at which the water level rises.

As discussed in Section 3.5, the JBA Consulting preliminary flood risk assessment indicates that the location of the development is at low risk (less than 25%) of groundwater flooding.

The initial site investigation carried out adjacent to Hollins Brook Way did not encounter any groundwater following intrusive drilling works up to 5.45m BGL. The more comprehensive site investigation carried out by Groundtech Consulting did encounter groundwater at depths ranging from 1.6m and 6.5m BGL.

There are currently no plans to construct basements or partially buried areas as part of the development.

Based on the topography of the site, which is located several meters above the location of the River Roch to the west and Hollins Brook to the south, the probability and impact of any groundwater flooding occurring on site can be considered low.

Assessment of Impact: LOW

Assessment of Probability: LOW

The overall risk posed to the site due to groundwater flooding is therefore considered **low**.

4.4 Artificial drainage

All existing drainage recently constructed within the site as part of the Phase 1 works has been designed to modern standards and is equipped with the required capacity to manage surface water runoff generated on site.

Assessment of Impact: Low

Assessment of Probability: Low

The overall risk posed to the due to existing artificial drainage flooding is therefore **low**.

4.4.1 Proposed drainage

The proposed drainage strategy for the site has been designed in accordance with the relevant design standards, industry guidance and government guidance.

Surface water discharge from Phase 2 will be restricted to 9 l/s before it is discharge into the recently constructed Phase 1 development. Attenuation has been provided within Phase 2 via a below ground attenuation tank, porous paving and rain gardens. Traditional drainage infrastructure such as channel drains, gullies and kerb drains have been proposed to intercept surface water runoff.

The capacity of any proposed drainage system will be set to ensure no flooding occurs in a 1 in 30 rainfall event and any flooding from a 1 in 100 (+40% allowance for climate change) rainfall event will be contained within the site boundary and will not flood any structures or properties.

Any discharge into public sewers will be agreed with United Utilities.

Additionally, a robust drainage maintenance strategy will ensure risk of flooding from any proposed drainage system will be low. Should the above action be taken, this will reduce the risk of flooding from the proposed drainage system.

Assessment of Impact: LOW

Assessment of Probability: LOW

The overall risk posed due to proposed drainage flooding is therefore considered **low**.

4.5 Infrastructure failure

4.5.1 Reservoir failure

The GOV.UK Long Term Flood Map (extract enclosed in Appendix F) shows that the site is not at risk of flooding from reservoir failure.

Assessment of Impact: LOW

Assessment of Probability: LOW

4.5.2 Canal failure

There are no canals near the site and it therefore safe to assume that there is a negligible risk of canal flooding on site.

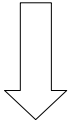
Assessment of Impact: LOW

Assessment of Probability: LOW

The overall risk posed to the site due to infrastructure flooding is therefore considered **low**.

4.6 Flood risk summary

A summary of the flood risks identified in Section 2 are shown in the table below.

RISK ASSESSMENT MATRIX				
	Impact			
Probability of Event 		Low	Medium	High
	Low	A, B, C, D, E, F, G		
	Medium			
	High			

Key:

- A: Tidal and Fluvial Flooding – (Section 4.1)
- B: Surface Water/Pluvial/Overland Flow – (Section 4.2)
- C: Groundwater Flooding – (Section 4.3)
- D: Artificial Drainage: Existing Drainage: Existing Site Drainage – (Section 4.4.1)
- E: Artificial Drainage: Proposed Drainage – (Section 4.4.2)
- F: Infrastructure Failure: Reservoirs – (Section 4.5.1)
- G: Infrastructure Failure: Canals – (Section 4.5.2)

5 Flood Risk Analysis & Mitigation

5.1 Mitigation

Surface water flooding from all sources is considered to be low risk.

It should be noted that the type of development itself is 'less vulnerable', meaning the impact of flooding occurring will have a lesser consequence due to the proposed use within the building.

The recent construction of the Phase 1 drainage system designed to current standards will offer a good management of surface water on site. Combined with the proposed development of the Phase 2 works, assuming maintenance/repairs carried out, then the development has done everything possible to reduce the risk of surface water flooding.

5.2 Residual Risk

Whilst the risk of flooding to the development is low, it should be acknowledged that there is potential for residual risks. The residual risk comes from the failure or blockage of site drains and sewers, or lack of maintenance of nearby infrastructure. Prudent design and planning will mitigate the potential impact these could have on the development. Enacting regular inspection and maintenance regimes and careful working practices should reduce the potential of failures of infrastructure. The utilisation of building finished floor levels above the surrounding area will prevent inflow into the buildings.

Designing in allowances for climate change provides extra capacity and so provides a level of future proofing in the drainage system for the potential changes to the climate over the design life of the development.

5.3 Access & Egress

Access and egress to the site should be properly managed in the event of flooding occurring on site. External levels should be developed to ensure safe routes for site users even during extreme rainfall events.

6 Drainage Strategy

This section of report will provide information used in the development of the drainage design and the principles that were followed. The drainage strategy uses sustainable principles and will aim to promote approaches in keeping with the nature of the existing site and current legislation.

This section should be read in conjunction with proposed drainage layout enclosed in Appendix G.

6.1 Design standards and guidance

The following (current revisions at the time of issue) design standards, industry guidance, government guidance and literature are used in the development of this drainage strategy.

British Standards and European Norms (BS EN)

- BS EN 752: Drain and sewer systems outside buildings
- BS EN 12056: Gravity drainage systems inside buildings

Construction Industry Research and Information Association (CIRIA)

- C753: The SuDS manual

Department of Communities and Local Government (DCLG)

- Building Regulations Approved Document H: drainage and waste disposal
- National Planning Policy Framework (NPPF)
- Flood risk and coastal change Planning Policy Guidance
- Climate Change Planning Policy Guidance
- Water supply, wastewater and water quality Planning Policy Guidance

Department of Environment, Food and Rural Affairs (DEFRA)

- Non-Statutory Technical Standards for Sustainable Drainage – Practice Guidance

Water Research Centre

- Sewerage Sector Guidance Appendix C – Design And Construction Guidance

6.2 Proposed Surface Water Drainage

6.2.1 Method of Surface Water Discharge From Site

The location of surface water discharge for this site has already been determined and constructed as part of the Phase 1 development works for this site. However, it is important to demonstrate through this FRA and Drainage Strategy how the decision to discharge surface water from the site was made.

All proposed surface water drainage systems should give preference to the SuDS hierarchy, which sets out that schemes should aim to mimic natural drainage as closely as possible, and that discharge of surface water runoff should be dealt with in the following ways (in order of preference):

- Collection for non-potable use
- Infiltration to ground
- To a above ground surface water body
- To a surface water sewer or other piped surface water drainage system
- To a combined sewer

When the first phase of this development was constructed the preference of collection of rainwater for non-potable use was not included in the hierarchy and therefore not considered as an option on site. Although not used as a form of discharge, the use of this as a form of SuDS has been discussed and is included further down in this section of the report.

The second preference of the drainage hierarchy proposes drainage to be discharged via infiltration to ground. Although initial proposals in Rev A of this document outlined potential for this to be a viable option this was later found not to be true. In a drainage strategy addendum written for the previous proposal testing by Groundtech Consulting was shown. The tests carried out on the 18/07/2022 demonstrated that results offered very low permeability in the ground and therefore deem the site unsuitable for the use of infiltration as a form of discharge. Additionally this site investigation encountered groundwater in some locations as shallow as 1.6m deep, which would limit the potential for infiltration SuDS.

Hollins Brook is located 200m south of the proposed development and presents itself as a possible connection to discharge surface water from the site too. As this option was assessed further it was deemed unsuitable, in between the brook and the site is Hollins Vale Local Nature Reserve, a Site of Biological Importance. Constructing through this area was therefore not feasible so this option was not progressed with.

Shown in the previous revision and the addendum submitted, a 300mm diameter public surface water sewer located on Pilsworth road was identified as a point of connection for surface water to discharge to from site. This was the option that was chosen and constructed during the phase 1 works. A discharge rate from the site was proposed at 25.0 l/s and received the required agreements.

As this development is being carried out in two phases the flow rate from phase 2 is restricted to 9 l/s before flowing in to Phase 1 to which that is then limited to 25.0 l/s when connecting to the public sewer. Therefore, the drainage strategy for Phase 2 of the project must provide enough attenuation to allow this reduced discharge rate.

6.2.2 Climate Change and Flooding Allowance

In line with the NPPF and Bury Council planning guidance, climate change should be considered for all developments. In accordance with this guidance, a climate change factor of 40% will be assessed for the 1 in 100-year event for the proposed surface water drainage system. For the 1 in 30-year event a climate change factor of 35% will be applied to the rainfall data.

Incorporating this into the drainage strategy there will be no flooding for a 1 in 30 year plus climate change storm event. However, for the 1 in 100 year plus climate change storm event small amounts of localised flooding to landscaping and sports pitches will be allowed. This flooding will not affect any buildings on site or access to the site.

6.2.3 Surface Water Drainage Proposals

To allow for a discharge rate from Phase 2 at 9 l/s whilst also preventing all flooding up to and including a 1 in 30 year + CC event and allowing small amounts of flooding for 1 in 100 year + CC events SuDS that provide attenuation must be proposed.

Initially blue and green SuDS were proposed but due to constraints on site most were not feasible. Spatial constraints meant that bioretention ponds and swales could not be proposed on site, whilst blue or green roofs were not feasible due to the required pitch of the roof. However, rain gardens have been adopted around the site as they can be proposed in smaller locations where other SuDS cannot fit.

Four rain gardens have been proposed within Phase 2 of the development however the attenuation provided by these would not be sufficient to prevent flooding when restricting the site discharge rate. To provide the required attenuation as well as the rain gardens, 2120 m² of porous paving and a geocellular attenuation tank with a volume of 320m³ have been proposed. The porous paving will cover car parking bays (excluding electric vehicle charging bays), the padel courts and the MUGA pitch. The geocellular attenuation tank has been proposed under the carpark to the north of the building.

Traditional drainage infrastructure is proposed immediately around the new building to manage the collection of surface water. Channel drains are positioned at all building entrances to prevent runoff from entering the internal areas. The roadway will be drained by kerb drains and gullies designed to capture and discharge surface water efficiently. All flows from these traditional drainage features will discharge into the surface water network where they will be attenuated within the below ground attenuation tank and porous paving.

6.2.4 InfoDrainage Models

The above proposals were modelled in InfoDrainage using FEH rainfall data and climate change allowances specified in Section 6.2.2 of this report. The results of the InfoDrainage model can be found in Appendix I.

The modelled impermeable area for the Phase 2 development was 0.872 ha. Flat areas of soft landscaping were not included in the catchment as runoff from these can be assumed as negligible. Also, the bin store was omitted from the catchment too as the gully here will be connected into the foul drainage system.

The results of the InfoDrainage model have shown that there is no flooding during any storm events up to the 1 in 30 years + 35% climate change storm events. A small negligible amount of flooding occurs at the 1 in 100 years + 40% climate change storm events. In the eastern most rain garden flooding of 3m³ occurs, this small flooding amount will stay on site in a low point and will not enter any building on site.

The model shows the below ground attenuation tank is fully utilised when attenuating water during storm events. Attenuation is provided elsewhere via porous paving in sports pitches and car parking, during the most critical storm events 40m³ of storm water is attenuated in porous paving across the site.

6.3 Proposed Foul Water Drainage

6.3.1 Strategy

A new drainage system will be constructed for the proposed development in accordance with BS EN 752 and Approved Document H. The foul flows will be collected in a separate gravity foul water drainage system. The pipework will be 150mm diameter and laid at falls to suit self-cleansing velocities. The foul water will drain to a sump pump, this will pump the foul water to FW11a where a gravity connection can then be made under Pilsworth Road into an existing public combined sewer.

A below ground foul attenuation tank is also proposed to provide 24 hours of emergency attenuation in the event of a pump failure. Currently the tank is sized for foul flows from the previous Phase 2 proposals, the tank has yet to be reduced in size. Once more accurate information is available regarding the new foul flows from the Phase 2 development the tank will be made smaller to suit.

The gravity connection under Pilsworth road will connect into a United Utilities combined sewer with a diameter that is yet to be confirmed. Immediately downstream of the proposed connection point the public sewer joins a 300mm diameter combined sewer. Therefore, it is assumed that the diameter of pipe the proposed connection will be made in to will be adequate for taking the required flows from the development.

All connections will be subject to agreement with United Utilities, including a S106 agreement.

6.3.2 Proposed flow rates

The drainage system has been designed to achieve a target self-cleansing velocity of 0.75m/s, but as a minimum have a gradient of no flatter than 1 in 40 when the peak flow is less than 1l/s and no flatter than 1 in 150 provided there are at least 5No. toilets connected to the pipe, in accordance with Approved Document Part H.

Once the internal design flows have been determined through detailed design, peak foul water flows will be calculated using BS EN 12056-2 and the proposed foul fixtures within the building.

7 Maintenance

Maintenance of the foul and surface water drains for the development will fall under a private maintenance plan and be the responsibility of the site owner.

A maintenance regime should be enacted regularly as part of the normal facilities management duties. A maintenance schedule should be established following construction and updated as necessary throughout the lifetime of the building. A record maintenance log should be kept and updated accordingly.

The following schedule should be used as the basis of maintenance at the site.

Maintenance Activity		Frequency of activity (months)				
		1	3	6	12	A/R
	Manholes (General)					
1	Check cover is not damaged and fits securely			X		
2	Check inlet and outlet are free flowing and not obstructed			X		
3	Check security of fitting for all manhole ironmongery			X		
4	Check benching for scour or build-up of debris			X		
5	Check joints in construction for damage or inflow				X	
6	Record maintenance inspection in log book			X		
	Gullies & drainage channels					
7	Check grating is undamaged and fits securely	X				
8	Inspect internal gully/sump chamber, remove debris from traps and check outfall is clear and free flowing			X		
9	Record maintenance inspection in log book	X				
	Conveyance Pipes					
10	Carry out flow test between manholes to ensure free flow of system				X	
11	Jetting and clearance of blockages, debris or silt					X
12	Inspection by CCTV – should problem arise as a result of the flow test					X
13	Cutting of growth into pipe					X
14	Record maintenance inspection in log book				X	X
	Flow Controls					
15	Check flow control mount to ensure secure fitting		X			
16	Check inlet to flow control is free flowing and not obstructed		X			
17	Remove silt from the sump			X		

18	Record maintenance inspection in log book		X			
	Attenuation Structure					
19	Inspect inlet/outlet chambers for evidence of poor operation, and clear when necessary.			X		
20	Visual inspection of overflow pipes and vent pipes				X	
21	Remove sediment from pre-treatment sump chamber			X		
22	Monitor any inspection chambers. Check for water level and silt at base of tank				X	
23	Record maintenance inspection in log book			X		
	Bioretention/Trees					
39	Inspection	X				
40	Litter and debris removal	X				X
41	Grass cutting					X
42	Weed and invasive plant control	X				X
43	Shrub management (including pruning)	X				X
44	Sediment management		X			
45	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required.					X
46	Structure rehabilitation / repair					X
47	Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours.	X				X
48	Repair erosion or other damage by re-turfing or reseeding					X
49	Inspect vegetation coverage			X		
50	Relevel uneven surfaces and reinstate design levels					X
51	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface					X
52	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip					X
53	Remove and dispose of oils or petrol residues using safe standard practices					X
54	Inspect inlets, outlets and overflows for blockages, and clear if required.	X				
55	Record maintenance inspection in log book	X				X

8 Conclusion & Recommendations

8.1 Conclusion

This FRA has considered the flood risk posed to the site by tidal and fluvial sources, surface water, groundwater, artificial drainage and infrastructure sources. The FRA has identified that the overall flood risk is low.

The risk posed by the proposed drainage will be minimised by ensuring the site is adequately drained under controlled conditions and, where possible, ensure that the ground slopes away from any structures within the development to assist in mitigating flood risk from surface water exceedance flows.

Any proposed surface water drainage strategy for the site has been designed in accordance with the relevant design standards, industry guidance and government guidance. Flows from Phase 2 discharge in to Phase 1 at a pre-agreed 9 l/s. The network is designed to not flood for a 1 in 30 year + 35% climate change event and allow small amounts of flooding for a 1 in 100 year + 40% climate change event. An attenuation tank, of 320m³ in volume, has been proposed along with 2120m² of porous paving and 4 rain gardens. Together this achieves the criteria for no flooding at a 1 in 35 + CC year event and small amounts for a 1 in 100 + 40%CC year event.

8.2 Further Recommendations

Further discussion should be had with the relevant authorities as design develops to ensure any proposed surface water drainage system, including flow rates, are acceptable by the LLFA (Bury Council), United Utilities and the existing drainage asset management team.

Appendix A – NPPF Technical Guidance

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,

³ For any proposal involving a change of use of land to a caravan, camping or chalet site, or to a mobile home site or park home site, the Sequential and Exception Tests should be applied.

⁴ See Circular 04/00: Planning controls for hazardous substances (paragraph 18) at: www.communities.gov.uk/publications/planningandbuilding/circularplanningcontrols

⁵ In considering any development proposal for such an installation, local planning authorities should have regard to planning policy on pollution in the National Planning Policy Framework.

⁶ For definition, see *Planning for Sustainable Waste Management: Companion Guide to Planning Policy Statement 10* at

www.communities.gov.uk/publications/planningandbuilding/planningsustainable

⁷ See footnote 3.

restaurants and cafes, hot food takeaways, offices, general industry, storage and distribution, non-residential institutions not included in "more vulnerable", and assembly and leisure.

- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do *not* need to remain operational during times of flood.
- Sewage treatment works (if adequate measures to control pollution and manage sewage during flooding events are in place).

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, *subject to a specific warning and evacuation plan*.

Notes to table 2:

a. This classification is based partly on Department for Environment, Food and Rural Affairs and Environment Agency research on *Flood Risks to People (FD2321/TR2)*⁵ and also on the need of some uses to keep functioning during flooding.

b. Buildings that combine a mixture of uses should be placed into the higher of the relevant classes of flood risk sensitivity. Developments that allow uses to be distributed over the site may fall within several classes of flood risk sensitivity.

c. The impact of a flood on the particular uses identified within this flood risk vulnerability classification will vary within each vulnerability class. Therefore, the flood risk management infrastructure and other risk mitigation measures needed to ensure the development is safe may differ between uses within a particular vulnerability classification.

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.

Appendix B – Site Location Plan





Just Health Bury
HGV Medical Clinic

Fire 2000

Pilsworth Rd

Pilsworth Rd

Hollins Brook Way

JD Group

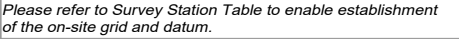
Brasher

Hollins Brook Way

Beech wood Apartments

Hollins Vale Local
Nature Reserve

Appendix C – Topographical Survey



1	05.05.22	External road & post-demo	JC	GH1363
Rev	Date	Description	Drawn	Q. Ref

24 Riverside Studios
Amethyst Road
Newcastle Business Park
Newcastle
NE4 7YL
t. (0191) 273 6391
newcastle@greenhatch-group.co.uk
www.greenhatch-group.co.uk

Derby (Head Office)	St Albans	London
Rowan House Duffield Road Little Eaton Derby DE21 5DR	Unit B, The Courtyard Alban Park St Albans Hertfordshire AL4 0LA	27 Cornwall Terrace Mew Regents Park London NW1 5LL
t. (0133) 283 0044	t. (0172) 785 4481	t. (0207) 224 1806

AEW
Architects

Former A-Plant Site
D Sports, Hollingsbrook Way
Bury, BL9 8RR

Topographical Survey

SCALE A2@ 1: 500	DATE 23.02.22
DRAWN JC	QUALITY REF GH12966

level datum	See notes
tid orientation	See notes

job number	42997
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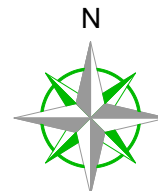
Drawing No.	Rev.
42997 T	1

This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.

dimensions should be checked on site prior design and construction.

ainage information (where applicable) has been usually inspected from the surface and therefore could be treated as approximate only.

Station	Easting (m)	Northing (m)	Level (m)
GH1	381483.164	408720.048	88.790
GH2	381577.831	408758.662	89.298
GH3	381617.360	408659.474	87.980
GH4	381522.390	408647.564	87.546



OS Note:
Some services may have been omitted due to parked vehicles.
The Ordnance Survey tile is to be used as a guide only.

OS Buildings Surveyed Buildings

This survey has been orientated to the Ordnance Survey (O.S.) National Grid OSGB36(15) via Global Navigational Satellite Systems (GNSS) and the O.S. Active Network (OS Net).

A true OSGB36 coordinate has been established near to the site centre via a transformation using the OSTN15GB & OSGM15GB transformation models.
The survey has been correlated to this point and a further one or more OSGB36 (15) points established to create a true O.S. bearing for angle orientation.

No scale factor has been applied to the survey therefore the coordinates shown are arbitrary & not true O.S. Coordinates which have a scale factor applied.

Please refer to Survey Station Table to enable establishment of the on-site grid and datum.

Legend:

Buildings	Overhead Cables	IC	Inspection chamber	Ba	Bollard
Wall	Overhead cable	Plw	Pipe insert	B	Illuminated bollard
Kerb line	Fence edge	Sy	Gully	Bn	Rubbish bin
Line marking	Glass window	Bq	Block gully	Vp	Vent pipe
Drop kerb	Canopy/Overhang	Dp	Down pipe	Gd	Ground light
Centre line	Verge	Pipe	Pipe above ground	Lbox	Letter box
100,000	Tree / Bush / Slipping	MH	Manhole	Lr	Ladder
Area of Undergrowth	Woodland	Station Level	Water level	Sh	Site
Ridge Level	Ridge Level	FL	Flood light	IFL	Internal floor level
Eaves Level	Eaves Level	Lp	Lamp post	THL	Threshold level
Flat Roof Level	Flat Roof Level	Tp	Telegraph post	Sp	Sign post
TWL	Top of Wall Level	Ep	Electricity post	TH	Trench hole
Fence types:	Fence types:	TI	Traffic light	BH	Bonhole
Interwoven	Interwoven	Bus	Bus stop	ELC	Electric
IR	Iron Railings	Sv	Stop valve	BT	British Telecom
WM	Wire Mesh	St	Stop tap	Cbox	Control box
P&R	Post & Rail	Er	Earth out	TT	Tackle
PW	Post & Wire	G	Gate	BP	Brick paved
CL	Chain Link	Gas	Gas valve	CFS	Concrete paving slabs
W	Wooden Panels	Air	Air valve	CWR	Cover
CP	Concrete Panels	ICU	Underside inspection	IC	Inspection chamber
SW	Street Works	Wo	Wash out	R/wall	Retaining wall
SW	Street Works	Re	Rodding eye	UTR	Unable to raise
SW	Street Works	BB	Ballistic beacon	TCL	Tree canopy level
SW	Street Works	CTV	Cable tv	G	Girth
SW	Street Works	Mkr	Marker post	MG	Multi grills
SW	Street Works	Gmr	Gas meter post	Smp	Tree Stump
SW	Street Works	So	Softs	CL	Cover level
SW	Street Works	So	Softs	CL	Cover level

1	05.05.22	External road & post-demo	JC	GH13638
Rev.	Date	Description	Drawn	Q. Ref.

☐ Topographical Surveys ☐ Measured Building Surveys
☐ Site Engineering ☐ 3D Laser Scanning
☐ Utility / CCTV Surveys ☐ Revit & BIM Models

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CLIENT
AEW Architects

PROJECT
**Former A-Plant Site
JD Sports, Hollingsbrook Way
Bury, BL9 8RR**

TITLE
Topographical Survey

SCALE A2@ 1: 500	DATE 23.02.22
DRAWN JC	QUALITY REF GH12966

Level datum Grid orientation	See notes See notes
Job number Drawing No.	42997 42997_T

Rev.	1
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Comments
This plan should only be used for its original purpose. Greenhatch Group accepts no responsibility for this plan if supplied to any party other than the original client.
All dimensions should be checked on site prior to design and construction.
Drainage information (where applicable) has been visually inspected from the surface and therefore should be treated as approximate only.
Notes:

Station Information:

Station	Easting (m)	Northing (m)	Level (m)
GH1	381483.164	408720.048	88.790
GH2	381577.831	408758.662	89.298
GH3	381617.360	408659.474	87.980
GH4	381522.390	408647.564	87.546

Appendix D – Existing Drainage & Sewer Map



- NOTES:**
1. DRAINAGE PIPE SIZES AND LEVELS BASED ON AS-BUILT INFORMATION PROVIDED BY CHADOCK & ASSOCIATES, L.L.C. (CVA) 10/15/2014.
 2. THIS DRAWING IS BASED ON THE ARCHITECTS' 10/15/2014 SITE PLAN.
 3. 10% AVERAGE INCH PER 100' (1:125) SLOPE.
 4. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH KENNESAW CITY REZONING ORDINANCE 10.01.010 (2010).
 5. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH BUILDING REGULATIONS.
 6. ALL CONSTRUCTION SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE CITY OF KENNESAW.
 7. ALL LEVELS TO BE CONFIRMED BY CONTRACTOR ON SITE PRIOR TO WORK COMMENCING.
 8. ALL EXISTING AND PROPOSED PIPES SHALL BE APPROPRIATE AND MAY BE UPDATED FOLLOWING FIELD SURVEY AND INSPECTION.
 9. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF KENNESAW.
 10. ALL UTILITIES ARE "UNKNOWN UNLOCATED" OTHERWISE INDICATED.
 11. ALL EXISTING CHIMNEYS ARE 150mm UNLESS INDICATED OTHERWISE.
 12. UNLESS INDICATED OTHERWISE ALL PIPES TO BE SLOPED TO SOFFIT.
 13. WHERE PROPOSED DRAINAGE ARE IN PROXIMITY TO EXISTING PIPES, THE PROPOSED DRAINAGE SHALL BE DEEPER TO AVOID THE EXISTING PIPES.
 14. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE CITY OF KENNESAW.
 15. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH BUILDING REGULATIONS.
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C07	05.11.25	SURFACE WATER PUMP ADDED	R.B	P.V
C06	20.06.24	AS-BUILT CONSTRUCTION ISSUE	R.B	P.V
C05	20.03.24	SITE LAYOUT UPDATED	R.B	P.V
C04	01.02.24	TANK LOCATION UPDATED	R.B	P.V
C03	05.12.23	UPDATED TO NEW FLOW RATE	R.B	P.V
C02	22.11.23	UPDATED TO NEW FLOW RATE	R.B	P.V
C01	13.11.23	CONSTRUCTION ISSUE	M.M	R.B

REV	DATE	DESCRIPTION	DRN	CHK
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CLIENT	JD SPORTS PLC
--------	---------------

PROJECT NAME
JD SPORTS OFFICE BURY

DRAWING TITLE
PROPOSED DRAINAGE LAYOUT PHASE 1

DATE	SCALE	SHEET SIZE	REV
00-11-00	1:050	A0	005

DATE FILED	FILED	FILE	507
DRAWING STATUS			

FC - FINAL CONSTRUCTION ISSUE

DRAWING NUMBER

211124 - KRD - XX - EX - DR - C - 00

Kennedy Redford

**20
Market Street,
Altrincham,
WA141PF**

FAO:

How to contact us:

**United Utilities Water Limited
Property Searches
Haweswater House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP**

Telephone: 0370 7510101

E-mail: propertysearches@uuplc.co.uk

**Your Ref: JD Sport
Our Ref: UUPS-ORD-353445
Date: 20/12/2021**

Dear Sirs

Location: JD Sports JD Sports Hollinsbrook Way, Bury, BL9 8RR

I acknowledge with thanks your request dated 16/12/2021 for information on the location of our services.

Please find enclosed plans showing the approximate position of United Utilities' apparatus known to be in the vicinity of this site.

The enclosed plans are being provided to you subject to the United Utilities terms and conditions for both the wastewater and water distribution plans which are shown attached.

If you are planning works anywhere in the North West, please read United Utilities' access statement before you start work to check how it will affect our network. <http://www.unitedutilities.com/work-near-asset.aspx>.

I trust the above meets with your requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please [contact us](#).

Yours Faithfully,



Karen McCormack
Property Searches Manager

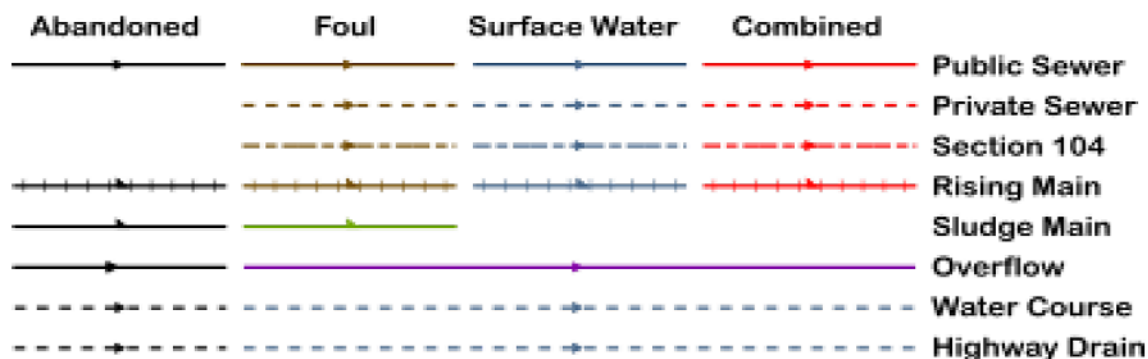
TERMS AND CONDITIONS - WASTEWATER AND WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

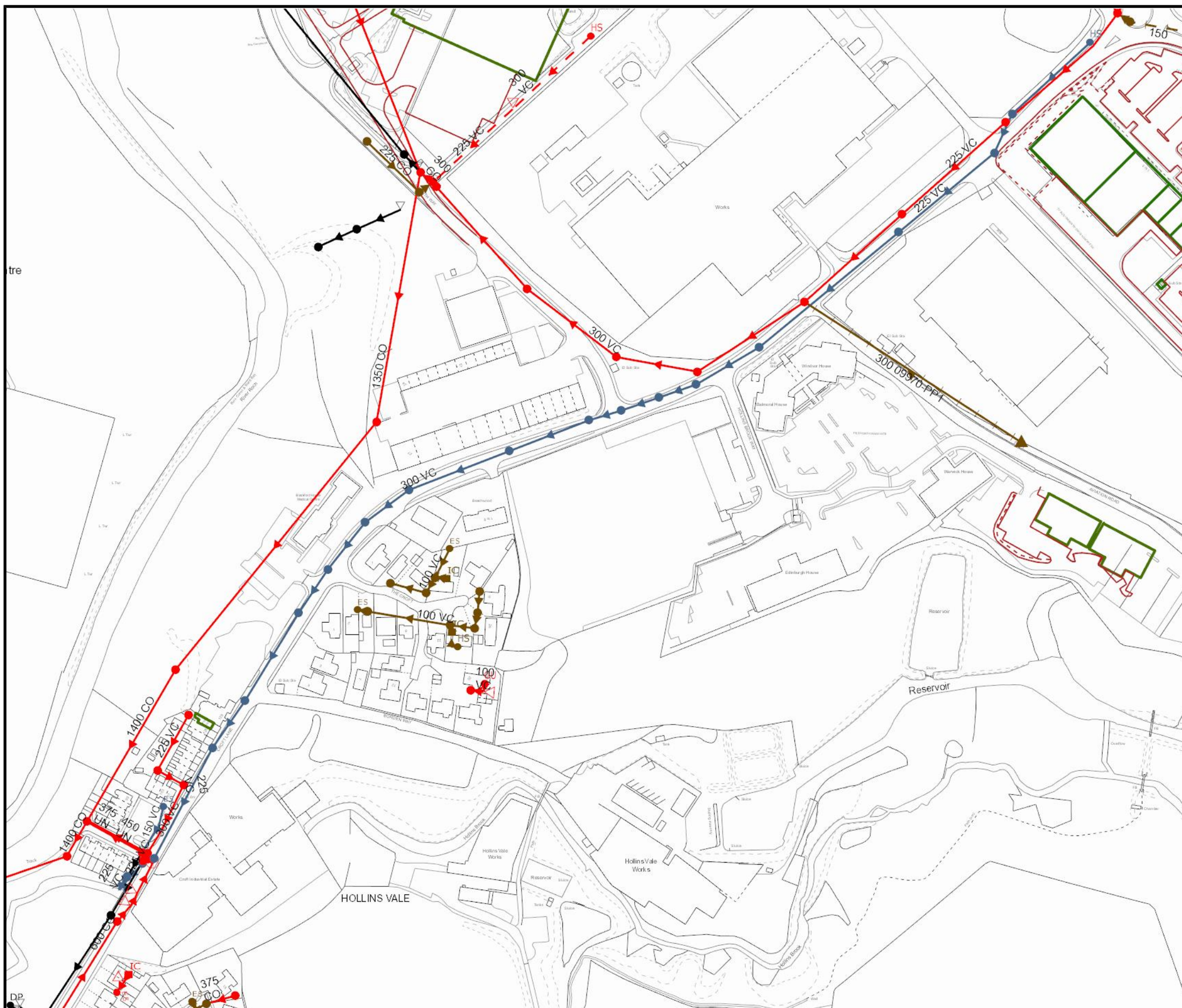
- This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.
- This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.
- In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.
- The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.
- The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.
- This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.
- No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.
- If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.
- This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

Wastewater Symbolology



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	



Water for the North West

SEWER RECORDS

Address or Site Reference

JD Sports JD Sports Hollinsbrook
Way,
Bury,
BL9 8RR

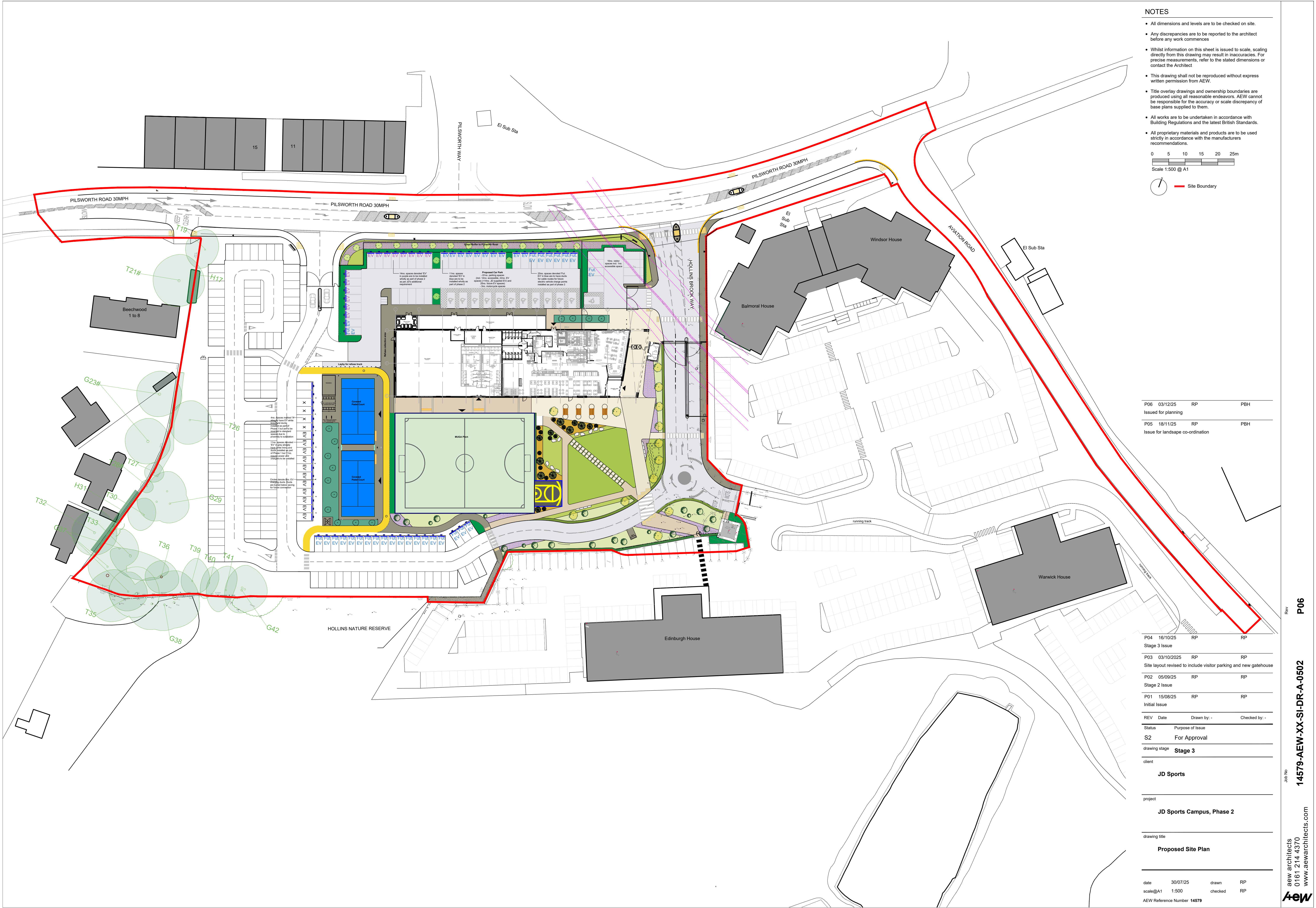
Scale: 1:2500
Date: 20/12/2021

Printed by: Property Searches

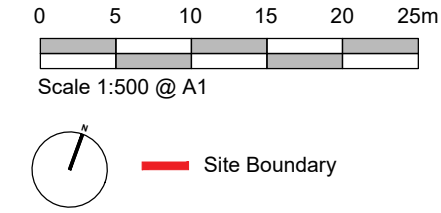
The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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Appendix E – Proposed Site Plan



- NOTES
- All dimensions and levels are to be checked on site.
 - Any discrepancies are to be reported to the architect before any work commences
 - Whilst information on this sheet is issued to scale, scaling directly from this drawing may result in inaccuracies. For precise measurements, refer to the stated dimensions or contact the Architect
 - This drawing shall not be reproduced without express written permission from AEW.
 - Title overlay drawings and ownership boundaries are produced using all reasonable endeavors. AEW cannot be responsible for the accuracy or scale discrepancy of base plans supplied to them.
 - All works are to be undertaken in accordance with Building Regulations and the latest British Standards.
 - All proprietary materials and products are to be used strictly in accordance with the manufacturers recommendations.



P06	03/12/25	RP	PBH
Issued for planning			
P05	18/11/25	RP	PBH
Issue for landscape co-ordination			

P04	16/10/25	RP	RP
Stage 3 Issue			
P03	03/10/2025	RP	RP
Site layout revised to include visitor parking and new gatehouse			
P02	05/09/25	RP	RP
Stage 2 Issue			
P01	15/08/25	RP	RP
Initial Issue			
REV	Date	Drawn by: -	Checked by: -
Status	Purpose of Issue		
S2	For Approval		
drawing stage	Stage 3		
client			

JD Sports			
project			
JD Sports Campus, Phase 2			
drawing title			
Proposed Site Plan			
date			
30/07/25	drawn	RP	
scale@A1			
1:500	checked	RP	
AEW Reference Number 14579			

Appendix F – Flood Plans

This location is in flood zone 1

In your proposed development site there is a risk of flooding from:

- surface water

Flood risk assessments

Developments in flood zone 1 that are less than 1 hectare (ha) only need a flood risk assessment (FRA) where:

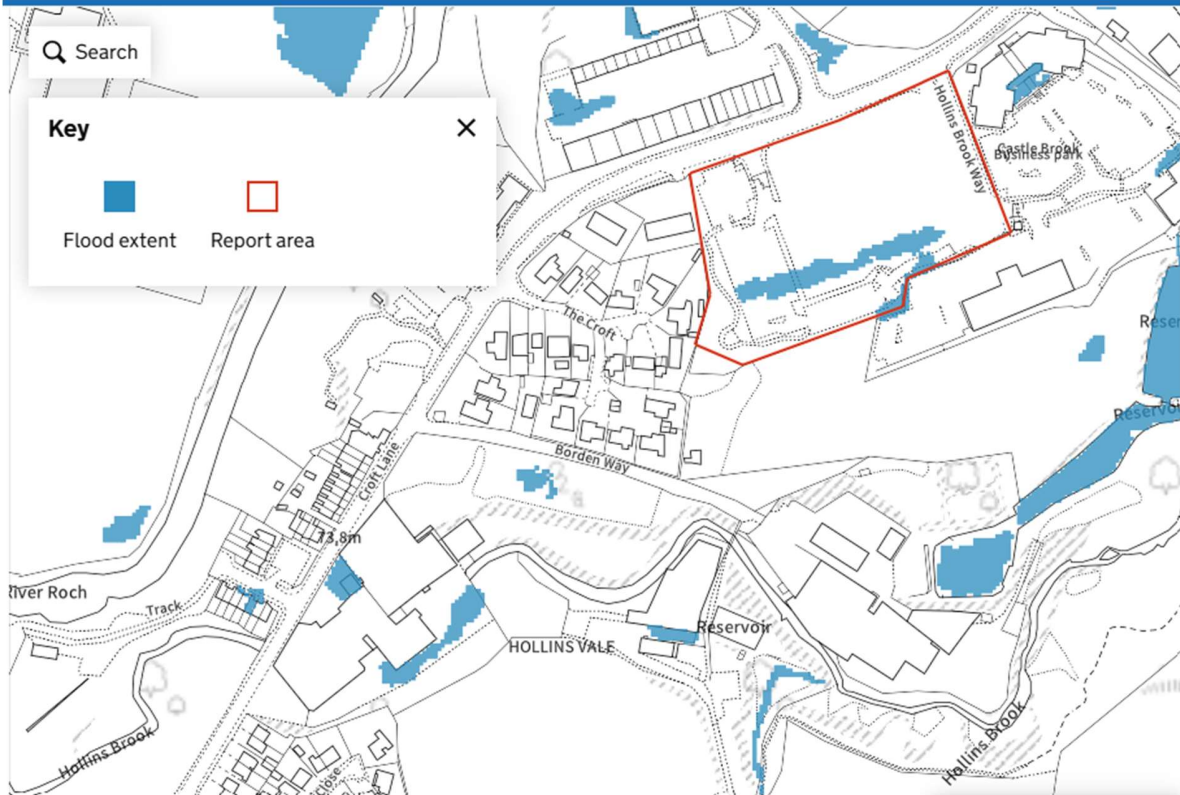
- land has been identified as having critical drainage problems
- land is identified in the local planning authority's (LPA) strategic flood risk assessment (SFRA) as being at increased flood risk in future
- it would increase the [vulnerability classification](#) and land may be subject to sources of flooding other than rivers or sea

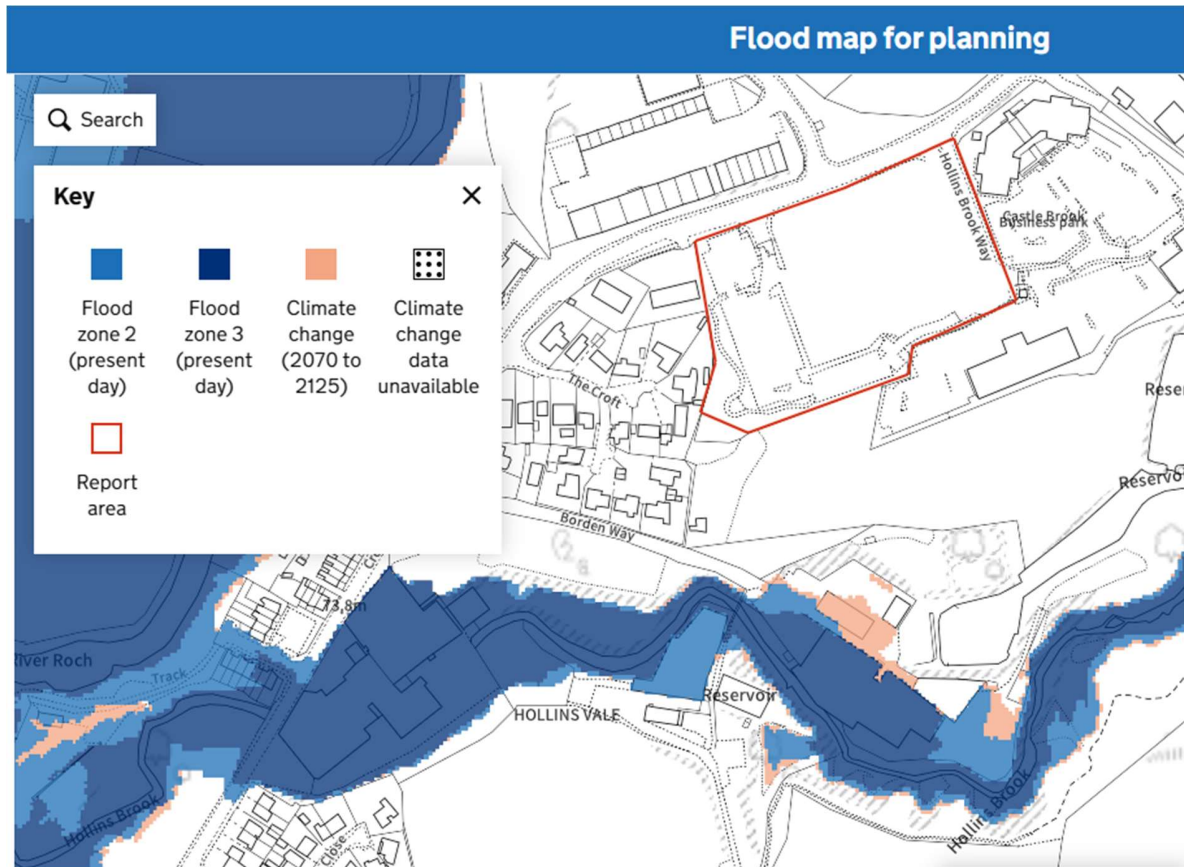
The site you have drawn is 0.79ha.

If the flood risk to your site is affected by flood defences, you will also need to assess [residual risk](#) from flood defence breach in this location. If available, we will provide breach hazard mapping data to help you do this.

Review the flood risks for your location then complete the next steps for your planning application.

Flood map for planning







Reservoirs map

Extent

- When river levels are normal
- When there is also flooding from rivers

Map details

- ☒ Show flooding

Flood map for planning

Search

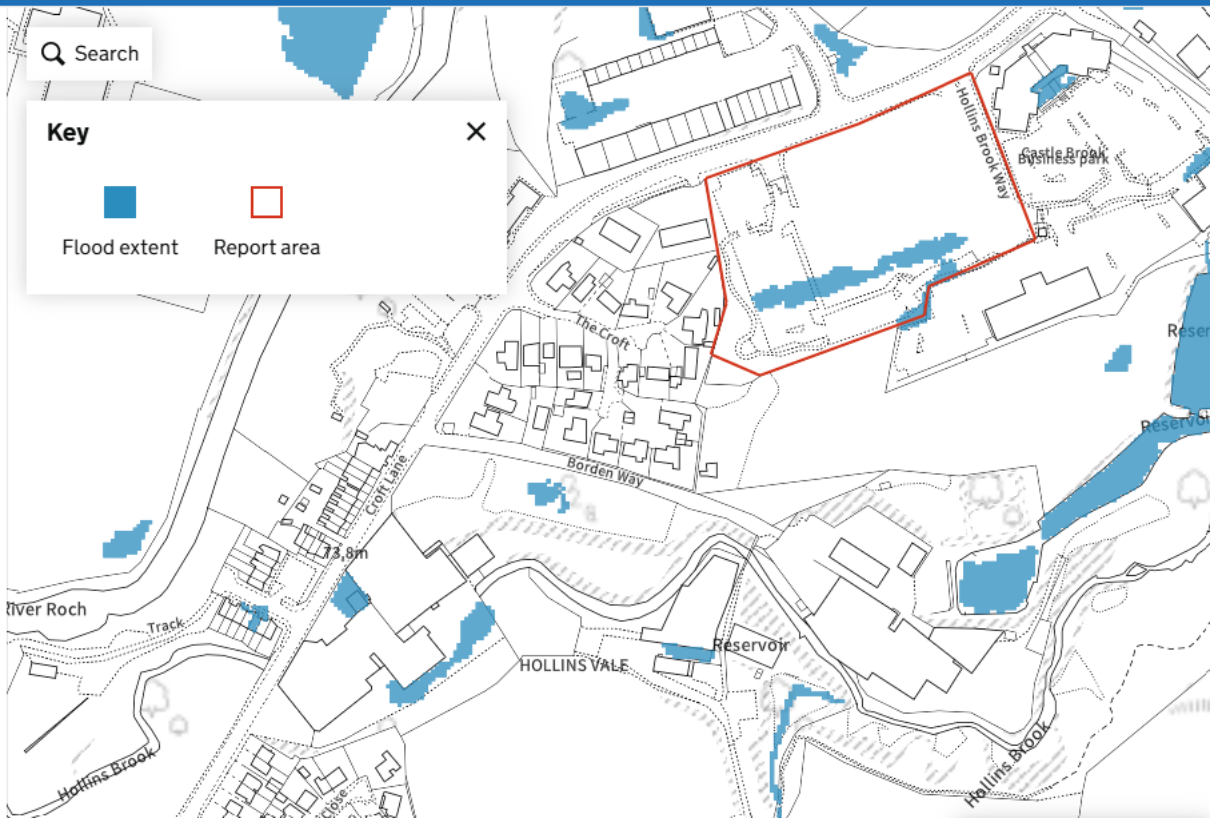
Key



Flood extent



Report area



Flood map for planning

Your reference
JD Sports

Location (easting/northing)
381524/408676

Created
26 May 2022 18:57

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger than 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

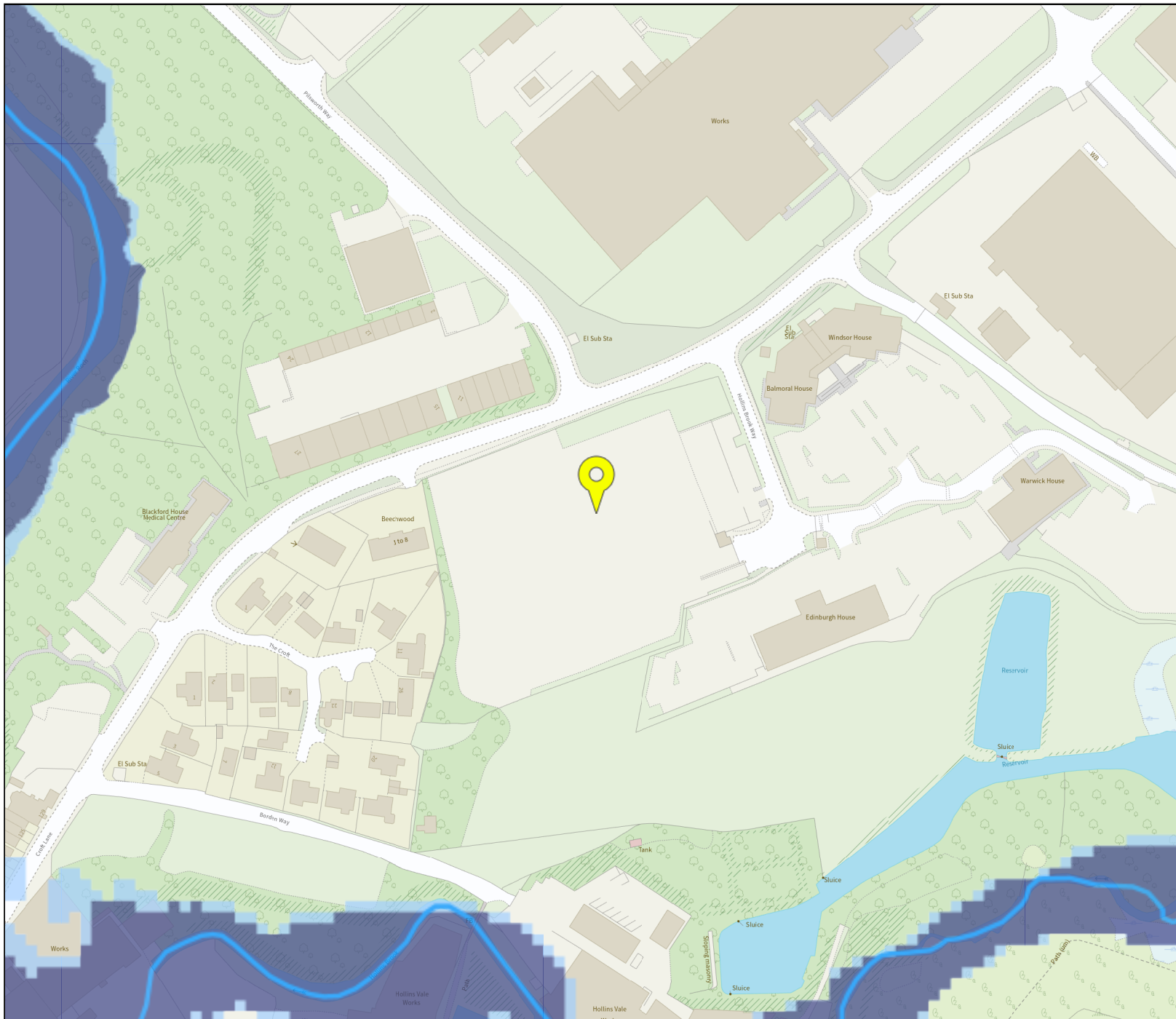
Notes

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 2021 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference

JD Sports

Location (easting/northing)

381524/408676

Scale

1:2500

Created

26 May 2022 18:57



Selected point



Flood zone 3



Flood zone 3: areas
benefitting from flood
defences



Flood zone 2



Flood zone 1



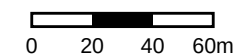
Flood defence



Main river



Water storage area





Reservoirs map

☐ Extent

When river levels are normal

When there is also flooding from rivers

Map details

☒ Show flooding

Flood map for planning

Search

Key



Flood zone 2
(present day)



Flood zone 3
(present day)



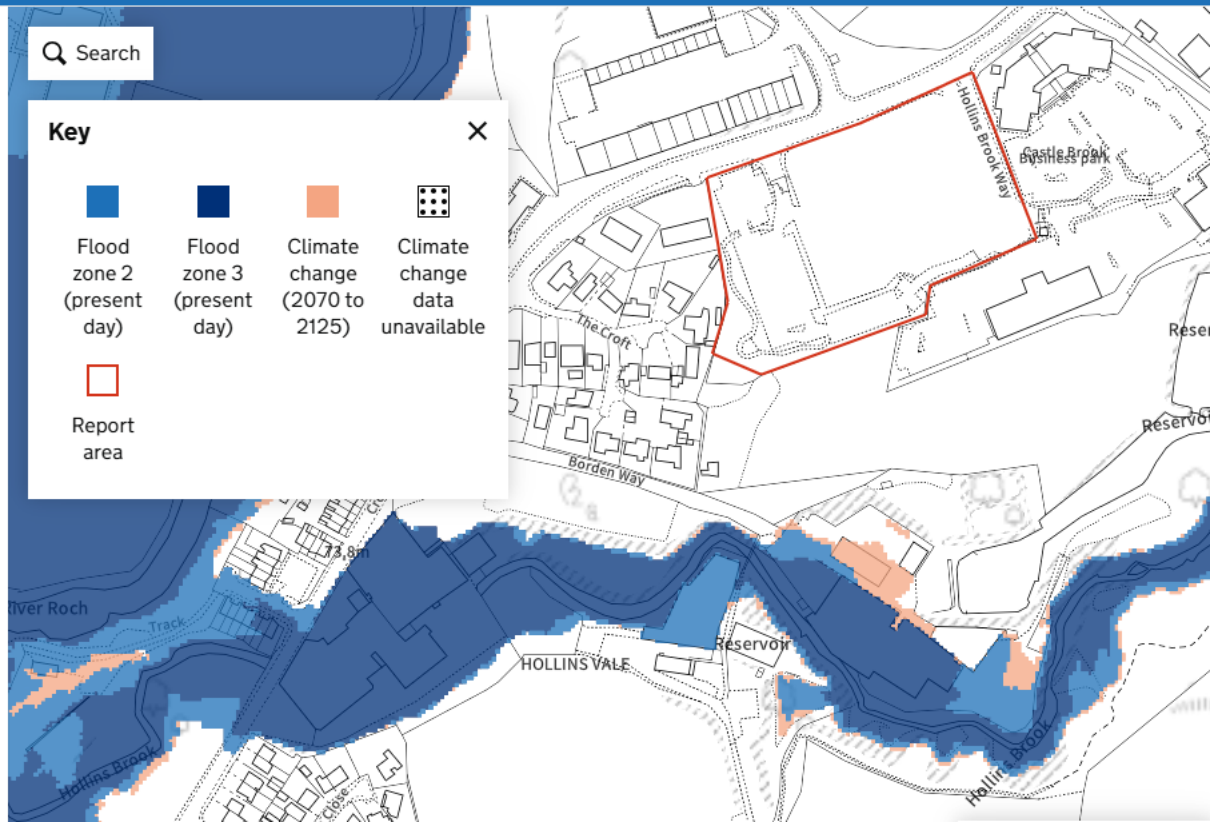
Climate change
(2070 to 2125)



Climate change
data
unavailable



Report
area



Appendix G – Proposed Drainage Layouts



- NOTES
- THIS DRAWING IS PRELIMINARY AND IS SUBJECT TO CHANGE DEPENDING ON FURTHER DEVELOPMENT OF THE S.A. SITE LAYOUT, PROPOSED LEVELS, RWP LAYOUT AND FOUL CONNECTION LOCATIONS.
 - TO BE READ IN CONJUNCTION WITH ALL RELEVANT KENNEDY REDFORD DRAWINGS.
 - PRIVATE DRAINS TO BE CONSTRUCTED IN ACCORDANCE WITH BUILDING REGULATIONS.
 - EXISTING SEWER AND DRAINAGE LOCATIONS AND LEVELS TO BE CONFIRMED BY CONTRACTOR ON SITE PRIOR TO WORK COMMENCING.
 - ALL MANHOLE AND PIPE POSITIONS ARE APPROXIMATE AND MAY BE UPDATED FOLLOWING FURTHER DISCUSSIONS WITH THE RELEVANT AUTHORITIES.
 - ALL MANHOLE SIZES ARE 1200mm UNLESS INDICATED OTHERWISE.
 - ALL INSPECTION CHAMBERS ARE 475mm UNLESS INDICATED OTHERWISE.
 - UNLESS INDICATED OTHERWISE ALL PIPES TO BE LAID SOFFIT TO SOFFIT.
 - WHERE PROPOSED DRAINS ARE IN PROXIMITY TO PROPOSED FOUNDATIONS, THE FOUNDATIONS SHALL BE TAKEN DEEPER TO BELOW THE DRAINS OR THE DRAIN SHOULD BE PROTECTED WITH A FULL CONCRETE SURROUND.
 - PROPOSED PIPEWORK WITH LESS THAN THE FOLLOWING DEPTHS TO SOFFIT REQUIRES A CONCRETE SURROUND:
 - 1.2m IN ROADS
 - 0.8m IN LIGHTLY TRAFFICKED AREAS
 - 0.6m UNDER FOOTPATHS AND UNDER BUILDINGS.
 - SETTING OUT OF RAINWATER PIPES AND FOUL CONNECTION LOCATIONS BY OTHERS.
 - LINEAR DRAINS NOT SIZED OR SPECIFIED AT THIS STAGE.
 - LINEAR DRAIN AND GULLY LOCATIONS SUBJECT TO DETAILED LEVEL DESIGN AND THEREFORE NUMBERS ARE SUBJECT TO CHANGE.
 - ALL LINEAR DRAINAGE TO HAVE SILT BUCKETS ON OUTLETS.
 - ALL LINEAR DRAIN, GULLY AND PERFORATED PIPE CONNECTIONS TO BE 150mm LAID AT A MINIMUM GRADE OF 1:40 UNLESS STATED OTHERWISE.
 - DISCHARGE RATE AND CONNECTION TO SEWER SUBJECT TO AGREEMENT WITH BURY COUNCIL AND UNITED UTILITIES.
 - THE CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY WORKS AND CONSTRUCTION PROCEDURES.
 - CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.
 - THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
 - AT LEAST ONE SOIL PIPE AT THE HEAD OF EACH FOUL RUN SHALL VENT TO THE ATMOSPHERE.
 - ALL UNDERSLAB FOUL PIPES TO BE 100mm LAID AT 1:40 GRADIENT U.N.O.

PO2	14.11.25	COST SAVING CHANGES	R.M.	J.H.	P.V.
PO1	17.10.25	FIRST ISSUE	R.M.	J.H.	P.V.

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CLIENT
JD SPORTS PLC

PROJECT NAME
JD SPORTS P2 PAVILION

DRAWING TITLE
PROPOSED DRAINAGE LAYOUT
PHASE 2

DATE	SCALE	SHEET SIZE	REV
17.10.25	1:250	A0	P01

DRAWING STATUS
D1 - ISSUED FOR COSTING

DRAWING NUMBER
251009 - KRD - XX - XX - DR - C - C - 0500

Appendix H – Site Investigation

Geo-Environmental Appraisal by GroundTech – 31 March 2022 (162 pages)

Phase 2 Site Investigation by ROC Consulting – 1 December 2021 (59 pages)



GROUNDTECH
CONSULTING

Job title: New Office Block, Bury

Report type: Geo-Environmental Appraisal

Prepared for: JD Sports

Date: 31 March 2022

Document Control Form	
PROJECT	NEW OFFICE BLOCK, BURY
REPORT NAME	GEO-ENVIRONMENTAL APPRAISAL
REPORT REFERENCE	GRO-21438-3308
STATUS	FINAL
ISSUE DATE	31 MARCH 2022
REVISION	
CLIENT	JD SPORTS
CLIENT CONTACT	-
For and Behalf of Groundtech Consulting	
SIGNATURE	
AUTHOR	Rebecca Rowlinson BSc (Hons)
SIGNATURE	
CHECKED	Callum Holden BSc (Hons) FGS
SIGNATURE	
REVIEWED	James Doyle BSc (Hons) CGeol FGS

SUMMARY

Site Details		
Site Location	The site is located circa 2.4km south east of Bury Town Centre and is approximately centred on National Grid Reference 381527, 408662.	
Site Area	The site is relatively level across its footprint and roughly rectangular in shape, encompassing an area of approximately 1.5 Ha. The site is predominantly formed by concrete hardstanding and is generally featureless. Unsurfaced rough ground is present in the north east in the footprint of the former warehouse building.	
Preliminary Risk Assessment		
Pollution Linkage (PL) Assessment	Human Health	The risk to human health was considered to be Moderate to Low.
	Controlled Waters	The risk to controlled waters was considered to be Low.
	Permanent Ground Gas	The risk from permanent ground gases was considered to be Moderate to High.
Ground Model		
Made Ground Soils	Made Ground was encountered in all locations to a maximum depth of 1.8m bgl, although it was generally less than 1.0m thick and typically comprised concrete or tarmac overlying brown gravelly sand or sandy gravel.	
Natural Soils	The natural strata encountered generally comprised orange brown slightly gravelly occasionally clayey Sand which was encountered underlying the Made Ground to depths between 4.0m and 6.0m bgl. This was in turn generally underlain by interbedded soft to firm sandy Clay and silty clayey Sand to depths between 15.5m and 17.0m bgl where firm to stiff sandy slightly gravelly Clay was encountered to the base of the Cable Percussive boreholes that progressed to this depth.	
Bedrock	Sandstone bedrock was encountered within BH01 at 23.5m and BH04 at 27.3m bgl and was present to the base of the boreholes at 45.0m bgl.	
Groundwater	Groundwater strikes were observed within the natural sand across the site from depths between 1.6m and 6.5m bgl.	
Ground Engineering Assessment		
Foundations	The most suitable foundations for the proposed development are considered to be piles transferring loads to the underlying medium dense to dense Sand. Based on the proposed loadings provided, pile groups will be required.	
Highways	Plate load testing was undertaken at five locations across the site and CBR values ranged between 1.6% and 5.4%. Proof rolling of the subgrade will be required as a minimum.	

SuDS	<i>Soil percolation testing was undertaken at a single location (SuDS1) within the natural Sand and infiltration rates recorded ranged between 2.17×10^{-5} and 4.37×10^{-5} m/s which are considered good drainage conditions and SuDS drainage is likely to be feasible for the proposed development.</i>
Constraints	<i>The main limitation of the site is the poor ground conditions observed to a maximum depth of 11.5m bgl in the form of loose to medium dense sand deposits overlying very soft to soft Low strength Clay in all boreholes. The loose Sand and low strength Clay are not considered a suitable bearing stratum for the proposed development which will exert high column loads.</i> <i>A high-pressure gas main is present in the north eastern corner of the site. An easement will be required in the vicinity of the gas main which should be accurately located prior to development.</i>
GQRA and Revised (PL) Assessment	
Human Health	<i>No elevated contamination has been detected, asbestos has been detected in two out of eight samples at low concentrations. Where present the proposed building and hardstanding will act as a cover layer for asbestos containing soils, in areas of soft landscaping a 600mm cover system should be in place. The risk to human health is considered to be Moderate prior to remedial action.</i>
Controlled Waters	<i>The risk to controlled waters is considered to be Low.</i>
Permanent Ground Gas	<i>A single gas monitoring visit has been undertaken to date and the site has been classified as CS1 and gas protection measures are not considered necessary at this stage. This will be confirmed or otherwise on completion of the monitoring programme.</i> <i>The site is not in an area affected by radon.</i>
Final Appraisal	

The following further work is considered necessary to progress the site to construction phase:

- *Completion of gas monitoring programme.*
- *Issue gas assessment.*
- *Detailed Foundation design.*
- *Confirmation of remedial recommendations with regulators.*

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 APPENDIX 12 - WASTE CLASSIFICATION REPORT
 APPENDIX 13 - CONTAMINATED LAND LEGISLATIVE BACKGROUND
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Plans		
<i>Plan Reference</i>	<i>Revision</i>	<i>Title</i>
GRO-21438-P01	-	Project Location Plan
GRO-21438-P04	-	Exploratory Hole Location Plan
GRO-21438-P05	-	Generalised Ground Model
GRO-21438-P06	-	Revised Illustrative CSM

1.0 INTRODUCTION

1.1 Project Objectives

Groundtech Consulting Limited have been instructed by Kennedy Redford on behalf of their client JD Sports to undertake a Geo-Environmental Appraisal for a site off Pilsworth Road in Bury.

A main investigation was undertaken in accordance with BS 5930:2015, BS 10175:2017, BS 8576:2013, CIRIA C758 and Eurocode 7 to revise the CSM and quantify the level of risk identified in the PRA. The Appraisal has been prepared in accordance with current UK Legislation and to discharge Land Quality pre-commencement planning conditions.

The following reports have previously been produced for the site:

- Preliminary Risk Assessment referenced GRO-21438-3118, dated February 2022 produced by Groundtech Consulting Limited.
- Coal Mining Risk Assessment referenced GRO-21438-3119, dated 26 January 2022 produced by Groundtech Consulting Limited.
- Phase 2 Site Investigation referenced 4251-ROC-ZZ-XX-RP-ES-PH2SI, dated 01 December 2021 produced by RoC Consulting.

1.2 Proposed Development

The proposed development is commercial end use comprising a three-storey office block with associated staff welfare facilities including two five-a-side football pitches.



1.3 Limitations

Other conditions may exist on the site that have not been taken into account in this assessment as they are outside the scope of works. Groundtech Consulting are not responsible for these circumstances that are not outlined in the report.

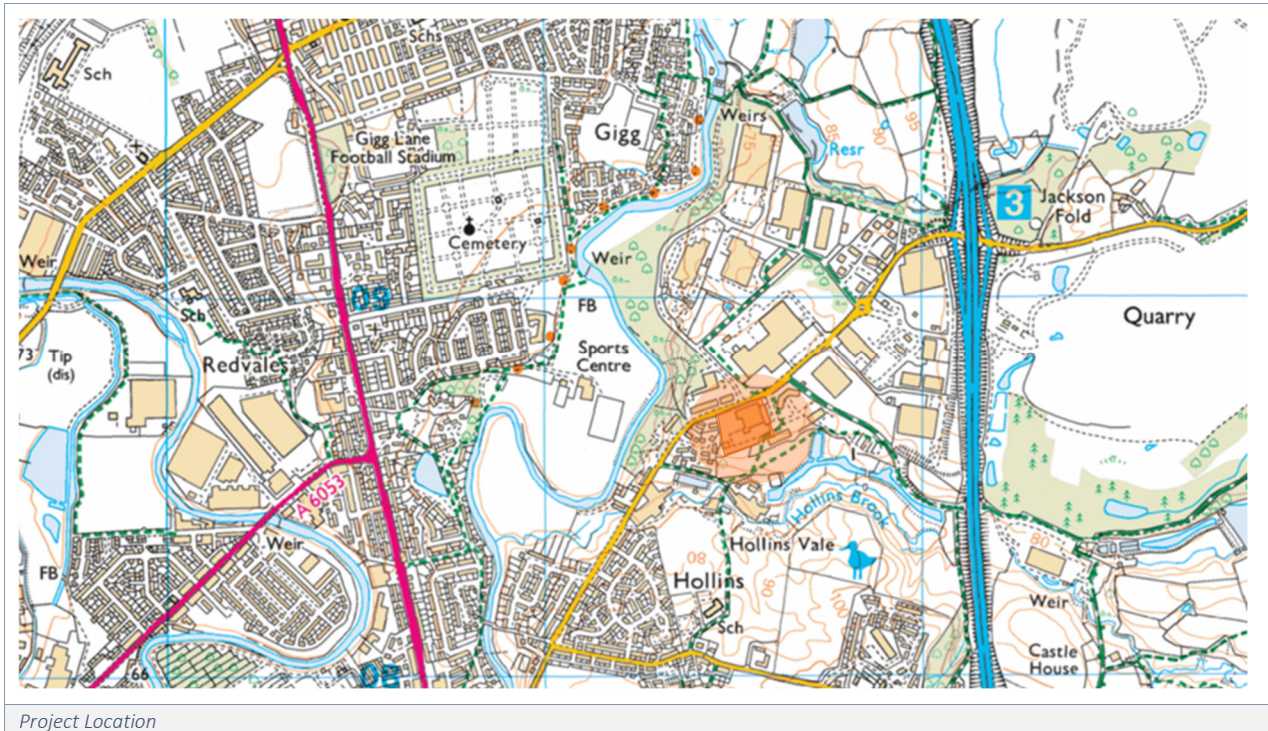


The assessment has been prepared for the exclusive use of the client. No third parties may rely on or reproduce the contents of the report without the written permission of Groundtech Consulting Limited. If any unauthorised third party comes into possession of the report they rely on it at their own risk and Groundtech Consulting Limited will not be obliged to provide a duty of care.

2.0 SITE SETTING

2.1 Location

The site is located circa 2.4km south east of Bury Town Centre, as shown on the Project Location Plan GRO-21438-P01. The site is approximately centred on National Grid Reference 381527, 408662.



Access to the site is gained off Pilsworth Road to the north east of the site.

2.2 Site Description

The site is relatively level across its footprint and roughly rectangular in shape, encompassing an area of approximately 1.5 hectares.

Site Features

The site was most recently occupied by a large warehouse unit which has recently been demolished. The footprint of the former building is surfaced with uneven ground with grass and some light vegetation. The remainder of the site is surfaced predominantly with concrete and is generally featureless.

A gas main crosses the north east corner of the site.

A vegetated strip is present along the sites northern boundary with some semi-mature and mature trees present.

Site Boundaries and Surrounding Features

The site boundaries are formed by metal fencing and trees are present close to the sites northern, eastern and southern boundaries.

The site is surrounded by the following features/land uses:



- North - *Pilsworth Road followed by light industrial/commercial units.*
- East - *Hollins Brook Way, commercial offices and an associated car park.*
- South - *Commercial office premises and Local Nature Reserve.*
- West - *Commercial buildings and residential housing estate.*

Site photographs are presented in *Appendix 2*.

3.0 PREVIOUS INVESTIGATIONS SUMMARY

3.1 Introduction

The following sections summarise the following reports previously completed for the site:

- *Preliminary Risk Assessment referenced GRO-21438-3118, dated February 2022 produced by Groundtech Consulting Limited.*
- *Coal Mining Risk Assessment referenced GRO-21438-3119, dated 26 January 2022 produced by Groundtech Consulting Limited.*
- *Phase 2 Site Investigation referenced 4251-ROC-ZZ-XX-RP-ES-PH2SI, dated 01 December 2021 produced by RoC Consulting.*

3.2 Site History and Consultations

Site History

The earliest historical records from 1848/51 indicate the site was formed by fields and was undeveloped. Six reservoirs were located between 80m and 150m south. The site remained undeveloped and formed by fields until the 1980s when a warehouse was constructed on the site which has been the only development on site until it was recently demolished.

3.3 Geology and Hydrogeology

Made Ground was not indicated to be present beneath the site, however Made Ground is thought to be present due to past development on the site.

The superficial deposits indicated to underly the site are Hummocky (moundy) Glacial Deposits which characteristically comprises clay, sand, and gravel and are classified as a Secondary A Aquifer.

The solid geology is indicated to be the Trencherbone Rock comprising Sandstone which is classified as a Secondary A Aquifer.

A coal seam is shown to subcrop on site striking north west to south east, dipping to the south west at an angle of 15°. The seam subcropping the site is not named on BGS geological maps.

3.4 Preliminary Conceptual Site Model

The following risks were identified by Groundtech Consulting Limited:

Receptor	Risk	Discussion
Site End Users from Contaminated Soils	Moderate to Low	Made Ground is likely present associated with the previous demolished commercial building and may be contaminated with a range of CoC. Soft landscaping will be present as part of the development.
Site End Users from Inhalation of Vapours	Low	Gross hydrocarbon contamination from former plant hire yard not anticipated.
Potable Water Supply Pipe	Moderate to Low	Former plant hire yard may be a source of organic contamination at installation depths.
Site End Users from Inhalation of Gas	Moderate to High	Deep Made Ground may be present associated with demolition of previous building on site. Numerous

		<i>sources identified in vicinity of site including landfills, ponds and reservoirs.</i>
<i>Controlled Waters</i>	<i>Low</i>	<i>Gross mobile contamination not anticipated and hardstanding across site will have restricted downward migration of contaminants.</i>

3.5 Coal Mining Risk Assessment

A Coal Mining Risk assessment was carried out by Groundtech Consulting which comprised a desk-based review of all available information related to coal mining at the site and should be read in conjunction with this report. The key findings are summarised below:

Recorded Coal Mining

The site is in an area requiring a Coal Mining Report. The Coal Authority Report confirms the property is not within a surface area that could be affected by any past recorded underground coal mining. However, the property is in an area where the Coal Authority believes there is coal which may have been worked at some time in the past.

There are no mine entries on or within 20m of the site and the site is not affected by recorded opencast coal mining.

No risk has been identified from recorded underground coal mine workings at the site.

Unrecorded Coal Mining

The southern half of the site, to the south of the coal seam bisecting the site is indicated to be within a Development High Risk Area and probable unrecorded coal mine workings are indicated in this area.

The coal seam subcropping at the site is anticipated to be the Blenfire Coal or Trencherbone Coal, both of which are recorded as being worked in the area.

A potential risk was identified from unrecorded mine workings and further investigation including intrusive boreholes was required.

3.6 Ground Model

RoC Consulting undertook a Ground Investigation at the site previously to inform proposed road widening works on Hollins Brook Way. The exploratory holes were resultantly localised to the eastern site boundary and are therefore not representative of wider site conditions.

The following scope of works was undertaken by RoC Consulting in October 2021:

- 3 No. windowless sample boreholes drilled to 5.45m bgl (WS101 to WS103).
- 2 No. TRL DCP tests (DCP101 to DCP102).
- 3 No. vacuum excavated slit trenches to locate the high pressure gas main (ST101 to ST103).

Made Ground was encountered at surface level in WS101 and WS102 as tarmac ranging in thickness from 0.05 to 0.1m bgl which was underlain by a limestone gravel subbase to circa 0.2m bgl.

At WS103 Topsoil was encountered at the surface to 0.2m bgl and underlain by a granular demolition fill material containing brick and limestone to 0.8m bgl this was also encountered in WS101 and WS102 to 0.5 and 0.7m bgl respectively.

In WS101 a thin layer of demolition fill material contained within a clay matrix was encountered at 0.50 to 0.75m bgl.

Groundwater strikes were not recorded within the Made Ground.

Immediately underlying Made Ground deposits at all boreholes was interbedded Sand and Clay deposits. Clay was generally comprised of orangish brown sandy clay gravelly Clay. Sand deposits were found to comprise a light brown fine to medium sand/gravelly silty sand.

The Phase 2 site investigation undertaken by RoC Consulting states that SPT values ranged from 2 to 16 in Clay deposits and 2 to 16 in Sand deposits.

Groundwater was not encountered within Glacial Clay deposits or Sand deposits

No visual or olfactory evidence of contamination was observed during the site works.

3.7 Geo-Environmental Testing Results

Six samples were screened for a range of CoC associated with the sites former use. Results from chemical testing analysis indicate there were no exceedances of Contaminants of Concern when screened against a commercial end use scenario. As such the site is not considered to pose a risk toward future users or construction persons during the development process. No asbestos was detected in any of the samples.

Groundwater was not encountered during the investigation and therefore no groundwater testing was undertaken.

3.8 Ground Gas

Ground gas monitoring standpipes were not included as part of the RoC investigation as the proposed development was associated with highway works.

3.9 Remedial Strategy

No specific remedial measures were recommended with respect to contaminated soils at the site due to the lack of elevated contamination identified.

3.10 Geotechnical

The Phase 2 site investigation undertaken by RoC Consulting states that CBR values ranged between 1% and 33% at the two locations where tests were undertaken with less than 5% being acceptable.

The plasticity index range varied between 4 and 16% with a mean value of 11%. These results indicate the Clay to be of a low plasticity.

Two Glacial Clay samples were tested for the determination of undrained shear strength from a depth of 1.0m bgl. Shear strength results vary between 103 and 194kPa with a mean value of 148.5kPa. These results indicate shallow Clay strengths vary between high to very high.



3.11 Gas Main Delineation

The high-pressure gas main present below the site was exposed by vacuum and hand excavation techniques. It was discovered that a protective concrete slab (c.900m in width) was present above the pipe along the entirety of the proposed junction works and beyond.

4.0 SCOPE OF INVESTIGATION AND RATIONALE

4.1 Project Objectives

The aim of the fieldwork was to:

Determine the stratification beneath the site.
Maintain watching brief for visual and olfactory evidence of contamination.
Obtain samples using methodology in current guidance for contamination analysis.
Identify realistic pollution linkages to groundwater.
Determine the presence of unrecorded mine workings.
Calculate soil infiltration rates to determine feasibility of SuDS drainage.
Determine modulus of subgrade reaction to inform highway/pavement design.
Obtain relevant geotechnical parameters for preliminary foundation design to address both ULS and SLS conditions.
Determine if targeted supplementary investigation in areas of concern is required and for remedial design.
Install monitoring standpipes for gas and groundwater monitoring.
Assess the identified pollution linkages in the CSM.

4.2 Scope of Works

The following scope of works was completed between the dates of 24th January and 4th February 2022:

- 4 No. cable percussive boreholes (BH01 to BH04) were drilled to depths between 15m and 20m bgl.
- Follow on Rotary open hole drilling was carried out from the base of cable percussive boreholes (BH01 & BH04) to a final depth of 45.0m bgl.
- 5 No. plate load tests were carried out at depths between 0.5m and 0.7m bgl.
- 3 No. trial pits (TP01 to TP03) were carried out to a maximum depth of 3.0m bgl.
- 1 No. soil percolation test (SuDS01) was carried out at a depth of 1.5m bgl.

The exploratory hole locations are presented on Groundtech Plan GRO-21438-P02 and the exploratory hole logs are in Appendix 3.

The exploratory holes were positioned to establish the stratification beneath the site, and target any areas of concern as summarised in the table below:

Location	Target Rationale
BH01 & BH04	Potential coal mine workings and building footprints
BH01 to BH04	Proposed building footprints
TP01 to TP03	Proposed car park/ Highways & Former plant hire yard
SuDS1	Feasibility of SuDS drainage
CBR1 to CBR5	Proposed highways, car parks and landscaped areas

The exploratory holes were logged by a suitably experienced geo-environmental engineer in general accordance with the following current guidance:

- *BS 5930 'Code of Practice for Site Investigations' 2015.*
- *BS EN 14688-1:2002 'Geotechnical Investigation and Testing – Identification and classification of soil'.*
- *BS EN ISO 14689:2002 "Geotechnical investigation and testing – Identification and classification of rock".*

4.3 Soil Sampling

During the intrusive investigation, representative samples were taken at regular intervals, changes of strata and where evidence of contamination existed. Laboratory analysis was scheduled on the samples obtained.

The samples obtained are summarised in the table below:

Soil Sample	Number
<i>Environmental Sample</i>	<i>22</i>
<i>Disturbed Sample</i>	<i>74</i>
<i>Undisturbed U100 Sample</i>	<i>9</i>

The samples have been obtained in accordance with current environmental and geotechnical guidance. The sampling plan has been designed obtain samples from all required strata using the correct methodology.

Disturbed samples of soil for geo-environmental testing were placed in the correct sampling containers as required by the laboratory in accordance with their MCERTS and UKAS Accreditation. Transportation was arranged in a timely manner and the samples were at the correct temperature

The sample locations and depths are recorded on the exploratory logs.

4.4 Geo-Environmental Testing

To inform the Generic Quantitative Risk Assessment, the following geo-environmental testing was scheduled to assess the risk from contamination on the site. The testing is based on the potential sources identified in the PRA and observations during the Ground Investigation.

Determinand	Matrix	Number
<i>Arsenic, cadmium, chromium (total and hexavalent), copper, lead, mercury, nickel, selenium, zinc and pH.</i>	<i>Soil</i>	<i>8</i>
<i>Total Petroleum Hydrocarbons (TPH CWG)</i>	<i>Soil</i>	<i>3</i>
<i>Asbestos Screening</i>	<i>Soil</i>	<i>8</i>
<i>Asbestos Quantification</i>	<i>Soil</i>	<i>2</i>
<i>Waste Acceptance Criteria (WAC)</i>	<i>Soil</i>	<i>2</i>

The Geo-Environmental Laboratory Testing Results are presented in *Appendix 4*.

Representative disturbed samples were obtained for all soil types encountered. Selected samples were scheduled for testing at an approved laboratory in accordance with BS 1377 'Method of Test for Soils for Civil Engineering Purposes' 1990. The following tests were scheduled:

BS 1377	Test Method	Number
Part 2	Water Content	5
Part 2	Plasticity Index Analysis	5
Part 2	Particle Size Distribution	2
Part 7	Determination of Undrained Shear Strength in Triaxial Compression	8
BRE	BRE Full Suite	5

The Geotechnical Laboratory Testing Results are presented in *Appendix 5*.

4.5 Gas and Groundwater Monitoring/Sampling

Gas and groundwater monitoring installations were constructed in the boreholes. The standpipes consisted of high-density polyethylene (HDPE) pipe - a bentonite seal was placed around the plain pipe and a clean gravel pack was placed around the slotted pipe. A summary of the installation construction is presented in the table below:

Location	Depth	Response Zone (m bgl)	Targeted Strata	Reason
BH01	5.0	1.0 - 5.0	Sand	Ground Gas
BH02	5.0	1.0 - 5.0	Sand & Clay	Ground Gas
BH04	5.0	1.0 - 5.0	Gravel, Sand & Clay	Ground Gas

Permanent gas and flow rate monitoring was carried out using GFM 436 infrared gas monitor with integral electronic flow analyser. The measurements taken are listed below:

- Oxygen (O₂), carbon dioxide (CO₂) and methane (CH₄) as the percentage volume in air (%v/v).
- Hydrogen sulphide (H₂S) and carbon monoxide (CO) as the percentage volume in air (%v/v).
- Lower Explosive Limit (%LEL) of methane.
- Atmospheric and borehole pressure, including pressure trend.
- Flow measurements (l/hr).
- Weather and ground surface conditions.

Both peak and steady state conditions were monitored to understand the behaviour of the permanent ground gas, the steady state conditions were recorded by allowing the gas monitor to run for a minimum of 3 minutes.

Interim permanent gas and groundwater monitoring results are presented in *Appendix 6*.

5.0 GROUND MODEL

5.1 Made Ground

Made Ground was encountered across the site to a maximum depth of 1.8m bgl and the surface of the site was almost entirely covered with concrete to a maximum depth of 0.3m bgl encountered at location SuDS1, TP01, TP02, TP03 and BH04.

Where the previously existing building had been demolished, the surface consisted of backfill material. In the east of the site. Where BH03 was drilled, there was tarmac surfacing to a depth of 0.15m bgl.

Three main Made Ground populations were encountered during the investigation and are described below:

- *Dark brown to black sandy gravel in SuDS1, TP01, TP03, BH03, and BH04 underlying the hardstanding from a minimum depth of 0.3m bgl to a maximum depth of 1.3m bgl.*
- *Dark brown clayey gravelly sand in TP02, BH01, and BH02 from a minimum depth at ground level to a maximum depth of 0.9m bgl.*
- *Orange brown sandy gravel in BH03 between depths of 0.4m and 1.8m bgl.*



Exploratory Hole Locations

5.2 Natural Ground

The natural strata encountered generally confirmed the published geological records and typically comprised orange brown slightly gravelly occasionally clayey Sand which was encountered underlying the Made Ground to depths between 4.0m and 6.0m bgl.

This was in turn generally underlain by interbedded soft to firm sandy Clay and silty clayey Sand to depths between 15.5m and 17.0m bgl where firm to stiff sandy slightly gravelly Clay was encountered to the base of the Cable Percussive boreholes.

Four main natural stratification encountered during the investigation and are described below:

- *Orange brown slightly gravelly locally clayey medium to coarse Sand in SuDS1, TP01, TP02, TP03, BH01, BH02, and BH03 between depths of 0.75m and 6.0m bgl.*
- *Very soft to soft brown sandy Clay was encountered in BH01 to BH04 from a minimum depth of 4.0m bgl to a maximum depth of 11.5m bgl.*
- *Firm to stiff brown locally gravelly sandy Clay was in BH01 to BH04 from a minimum depth of 6.0m bgl to a maximum depth of 20.0m bgl.*
- *Brown, occasionally silty, occasionally clayey Sand in BH01 to BH04 from a minimum depth of 7.5m bgl to a maximum depth of 17.5m bgl.*

5.3 Bedrock

Bedrock was encountered within BH01 and BH04 at 23.5m and 27.3m bgl respectively and consisted of Sandstone to the maximum investigation depth of 45.0m bgl where the boreholes were terminated.

5.4 Groundwater

Groundwater strikes were observed at locations TP01 to TP03, BH02 and BH03 at depths between 1.6m and 4.0m bgl and were observed within the natural Sand deposits.

5.5 Watching Brief

A watching brief was maintained during the ground investigation for visual and olfactory evidence of contamination.

Ash was encountered within the Made Ground in BH03 between the depths of 0.4m and 1.8m bgl. No other evidence of potential contamination was noted during the investigation.

5.6 Excavation Stability

Collapse was noted during excavation of all trial pits within the natural Sand deposits locally due to the presence of groundwater.

5.7 Excavation/ Borehole Progress

Slow progress while excavating the trial pits or advancing the boreholes was not experienced. No obstructions were noted during the investigation.

6.0 GROUND ENGINEERING

6.1 Geotechnical Testing Results

Comparison of water content and the value of 0.4 times the Liquid Limit in accordance with BRE Digest 412 'Desiccation in Clay Soils' suggests significant desiccation has taken place when 0.4 times the Liquid Limit is greater than the actual water measured water content. This is a rudimentary method but also a good guide.

Results of the plasticity testing and the volume change potential of the Clay is summarised in the table below:

Reference	Depth	Modified PI	Volume Change Potential	Dessicated Y/N
TP02	0.70	23.00	Medium	No
BH01	6.00	19.00	Low	No
BH02	4.00	18.00	Low	No
BH03	6.50	20.68	Medium	No
BH04	4.00	19.40	Low	No

Quick undrained triaxial testing was carried out on eight samples of natural undisturbed Clay and the results of the triaxial test are summarised in the table below:

Reference	Depth (m)	Undrained Shear Strength (kN/m ²)	Relative Strength
BH01	6.5	24.0	Low
BH01	9.5	30.0	Low
BH01	12.5	89.0	High
BH02	6.5	23.0	Low
BH02	9.5	31.0	Low
BH03	5.0	23.0	Low
BH03	9.0	69.0	Medium
BH04	17.0	71.0	Medium

Particle Size Distribution Testing was undertaken two samples of silty sandy Clay and the results are included within the strata descriptions on the exploratory hole logs presented in *Appendix 3*.

6.2 Assessment Background

Background

The ground engineering investigation has been undertaken to formulate an accurate ground model in order to undertake preliminary foundation design. The ground model has been constructed with a moderate to high level of confidence, the ground model has evolved from the information obtained by the PRA.

The site is flat lying and was most recently occupied by a large warehouse unit which has recently been demolished. The footprint of the former building is surfaced with uneven ground with grass and some light vegetation. The remainder of the site is surfaced predominantly with concrete and is generally featureless. A high pressure gas main crosses the north east corner of the site. The hardstanding across the site will require breaking out and crushing as part of the enabling works, any below ground substructure associated with the former building will require grubbing out, and also sorted and crushed for reuse.

It is proposed to develop a maximum 3-storey office block to the east of the site and separate Creche facility building on the western boundary of the site. The design of the superstructure elements has not yet been fully developed, but it is envisaged that a framed structure of beams and columns supporting upper floors and roof will be appropriate. It is anticipated that columns loads for the development will be in the order 500 to 2000 kN (SLS).

Ground Conditions

Made Ground was encountered across the entire site to a maximum depth of 1.8m bgl. However, Made Ground was generally present to less than 1.0m bgl. The Made Ground was almost entirely composed of granular material. Natural strata encountered generally comprised orange brown medium to coarse Sand between the depths of 0.75m and 6.0m bgl which was underlain by interbedded very soft to soft brown sandy Clay/brown locally clayey Sand. Firm to stiff dark brown sandy locally gravelly Clay was encountered to a maximum depth of 20.0m bgl in the cable percussive boreholes.

Bedrock was encountered within BH01 and BH04 at 23.5m and 27.3m bgl respectively and consisted of Sandstone to a maximum depth of 45.0m bgl where the boreholes were terminated. No coal seams or evidence of coal mine workings were encountered during the investigation.

Groundwater has been encountered across the site within the natural Sand deposits between depth of 1.6m and 4.0m bgl.

Limitations

The main limitation of the site is the poor ground conditions observed to a maximum depth of 11.5m bgl in the form of loose to medium dense sand deposits overlying very soft to soft Low strength Clay which was encountered in all boreholes. The loose Sand and low strength Clay is not considered a suitable bearing stratum for the proposed development which will exert high column loads.

Due to the proposed loadings it is anticipated that a deep foundation solution will be required, transferring loads to the underlying high strength Sand strata at depth. The depth to bedrock is another factor that will need to be taken into consideration for foundation design.

A high-pressure gas main is present in the north eastern corner of the site which has previously been located and exposed by RoC Consulting during a previous investigation. Where exposed the gas main had a protective concrete covering. However, this may not be present across the entire length of the gas main on site. An easement will be required in the vicinity of the gas main which should be accurately located prior to development and Cadent should be consulted and informed of the proposed development plans so that necessary mitigation measures can be implemented.

Groundwater has been encountered across the site between 1.6m and 4.0m bgl and dewatering of excavations may be required due to seasonal fluctuations or artificial ground levels caused by construction activities.

6.3 Geotechnical Parameters

The geotechnical test results have been evaluated to derive geotechnical parameters for the soils underlying the site. A 'Depth to C_u ' and 'Depth to SPT N ' value graph is presented on GRO-21438-P05 to provide a generalised ground model for the site.

Characterization of the geotechnical parameters above has been undertaken to select a characteristic value, which is a cautious estimate of the value affecting the occurrence of the limit state.

- For the loose Sand, a characteristic SPT 'N' value of 6 has been recorded and by correlation a ϕ' of 28° has been selected for ULS conditions.
- For the medium dense Sand, a characteristic SPT 'N' value of 11 has been recorded and by correlation a ϕ' of 30° has been selected for ULS conditions.
- For the dense Sand, a characteristic SPT 'N' value of 40 has been recorded and by correlation a ϕ' of 45° has been selected for ULS conditions.
- For the low strength Clay an undrained shear strength (C_u) characteristic value of 23kPa has been selected to satisfy ULS conditions based on direct measurement from laboratory testing.
- For the medium strength Clay an undrained shear strength (C_u) characteristic value of 69kPa has been selected to satisfy ULS conditions based on direct measurement from laboratory testing.
- For the high strength Clay an undrained shear strength (C_u) characteristic value of 89kPa has been selected to satisfy ULS conditions based on direct measurement from laboratory testing.

6.4 Preliminary Foundation Design – Office Building

As loose Sand and soft low strength Clay has been encountered beneath the site to a maximum depth of 11.5m bgl, traditional shallow foundations are not considered suitable for the proposed commercial development. We understand that it is anticipated that column loads for the development will be in the order 500 to 2000 kN (SLS). Preliminary design has been undertaken based on this criterion.

Loads will be transferred to the piles from ground beams, pile caps and floor slabs of the superstructure. Transverse loading on the piles and the requirement for reinforcement should be taken into consideration in the detailed design to satisfy Equilibrium Limit State conditions.

Pile Foundations

The most suitable foundations for the proposed development are considered to be piles end-bearing within the medium dense to dense Sand. Deepening the piles to the underlying Sandstone which has been encountered from depths between 23.5m and 27.3m bgl is also an option, however unlikely to be economical. End bearing in the firm to stiff Clay does not provide sufficient allowable load for a single pile.

Good workmanship will be required when installing the piles to ensure the assumptions in the design by calculation are met. The type of pile should provide sufficient lateral stability due to the poor ground conditions observed up to 11.5m bgl.

Both CFA and driven piles are considered to be suitable, the allowable loads for the different diameter and types of piles are discussed below.

A suitable working platform should be designed in accordance with BR470 in advance of the piling works.

Piled Solution – Design by Calculation

Preliminary design by calculation has been carried out using due skill and care using the global factor of safety method for pile design, a global factor of safety of 3 has been used. An allowable load has been calculated for a single pile for each cable percussive borehole and is summarised in the table below:

	BH01	BH02	BH03	BH04
CFA Pile (600mm 15-16m)	1350kN*	1550kN	1450kN	1320kN
Driven Pile (300mm 15-16m)	530kN*	600kN	600kN	560kN

*proposed creche area and piles unlikely to be required

For a 600mm diameter pile 15m in length end bearing in the medium dense Sand, allowable loads between 1320kN and 1550kN can be achieved for a 600mm diameter CFA pile. Pile groups will be required for the proposed maximum allowable load of 2000kN. The allowable loads are based on the assumption the piles end bear in the medium dense to dense Sand.

The end bearing resistance of CFA piles will depend on the drilling technique and magnitude of disruption of the medium dense to dense Sand which may reduce the base resistance.

The variability of the Sand end bearing strata requires discussion with the piling contractor. In BH03 and BH04 the Sand strata was encountered shallower at between 7.5m and 10.3m bgl, the strata was in excess of 4.7m and 8m thick. The Sand was encountered between 14m and 17.5m bgl in BH02 (where the borehole was terminated) and was interbedded with stiff Clay. High SPT values of between 40 and 44 were recorded in this strata.

Based on the variability of the end bearing strata, driven piles may be a better solution as they can be driven to sett using pile driving formulae. This will allow the drilling process to determine the end bearing strata over the piling area and the design to be verified or revised accordingly. Relatively conservative N_q bearing capacity factors have been used for the Sand strata and driven piles would allow a more efficient design to be produced if favourable ground conditions are encountered.

In BH03 and BH04 Clay strata beneath the Sand was circa 15m bgl, therefore piles should be shorter to ensure they end bear in the Sand strata and sufficient Sand for the depth of influence of the pile is beneath.

Deepening the piles to the Sandstone bedrock would provide consistent end bearing strata, however is unlikely to be cost beneficial.

Depending on the proposed finished site levels, the ground conditions indicate downdrag may be an issue and should be taken into consideration in the detailed design.

Design Validation

The piling type, length, depth of reinforcement and design should be discussed with a specialist piling contractor. They can then undertake the detailed design including drawings and specifications to provide fitness for purpose design. In accordance with EC7, static load testing is recommended to validate the design, static load testing may also allow a more efficient design to be produced. Static load testing can be undertaken on preliminary piles or more than 1% of working piles to 1.5 times the characteristic load.

The piling works should be carried out in accordance with Execution Standard EN 1536 for Bored Piles or BS EN 12699:2015 for Displacement Piles.

If the ground conditions encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision should be on a continuous basis to check the design assumptions are correct and construction conforms to design. Supervision should include inspections, Control Ground Investigations and monitoring.

6.5 Preliminary Foundation Design – Creche

The loadings of the proposed creche building is no greater than 250kN, BH01 was drilled in this area and encountered medium dense Sand between 0.9m and 5m bgl, the Sand became loose between 5m and 6m overlying the Soft Clay strata beneath. The Sand strata will provide a safe Allowable Bearing Pressure of 150kN/m² for a 1.5m square pad foundation. Using the bearing pressure the total settlement will be minimal and will be immediate occurring in the construction phase.

Only one exploratory location has been undertaken in this location of the site to obtain parameters for preliminary design, a watching brief should be maintained during the enabling works/removing slab to confirm the ground conditions are consistent. The watching brief will also confirm or otherwise if differential settlement is a potential issue.

If the ground conditions encountered during the construction phase differ significantly to the conditions encountered during the Ground Investigation, work should cease and Groundtech Consulting contacted for further advice.

During the construction phase, supervision should be on a continuous basis to check the design assumptions are correct and construction conforms to design. Supervision should include inspections, Control Ground Investigations and monitoring.

6.6 Building Near Trees

Trees and bushes are present along the site boundaries including mature trees, and some small bushes and trees are present in the north eastern corner of the site. Foundation excavations will not encounter cohesive strata in the vicinity of existing, proposed or recently removed trees and therefore foundation depths will not requires deepening in accordance with current guidance or heave precautions installed.

All foundations should be deepened below roots of greater than 5mm diameter during excavations for footings.

6.7 Floor Slabs

Made Ground is generally present in excess of 0.6m bgl and therefore a suspended floor slab is recommended. A suspended floor slab is considered to be suitable for the proposed development and is compatible with the proposed piled foundations.

6.8 Construction

The trial pits indicate that instability of excavations is anticipated within the natural Sand deposits where collapse of the trial pits has been observed. Instability of the Made Ground is a possibility and should be considered in the groundworks method statements.

Tracked high specification plant is recommended to maintain the build programme. Breaking equipment will also be required for the hardsurfacing and locally to penetrate obstructions associated with the former building on site. No notable obstructions have been encountered during the investigation, however they cannot be ruled out.

Groundwater has been encountered within the natural Sand deposits at depths between 1.6m and 4.0m bgl and dewatering of excavations may be required locally.

6.9 Concrete Classification

Made Ground

Water soluble sulphate testing was undertaken on eight samples of the Made Ground. The range of soluble sulphate (SO_4) recorded is 15.4mg/l to 1350mg/l. Associated pH values ranged between 7.6 and 10.8 indicating slightly alkaline to alkaline conditions.

For a dataset containing five to nine results, the mean of the highest two sulphate test results should be taken as the characteristic value along with the lowest of the pH results. For the Made Ground, the characteristic water soluble sulphate concentration is 1320mg/l and the pH value is 7.6.

Natural Strata

Water soluble sulphate testing was undertaken on 5 samples of the natural ground. The range of soluble sulphate (SO_4) recorded is 43.2mg/l to 413mg/l. Associated pH values ranged between 7.0 and 8.9 indicating neutral to slightly alkaline conditions.

For a dataset containing less than five results, the highest sulphate test result should be taken as the characteristic value along with the lowest of the pH results. For the natural strata, the characteristic water soluble sulphate concentration is 413mg/l and the pH value is 7.0.

Discussion and Assessment

Due to the granular deposits present beneath the site where groundwater has been encountered, the groundwater regime is considered to be mobile.

The results of laboratory pH and sulphate content indicate that ACEC Class AC-2 and sulphate class DS-2 conditions prevail within the Made Ground soils, and ACEC Class AC-1 and sulphate class DS-1^d conditions prevail within the natural ground in accordance with BRE Special Digest 1 "Concrete in aggressive ground" 2005. The specific concrete mixes (the Design Concrete Class) to be used on site will be determined by the site specific concrete requirements in terms of the durability and structural performance. These are assessed in terms of the Structural Performance Level (SPL) and any need for Additional Protective Measures (APM) detailed in Part D of BRE Special Digest 1 with further guidance in Pt E and F.

Pyritic Ground

To classify site locations where natural strata may contain sulphides, it is essential to take into account of the total potential sulphate content which may result from oxidation following ground disturbance.

The value of oxidisable sulphides has been calculated by subtracting the results of the acid-soluble sulphate test (AS % SO_4) from the results of the total potential sulphate (TPS % SO_4) and the results are below 0.3% indicating pyrite is not present and this does not affect the classification.

6.10 Highway Design

Five plate load tests were undertaken across the site and the results are presented in the table below. The CBR testing results are presented in *Appendix 7*.

Location	Depth	Strata	CBR Value (%)
CBR1	0.5	Brown Clay	2.1
CBR2	0.5	MG: Dark brown sandy gravel	3.1
CBR3	0.5	Brown Clay	1.6

CBR4	0.7	MG: Dark brown sandy gravel	5.4
CBR5	0.6	Brown Clay	1.8

CBR values of less than 5% were typically achieved for pavement design purposes, with exception of CBR4. As a minimum the subgrade should be proof rolled prior to construction. Some reengineering of the subgrade is required prior to highway construction to achieve the required design CBR value.

The soils are considered to be frost susceptible due to the fines content, highway construction should be a minimum thickness of 450mm to mitigate against the risk.

6.11 Sustainable Urban Drainage System (SuDS)

Soil percolation testing was carried out in general accordance with BRE Digest 365 at position SuDS1. The results are presented in *Appendix 8* and a summary is presented in the table below:

Location	Test No.	Depth (m bgl)	Stratum	Soil Infiltration Rate (m/sec)
SuDS1	1	1.50	Sand	4.37×10^{-5}
SuDS1	2	1.50	Sand	3.03×10^{-5}
SuDS1	3	1.40	Sand	2.17×10^{-5}

In SuDS1, the natural strata where the infiltration test was carried out consisted of orange brown slightly gravelly fine to coarse Sand. Three soil fills were carried out and soil infiltration rates of between 2.17×10^{-5} and 4.37×10^{-5} m/s were calculated. The first two tests were BRE compliant and the final test was not BRE compliant due to insufficient time to drain past 25% effective depth.

The results at this location and depth indicate that the use of a SuDS drainage scheme within the natural Sand deposits is a possibility as good drainage conditions have been recorded. Groundwater levels observed across the site were generally between 4.0m and 6.5m bgl. Locally, perched groundwater was present between the depths of 1.6m and 2.7m bgl within the trial pits. This will need to be considered within the design of SuDS drainage as the groundwater table should be below 1m of the base of SuDS drainage to account for seasonal variations.

6.12 Revised Coal Mining Risk Assessment

Recorded Coal Mining

No risk was identified by the Coal Authority Report and no further action was recommended at the preliminary stage.

Unrecorded Coal Mining

A potential risk from unrecorded shallow mine working was identified by the Coal Mining Risk Assessment undertaken by Groundtech Consulting. This was based on the coal outcrop beneath the southern area of the site and the uncertainty of depth to bedrock.

Sandstone bedrock has been encountered at locations BH01 and BH04 from depths between 23.5m and 27.3m bgl respectively. The Sandstone bedrock was present to the base of both boreholes at 45.0m bgl and no coal or evidence of coal mine workings was encountered.

The risk of unrecorded workings was within either the Blenfire Coal seam or Trencherbone Coal seam which had recorded thicknesses of 0.7m and 1.83m respectively.



The depth of superficial deposits and presence of groundwater indicates the presence of unrecorded mine entries or workings is highly unlikely. In addition, the depth of rock cover proves in excess of ten times the thickness of the coal seams in accordance with CIRIA C758, therefore the risk to the stability of the surface of the site is *Very Low* and no further action is required.

7.0 LAND QUALITY

7.1 Geo-Environmental Testing Results - Soils

Samples of Made Ground and natural strata have been tested for a range of relevant Contaminants of Concern. A Generic Quantitative Risk Assessment (GQRA) has been undertaken to determine the significance of the concentrations as derived through Geo-Environmental analysis.

The GQRA process comprises the comparison of the actual concentrations measured on site with Generic Assessment Criteria (GACs) for the protection of human health.

The GACs used for the assessment of soil concentrations have been derived using the CLEA model. The GACs used and their ranking of importance are listed below:

- *Soil Guideline Values (SGVs) which demonstrate minimal risk,*
- *LQM/CIEH S4ULs which use the same toxicological data as the SGVs but different exposure criteria.*
- *C4SLs which demonstrate low risk.*

In deriving the GACs for use on Brownfield sites we have assumed a 1% Soil Organic Matter, unless the results indicate otherwise.

The proposed end-use for the site is a commercial development comprising a maximum 3-storey office block to the east of the site and separate Creche facility building on the western boundary of the site. Areas of soft landscaping and two football pitches will also be included as part of the development. We have therefore undertaken the GQRA on the basis that the proposed development site falls under the Commercial land-use scenario as defined in SR3 (EA, 2009b).

The strata or sources of contamination targeted by the laboratory testing scheduled is summarised in the table below:

Strata	Number of Samples Tested	Locations
<i>Granular Made Ground</i>	<i>7</i>	<i>TP01 to TP03, BH01, BH03, BH04</i>
<i>Natural Sand</i>	<i>1</i>	<i>BH02</i>

A summary of the Geo-Environmental Testing results is presented below and the GQRA Screening Values are presented in *Appendix 9*:

Contaminant	Range (mg/kg)	Metals		
		Commercial Screening Value	Exceedances	Locations
<i>Arsenic</i>	<i>6.6 - 11</i>	<i>640</i>	<i>0</i>	<i>-</i>
<i>Cadmium</i>	<i><0.2 - 0.6</i>	<i>230</i>	<i>0</i>	<i>-</i>
<i>Chromium</i>	<i>10 - 28</i>	<i>8600</i>	<i>0</i>	<i>-</i>
<i>Hexavalent Chromium</i>	<i><4.0</i>	<i>49</i>	<i>0</i>	<i>-</i>
<i>Copper</i>	<i>12 - 34</i>	<i>68000</i>	<i>0</i>	<i>-</i>
<i>Lead</i>	<i>14 - 110</i>	<i>2300</i>	<i>0</i>	<i>-</i>
<i>Mercury</i>	<i><0.3</i>	<i>26</i>	<i>0</i>	<i>-</i>
<i>Nickel</i>	<i>13-37</i>	<i>1800</i>	<i>0</i>	<i>-</i>
<i>Selenium</i>	<i><1.0</i>	<i>13000</i>	<i>0</i>	<i>-</i>

<i>Zinc</i>	<i>31-130</i>	<i>730000</i>	<i>0</i>	<i>-</i>
Polycyclic Aromatic Hydrocarbons (PAHs)				
Contaminant	Range (mg/kg)	Commercial Screening Values	Exceedances	Locations
<i>Naphthalene</i>	<i><0.05</i>	<i>190</i>	<i>0</i>	<i>-</i>
<i>Acenaphthylene</i>	<i><0.05</i>	<i>83000</i>	<i>0</i>	<i>-</i>
<i>Acenaphthene</i>	<i><0.05 - 0.44</i>	<i>84000</i>	<i>0</i>	<i>-</i>
<i>Fluorene</i>	<i><0.05 - 0.29</i>	<i>63000</i>	<i>0</i>	<i>-</i>
<i>Phenanthrene</i>	<i><0.05 - 2.5</i>	<i>22000</i>	<i>0</i>	<i>-</i>
<i>Anthracene</i>	<i><0.05 - 0.63</i>	<i>520000</i>	<i>0</i>	<i>-</i>
<i>Fluoranthene</i>	<i><0.05 - 3.8</i>	<i>23000</i>	<i>0</i>	<i>-</i>
<i>Pyrene</i>	<i><0.05 - 3.5</i>	<i>54000</i>	<i>0</i>	<i>-</i>
<i>Benzo(a)anthracene</i>	<i><0.05 - 2.0</i>	<i>170</i>	<i>0</i>	<i>-</i>
<i>Chrysene</i>	<i><0.05 - 1.4</i>	<i>350</i>	<i>0</i>	<i>-</i>
<i>Benzo(b)fluoranthene</i>	<i><0.05 - 2.1</i>	<i>44</i>	<i>0</i>	<i>-</i>
<i>Benzo(k)fluoranthene</i>	<i><0.05 - 0.86</i>	<i>1200</i>	<i>0</i>	<i>-</i>
<i>Benzo(a)pyrene</i>	<i><0.05 - 2.1</i>	<i>35</i>	<i>0</i>	<i>-</i>
<i>Indeno(123cd)pyrene</i>	<i><0.05 - 1.0</i>	<i>500</i>	<i>0</i>	<i>-</i>
<i>Dibenzo(ah)anthracene</i>	<i><0.05</i>	<i>3.5</i>	<i>0</i>	<i>-</i>
<i>Benzo(ghi)perylene</i>	<i><0.05 - 1.3</i>	<i>3900</i>	<i>0</i>	<i>-</i>
TPH CWG – Aliphatics				
Contaminant	Range (mg/kg)	Commercial Screening Values	Exceedances	Locations
<i>>C5-C6</i>	<i><0.001</i>	<i>3200</i>	<i>0</i>	<i>-</i>
<i>>C6-C8</i>	<i><0.001</i>	<i>7800</i>	<i>0</i>	<i>-</i>
<i>>C8-C10</i>	<i><0.001</i>	<i>2000</i>	<i>0</i>	<i>-</i>
<i>>C10-C12</i>	<i><1.0</i>	<i>9700</i>	<i>0</i>	<i>-</i>
<i>>C12-C16</i>	<i><2.0</i>	<i>59000</i>	<i>0</i>	<i>-</i>
<i>>C16-C21</i>	<i><8.0</i>	<i>1600000</i>	<i>0</i>	<i>-</i>
<i>>C21-C35</i>	<i><8.0</i>	<i>1600000</i>	<i>0</i>	<i>-</i>
<i>Total aliphatics C5-35</i>	<i><10.0</i>		<i>0</i>	<i>-</i>
TPH CWG – Aromatics				
Contaminant	Range (mg/l)	Commercial Screening Values	Exceedances	Locations
<i>>C5-EC7</i>	<i><0.001</i>	<i>26000</i>	<i>0</i>	<i>-</i>
<i>>EC7-EC8</i>	<i><0.001</i>	<i>56000</i>	<i>0</i>	<i>-</i>
<i>>EC8-EC10</i>	<i><0.001</i>	<i>3500</i>	<i>0</i>	<i>-</i>
<i>>EC10-EC12</i>	<i><1.0</i>	<i>16000</i>	<i>0</i>	<i>-</i>
<i>>EC12-EC16</i>	<i><2.0</i>	<i>36000</i>	<i>0</i>	<i>-</i>
<i>>EC16-EC21</i>	<i><10.0</i>	<i>28000</i>	<i>0</i>	<i>-</i>
<i>>EC21-EC35</i>	<i><10.0 – 48.0</i>	<i>28000</i>	<i>0</i>	<i>-</i>
<i>Total aromatics C5-35</i>	<i><10.0 – 53.0</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>Total aliphatics and aromatics(C5-35)</i>	<i><10.0 – 53.0</i>	<i>-</i>	<i>-</i>	<i>-</i>
<i>MTBE</i>	<i><1.00 ug/kg</i>	<i>7900</i>	<i>0</i>	<i>-</i>
<i>Benzene</i>	<i><1.00 ug/kg</i>	<i>95</i>	<i>0</i>	<i>-</i>
<i>Toluene</i>	<i><1.00 ug/kg</i>	<i>4400</i>	<i>0</i>	<i>-</i>

<i>Ethylbenzene</i>	<i><1.00 ug/kg</i>	<i>2800</i>	<i>0</i>	<i>-</i>
<i>m/p-Xylene</i>	<i><1.00 ug/kg</i>	<i>3200</i>	<i>0</i>	<i>-</i>
<i>o-Xylene</i>	<i><1.00 ug/kg</i>	<i>2600</i>	<i>0</i>	<i>-</i>
Others				
<i>Natural Moisture Content 5.9 – 15.0%</i>				
<i>pH value 7.6 – 10.8</i>				
<i>Organic Matter 0.6 – 3.0%</i>				
Asbestos Screen				
Position	Depth (m bgl)	Asbestos Type	Quantification (mass%)	
<i>TP01</i>	<i>0.25</i>	<i>None Detected</i>	<i>-</i>	
<i>TP01</i>	<i>0.7</i>	<i>Amosite-Loose Fibres</i>	<i><0.001</i>	
<i>TP02</i>	<i>0.35</i>	<i>None Detected</i>	<i>-</i>	
<i>TP03</i>	<i>0.55</i>	<i>Chrysotile-Loose Fibrous Debris</i>	<i>0.005</i>	
<i>BH01</i>	<i>0.5</i>	<i>None Detected</i>	<i>-</i>	
<i>BH02</i>	<i>1.0</i>	<i>None Detected</i>	<i>-</i>	
<i>BH03</i>	<i>1.0</i>	<i>None Detected</i>	<i>-</i>	
<i>BH04</i>	<i>0.5</i>	<i>None Detected</i>	<i>-</i>	

7.2 Generic Quantitative Risk Assessment - Soils

Made Ground was encountered beneath the site to a maximum depth of 1.8m bgl. However, it was generally present to depths of less than 1.0m bgl. Made Ground generally consisted of dark brown gravelly sand and dark brown sandy gravel. No evidence of contamination was noted during the investigation.

No elevated concentrations of metals, speciated Polycyclic Aromatic Hydrocarbons (PAHs) or hydrocarbons have been recorded by the laboratory testing based on the site having a commercial end use. Furthermore, TPH concentrations were almost entirely recorded at levels below the laboratory limits of detection.

A creche is to be included in the proposed development. Young children are a more sensitive receptor, therefore the samples tested were also screened against more stringent screening values of residential without plant uptake. No elevated concentrations of metals, speciated Polycyclic Aromatic Hydrocarbons (PAHs) or hydrocarbons were identified based on using more stringent CoC screening values.

Asbestos

Amosite loose fibres were detected at a trace concentration of <0.001 mass% in TP01 at a depth of 0.7m bgl in the west of the site. Chrysotile loose fibrous debris was detected at a concentration of 0.005 mass% in TP03 at a depth of 0.55m bgl in the south east of the site.

The asbestos was associated with black brown sandy gravel with fragments of brick and tarmac present at both locations. The source of the asbestos is likely to be the previously demolished commercial building. No other asbestos has been identified within the samples screened through laboratory testing. The source of the asbestos is likely the subgrade material imported historically to construct the hardsurfacing and warehouse, shown on historical maps in 1988/92, for use within the subbase. No other asbestos has been identified within the samples screened through laboratory testing, however should be assumed to be widespread as the Made Ground is similar in nature.

7.3 Permanent Ground Gases

Three standpipes were installed for gas monitoring within BH01, BH02 and BH04. One monitoring visit has been carried out to date on 28th February 2022 and a further three visits are planned.

Concentrations of methane (CH₄) were not recorded within any monitoring locations. Carbon dioxide (CO₂) has been recorded at a maximum concentration of 4.3% v/v within BH01. Detectable levels of oxygen (O₂) were recorded within the standpipes at a minimum level of 12.3% v/v.

No positive gas flow rates were detected during the monitoring visits.

The atmospheric pressure was 1008mb on the monitoring visit which was completed during a period of falling barometric pressure.

Groundwater was recorded within all standpipes, at depths of between 0.47m and 4.0m bgl.

Characterisation of the Gas Screening Value (GSV)

Based upon the initial results recorded, in accordance with CIRIA Report C665, the risk to the site from ground gases has been assessed by converting the results to gas screening values (GSVs), calculated by multiplying the typical maximum gas concentrations with the recorded maximum positive flow rates. In addition, individual “hazardous gas flow rates” (Q_{hg}) have been derived for each monitoring point. As no levels of methane have been recorded, a GSV for carbon dioxide only has been calculated.

$$GSV (l/hr) = \text{max borehole flow rate (l/hr)} \times \text{max gas concentration (\%)}$$

For this assessment, the maximum recorded concentration of carbon dioxide of 4.3%v/v has been used. No positive gas flow rates have been detected therefore the limit of detection of the gas analyser of 0.1l/hr has been adopted to calculate the GSV.

$$\text{Carbon Dioxide GSV} = 0.043 (4.3\%) \times 0.1 = 0.0043 \text{ l/hr}$$

Assessment

In order to assess the ground gas regime beneath the site and the need to incorporate ground gas precautions, guidance was taken from CIRIA C655 ‘Assessing risks posed by hazardous ground gases to buildings’. Based on the site having commercial end use, the Wilson and Card method has been used to carry out the assessment.

When considering the results to date in accordance with CIRIA C665 (Section A Development and Table 8.5 – Modified Wilson and Card Classification) it can be seen that the GSV value for carbon dioxide is below the assessment GSV of 0.07l/hr and typical carbon dioxide concentrations are generally less than 5% v/v , the site falls into CS1 based on the monitoring undertaken to date.

Characteristic Situation 1

The proposed development is classified as Building Type C in accordance with BS 8485:2015 and the site falls into CS1 in accordance with Table 2 of the above guidance and no gas protection measures are required.



The above recommendations are based on the gas monitoring carried out to date and a full assessment will be provided upon completion of the gas monitoring programme.

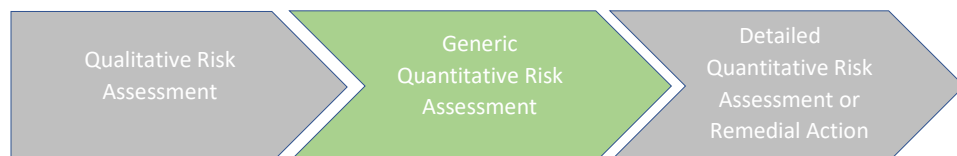
Radon

The site is not located in an area where radon precautions are required within new structures.

7.4 Revised Pollution Linkage Assessment

A pollution linkage assessment has been revised based on the Ground Investigation and testing in accordance with LCRM and CIRA C552 as set out in *Appendix 10* to identify any realistic pollution linkages in order to quantify the risks to human health and controlled waters. The revised pollution linkages are displayed on *GRO-21438-P06* - Illustrative Revised CSM.

Human Health Pollution Linkage Assessment



- The table below represents the second stage in the land quality risk assessment process - **the Generic Quantitative Risk Assessment**.
- In order for a development site to be deemed 'suitable for use' the level of risk needs to be reduced to an acceptable level - low to negligible risk. The purpose of each stage of risk assessment is to establish if there is a requirement for additional stages of assessment in order to have sufficient confidence to support a risk characterisation or remedial action.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL1	Contaminated Soils	Ingestion of soil and dust. Dermal contact with soil.	Unlikely to Low Likelihood	Medium	Moderate	<i>Pollution Linkage 1 refers to proposed site users coming into contact with contaminated soils on the site.</i> <i>The site is currently utilised as an overflow car park to the adjacent JD Sports offices to the east. Historically, there has been a warehouse located on the site which has now been demolished.</i> <i>Made Ground was present beneath the site, no evidence of contamination was noted. No elevated concentrations of metals, speciated PAHs or hydrocarbons were detected by the laboratory testing. Asbestos fibres were detected within TP01 at 0.7m bgl and TP03 at 0.55m bgl at concentrations between <0.001 mass% and 0.005 mass%. The source of the asbestos is likely to be demolition material from the previous warehouse. The JIWG Receptor tool concluded the overall ranking is Low.</i> <i>No elevated contamination or asbestos was detected in the previous investigation undertaken by RoC Consulting.</i>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
						The proposed development is commercial end use comprising a three-storey office block in the east and separate Creche facility building on the western boundary of the site with associated staff welfare facilities including two five-a-side football pitches. Asbestos has been detected in the west and east of the site and should be assumed to be site wide at low concentrations. In conclusion, Made Ground is present beneath the site however no elevated levels of CoC were detected within the samples tested. Asbestos has been detected and areas of soft landscaping are proposed. Therefore a pollution linkage has been identified.
PL2	Contaminated Soils	Inhalation of vapour.	Unlikely	Medium to Severe	Low	Pollution linkage 2 refers to vapours migrating into confined spaces within the proposed development. No significant sources of volatile contamination have been identified on the site and no visual or olfactory evidence of hydrocarbon contamination was noted during the Ground Investigation. No elevated concentrations of hydrocarbons were detected by the laboratory testing and recorded concentrations were predominantly below laboratory detection limits. Therefore, no plausible pollution linkage is considered to exist.
PL3	Contaminated Soils	Inhalation of soil dust by adjacent site users.	Unlikely	Medium	Low	Pollution Linkage 3 relates to contamination on the subject site affecting adjacent site users. No sources of mobile contamination have been identified on the site therefore a viable pollution linkage has not been identified.

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential Source	Pollution Linkage	Likelihood	Consequence/ Severity	Risk Rating	Rationale and Action
PL4	Contaminated Soils	Attacking potable water supply pipe.	Unlikely	Medium	Low	<i>Pollution Linkage 4 refers to the possible contaminants permeating potable water pipes and consumption by the future site end users of the tainted water supply. Made Ground is present at installation depths across the site. However, no evidence of organic contamination was noted during the investigation and hydrocarbon concentrations recorded were predominantly below laboratory detection limits. It is anticipated that standard PE pipes will be suitable. However, it would be prudent to undertake a local water company risk assessment to select the correct material.</i>
PL5	Ground Gas	Migration and accumulation of ground gas in internal spaces.	Unlikely	Medium to Severe	Low	<i>Made Ground is present beneath the site, it is generally present at shallow depths of less than 1.0m bgl. Deep Made ground was encountered at a single location to 1.8m bgl. Widespread demolition material does not appear to be present on site associated with the former warehouse.</i> <i>No methane has been detected by the monitoring undertaken to date and a maximum carbon dioxide concentration of 4.3%v/v has been recorded along with no positive flow rates. Interim gas monitoring results categorise the site as CS1 based on the GSV and therefore no gas protection measures are considered necessary at this stage.</i> <i>This will be confirmed upon completion of the gas monitoring programme.</i> <i>The site is not within an area requiring radon precautions within foundations.</i>

Conceptual Site Model					Generic Quantitative Risk Assessment	
PL	Potential source	Pollution linkage	Likelihood	Severity	Level of risk	Rationale
PL7	Contaminated Soils	Migration of soil and groundwater contamination impacting surface waters.	Unlikely	Medium	Very Low	Pollution Linkage 7 refers to the impaction of Hollins Brook 91m south of the site from contaminated soils and groundwater. No sources of mobile contamination have been identified through the Ground Investigation and a plausible pollution linkage does not exist.

7.5 Outline Remedial Strategy

Soils

Made Ground was encountered beneath the entire site to a maximum depth of 1.8m bgl. No elevated concentrations of CoC above commercial screening values were detected by the laboratory testing. Asbestos was detected locally at concentrations between <0.001 mass% and 0.005 mass%.

The majority of the site will be covered with hardsurfacing which will break the pollution linkage to the Made Ground containing asbestos fibres. Where soft landscaping areas are present, it is recommended that 600mm of suitably clean topsoil is placed including a demarcation layer or a 100mm thick hard dig layer to mitigate the risk of asbestos fibres in the Made Ground.

Controlled Waters

No specific remedial measures are required with respect to controlled waters.

Permanent Ground Gasses

Based on the single gas monitoring visit undertaken to date the site falls into CS1 and gas protection measures are not considered necessary at this stage. This will be confirmed or otherwise on completion of the monitoring programme.

The site is not in an area requiring radon precautions.

Watching Brief and Regulatory Compliance

A watching brief is recommended during future ground works for any previously unseen contamination. If identified, work should cease in that area and advice sought from Groundtech Consulting Limited.

Approval from the regulators should be obtained prior to the development commencing to avoid any delays at the construction stage.

7.6 Asbestos in Soils

Asbestos fibres were detected within two out of eight samples of Made Ground that were screened. One of the samples had trace concentrations of <0.001 mass% and one sample had concentrations of 0.005 mass% where loose fibrous debris was present.

Where possible, it is advised that any Made Ground soils containing asbestos are left in the ground undisturbed.

Where soils will be disturbed as part of the ground works, in accordance with the Joint Industry Working Group (JIWG) decision support tool for CAR2012 work categories, the combined hazard and exposure ranking is Medium for the asbestos detected. The work is classified as non-licensed, and CAR does not apply.

The JIWG tables are presented in *Appendix 11*. This should be used as an aid to classify risk and recommend the level of protection required, the final decision on how asbestos within the soils should be managed should be made by the contractor.

7.7 Health and Safety - Construction and Ground Workers

During the reclamation and construction phases of the site development it will be necessary to protect the health and safety of site personnel. The risk to construction and ground workers is assessed in the table below:

PL Ref	Potential Source	Pollution Linkage	Likelihood	Severity	Level of Risk
PL8	Made Ground	Ingestion, direct contact, inhalation of dusts.	Unlikely	Medium	Low
PL8	Asbestos	Inhalation of dusts	Low likelihood	Medium	Medium

The risks from asbestos fibres and loose fibrous debris should be communicated to ground workers through a site induction and information on noticeboards.

General guidance on these matters is given in the Health and Safety Executive (HSE) document “Protection of Workers and the General Public during the Redevelopment of Contaminated Land”. In summary, the following measures are suggested to provide a minimum level of protection:

- All ground workers should be issued with the relevant protective clothing, footwear and gloves. These protective items should not be removed from the site and personnel should be instructed as to why and how they are to be used.
- Hand-washing and boot-washing facilities should be provided.
- Care should be taken to minimise the potential for off-site migration of contamination by the provision of dust suppression control and wheel cleaning equipment during the construction works.
- Good practices relating to personal hygiene should be adopted on the site.
- The contractor shall satisfy the Health and Safety Executive with regard to any other matters concerning the health, safety and welfare of persons on the site.

7.8 Waste Classification by Assessment

We have reviewed the testing results and inputted them into the HazWasteOnline model which allows users to code and classify waste as defined in the EWC (European Waste Catalogue 2002) based on EC Regulation 1272/2008 on the Classification, labelling and packaging of substances and mixtures (CLP) and latest Environment Agency guidance (WM3 “Guidance on the classification and assessment of waste (1st edition 2015)-Technical Guidance”).

This is a useful tool as waste producers have the legal responsibility to classify any waste they produce.

Eight samples were tested to assess whether they contained any contaminants in the hazardous range when screened against assessment criteria within WM3. The results are in the Waste Classification Report presented in *Appendix 12*.

Location	Depth (m bgl)	Material	Classification	Hazardous Properties
TP01	0.25	MG: Dark brown sandy gravel	Non-Hazardous	-
TP01	0.70	MG: Black clayey sandy gravel	Non-Hazardous	-
TP02	0.35	MG: Dark brown gravelly sand	Non-Hazardous	-
TP03	0.55	MG: Dark brown sandy gravel	Non-Hazardous	-

BH01	0.50	MG: Dark brown clayey gravelly sand	Non-Hazardous	-
BH02	1.00	Brown slightly gravelly clayey Sand	Non-Hazardous	-
BH03	1.00	MG: Orange brown sandy gravel	Non-Hazardous	-
BH04	0.50	MG: Brown sandy gravel	Non-Hazardous	-

Asbestos fibres were detected at concentrations of less than 0.1 mass% and these concentrations therefore do not affect the classification.

7.9 Waste Acceptance Criteria (WAC) Results

The Landfill Directive (Directive 1999/31/EC on the landfilling of waste) led to the establishment of a methodology for classifying wastes. Wastes can only be accepted at a landfill if they meet the relevant Waste Acceptance Criteria (WAC) for that type of landfill. There are three different WAC, these are for:

- Inert waste
- Non –hazardous waste
- Hazardous waste

Wastes should first be classified based on their total concentrations as detailed in the previous section. WAC testing is then required if the end disposal route is a landfill.

Solid and eluate WAC analysis was undertaken on two samples, the findings of which are presented in the table below.

Reference	Depth (m)	Strata Type	Classification	WAC Analysis	Landfill Disposal
TP01	0.25	MG: Dark brown sandy gravel	Non-Hazardous	SNR	Non-hazardous
BH03	1.0	MG: Brown sandy gravel	Non-Hazardous	Inert	Inert Landfill

The WAC testing has revealed that if the end disposal route of the Made Ground is landfill the material would be accepted at an Inert or Non-Hazardous landfill.

The possibility of automatic inert classification of the natural soils should be explored in accordance with Section 4.3 of the EA guidance document. The Council Decision includes a list of wastes in Section 2.1.1 of the document that are assumed to be inert and therefore acceptable at a landfill for inert waste without testing, this is the case if:

- They are single stream waste of a single waste type (although different waste types from the list may be accepted together if they are from a single source) and
- There is no suspicion of material or substances such as metals, asbestos, plastics, chemicals, etc to an extent which increases the risk associated with the waste sufficiently to justify contamination and they do not contain other their disposal in other classes of landfill.

If any organic contaminated material is encountered during the construction phase, it is possible that this may be classified as hazardous and testing should be undertaken at that time.

Materials should be segregated and where necessary sufficient time is allowed to further classify the material properly, including discussion with landfill sites and waste transfer stations to find the best disposal route. It



is recommended that where possible that the soils could be recycled at a suitable local waste treatment plant or transfer station rather than a landfill disposal route.

The reuse of soils on the site this should be done in accordance with the CL:AIRE “Development Industry Code of Practice for the Definition of Waste” (CL:AIRE CoP). Any re-use scheme should be designed to minimise disposal costs.

After a cut and fill balance plan/volume calculation has been carried out, a U1 and T5 exemption could be registered. This will allow the use of the following soils without a waste permit or under Dow CoP MMP:

- *1,000 tonnes (c. 600m³) of non-hazardous soil*
- *5,000 tonnes (c. 3,000m³) of natural sand and gravels.*
- *50,000 tonnes (c. 25,000m³) of bituminous material to be used in roadways.*
- *5,000 tonnes (c. 3,000m³) of crushed concrete / stone.*

8.0 FINAL APPRAISAL

8.1 Land Quality

Made Ground has been encountered across the site to a maximum depth of 1.8m bgl and generally consisted of either dark brown gravelly sand or sandy gravel. No visual or olfactory evidence of contamination has been noted.

Geo-Environmental testing indicates that there are no elevated concentrations of metals, speciated PAHs or hydrocarbons above commercial screening values. Asbestos fibres were detected within TP01 at 0.7m and TP03 at 0.55m bgl at concentrations of <0.001 mass% and 0.005 mass% respectively. No elevated contamination or asbestos was detected during the previous investigation of the site undertaken by RoC Consulting.

The risk from contaminated soils is considered to be *Moderate*. The majority of the redevelopment will be covered by hardsurfacing which will act as a cover system, in areas of soft landscaping a 600mm of suitably clean subsoil/topsoil and hard dig layer should be placed to mitigate the risk from asbestos fibres.

No evidence of hydrocarbon contamination has been observed or detected during the investigation and hydrocarbons were generally present at concentrations below laboratory detection limits. The risk from vapours is considered to be *Low*.

Based on the initial ground gas monitoring visits, the site falls into CS1 and gas protection measures are not considered necessary at this stage. This will be confirmed on completion of the gas monitoring programme. The site is not in an area affected by radon.

The risk to controlled water has been assessed as *Low*.

Eight samples of Made Ground/natural ground have been analysed and all have been classified as *Non-Hazardous* for waste disposal.

8.2 Ground Engineering

The most suitable foundations for the proposed development are considered to be piles transferring loads to the underlying medium dense to dense Sands. A range of allowable loads have been calculated for different types of piles and diameters. Based on the proposed loading provided, pile groups will be required.

Suspended floor slabs should be adopted at the site due to the compatibility with the proposed pile foundation solution and depth of Made Ground.

Three soil percolation tests were undertaken at a single location and the use of SuDS drainage is considered feasible within the natural Sand deposits where good soil infiltration rates have been calculated.

Five plate load tests have been undertaken across the site and CBR values for the underlying Clay ranged between 1.6% and 5.4%. Proof rolling of the subgrade will be required as a minimum.

Constraints

A high-pressure gas main is present in the north east of the site which has been located by slit trenches carried out in a previous investigation by RoC Consulting. An easement will be required around the gas main and its location need to be considered by the development layout.

8.3 Required Supplementary Investigation

The following further work is considered necessary to progress the site to construction phase:

Completion of gas monitoring programme.

Issue gas assessment.

Detailed foundation design.

Confirmation of remedial recommendations with regulators.

9.0 RELEVANT INDUSTRY REFERENCES

- British Standards Institution. *Investigation of Potentially Contaminated sites - code of practice*. BS 10175:2017.
- British Standards Institution '*Code of Practice for Site Investigations*' BS 5930:2015
- British Standards Institution "*Geotechnical investigation and testing – Identification and classification of soil*" BS EN ISO 14688:2002.
- British Standards Institution "*Geotechnical investigation and testing – Identification and classification of rock*" BS EN ISO 14689:2002.
- BRE Report BR211 '*Radon – Guidance on protective measures for new buildings*' 2015 Edition.
- BRE Special Digest 1: "*Concrete in Aggressive Ground*" 3rd Ed 2005.
- CIRIA 552 "*Contaminated Land Risk Assessment – A guide to good practice*" 2001.
- CIRIA C665 "*Assessing Risks Posed by Hazardous Ground Gases to Buildings*" 2007.
- Wilson & Card "*Proposed method classifying gassing sites*" Ground Engineering 1999.
- Card & Steve Wilson in "*A pragmatic approach to ground gas risk assessment for the 21st Century*" - CIRIA/Environmental Protection UK Ground gas seminar 2011
- BS 8576:2013 '*Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)*'
- BS 8485:2015 '*Code of practise for the design of protective measures for methane and carbon dioxide ground gases for new buildings*'
- The Hazardous Waste (England) Regulations 2005.
- Environment Agency Hazardous Waste: "*Guidance on the classification and assessment of waste*" WM3 ver 1 May 2015.
- The National Planning Policy Framework (NPPF) March 2012
- DETR. Circular 02/2000 Contaminated Land.
- Environment Agency, 2009 '*Using Soil Guideline Values*'.
- Environment Agency, 2009 '*Updated Technical Background to the CLEA model*'.
- Environment Agency, 2009 '*Human health toxicological assessment of contaminants in soil*'.
- Department of the Environment, 1994, CLR Report No 1 '*A framework for assessing the impact of contaminated land on groundwater and surface water*'.
- Department of the Environment, 1994, CLR Report No 2 '*Guidance on Preliminary Site Inspection of Contaminated Land*'.
- Department of the Environment, 1994, CLR Report No 3 '*Documentary research on Industrial Sites*'.
- Department of the Environment, 1994, CLR Report No 4 '*Sampling Strategies for Contaminated Land*'.
- DEFRA and the Environment Agency, 2002-2004, CLR10 '*Soil Guideline Value Reports for Individual Soil Contaminants*'.
- DEFRA and the Environment Agency, 2004, CLR Report No 11 '*Model Procedures for the Management of Contaminated Land*'.
- Nathanail, C. P., McCaffrey, C., Gillett, A., Ogden, R. C. and Nathanail, J.F. 2015. The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.
- CL:AIRE, 2014 '*Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*'.
- Water Framework Directive.
- Environmental Quality Standards.

UK Drinking Water Standards: Water Supply (Water Quality) Regulations 1989 (SI 1989/1147) and Water Supply (Water Quality) Regulations

UKWIR Report 10/WM/03/21 2010 "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites"

Health & Safety Executive, 1991. 'Protection of Workers & the General Public during the Development of Contaminated Land'.

Environment Agency & NHBC, 2000. R&D Publication 66. Guidance for the Safe Development of Housing on Land Affected by Contamination.

Environment Agency "Guidance on the classification and assessment of waste (1st edition 2015) Technical Guidance WM3"

NHBC Standards 2019

CL:AIRE "*The Definition of Waste: Development Industry Code of Practice*" Version 2 March 2011.

CIRIA "*Asbestos in soil and made ground: a guide to understanding and managing risks*" C733 2014

Control of Asbestos Regulations (CAR) 2012

Harris, M R, Herbert, S. M, Smith, M A 'Remedial Treatment for Contaminated Land' (twelve volumes), special publications 101-112, CIRIA 1996.

Department of the Environment. 1995. Industry Profiles - 48 separate publications available from The Stationery Office, London

BRE Digest 365 "Soakaway Design" 2015.

Environment Agency. R&D Publication 20. Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources. 1999.

Environment Agency Technical Guidance Note 01. Hydrogeological Risk Assessment for Landfills.

Specification for Highways Works – Series 600 Earthworks November 2016

APPENDIX 1 - Plans

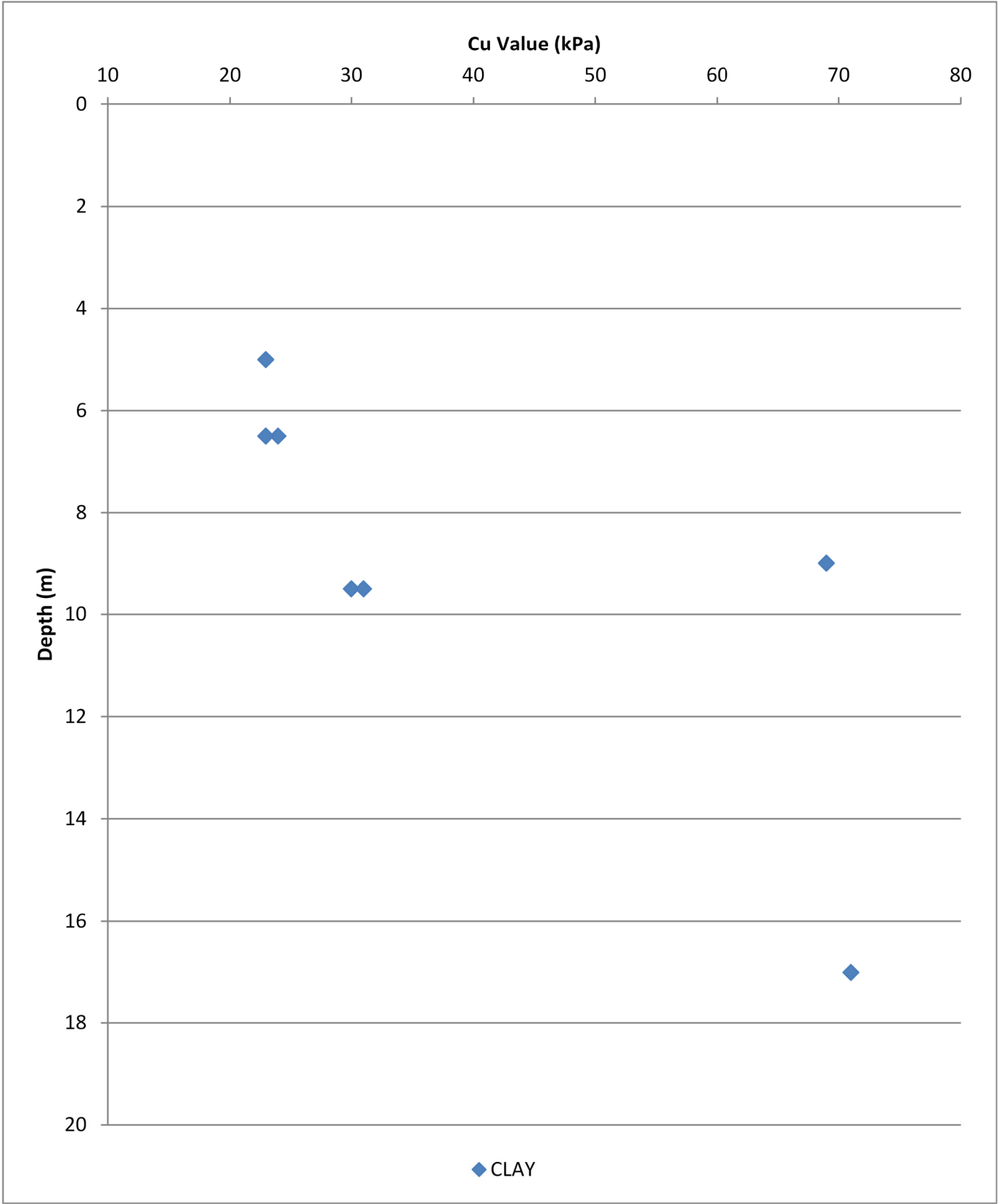
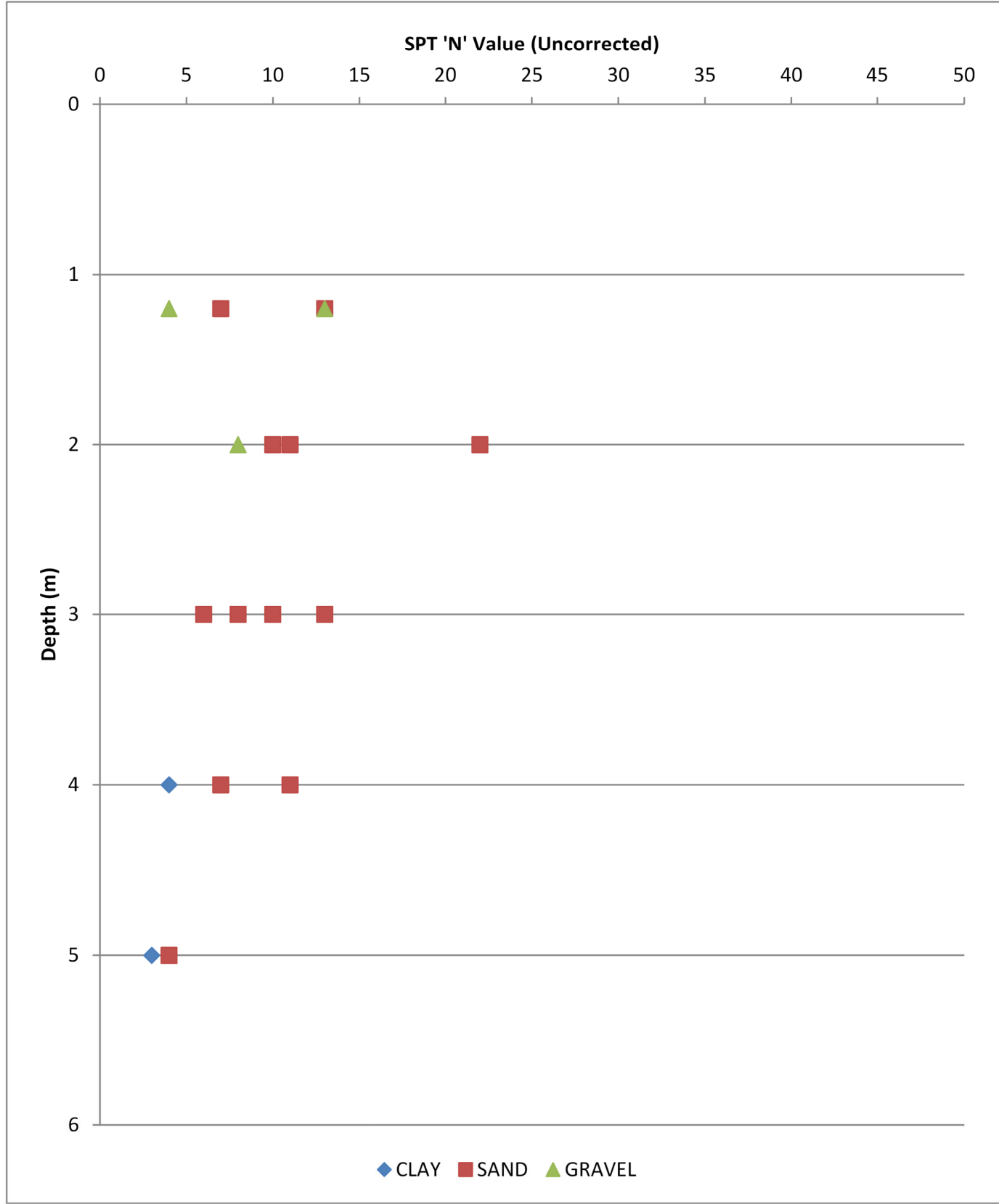


GROUNDTECH CONSULTING	CLIENT	DATE			Status	Notes - Site Location
	JD SPORTS	JANUARY 2022			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	NEW OFFICE BLOCK, BURY	NTS			Issued	
	PLAN TITLE	PLAN NUMBER			For Comment	
PROJECT LOCATION PLAN	GRO-21438-P01		Rev.	Details	Date	Approved





GROUNDTECH CONSULTING	CLIENT	DATE			Status		Notes - Site Location - Borehole Location - Trial Pit Location - CBR Location
	JD SPORTS	JANUARY 2022			Preliminary		
	PROJECT TITLE	SCALE			Draft		
	NEW OFFICE BLOCK, BURY	NTS			Issued		
	PLAN TITLE	PLAN NUMBER			For Comment		
	EXPLORATORY HOLE LOCATION PLAN	GRO-21438-P04	Rev.	Details	Date	Approved	



GROUNDTECH
CONSULTING



CLIENT

JD SPORTS

PROJECT TITLE

NEW OFFICE BLOCK, BURY

PLAN TITLE

GENERALISED GROUND MODEL

DATE

FEBRUARY 2022

SCALE

NTS

PLAN NUMBER

GRO-21438-P05

Rev.

Details

Date

Status

Preliminary

Draft

Issued

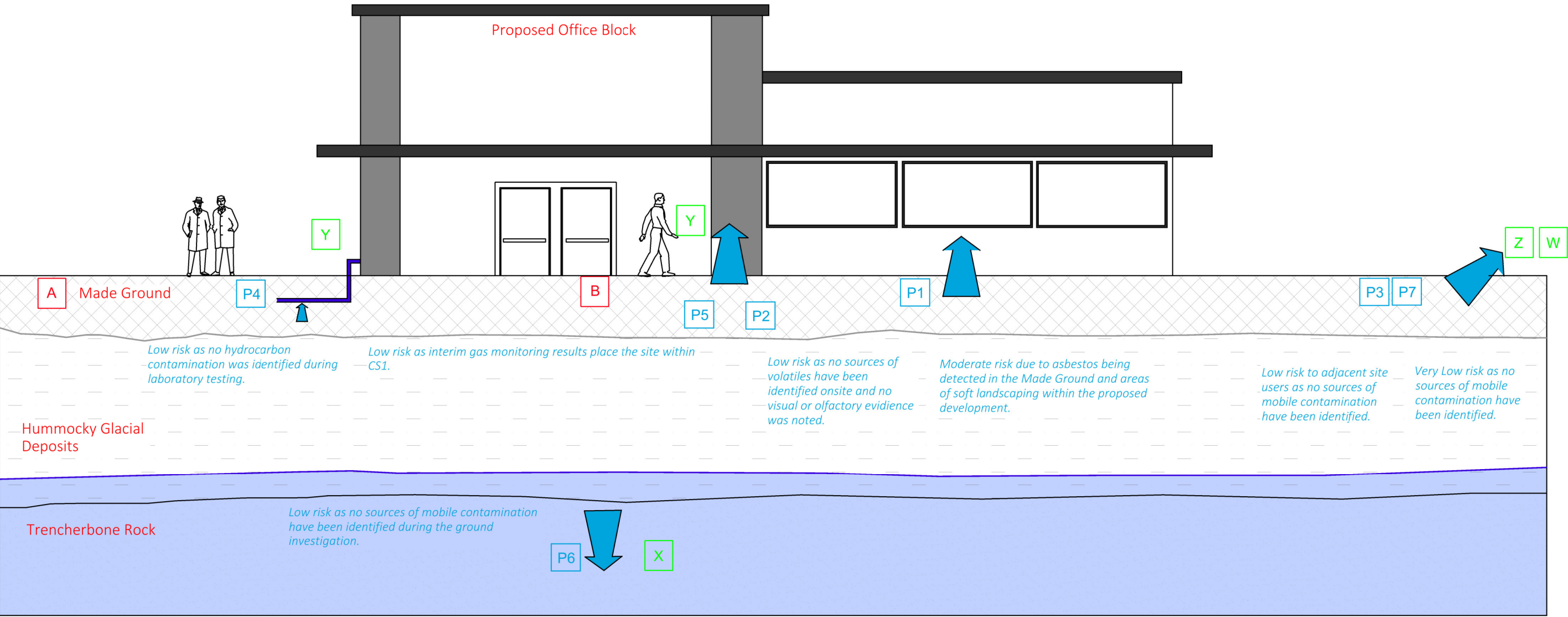
For Comment

Approved

Notes



SOURCES	POLLUTION LINKAGES	RECEPTORS
A. Contaminated soils / Made ground. B. Ground gas.	P1. Ingestion of soil and dust. P2. Inhalation of vapour. P3. Inhalation of soil dust by adjacent site users. P4. Attacking of potable water supply pipe. P5. Migration and accumulation of ground gas in internal places. P6. Impaction of groundwater from soil contamination. P7. Migration of soil and groundwater contamination impacting surface waters.	W. Hollins Brook X. Groundwater within the Secondary A Aquifer. Y. Site end users. Z. Adjacent site users.



GROUNDTECH CONSULTING G	CLIENT	DATE			Status	Notes
	JD SPORTS	JANUARY 2022			Preliminary	
	PROJECT TITLE	SCALE			Draft	
	NEW OFFICE BLOCK, BURY	NTS			Issued	
	PLAN TITLE	PLAN NUMBER			For Comment	
	REVISED ILLUSTRATIVE CSM	GRO-21438-P06	Rev.	Details	Date	Approved





APPENDIX 2 - Site Photographs