

Rugby Football League Our League Life Hub

Phase 2 Ground Investigation

Curtins Ref: 077652-CUR-00-XX-RP-GE-003

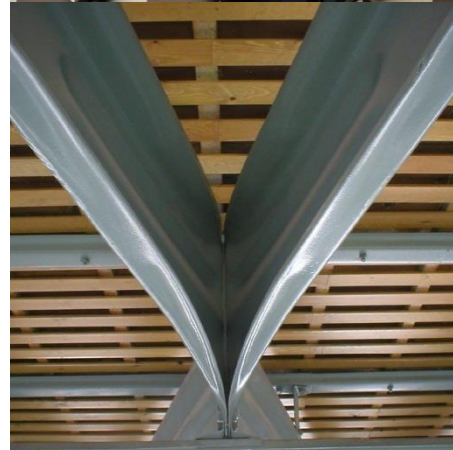
Revision: P02

Issue Date: 11 October 2021

Client Name: Holmes Miller

Client Address: 89 Minerva Street, Finnieston, Glasgow, Glasgow, G3 8LE

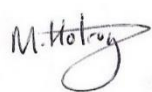
Site Address: Land off Kirkstead Close, Beswick, Manchester, M11 3DS



Rev	Description	Issued by	Checked	Date
V01	Revision for comments from Planning Consultant	TW	JJ	19/11/2021

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
T Walker BSc (Hons) MSc Graduate Geo-Environmental Engineer		11 October 2021

Reviewed	Signature	Date
M Holroyd BSc (Hons) MSc Geo-Environmental Engineer		11 October 2021
R Amirhosseiny Meng Principal Geotechnical Engineer		11 October 2021

Authorised	Signature	Date
M Lomas BSc (Hons) CEnv CSci CWEM MCIWEM Technical Director		11 October 2021

Executive Summary

Appointment	In June 2021 Curtins were instructed by Muse to undertake a Phase 2 Ground Investigation of land off Kirkstead Close, Beswick, Manchester, M11 3DS. The site covers an area of approximately 1.92 Ha. It is understood that the site is to be redeveloped with the Our League Life Hub Education Facility, with ancillary facilities including an integrated sports stand. Development plans were available at time of writing and are presented in Appendix A.
Current Site Status	The site is currently occupied by a derelict commercial building called Beswick Local Shops with large car parking adjacent with areas of landscaping near streetlights in the east of the site. A fence separates the building and car park from a built-up slope and the large rugby field to the west and north of the building.
Summary of Phase 1	Earliest mapping (1840's) shows the site as undeveloped. By 1891, the site is developed with terraced residential development across the site with several residential roads. The site is surrounded within 500m by industrial land use. The site was completely re-developed by 1974; interconnected cul-de-sacs built with one large building separated into units such as surgery and post-office on site. Electrical substation is constructed in the centre of the site. Between 2006 and 2021, the site buildings were demolished, a car parking area is present to the south and east of the building on site with the landscaped field area to the west. BGS mapping indicates the site is underlain by Glacial Till superficial deposits and bedrock geology of the Etruria Formation in the southwest of the site and Pennine Upper Coal Measures in the northeast. BGS mapping records do not indicate the presence of Made Ground on site; a local BGS borehole records Glacial Till underlying Made Ground to a depth of 15.24m bgl. Defra data indicates the site is underlain by a Secondary Undifferentiated Aquifer associated with the superficial deposits and Secondary A Aquifers in the bedrock (Etruria Formation and Pennine Upper Coal Measures Fm). The site is not located within a Source Protection Zone (SPZ). The nearest surface water feature 597m southeast of the site and is a pond. There are no surface water abstractions within 700m.
Fieldworks Undertaken	Intrusive Investigation was undertaken in June 2021 and comprised 4 No. cable percussion boreholes to approximately 10m bgl, and 4 No. Window Sample boreholes to 3.00m to 4.42m bgl. Two mechanical trial pits were excavated for infiltration testing up to 1.50m bgl. Dynamic cone penetrometer (DCP) tests were undertaken in 6 No. positions across part of the site. Ground gas monitoring standpipes were installed within all cable percussion boreholes and all window sample boreholes. Selected soil samples were subjected to laboratory analysis. No groundwater samples were taken. Six ground gas monitoring visits have been undertaken.
Encountered Ground Conditions	Tarmacadam up to 0.15m thick was encountered across most of the site, with some areas of rough vegetation in the soft landscaping. Variable Made Ground was encountered across the site consisting of both cohesive and granular material to 1.80m bgl or 54.70m AOD. the gravel fraction includes brick, concrete, sandstone, mudstone, quartzite and occasional coal and tarmac. Soils indicative of cohesive glacial till were encountered in all exploratory holes which progressed through made ground from 0.50m to 1.50m bgl (57.18 to 54.70m AOD). The soils were encountered to a depth of between 9.90m bgl and 10.40m bgl (47.20m to 45.94m AOD), comprising firm to very stiff, slightly gravelly to gravelly clay. Sand bands were noted within the glacial till in CP01, CP02 and CP03 from depths between 6.95m and 9.50m bgl (50.15m to 46.70m AOD) in CP03. All were recorded as dry. Organic rich soils were encountered in WS01 from 2.30m to 3.50m bgl (55.15m to 53.95m AOD) comprising very soft fibrous slightly sandy clayey peat and peaty clay. Soils indicative of granular glacial till were only encountered in in CP01 and CP03, at proven depths of between 9.90m bgl and 10.40m bgl (47.20m to 45.94m AOD). Bedrock geology was not encountered during this ground investigation. A groundwater table appears to be present within the glacial till at an elevation range between 45.70m and 47.90m AOD. Perched water zones appear to be present in shallow soils across the site. Water, as perched water or pore water sweating, is likely to be encountered in excavations >2.50m bgl.
Environmental Laboratory Testing	With respect to the proposed end-use of the site, soil testing results were compared against 'Commercial' GACs. No exceedances were recorded against the GACs thresholds and therefore no contamination was identified across the site. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or laboratory screening. The risk to site end users from soils is therefore considered to be Low.
Ground Gas Assessment	During the Curtins ground gas monitoring programme methane (CH₄) was recorded below the instrument's detection limit within all the monitoring wells within the building footprint. The maximum carbon dioxide concentrations were recorded in WS01 (6.1% (v/v) however this location is outside of the proposed footprint, and the monitoring well was installed within organic rich soils, which were not recorded beneath the footprint. The next highest CO₂ concentration was 3.2% v/v recorded in WS04. Using the 'borehole Q_{hg} representative' scenario, the calculated Q_{hg} for the site was 0.0256/hr l/hr for carbon dioxide and methane concentrations below the limit of detection of the monitoring instrument for all monitoring wells beneath

Geotechnical Assessment and Recommendations	the proposed building footprint. The Gas Screening Value for the site indicates CS1 gas regime for the development, with no requirement for gas protection measures. The risk to site end users from ground gases is therefore considered to be Low. Estimated building loads, provided by the structural engineer, at the time of writing indicate: • Maximum column loads of approximately 1000kN, unfactored, excluding the ground floor slab; Made Ground is not suitable to be able to support shallow foundations, or indeed ground bearing slabs. Site levels are different across the site, at levels of 56.34m AOD to 55.70m AOD and at levels of 57.45m AOD to 57.10m AOD. It is envisaged that a cut and fill operation might be necessary to facilitate the proposed development. Based on observations onsite together with the results of laboratory tests, due to presence of made ground and softer unsuitable deposits, it is recommended that consideration is given to a suspended ground floor slab. Cohesive glacial till can provide an allowable bearing capacity of approx. 100kN/m² for 1m wide strip or pad foundation founded across the stiff clays at generally 1.2m bgl, unless deeper made ground or unsuitable stratum is encountered. Alternatively an allowable bearing capacity of up to 150 kN/m² at 3m bgl. This allowable bearing capacity is provided, allowing for up to 25mm total settlement. All foundation formations should be inspected by a qualified geotechnical engineer to ensure suitable soils are used for construction. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 with an ACEC class of AC-1 for Made Ground, cohesive glacial till, and the granular glacial till. Groundwater cannot be discounted during shallow excavations and any excavations for foundations and services are likely to require close side support in the short term.
Recommendations	Based on the findings of the ground investigation, the following recommendations are made: 1) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer. 2) Construction and maintenance workers should be provided with appropriate PPE with reference to the environmental testing results.

Table of Contents

1.0	Introduction	1
1.1	Project Background	1
1.2	Scope of Services	1
2.0	Phase 1 Preliminary Site Assessment Summary	2
2.1	Current Setting	2
2.2	Previous Site Use	3
2.3	Published Geology	3
2.3.1	Geological Map	3
2.3.2	British Geological Survey Historic Exploratory Holes	3
2.3.3	Anticipated Geology	4
2.3.4	Mining	5
2.3.5	Radon	5
2.4	Hydrogeology and Hydrology	5
2.5	Unexploded Ordnance (UXO) Risk Assessment	6
2.6	Landfill and Infilled Land	6
2.7	Summary of Phase 1 PCSM	6
3.0	Ground Investigation Scope of Works	9
3.1	Soil Logging and Sampling	9
3.2	Monitoring Well Installations	10
3.3	Post-Investigation Monitoring	10
3.3.1	Groundwater and Ground Gas Monitoring	10
3.4	Soakaway Infiltration Testing	11
3.5	Dynamic Cone Penetrometer (DCP) Testing	11
4.0	Laboratory Analysis	12
4.1	Geo-environmental Analysis	12
4.1.1	Soil Analysis	12
4.1.2	Groundwater Analysis	13

4.2	Geotechnical Testing	13
5.0	Ground Conditions.....	14
5.1	Encountered Ground Conditions.....	14
5.2	Made Ground	15
5.3	Cohesive Glacial Till.....	16
5.4	Organic Rich Soils.....	16
5.5	Granular Glacial Till.....	16
5.6	Observed Potential Contamination	17
5.7	Obstructions Encountered.....	17
5.8	Groundwater.....	17
6.0	Ground Model.....	19
6.1	Made Ground	19
6.2	Cohesive Glacial Till.....	19
6.3	Organic Rich Soils.....	26
6.4	Granular Glacial Till.....	26
6.5	California Bearing Ratio (CBR) Estimates	27
6.6	Aggressive Ground Conditions	28
7.0	Ground and Groundwater Contamination Assessment.....	29
7.1	Human Health GQRA.....	29
7.1.1	Adopted Soil Human Health GACs Screening Methodology	30
7.1.2	Generic Assessment Criteria Screening of Soil Laboratory Results.....	31
8.0	Ground Gas Assessment	32
8.1	Ground Gas Monitoring Results.....	32
8.2	Ground Gas Assessment	33
9.0	Revised Conceptual Site Model	36
9.1	Summary of Significant Pollutant Linkages.....	38
10.0	Geotechnical Assessment and Recommendations.....	39
10.1	Introduction.....	39

10.2	Geotechnical Considerations	39
10.3	Ground Floor Slabs	40
10.4	Chemical Attack on Buried Concrete	40
10.5	Excavation and Support	40
10.6	Soakaways	41
11.0	Conclusions & Recommendations	42
11.1	Conclusions	42
11.1.1	Ground and Groundwater Contamination	42
11.1.2	Ground Gas Assessment	42
11.2	Recommendations	43
12.0	References	44

Appendices

- Appendix A - Drawings
- Appendix B - Exploratory Hole Logs
- Appendix C - Chemical Laboratory Testing Results
- Appendix D - Geotechnical Analysis Results
- Appendix E - Ground Gas and Groundwater Monitoring Results
- Appendix F - GAC Screening Thresholds
- Appendix G - Risk Assessment Methodology

1.0 Introduction

1.1 Project Background

In June 2021 Curtins were instructed by Holmes Miller to undertake a Phase 2 Ground Investigation of land off Kirkstead Close, Beswick, Manchester, M11 3DS. The site is centred on NGR SJ 87084 97806 and covers an area of approximately 1.92 Ha. A site location plan is presented on *Figure 2.1*.

Development proposals suggest the site is to be redeveloped for the Our League Life Hub Education Facility, with ancillary facilities including an integrated sports stand adjacent to the rugby pitch.

Proposed development plans are included in *Appendix A*.

1.2 Scope of Services

A scope for the intrusive ground investigation was developed with the following aims:

- i) Support the planning application and support discharge of relevant pre-commencement contaminated land planning conditions; and
- ii) Obtain geotechnical information and characterise shallow site soils for foundation design for the proposed structures.

Specifically, the Phase 2 Ground Investigation Report is intended to:

- a) Determine the risk of the proposed end-user being adversely impacted by potential contamination in shallow site soils that may be present on the site due to its known current, recent and historical use;
- b) Determine if there is a risk to the end-user from soil gases including methane, carbon dioxide, carbon monoxide and hydrogen sulphide;
- c) Characterise site wide natural soils;
- d) Recommendations for the design of foundations and building ground floor slabs; and
- e) Recommendations for the specification of sub-structure concrete.

Detailed flood risk assessment, ecology, archaeological studies and waste classification for off-site disposal are outside of the scope of this report.

2.0 Phase 1 Preliminary Site Assessment Summary

A Phase 1 Desk Study was undertaken for the site by Curtins in July 2021 (Ref.1). A summary of the detailed findings of this Desk Study, comprising current site setting, history, geology and hydrogeology/hydrology is presented within this Section with reference to additional information sources.

2.1 Current Setting

The site is currently occupied by a derelict commercial building called Beswick Local Shops with large car parking adjacent with areas of landscaping near streetlights in the east of the site. A fence separates the building and car park from a built-up slope and the large rugby field to the west and north of the building. The car park slopes gently southwest towards the rugby field. The field is elevated by approximately 1m with respect to the car park. The site's topography is relatively flat.

The site location and boundary are illustrated in *Figure 2.1*.

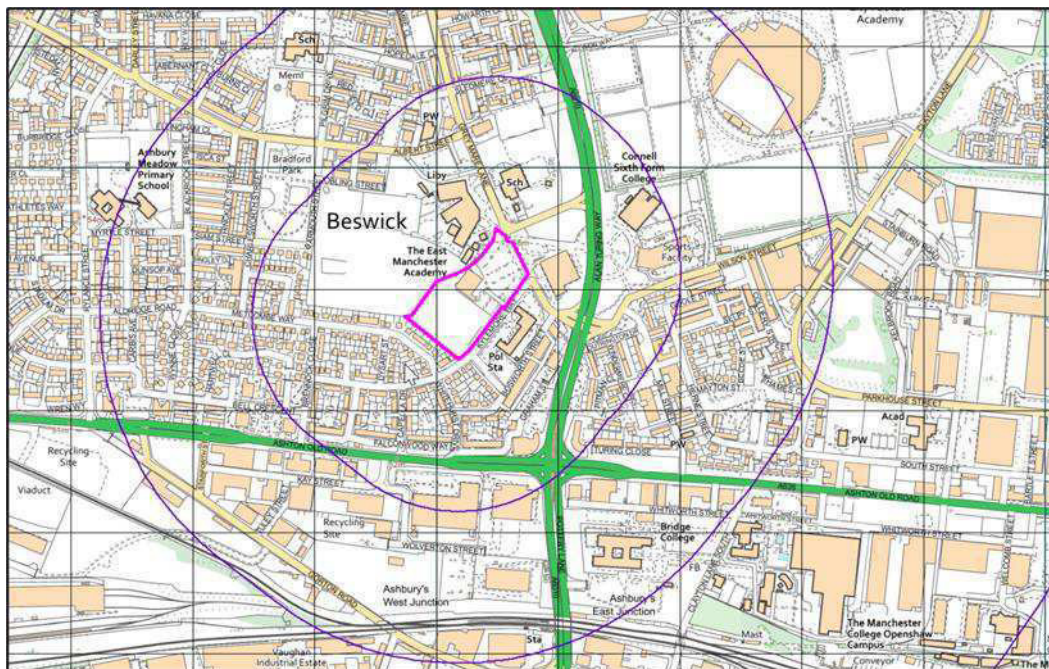


Figure 2.1 – Site Location Plan (site boundary shown in pink. 250m and 500m buffers in purple).
Crown Copyright. License Number 100022432.

The surrounding land use generally comprises Beswick Library and East Manchester Academy grounds to the north, East Manchester Leisure Centre and Manchester City Training Ground further east of Alan Turing Way to the east, and more school playing fields and Metcombe Way and residential estates further west noted further west of the site. Bell Crescent and more residential estates and some commercial businesses are noted to the south.

2.2 Previous Site Use

Earliest mapping (1840's) shows the site as undeveloped, with reservoirs already established to the southeast. By 1891, the site is developed with terraced residential development across the site with several residential roads. The site is surrounded within 500m by industrial land use such as clay pits, brick works, collieries, tanneries, dye works and goods yards. From 1908, the reservoirs south of the site are backfilled. Site completely re-developed by 1974; interconnected cul-de-sacs built with one large building separated into units on site with terraced housing to the southwest and amenities directly on site such as playground, surgery and post office. Electrical substation is constructed in the centre of the site. Between 2006 and 2021, the site buildings have all been demolished except the western extent of the large building. As seen today, a car parking area is present to the south and east of the building on site with the landscaped field area to the west.

2.3 Published Geology

2.3.1 Geological Map

A study of the Envirocheck within the Phase 1 Preliminary Risk Assessment (Ref. 1) Report and the British Geological Survey (BGS) 1:50,000 mapping records (Solid and Drift) for Manchester (Sheet 085) dated 2010 (Ref. 2) indicates the following geological and hydrogeological succession underlying the site:

- **Superficial Deposits:** Glacial Till comprising a heterogenous mixture of clay, sands and gravels and occasionally boulders varying widely in size and shape.
- **Solid Geology:** Etruria Formation comprising sandstone and mudstone (southwest of the site) and Pennine Upper Coal Measures Formation (northeast of the site) comprising interbedded grey mudstone, siltstone and pale grey sandstone, commonly with coal seams, but no mudstones containing marine fossils are present.

2.3.2 British Geological Survey Historic Exploratory Holes

BGS recorded boreholes logs were available for review within 250m of the site. However, most of these boreholes are restricted or shallow trial pit excavations which do not give relevant information of deeper ground conditions. There is one borehole located 240m east of the site to a maximum depth of 15.24m bgl, which has been summarised in *Table 2.3* below and in the Phase 1 Preliminary Risk Assessment (Ref. 1).

Table 2.3 – BGS Borehole Record

Record Reference	Location (NGR)	Details (bottom to top of strata/details/thickness of strata)	
SJ89NE1117	Off Site 240m east (387390,397800)	0.00m to 0.91m bgl	Ash fill. (0.91m)
		0.91m to 1.37m bgl	Firm, grey/brown mottled, sandy clay with stone inclusions. (0.46m)
		1.37m to 2.13m bgl	Stiff, brown, silty sandy clay with grey fissures and occasional stone inclusions. (0.76m)
		2.13m to 3.81m bgl	Stiff, brown sandy clay with stone inclusions. (1.68m)
		3.81m to 5.94m bgl	Stiff, brown, silty sandy clay with stone inclusions. (2.13m)
		5.94m to 7.01m bgl	Stiff, brown, sandy clay with stone inclusions. (1.07m)
		7.01m to 7.92m bgl	Stiff to very stiff, brown, sandy clay with stone inclusions. (0.91m)
		7.92m to 11.13m bgl	Brown, silty sand with lenses of silt and clay. (3.21m)
		11.13m to 12.50m bgl	Obstruction- possible boulder. (1.37m)
		12.50m to 15.24m bgl	Hard brown sandy and very sandy clay with frequent lenses of silty fine sand. (2.74m)
		15.24m bgl	Borehole complete

2.3.3 Anticipated Geology

Made Ground Deposits

BGS mapping records do not indicate the presence of Made Ground on site; however a BGS borehole log in the area east of the site records Made Ground to 0.91m bgl, therefore it is considered likely that Made Ground in limited thicknesses underlies the site.

Superficial Deposits

Superficial deposits are recorded as Glacial Till comprising of a heterogeneous mixture of clay, sand, gravel, and occasionally boulders varying widely in size and shape.

Glacial Till is recorded to underlie the Made Ground to a depth of 7.92m bgl with a subordinate silty sand strata overlying sandy clay to a depth of 15.24m bgl.

Bedrock Deposits

The site is underlain by Etruria Formation comprising sandstone and mudstone (southwest of the site) and Pennine Upper Coal Measures Formation (northeast of the site) comprising interbedded grey mudstone, siltstone and pale grey sandstone, commonly with coal seams, but no mudstones containing marine fossils are present. No BGS borehole records have encroached bedrock. The rockhead levels are therefore unknown.

2.3.4 Mining

A review of the Coal Authority interactive mapping (Ref. 3) for the area indicates that is located within a Coal Mining Reporting Area, however it is not located within a Development High-Risk Area.

There are two recorded mine entries within 250m of the site, the nearest being approximately 100m east of the site, both are recorded as shafts. The site is not within the zone of influence of the mine entries.

There are no recorded coal workings and no probable coal workings within 500m of the site.

Consequently, the risk to development from historic coal mining is considered to be **Low**. No further actions are required to further assess the risk to development from historic coal mining.

2.3.5 Radon

The site is located within a Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level). No radon protective measures are necessary.

If a basement is proposed, a radon specialist should be contacted for advice.

2.4 Hydrogeology and Hydrology

The Envirocheck Report within the Phase 1 Preliminary Risk Assessment (Ref. 1) data indicates that the geological sequence underlying the site has the following hydrogeological characteristics:

Table 2.4 – Hydrogeology and Hydrology Summary

Geology	Associated Hydrogeological Classification
Glacial Till – Devensian, Clay, Sand, Gravel and Boulders	Secondary Undifferentiated Aquifer ¹
Etruria Formation – Sandstone and Mudstone ³ (southwestern area)	Secondary A Aquifer ²
Pennine Upper Coal Measures Formation – Mudstone, Siltstone and Sandstone ⁵ (northeast of the site)	

Notes:

1. These layers have not been assigned an attribute either category A or B rock type due to not being possible. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
2. These are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The site is not located within a Source Protection Zone (SPZ).

There are no groundwater abstraction points located within 500m of the site. There are no groundwater abstractions for potable water supplies located within 1km of the site.

The nearest surface water feature identified within the Phase 1 Preliminary Risk Assessment (Ref.1) is 597m to the southeast which is a pond.

There are no discharge consents within 250m of the site.

2.5 Unexploded Ordnance (UXO) Risk Assessment

The likelihood of UXO being encountered on a development site is influenced by several factors including; the proximity to strategic targets, the nature of the development works being undertaken and evidence of local damage in the post-war periods amongst others. To determine the likelihood of UXO being present on a site, a step-wise risk assessment process is followed. This process is outlined within CIRIA C681 Unexploded Ordnance: A Guide for the Construction Industry (Ref. 4).

Risk mapping (Ref. 5) for UXO's has placed the site in a **Moderate** risk area. Moderate-risk regions are those with a bombing density of less than 15 to 50 bombs per 1000 acres.

A review of the available historic identified two small ruins approx. 50m and 150m southeast. A review of available online bomb damage mapping for Manchester shows no bombing damage on or within 150m of the site.

Considering the above and that the site has been re-developed several times since WWII so any UXO on site would likely have been encountered, the risk of encountering potential UXO as part of the ground investigation works is considered **Low**, and no further action is required.

If unexploded ordnance is discovered during any works, stop immediately, prevent access to the area, and inform the police. If the site boundary or location changes then the UXO risk should be reassessed.

Contractors undertaking works which would cause a greater ground disturbance than the intrusive works outlined herein should carry out their own UXO Risk Assessment in respect to their works.

2.6 Landfill and Infilled Land

There are no historical landfill sites recorded within 700m of the site.

There are seven potentially infilled water features within 250m of the site; the nearest being 23m southeast of the site, historical mapping suggests this is the infilled reservoir and is a potential gas generating feature within influencing distance of the site. There is one potentially infilled land feature within 250m of the site, recorded to be 128m southwest of the site and is also a potential gas generating feature.

2.7 Summary of Phase 1 PCSM

A summary of potential pollutant linkages at the development site as identified in the Phase 1 Report (Ref. 1) are presented in Table 2.7. These potential pollutant linkages were identified as requiring further investigation to enable the safe redevelopment of the site.

Potential contaminants of concern associated with any Made Ground present include, amongst others; broad range aliphatic and aromatic hydrocarbons present within any fuel oils; polycyclic aromatic hydrocarbons (PAHs); inorganic compounds including heavy metals; and asbestos present in discarded building materials. Analysis of polychlorinated biphenyls should be undertaken on soil samples in the immediate vicinity of the substation if visual or olfactory evidence of contamination is recorded during the investigation.

The risks presented to controlled waters (groundwater and surface water) were identified as Low and Very Low respectively due to the site not located in a SPZ and relative distance of the nearest surface water feature. Water samples are therefore considered unlikely to be required unless visual or olfactory evidence of soil contamination suggests there may be a risk to controlled waters.

Table 2.7 – Preliminary Conceptual Site Model

Source	Pathway	Receptor	Risk Rating	Action
On-site sources of potential contamination: Made Ground of unknown composition from uncontrolled deposition of materials associated with previous phases of development including asbestos from buildings demolished pre-2000. Potential for contamination notably polychlorinated biphenyls from the electrical substation. Only tested for in immediate vicinity of substation if visual or olfactory evidence of contamination is recorded Potential for contaminants associated with the site's use (in hardstanding areas) as a car park, fuels and oil leaks/spills	Direct contact, ingestion, inhalation (dust and vapours)	End-user of site (Stand users) & Construction Workers	Moderate/Low	Undertake shallow soil testing of shallow soils across the site and in the area where the stand is proposed to confirm risk assessment
	Vertical migration through the superficial deposits (soils) May occur due to existing service corridors and physical processes including; capillary action and downwards flow into the natural deposits through infiltration.	Controlled Waters (Groundwater) Superficial: Secondary Undifferentiated Aquifer (Glacial Till) Bedrock: Secondary A Aquifer (Etruria Fm and Upper Pennine Coal Measures) There are no active potable groundwater abstraction points within 500m. The site is not within a designated Source Protection Zone.	Low	No further action required unless gross contamination identified in site soils in GI.
	Horizontal migration over and through the superficial deposits (soils)	Controlled Waters (Surface Water) Nearest surface water feature is a pond 597m southeast of the site. There are no surface water abstractions within 700m.	Very Low	No further action required
On and off-site soils with the potential to generate ground gases: Potential for unknown thickness of Made Ground and demolition material on site. Infilled water features within 100m of the site boundary.	Vertical and horizontal migration through underlying superficial deposits into buildings and air spaces	Site End Users (Stand users)	Moderate/Low	Undertake ground gas monitoring in the area of the site where the development proposed to confirm risk assessment and gas regime.

3.0 Ground Investigation Scope of Works

Site investigation works were undertaken by Ian Farmers Associates (IFA) between 14th and 26th May 2021.

The scope of the ground investigation was designed in general accordance with current UK guidance including:

- LCRM (Ref. 6);
- British Standard (BS) 10175:2011+A2:2017 (Ref. 7);
- BS5930:2015+2020 (Ref. 8);
- and BS EN1997: Part 2:2007 Eurocode 7 (Ref. 9).

The scope and rationale are summarised in *Table 3.0*.

Table 3.0 – Scope and Rationale of Fieldwork Undertaken

Exploratory Hole Type	Exploratory Hole Ref.	Ground level (m AOD)	Exploratory Hole Depth (m bgl)	Rationale
Cable Percussion and Rotary Borehole	CP01	56.34	11.00	Confirm the shallow and deeper ground and groundwater conditions during site investigation; Collect soil samples for chemical analysis; Collect samples for geotechnical soil testing; and Ground gas and groundwater level monitoring.
	CP02	56.20	10.20	
	CP03	57.10	10.25	
	CP04	57.13	10.45	
Window Sample Boreholes	WS01	57.45	4.00	Confirm shallow ground and groundwater conditions during site investigation; Collect soil samples for chemical analysis; Collect samples for geotechnical soil testing; and Gas and groundwater level monitoring.
	WS02	56.14	4.44	
	WS03	55.70	3.40	
	WS04	57.10	3.44	
Machine Excavated Trial Pit	SA01	57.07	1.50	Confirm shallow ground and groundwater conditions including any subsurface structures below the site; Confirm shallow natural soil infiltration rates.
	SA02	57.68	1.50	
Dynamic Cone Penetrometer Tests	TRL01	N/A	0.704	Determine geotechnical parameters of shallow site soils.
	TRL02		0.943	
	TRL03		0.946	
	TRL04		0.924	
	TRL05		0.934	
	TRL06		0.928	

Note: All CP boreholes and WS boreholes were installed with ground gas/water monitoring points.

For the location of the exploratory holes refer to Curtins drawing ref: 077652.300-CUR-00-XX-DR-GE-80002-P01 Exploratory Hole Location Plan BB included in *Appendix A*.

3.1 Soil Logging and Sampling

Exploratory hole arisings were logged onsite by an Engineer from Curtins and in accordance with the requirements of BS5930 (Ref. 8). No observed visual and olfactory indications of contamination were recorded. Exploratory hole logs can be referred to in *Appendix B*.

3.2 Monitoring Well Installations

Ground gas and groundwater monitoring 50mm diameter slotted pipes were installed within the cable percussive exploratory boreholes (CP01, CP02, CP03 and CP04), and in all four of the window sample boreholes (WS01, WS02, WS03 and WS04). A bentonite seal was placed at the top and bottom of each of the exploratory holes, surrounding the screened sections of the pipe. A gravel surround was installed in the annulus between the sides of the borehole and the slotted sections of the pipe.

The monitoring wells were designed to assess the potential for ground gas and monitor groundwater levels. The screened sections therefore focused on the more permeable deposits where encountered, where ground gas and groundwater may be encountered.

A summary of the response zone is presented in *Table 3.2*.

Table 3.2 – Monitoring Well Response Zones

Borehole Ref.	Response Zone m bgl (m AOD)	Strata Description(s)
CP01	6.00 – 10.00 (50.34 - 46.34)	Cohesive Glacial Till
CP02	5.00 – 10.00 (51.20 - 46.20)	Cohesive Glacial Till
CP03	6.00 – 10.00 (51.10 - 47.10)	Cohesive & Granular Glacial Till
CP04	0.50 – 1.50 (56.63 - 55.63)	Made Ground (Cohesive)
WS01	2.00 – 3.00 (55.45 - 54.45)	Organic Peat & Cohesive Glacial Till
WS02	1.00 – 4.00 (55.14 - 52.14)	Cohesive Glacial Till
WS03	0.50 – 3.00 (55.20 - 52.70)	Made Ground and Cohesive Glacial Till
WS04	1.00 – 3.00 (56.10 - 54.10)	Cohesive Glacial Till

A copy of the borehole logs can be referred to in *Appendix B* of this report.

3.3 Post-Investigation Monitoring

3.3.1 Groundwater and Ground Gas Monitoring

Six groundwater level and ground gas monitoring visits over three months have been undertaken, to assess the groundwater levels and the ground gas conditions.

The results of the groundwater level monitoring are detailed in *Section 5.8*.

The results of the ground gas monitoring are detailed in *8.0*.

3.4 Soakaway Infiltration Testing

Soakaway infiltration testing in line with BRE 365 was undertaken in machine excavated trial pit SA02 located on the western part of the site. For details of positions, see exploratory hole location plan presented in *Appendix A*.

SA01 encountered deeper Made Ground to 1.50m bgl with buried concrete obstructing the excavation so a test was not undertaken in SA01.

For details of strata, see exploratory hole logs presented in *Appendix B*.

3.5 Dynamic Cone Penetrometer (DCP) Testing

6 no. DCP test were undertaken on 1st July 2021 across the rugby field on site (TRL01 to TRL06) to obtain estimated in-situ CBR values for the shallow soils (<1.0m bgl) across the rugby field.

For details of positions, see exploratory hole location plan presented in *Appendix A*.

DCP tests and estimated CBR values are discussed within Section 6.5 in the Ground Model section.

4.0 Laboratory Analysis

4.1 Geo-environmental Analysis

Representative soil samples were selected for laboratory chemical analysis, based on field observations and to provide information about the encountered ground conditions.

A total of 9 No. topsoil, made ground and natural samples were selected for chemical testing. Soil samples were placed in laboratory provided containers and stored in cool boxes prior to being transported to the nominated laboratory under the laboratory's chain of custody documentation. The laboratory selected by Curtins for chemical and geotechnical analysis was Envirolab (UKAS and MCERTS accredited).

Given the lack of any obvious sources of potential contamination the sampling positions were generally located in a non-targeted, systematic array, beneath the proposed development footprint, and other areas of landscaped development, to give adequate and representative coverage of the sites proposed end use and the immediate environmental setting, concentrated in the near surface deposits.

4.1.1 Soil Analysis

The source material of contaminants of concern potentially present on the site was considered to include, amongst others; organic matter, ash and fill, hydrocarbons (e.g. fuel/oils), polyaromatic hydrocarbons (PAHs), heavy metals, and asbestos.

The extent of the above is captured by the broad environmental testing suites listed in *Table 4.1.1*.

Table 4.1.1 – Environmental Chemistry Analysis Suite: Soils

Suite Ref.	Analyte	LOD
Soils Suite A	Asbestos Screen	-
	pH Value	0.01 pH
	2:1 Water Soluble Sulphate	0.01 g/l
	Soil Organic Matter (SOM)	0.1% w/w
	Arsenic, Chromium, Chromium VI, Copper, Lead, Nickel, Selenium, Boron (water soluble), Cyanide (total)	1 mg/kg
	Zinc	5 mg/kg
	Cadmium	0.5 mg/kg
	Mercury	0.17 mg/kg
	Phenols (screen)	0.2 mg/kg
	PAHs (USEPA 16)	0.01-0.08 mg/kg
	TPH (Aro/Ali Split)	1 mg/kg

A total of 9 No. soil samples were obtained from the boreholes and tested for Suite A.

Copies of the environmental chemistry testing certificates are presented in *Appendix C*.

4.1.2 Groundwater Analysis

No groundwater samples were obtained as part of this investigation.

4.2 Geotechnical Testing

Soil samples for testing were prepared in accordance with BS1377: Part 1:2016 (Ref. 12). The undertaken geotechnical testing is summarised in *Table 4.4*.

Table 4.4 – Geotechnical Testing

Test Type	Quantity	Standard
In Situ Testing		
Standard Penetration Testing	36	BS 5930: 2015, Clause 41
Laboratory Testing		
Atterberg Limit (4 Point)	8	BS1377 1990, Part 2 (clause 4.5, 5.3 & 5.4)
Unconsolidated Undrained Multistage Triaxial Compression Test	11	BS1377 1990, Part 7 (clause 9.0)
Moisture Content	8	BS1377 1990, Part 2
Water Soluble Sulphate	17	ISO 17025 MCERTS
pH Value	17	ISO 17025 MCERTS

The results of the geotechnical testing are summarised in *Section 6.0* of this report.

Copies of the geotechnical testing certificates can be referred to in *Appendix D*.

5.0 Ground Conditions

The ground conditions across the site, determined during the Curtins' ground investigation works, generally comprise variable thicknesses of made ground, overlying cohesive glacial till deposits with occasional bands of granular fine and medium sands. Rockhead was not encountered as a part of the ground investigation works.

The natural soils encountered were generally consistent across the site and will be summarised in the following sections.

5.1 Encountered Ground Conditions

A summary of the ground conditions encountered during the Curtins' site investigation works is presented in Table 5.1, with detailed information presented on the exploratory hole logs which can be referred to in *Appendix B*.

Table 5.1 – Summary of Ground Conditions Encountered in the Curtins' Investigation

Stratum	Depth to top of strata, m bgl (m AOD)	Recorded Thickness (m)		Description
		Min	Max	
Made Ground	0.00 (57.68 to 55.70)	0.50	1.80	Tarmacadam surface cover overlying: Granular sub-base, including brown slightly clayey gravelly sand. Gravel includes fine to coarse brick, tarmac, concrete, sandstone and mudstone. Occasional cobbles of sandstone. overlying Brown and blackish brown, slightly silty slightly gravelly sandy clay. Localised area of granular material comprising orangish brown and black slightly clayey very gravelly sand. Gravel includes fine to coarse brick, concrete, sandstone, mudstone and quartzite. Localised areas of brick cobbles Or Brown, slightly gravelly to gravelly clayey sand with occasional cobble content. overlying Blackish brown to orangish brown, slightly gravelly sandy clay with variable silt and cobble content. and/or Localised areas of granular material comprising slightly clayey slightly gravelly sand to sandy gravel and cobbles. Gravels including fine to coarse brick, concrete, tarmac, coal, sandstone and mudstone. Cobbles of brick and sandstone.
Cohesive Glacial Till	0.50 to 1.80 (57.18 to 54.70)	8.50 ¹	9.80 ¹	Firm to very stiff, brown, orangish brown with variable mottling of blueish grey and grey,

Stratum	Depth to top of strata, m bgl (m AOD)	Recorded Thickness (m)		Description
		Min	Max	
				slightly sandy to sandy, slightly gravelly to gravelly CLAY with variable silt content. Gravel includes mudstone, quartzite, sandstone and occasionally coal.
Organic Rich Soils	2.30 ² (55.15)	1.20 ²	1.20 ²	Very soft blackish brown fibrous slightly sandy clayey PEAT with high organic content and vegetation matter. overlying Loose blackish brown clayey fine SAND with slight organic odour and occasional vegetation matter. overlying Soft, brown and black, slightly silty slightly peaty sandy CLAY with slight organic odour and occasional vegetation matter.
Granular Glacial Till¹	9.90 to 10.40 (47.20 to 45.94)	3	3	Dense, reddish brown fine to medium SAND. or Dense, orangish brown, slightly gravelly clayey fine to medium SAND. Gravel includes fine to medium mudstone and sandstone.

¹ Base of cohesive strata was proven in CP01 and CP03 only

² Organic rich soils only encountered in WS01.

³ Base not proven

5.2 Made Ground

Made Ground soils were encountered in all exploratory holes in the site investigation. No Made Ground soils were sent for geotechnical testing.

Southern portion

The surface covering of the site comprised tarmacadam overlying a granular subbase of gravelly sand to sandy gravel in CP01, CP02, WS02 and WS03 to depths ranging between 0.40m and 0.80m bgl (55.84m to 55.00m AOD). Tarmacadam thicknesses ranged between 0.10m and 0.15m. The sub-base contained fragments of brick, concrete, and sandstone and occasional cobbles of sandstone.

Deeper Made Ground was recorded in CP01, CP02, WS02 and WS03 underlying the subbase. Deeper Made Ground was recorded to be variable across the site recording both granular and cohesive material to depths between 0.60m and 1.10m bgl (55.74m to 54.70m AOD); comprising blackish brown sandy gravelly clay, orangish brown and black slightly clayey very gravelly sand and in the area around CP01 and WS02 brick cobbles were recorded.

Northern Portion

CP03, CP04, WS01, WS04, SA01 and SA02 recorded long grass and rough vegetation overlying granular Made Ground materials comprising brown slightly clayey slightly gravelly sand with occasional

cobbles between 0.20m and 0.80m bgl (57.48m and 55.55m AOD). WS01 was recorded granular subbase of sandy gravel similar to that underlying tarmac surface cover to a depth of 0.50m bgl (56.95m AOD). CP03 and CP04 recorded cohesive Made Ground material, underlying granular Made Ground, comprising blackish brown to orangish brown slightly gravelly slightly sandy to sandy clay with variable silt and cobble content to depths between 1.50m and 1.80m bgl (55.60 to 55.33m AOD). WS01, SA01 and SA02 recorded cohesive and granular Made Ground slightly gravelly to gravelly sandy clay with variable silt and cobble content, and/or slightly clayey slightly gravelly sand. WS01 recorded sandstone and concrete cobbles between 0.80m and 1.30m bgl (56.65m to 56.15m AOD). Gravel in all Made Ground materials (in all exploratory holes) included brick, concrete, sandstone, mudstone, quartzite and occasional coal and tarmac.

5.3 Cohesive Glacial Till

Cohesive glacial till were encountered in all exploratory holes, except SA01 (terminated within made ground), from 0.50m to 1.50m bgl (57.18 to 54.70m AOD). Cohesive glacial till was encountered in CP01 and CP03, to a maximum depth of between 9.90m bgl and 10.40m bgl (47.20m to 45.94m AOD), underlain by granular glacial till.

Cohesive glacial till comprised generally firm to very stiff, brown, orangish brown with variable mottling of blueish grey to grey, slightly sandy to sandy, slightly gravelly to gravelly clay with variable silt content. Gravel includes mudstone, quartzite, sandstone and occasionally coal.

5.4 Organic Rich Soils

Soils containing organic matter, and an organic odour was noted as olfactory evidence on site, were encountered in WS01 from 2.30m to 3.50m bgl (55.15m to 53.95m AOD).

Soils comprised very soft blackish brown fibrous slightly sandy clayey peat with high organic content and vegetation matter from 2.30m to 2.70m bgl (54.75m AOD) overlying loose blackish brown clayey fine sand with slight organic odour and occasional vegetation matter to 2.80m bgl (54.65m AOD) overlying soft, brown and black, slightly silty slightly peaty sandy clay with slight organic odour and occasional vegetation matter to 3.50m bgl (53.95m AOD).

The distribution or extent of this layer (laterally or vertically) was not delineated due to site constraints during the ground investigation works. This location is outside of the proposed grandstand footprint.

5.5 Granular Glacial Till

Sand bands were noted within the cohesive glacial till in CP01, CP02 and CP03 from depths between 6.95m and 9.50m bgl (50.15m to 46.70m AOD) in CP03. Approximate thickness of the sand bands encountered was recorded between 50mm to 100mm. Soils were not recorded as water bearing.

Soils described as dense, reddish brown fine to medium sand and dense, orangish brown, slightly gravelly clayey fine to medium sand were recorded in CP01 from 10.40m (45.94m AOD) and CP03 from 9.90m bgl (47.20m AOD) respectively. Gravel includes fine to medium mudstone and sandstone.

5.6 Observed Potential Contamination

No potential visual contamination was observed during the intrusive investigation works. Soils containing organic matter, and an organic odour was noted as olfactory indicators on site, were encountered in the following borehole: in WS01 from 2.30m to 3.50m bgl (55.15m to 53.95m AOD).

5.7 Obstructions Encountered

Concrete obstruction encountered in SA01 at 1.20m bgl (55.87m AOD).

5.8 Groundwater

All boreholes were recorded as dry throughout progression of the cable percussion boreholes, window sample boreholes and machine excavated trial pits.

Six rounds of groundwater monitoring have been undertaken between 19th July 2021 and 20th September 2021, the results of which are presented in *Table 5.9a*. It was not possible to determine groundwater levels on the second monitoring visit.

Table 5.9a – Groundwater Monitoring Results

Borehole Ref.	Installation Strata	Response Zone m bgl	Depth, m bgl (m AOD)					
			19/07/21	28/07/21	09/08/21	23/08/21	06/09/21	22/06/21
WS01	Glacial Till and Organic Rich Deposits	2.00 – 3.00	1.80 (55.65)	-	1.53 (55.92)	1.78 (55.67)	1.93 (55.52)	1.97 (55.48)
WS02	Glacial Till	1.00 – 4.00	0.45 (55.69)	-	0.32 (55.82)	0.41 (55.73)	0.54 (55.60)	0.49 (55.65)
WS03	Glacial Till	0.50 – 3.00	0.95 (54.75)	-	0.68 (55.02)	0.73 (54.97)	0.90 (54.80)	0.94 (54.76)
WS04	Glacial Till	1.00 – 3.00	-	-	-	-	0.66 (56.44)	-
CP01	Glacial Till	6.00 – 11.00	10.64 (45.70)	-	9.55 (46.79)	9.70 (46.64)	10.09 (46.25)	10.19 (46.15)
CP02	Glacial Till	5.00 – 10.00	10.01 (46.19)	-	10.02 (46.18)	10.02 (46.18)	10.01 (46.19)	10.02 (46.18)
CP03	Glacial Till	6.00 – 10.00	10.20 (46.90)	-	9.20 (47.90)	9.20 (47.90)	9.23 (47.87)	-
CP04	Made Ground	0.50 – 1.50	Dry	-	1.50 (55.63)	1.50 (55.63)	1.52 (55.61)	-

Based upon groundwater elevations and the underlying geology, the following considerations are given to the underlying groundwater regime:

Phase 2 Ground Investigation

- A groundwater table appears to be present within the glacial till at an elevation range between 45.70m and 47.90m AOD. Perched water zones appear to be present in shallow soils across the site.
- Water, as perched water or pore water sweating, is likely to be encountered in excavations >2.50m bgl.

6.0 Ground Model

The ground model for the site incorporates the findings of the ground investigation, including exploratory hole logs and geotechnical testing results.

6.1 Made Ground

Made Ground of variable composition was encountered in all exploratory boreholes from ground level to 1.80m bgl

8 no. samples were obtained of Made Ground, pH and Sulphate analysis was undertaken on these soils.

Due to variable nature of the made ground and its unsuitability as an engineering stratum, no laboratory geotechnical analysis was undertaken on these soils.

Table 6.1 summarises the in-situ and laboratory testing undertaken on the Made Ground.

Table 6.1 – Summary of geotechnical test results – Made Ground

Parameter	No. of Tests	Results
In-Situ Tests		
SPT 'N' Value – Cohesive	2	Min: 9 Max: 15 Average: 7
Laboratory Tests		
pH	8	Min: 8.05 Max: 8.35 Average: 8.19
Water Soluble Sulphate (mg/l)	8	Max: <10 Average: <10

6.2 Cohesive Glacial Till

The results of geotechnical tests undertaken on cohesive glacial till are summarised in Table 6.2.

Table 6.2 – Summary of geotechnical test results – Cohesive Glacial Till

Parameter		No. of Tests	Results
In-Situ Tests			
SPT 'N' Value – Cohesive		33	Min: 4 Max: 50 Average: 24
Laboratory Tests			
Atterberg Test	Liquid Limit (%)	8	Min: 27 Max: 45 Average: 37
	Plastic Limit (%)	8	Min: 11 Max: 21 Average: 16.6
	Plasticity Index (%)	8	Min: 15 Max: 26 Average: 20.5
	Modified Plasticity Index (%) ¹	8	Min: 14 Max: 26 Average: 20
Moisture Content (%)		19 ²	Min: 10 Max: 20 Average: 15.16
pH		8	Min: 8.26 Max: 8.59 Average: 8.4
Water Soluble Sulphate (mg/l)		8	Min: <10 Max: 70 Average: 33.25
Unconsolidated Undrained Multistage Triaxial – Cu (kPa) (Overburden Pressure)		11	3

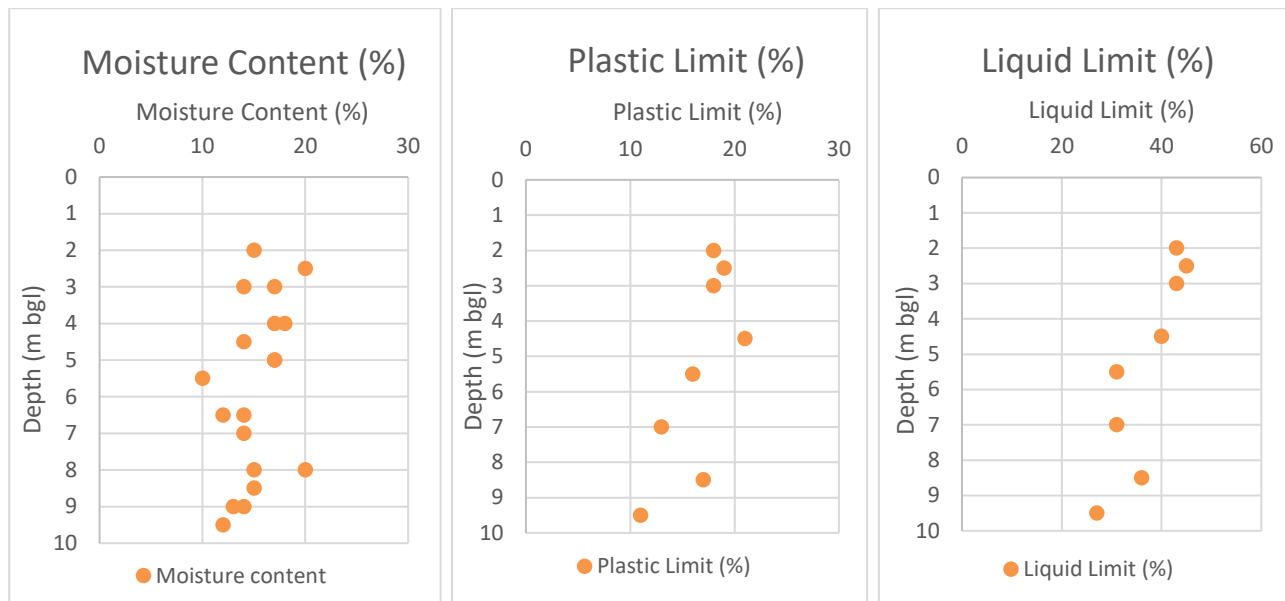
(1) Modified plasticity index is the plasticity of components <425µm.

(2) Moisture content includes values given from Multistage Triaxial test samples.

(3) Full presentation of Multistage Triaxial results are shown in Appendix D.

The moisture content, liquid limit and plastic limit results are presented on *Figure 6.2a* below.

Phase 2 Ground Investigation



The SPT N results are presented on *Figure 6.2b*, predominantly increasing with depth.

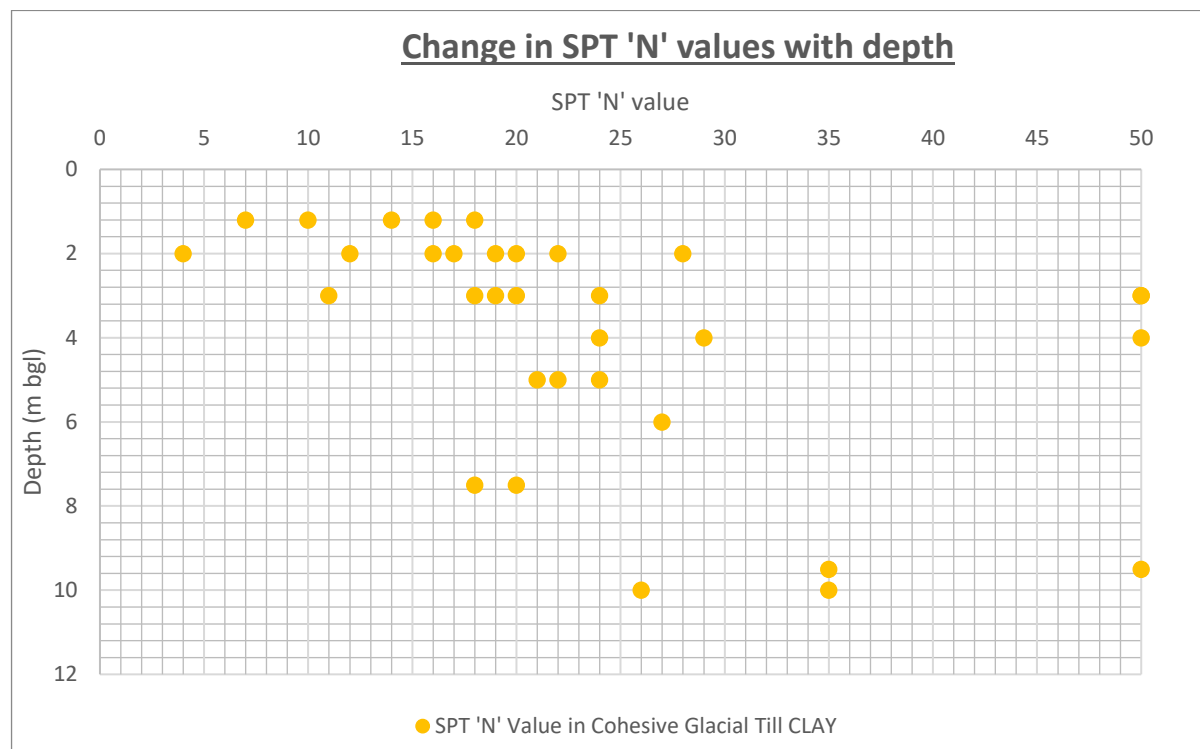


Figure 6.2b – Summary of SPT 'N' Values from Cohesive Glacial Till

A total of eight Atterberg Tests were undertaken in the cohesive material, generally indicating the soils are intermediate plasticity clay. Three samples obtained (9.50m bgl in CP02, 7.00m bgl in CP03, and 5.50m bgl in CP04) were recorded as low plasticity clays.

The Undrained Shear Strength, C_u , of cohesive glacial till can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 13) using Equation 1:

$$C_u = f_1 \times \text{SPT N} \quad \text{Equation 1}$$

Where:

C_u is the Undrained Shear Strength

f_1 is the Stroud Factor determined from Figure 1.5 (Ref. 13)

SPT N is Characteristic Standard Penetration Test Result

Based on the Atterberg Limit results of analysis of eight soil samples, an average plasticity index of 20% was determined, correlating with an f_1 value of 5.5. There was variability in the plasticity indices and as such, a more conservative estimated f_1 value of 5 has been selected. Figure 6.2c illustrates the variability in Plasticity Index within the cohesive glacial till.

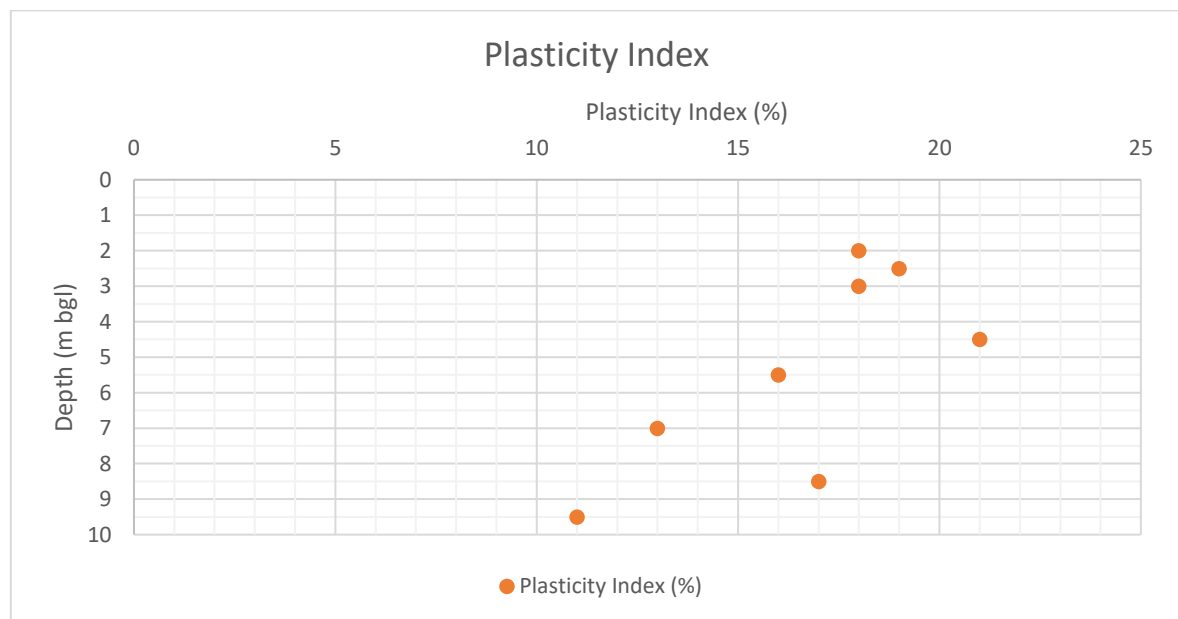


Figure 6.2c – Plasticity Indices within Cohesive Glacial Till

C_u values ranging between 22 kPa and 275 kPa were determined. These results indicate a medium to very high strength clay with majority of the samples indicating high strength clay, based on estimated values from the correlation described in Equation 2. Two samples (WS01 at 2.0m bgl and WS04 at 1.20m bgl) indicate low strength clay. The estimated strength of the cohesive glacial till appears to increase with depth.

Figure 6.2d indicates that the estimated Undrained Shear Strength of the cohesive glacial till, derived through the correlation between SPTs and plasticity indices is less than the strength of the soils determined through laboratory analysis, where shear strength values ranging between 63 kPa (CP01 at 5.00m bgl) and 240 kPa (CP04 at 9.00m bgl). It is considered that, given the variability in plasticity

index identified in samples of cohesive glacial till, that triaxial compression tests may have been undertaken on samples of lower plasticity, resulting in higher undrained shear strength values.

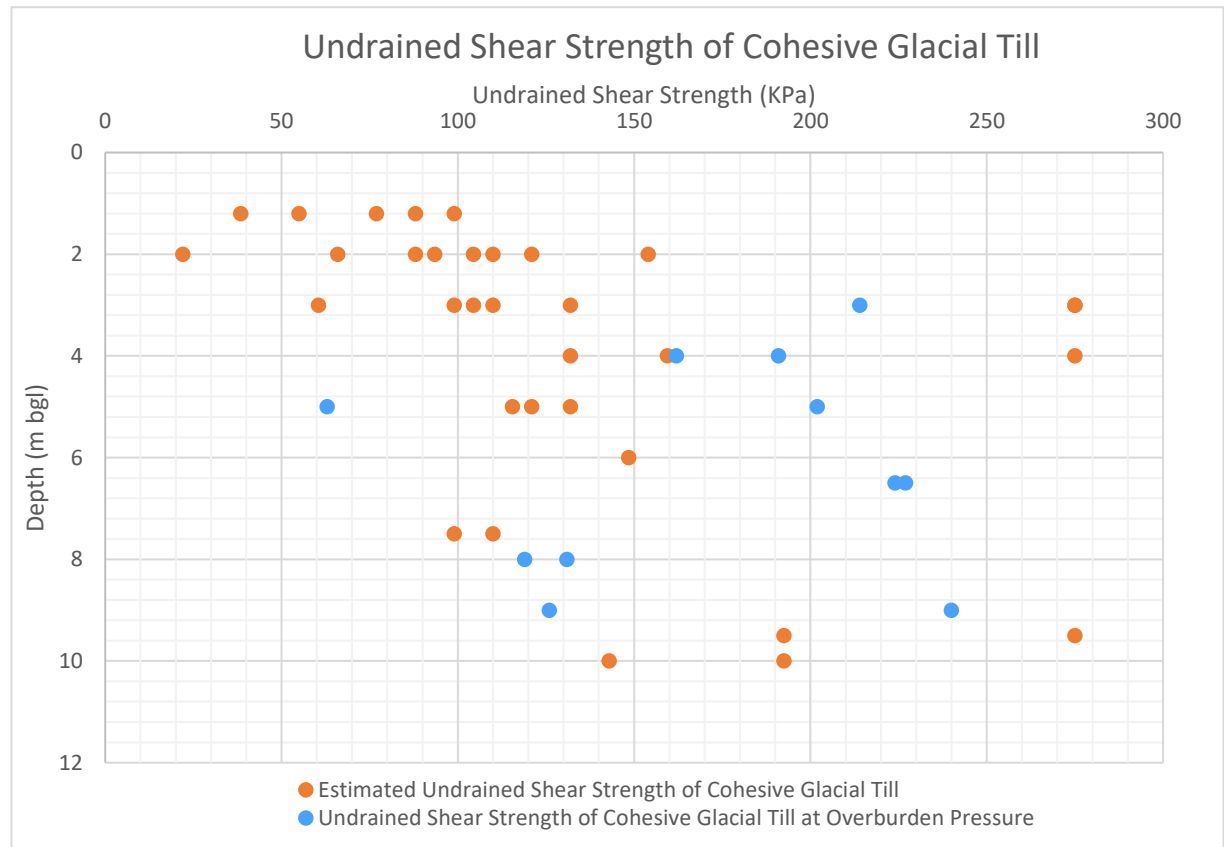


Figure 6.2d – Summary of Undrained Shear Strength of Cohesive Glacial Till

A moderately conservative unit weight range of 16kN/m³ is deemed suitable for generally medium strength cohesive glacial till, increasing to 23kN/m³ for high density soils, from a review of published sources (BS8004, Ref. 14).

The coefficient of volume compressibility, m_v , of cohesive soils can be estimated from the correlation between Plasticity Indices (PI) and SPT N values (Ref. 13) using Equation 2:

$$m_v = 1 / (f_2 \times \text{SPT } N) \quad \text{Equation 2}$$

Where:

C_u is the Undrained Shear Strength

f_2 is the Stroud Factor determined from Figure 1.5 (Ref. 13)

SPT N is Characteristic Standard Penetration Test Result

Based on the Atterberg Limit results of analysis of eleven soil samples, an average plasticity index of 20% was determined. Using this value, an f_2 value of 0.55 has been selected.

Coefficients of volume compressibility, mv , values ranging between $0.04 \text{ m}^2/\text{MN}$ and $0.45 \text{ m}^2/\text{MN}$ were determined. Generally, this material is classified as very low to medium compressibility soil. One sample (WS01 at 2.00m bgl) is indicated to be a high compressibility soil. The change in Coefficient of Volume Compressibility with depth is presented in *Figure 6.2e*.

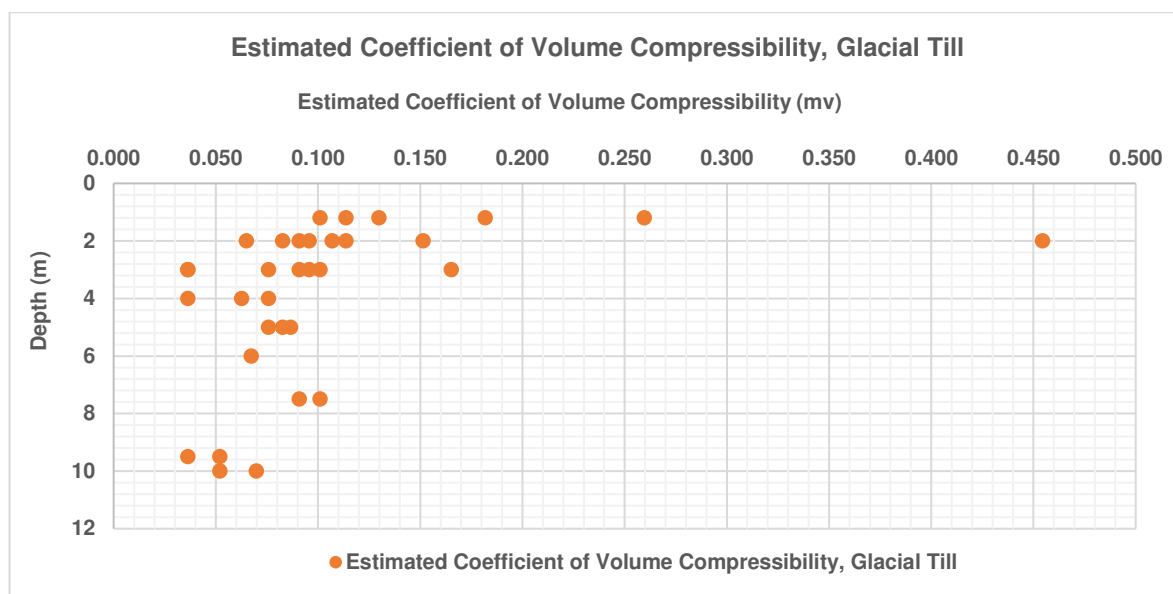


Figure 6.2e – Summary of Estimated Coefficient of Volume Compressibility of Cohesive Glacial Till

The Angle of Shearing Resistance, ϕ' , for cohesive Glacial Till has been derived from the correlation with Plasticity Indices (Ref. 15). *Figure 6.2f* summarises the change in angle of shearing resistance of cohesive soils with changes in elevation. The graph presents an increase in angle of shearing resistance with depth within the glacial till. An angle of drained shearing resistance of between 27° to 30° is recommended based on this correlation taking into consideration the guidance from Gibson (1953) and Trenter (1999) regarding the variation in angle of friction with Plasticity Index for UK Glacial Tills. An angle of undrained shearing resistance of between 21° and 25° is recommended. Equations representing the relationship between angle of shearing resistance is presented in *Figure 6.4f* which can be used to estimate a representative value for a given depth within the glacial till.

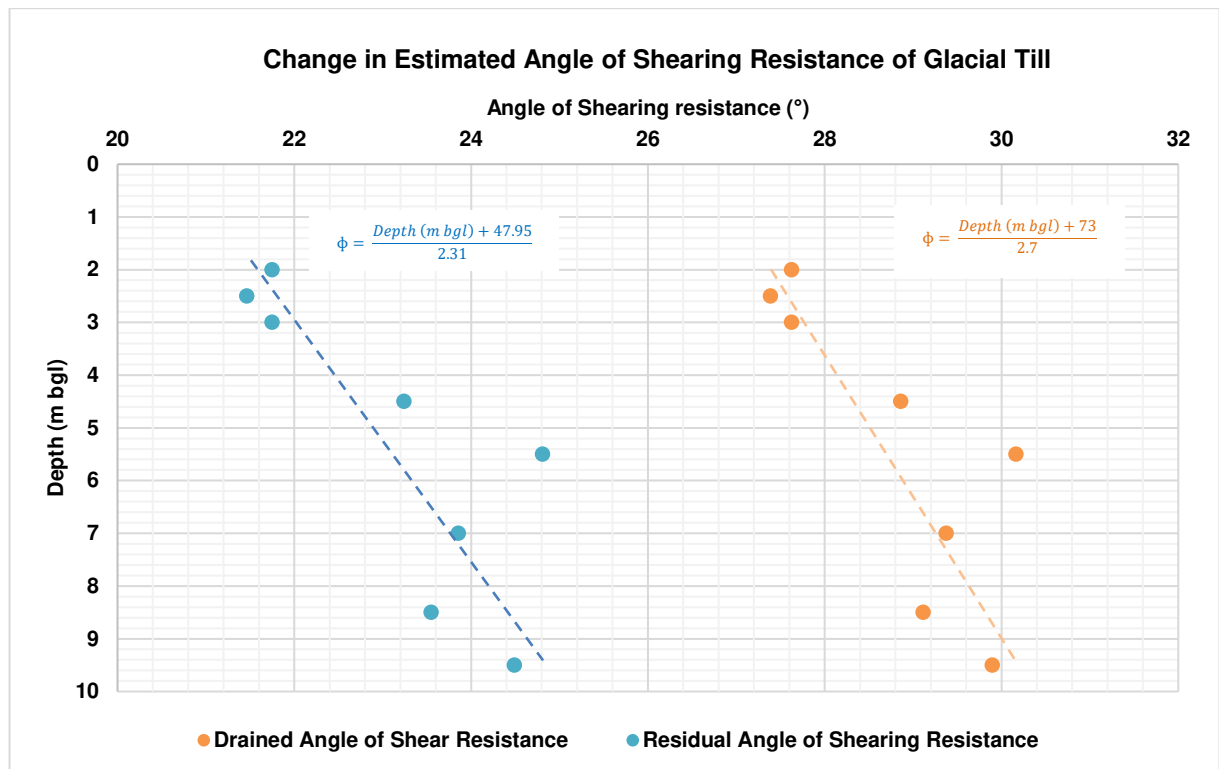


Figure 6.4f – Summary of Angle of Shear Resistance vs. Elevation in Cohesive Glacial Till

The Drained and Undrained Young's Modulus, E' and E_u , can be derived for cohesive material from the relationship with SPT N values as presented in Equation 3 and Equation 4.

An increasing with depth Young's modulus is proposed for design, according to the following relationships obtained from the ICE Manual of Geotechnical Engineering, 2012:

$$E_u = 330 \times c_u \quad \text{Equation 3}$$

$$E' = 200 \times c_u \quad \text{Equation 4}$$

It should be noted that care should be taken in using linear stiffness values derived from relationships as they do not necessarily reflect the non-linear nature of soil stiffness. The actual stiffness will be strain dependent and non-linear and should be considered in detailed design of sensitive structures.

Moderately conservative Drained and Undrained Young's Modulus, E' and E_u , have been estimated using this correlation and are shown on Figure 6.2g. The stiffness of the soils appears to increase with depth.

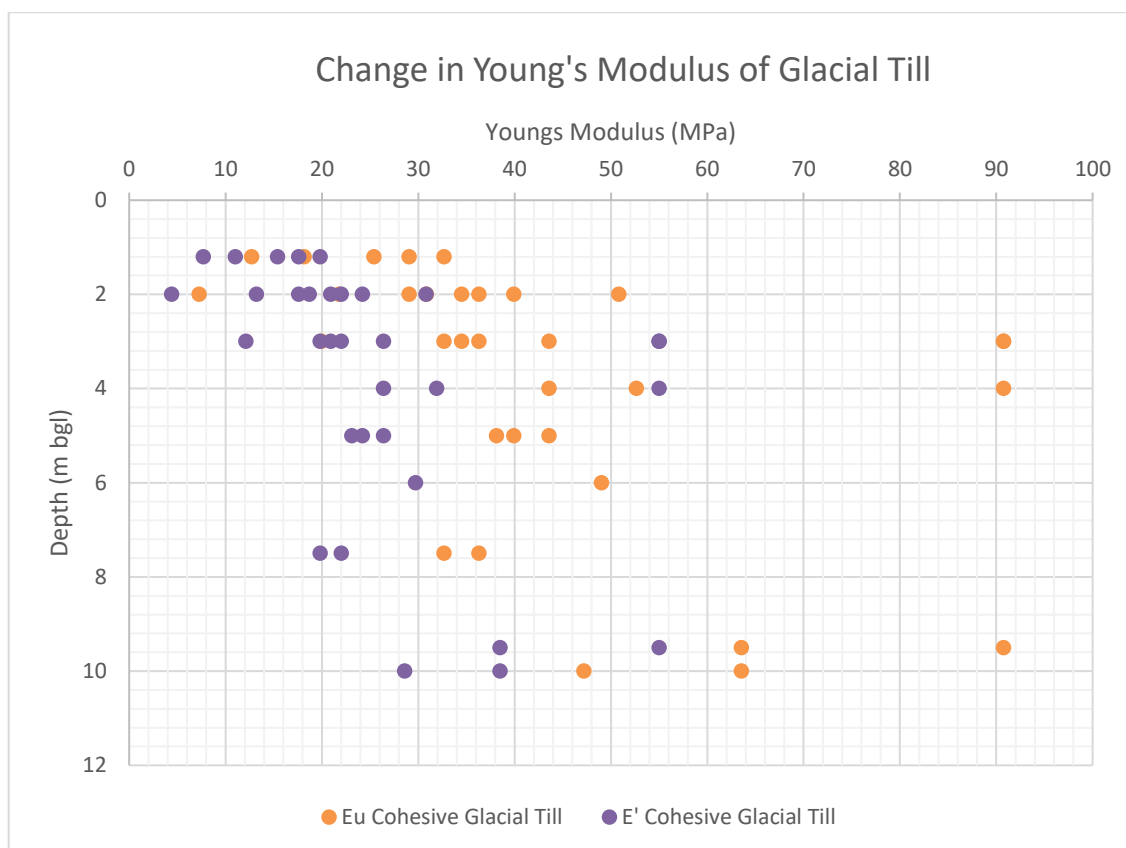


Figure 6.4g – Summary of Young's Modulus vs. Depth in Cohesive Glacial Till

6.3 Organic Rich Soils

Soils enriched in organic matter were encountered in WS01 summarised in Section 5.3.

No geotechnical testing has been undertaken on these soils due to their high organic content and compressible nature and due to the position of WS01 being outside the development footprint for the grandstand.

6.4 Granular Glacial Till

Table 6.4 summarises the laboratory testing undertaken on the granular glacial till.

Table 6.4 – Summary of geotechnical test results – Granular Glacial Till

Parameter	No. of Tests	Results
Laboratory Tests		
pH ¹	1	8.44
Water Soluble Sulphate (mg/l) ¹	1	30

¹ Sample taken from CP01 at 10.00m bgl.

No in-situ SPT geotechnical testing has been taken within this stratum, therefore it is advised that more representative published values are used for the purposes of design for these materials.

6.5 California Bearing Ratio (CBR) Estimates

TRL01 encountered an obstruction in Made Ground at 0.704m bgl and did not reach the full metre of penetration. All other positions successfully reached a maximum depth of 0.946m bgl.

CBR values were estimated based on the Webster et al., 1992 (Ref. 10) for CBR1 estimates and based on DMRB, 2008 (Ref. 11) for CBR2.

DCP testing undertaken is summarised in *Table 6.5* below.

Table 6.5 – Estimated CBR values from Dynamic Cone Penetrometer (DCP) testing

Location Ref.	Depth m bgl	CBR1 and CBR2 Results (%)	
		CBR1	CBR2
TRL01	0.00 – 0.704	Min: 3.5 Max: 14 Average: 9.19	Min: 5 Max: 17 Average: 11.64
TRL02	0.00 – 0.943	Min: 2.6 Max: 30 Average: 15.39	Min: 4 Max: 36 Average: 18.86
TRL03	0.00 – 0.946	Min: 3.4 Max: 170 Average: 60.73	Min: 5 Max: 184 Average: 68.08
TRL04	0.00 – 0.924	Min: 4 Max: 46 Average: 21.40	Min: 6 Max: 53 Average: 25.73
TRL05	0.00 – 0.934	Min: 3.1 Max: 40 Average: 18.47	Min: 4 Max: 47 Average: 22.39
TRL06	0.00 – 0.928	Min: 4 Max: 259 Average: 67.91	Min: 5 Max: 273 Average: 74.81

The results from all the positions (TRL01 to TRL06) across the rugby field area show that the estimated CBR values are highly variable within the first 0.5m bgl. CBR tests were conducted predominantly within Made Ground so were likely to be highly variable.

TRL01 encountered an obstruction at 0.704m bgl and could not be taken to 1.0m bgl.

Generally, estimated CBR values are seen in the top 0.3m bgl of between 4% and 35%, TRL03 shows CBR values of less than 15% for the top 0.3m bgl. TRL03 encountered soils between 0.35m to 0.40m bgl, and between 0.50m and 0.57m bgl which characterised much higher estimated CBR values of greater than 83%. TRL06 encountered soils which soils between 0.1m to 0.73m bgl which characterised estimated CBR values of less than 30%, at 0.75m bgl the estimated CBR values were greater than 80% to 1.0m bgl. There is high variability within the top 1.0m with regards to estimated CBR values and there is not a significant pattern of strength profile with depth between the positions.

Given that the soils tested are Made Ground and highly variable caution should be adopted in any value adopted for detailed design. Any design value adopted should be verified on site at the specific line and level of proposed hardstanding design. Proposed formations should be protected during the works with revealed soils likely to be susceptible to inclement weather.

The DCP results graphs are presented in full in *Appendix D*.

6.6 Aggressive Ground Conditions

The classification of the site in terms of concrete in aggressive ground is based on the guidance provided in Table C2 of the Building Research Establishment (BRE) Special Digest 1, 3rd edition of 2005 (Ref. 16). A summary of the results obtained as a part of the ground investigation are summarised in *Table 6.6a* below.

Table 6.6a –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Test Type	Range
Made Ground	pH	8.05 – 8.35
	Water Soluble Sulphate (mg/l)	<10
Cohesive Glacial Till	pH	8.26 – 8.59
	Water Soluble Sulphate (mg/l)	<10 - 70
Granular Glacial Till	pH	8.44
	Water Soluble Sulphate (mg/l)	30

Table 6.6b –Aggressive Chemical Environment for Concrete (ACEC) Site Classification

Stratum	Design Sulphate Class	ACEC Class ⁽¹⁾
Made Ground	DS-1	AC-1
Cohesive Glacial Till	DS-1	AC-1
Granular Glacial Till	DS-1	AC-1

In these conditions, and as a preliminary assessment and subject to further testing, it is considered that deterioration of buried concrete due to sulphate or acid attack is unlikely to occur. The preliminary design of buried concrete according to Table C2 of BRE Special Digest 1:2005 should be in accordance with Class DS-1 (AC-1) conditions assuming mobile groundwater.

7.0 Ground and Groundwater Contamination Assessment

This section of the report includes the assessment of the potential contamination, solid, liquid and gas, identified on the subject site which may present a risk to the proposed end-users, associated utilities and the wider environment.

In guidance published by the Environment Agency, the risk to human health or controlled waters is determined through an assessment of pollutant linkages between a source of contamination (within the ground or groundwater either on or off site) and a sensitive receptor such as end-users of the site, building materials, edible plants grown in gardens or groundwater abstracted for drinking. This is termed a source-pathway-receptor relationship. The same model is applied to the assessment of risk arising from ground gases as detailed within BS8576:2013 (Ref. 17).

These models have a common approach, which is one of a tiered assessment. At each stage of the assessment further detail can be applied to the conceptual site model to provide a detailed interpretation on a site by site basis. As part of the planning process this approach is adopted to establish either if the site is 'suitable for use' or whether additional work or else remedial work is required for the site to be deemed so.

The sub-sections hereafter therefore incorporate the first tier (Tier 1) of this approach otherwise referred to as the Generic Quantitative Risk Assessment (GQRA). The GQRA builds on the qualitative risk assessment presented in the Phase 1 Desk Study in conjunction with observations made during the ground investigation and is based solely on the results of the chemical and other testing data obtained as part of Curtins ground investigation. The GQRA is used to build/refine the Conceptual Site Model (CSM) for the site as detailed and presented in *Section 9.0* of this report.

The following sections present more detail on the risk assessment methodology rationale for the main receptors.

7.1 Human Health GQRA

The soil results will be screened against the relevant Generic Assessment Criteria (GAC) where available, including:

- i) **Soil Guideline Values (SGVs):** These have been published by the Environment Agency and are trigger values for screening out low risk areas of land contamination. SGV's give an indication of representative average concentrations of chemicals in soil, below which long-term health risks are likely to be minimal. SGVs have been published for several contaminants including arsenic, cadmium, mercury, nickel, selenium, BTEX, phenols and dioxins, furans and dioxin-like PCB substances for land uses including residential, allotments and commercial. The SGVs have been developed for a sandy loam soil with 6% soil organic matter (SOM) content;
- ii) **Supplementary Screening Values (SSVs):** In addition to the SGVs developed by the EA, other third party organisations have derived SSVs for a wider range of contaminants and land uses using the CLEA Model. Curtins have adopted these numbers where applicable, including

those developed by Atkins AtriskSoil™, the LQM/CIEH Suitable for Use Levels (S4UL) and EIC/AGS/CL:AIRE published thresholds;

- iii) **Category 4 Screening Levels (C4SLs):** In March 2014 Defra published C4SLs for arsenic, benzene, benzo(a)pyrene, cadmium, hexavalent chromium and lead. These values were derived to support the revised Part 2A Statutory Guidance issued in 2012 (Ref. 18) in which four categories of contaminated land are included, ranging from Category 1 (significant/high risk) to Category 4 (low risk). C4SLs are not representative of significant possibility of significant harm (SPoSH) and are low risk levels which, and therefore where the C4SLs are not exceeded, land can be demonstrated to be in Category 4 and cannot be determined as contaminated land.

7.1.1 Adopted Soil Human Health GACs Screening Methodology

Current development proposals indicate the construction of an educational facility with ancillary facilities including an integrated spectator stand and new landscaped areas. Large proportions of the external space will be covered by hardstanding (car parking and by the grandstand itself) with small pockets of soft landscaping generally including raised grass mounds. In line with exposure modelling for how GAC thresholds are generated, the exposure pathways for contaminants for an educational facility with minimal soft landscaping is very limited. As such in line with the published guidelines, the site end use is considered to be most analogous with a 'Commercial' end use scenario.

The assessment has been undertaken against the following GACs, in order of preference:

1. Environment Agency Soil Guideline Values,
2. CL:AIRE, AGS, EIC. Soil Generic Assessment Criteria for Human Health Risk Assessments,
3. LQM/CIEH 2015 S4ULs for Human Health Risk Assessment, and
4. DEFRA Category 4 Screening Levels.

The soil organic matter (SOM) content has an influence on the volatilisation of organic contaminants (i.e. the higher the SOM, the lower the volatilisation rate and therefore inhalation exposure risk). Soil organic matter (SOM) values for soils ranged from 0.7% to 9.1%. The greatest organic matter concentrations were recorded in samples of Made Ground described in Section 5.4.

The samples of Made Ground obtained from window sample boreholes and cable percussion boreholes recorded a SOM of 0.70% to 9.1% and natural clay sample from WS03 recorded a SOM of 1.50%. With consideration for a calculated geometric average, Made Ground soils determine a SOM of 2.46%. As such, a comparison against Generic Assessment Criteria (GAC) thresholds for more a conservative SOM of 1% for the identified end use thresholds have been adopted for made ground and natural soils.

The adopted GAC's can be referred to in *Appendix F*.

7.1.2 Generic Assessment Criteria Screening of Soil Laboratory Results

The results of the environmental testing can be referred to in *Appendix C*.

With respect to 'Commercial' thresholds. No exceedances of the nominated GACs were recorded in any of the soil samples tested.

All soil samples were screened for asbestos. No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or laboratory screening.

The risks to site end users are considered to be low.

The risks to construction and maintenance workers is considered to be low. Workers should be provided with appropriate PPE accounting for the laboratory chemical analysis results.

8.0 Ground Gas Assessment

The assessment of risk presented by ground gases is assessed with reference to guidance published by CIRIA Assessing Risks Posed by Hazardous Ground Gases to Buildings, C665 (Ref. 19), BSI Publication code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings BS8485:2019 (Ref. 20) and other broadly accepted references such as the Ground Gas Handbook 2009 (Ref. 21).

The gas risk assessment adopts a tiered approach. In the first instance this involves a re-evaluation of the Conceptual Site Model described within the Phase 1 Desk Study (Ref. 1) and thereafter validating this conceptual model with the ground gas data, the semi-quantitative risk assessment.

8.1 Ground Gas Monitoring Results

To characterise the site's ground gas regime and validate the qualitative assessment of ground gas risk, standpipe installations were incorporated within the four cable percussive boreholes (CP01 to CP04) and the four window sample boreholes (WS01 to WS04) as detailed in *Section 3.2*.

An initial programme of six gas monitoring visits over twelve weeks was proposed. Six gas monitoring visits have been undertaken between 19th July 2021 and 22nd September 2021, with barometric pressure recorded between 1000 mb and 1027 mb. Falling barometric pressure was recorded on the first (19/07/21), second (28/07/21) and sixth (22/09/2021) visits.

The second (28/07/21) visit and fourth (23/08/21) visit were undertaken during a period of rainfall.

The results log sheets are contained within *Appendix E* and summarised in *Table 8.1*.

Table 8.1 – Summary of Ground Gas Monitoring Results

Exploratory Hole ID	Maximum Methane Concentration (%)	Maximum Carbon Dioxide Concentration (%)	Minimum Steady Oxygen Concentration (%)	Maximum Peak Gas Flow (l/hr)	Maximum Steady State Gas Flow (l/hr)
WS01	0.2 (Visit 2)	6.1 (Visit 5 and 6)	4.3 (Visit 5)	-0.4 (Visit 5)	-0.1 (Visit 1)
WS02	<0.1	1.0 (Visit 3)	19.8 (Visit 6)	-2.5/0.2 (Visit 3/Visit 1)	0.2 (Visit 1)
WS03	<0.1	0.6 (Visit 3)	18.6 (Visit 2)	30.3 (Visit 1)	0.2 (Visit 2)
WS04	<0.1	3.2 (Visit 5)	15.0 (Visit 5)	53.9 (Visit 1)	7.3 (Visit 1)
CP01	<0.1	1.5 (Visit 6)	18.5 (Visit 1)	0.1 (Visit 1 and 5)	0.1 (Visit 5)
CP02	<0.1	1.6 (Visit 1)	5.3 (Visit 1)	<0.1	<0.1
CP03	<0.1	0.9 (Visit 1)	15.9 (Visit 1)	-0.9/0.1 (Visit 5/Visit 2)	-0.8
CP04	<0.1	0.1 (Visit 5)	20.3 (Visit 5)	0.1 (Visit 5)	0.1 (Visit 5)

Ground gas monitoring installations were installed mainly within glacial till deposits across the site as limited thicknesses of Made Ground were encountered in the exploratory hole locations ranging from 0.60m to 1.80m bgl. The potential of these thicknesses of Made Ground to be gas generating sources is also reduced due to the fact that the Made Ground comprised up to 0.6m thick subbase material with low soil organic matter content. CP04 encountered cohesive Made Ground to 1.80m bgl and is located within the building footprint and therefore the Made Ground was targeted within the installation.

Organic rich soils were only encountered in WS01 located outside the building footprint and were targeted within the installation to identify if these soils had gas generating potential.

The maximum recorded concentration of carbon dioxide of 6.1% v/v was recorded in WS01 on the fifth and sixth monitoring visits, but this location is sufficiently far from the building and there is no evidence from the results in the installations within the glacial till that carbon dioxide or methane is laterally migrating through a pathway in the glacial till. CP04, targeting Made Ground deposits, recorded concentrations below the limit of detection of the monitoring instrument throughout the monitoring period. WS04, installed within glacial till, recorded a maximum carbon dioxide concentration of 3.4% v/v on the fifth monitoring visit.

Methane (CH_4) was recorded below the instrument's detection limit within all the monitoring wells throughout the monitoring period, with exception of WS01 on the second monitoring visit, recording a maximum methane concentration of 0.2% v/v , reducing to a steady state of 0.1% v/v .

Maximum hydrogen sulphide concentrations of 9 ppm were recorded in WS03 on the second visit and maximum carbon monoxide concentrations of 2 ppm were recorded in CP01 on the fourth visit.

The greatest peak air flow rate was recorded in WS04 (53.9 l/hr) on the first monitoring visit. This reduced to a steady state of 7.3 l/hr, recorded after 10 seconds. WS03 also recorded elevated peak air flow rate (30.3 l/hr), which reduced to <0.1 l/hr. WS03 and WS04 were the only boreholes to record consistently high peak air flow rates through the monitoring period. CP04, installed in the Made Ground, recorded peak air flow rates of 0.1 l/hr or below the detection limit of the monitoring instrument across the monitoring period.

WS02 and WS03 recorded a maximum steady state air flow rate of 0.2 l/hr.. WS01 recorded a maximum steady state air flow rate of -0.1 l/hr. Steady state air flow rates were recorded as <0.1 l/hr within all remaining monitoring wells throughout the monitoring period.

8.2 Ground Gas Assessment

The Conceptual Site Model presented in *Section 2.8* highlighted potential Made Ground and natural soils containing organic / putrescible content as a potential source of ground gas generation.

Noxious and asphyxiate gases were attributed to include, but not limited to, carbon dioxide, carbon monoxide, methane and hydrogen sulphide.

The ground investigation and subsequent ground gas monitoring included the monitoring of boreholes in areas around and within the development footprint.

The ground investigation revealed a ground model generally consistent with the preliminary conceptual site model. Ground conditions pertaining to the development site comprise thicknesses of Made Ground overlying cohesive glacial till, with localised organic rich deposits including peat, organic sand and peaty clay, and deeper granular glacial till. As previously discussed, limited thicknesses of Made Ground were encountered across the site of which most of the deposits consisted of subbase material limiting the gas generating potential of the deposits. CP04 was installed within cohesive Made Ground and the results suggest that these soils are not a source of gas generation across the site and recorded little to no flows across the monitoring period. As such the conceptual site model can be revised, as there is no evidence from the monitoring results that the Made Ground is a source of gas generation across the site.

In accordance with BS8485:2015+A1:2019 (Ref. 21), consideration of the recorded soil gas flow rates, presented below, enables hazardous gas flow rates (Q_{hg}) to be evaluated. Q_{hg} can be derived for both 'borehole' and 'worst case' scenarios and a comparison made in support of an appropriate assessment of ground gas risk. For a 'borehole' scenario (highest hazardous gas flow rate identified a single borehole) steady state flow rates and maximum gas concentrations are adopted, whilst for a 'worst case' scenario (highest Q_{hg} across the entire dataset irrespective of location and discrete monitoring events) peak flows and gas concentrations are adopted.

The dataset obtained is considered to be representative of site conditions beneath the proposed development footprint. A range of data has been collated which captures significant temporal variation including barometric variability and various ground saturation states. All monitoring wells were successfully monitored throughout the monitoring period and in accordance with BS8485:2015+A1:2019 (Ref. 21).

Given the representative dataset available, it is considered that steady state air flow rates may be utilised in the ground gas risk assessment, to determine the Q_{hg} and gas screening value (GSV) for the site.

The first visit recorded a maximum steady state air flow rate of 7.3 l/hr in WS04, installed within cohesive glacial till. The exploratory hole logs do not indicate a specific gassing source which would result in the elevated air flow rates recorded. The elevated steady state air flow rate was only recorded on the first monitoring visit, with no other substantial steady state air flow rates recorded during the monitoring period. As such, this value is discounted from the ground gas risk assessment.

The highest representative steady state air flow rate was recorded in CP03 (-0.8 l/hr).

Slightly elevated concentrations of carbon dioxide (>5% v/v) were recorded in WS01 on the fifth and sixth visit. Methane concentrations of 0.2% v/v were also recorded on the second visit. The gas

monitoring well was installed within the organic rich soils, which may be acting as a gas generating source. This location is outside of the proposed development footprint. Although the extent of the organic rich soils has not been determined, such soils will be removed to facilitate construction, removing a possible gassing source. No evidence is seen within the remaining gas monitoring results in the boreholes within the building footprint that there is a pathway across and up through glacial till deposits underlying the proposed development footprint. As such, these values have been discounted from the assessment, which account for the Made Ground and cohesive glacial till underlying the site.

The greatest concentration of carbon dioxide, outside of WS01, was recorded in WS04 on visit 5 (3.2% v/v).

Methane concentrations were recorded below the limit of detection of the monitoring instrument for all locations outside of WS01 throughout the monitoring period.

Evaluation of the 'borehole' scenario (highest hazardous gas flow rate that is realistically possible, i.e. in a single borehole) records a maximum Q_{hg} of 0.0256 l/hr for carbon dioxide where maximum steady state reading of 0.8 l/hr, and maximum gas concentrations of 3.2% v/v on the fifth visit. The same value is recorded for the 'worst case' scenario.

The risk presented from methane is considered to be low, as all concentrations beneath the proposed building footprint are recorded below the limit of detection of the monitoring period.

The borehole Q_{hg} calculated from the available dataset therefore indicates a CS1 classification on site, not requiring gas protection measures.

The potential risks from ground gases to the excavations are to be dealt with by the Contractor, in accordance with the Confined Space Regulations, during construction. Appropriate ground gas monitoring and safety measures should be in place during the works, as the potential presence of ground gases could pose a risk in any confined spaces of deep excavations.

9.0 Revised Conceptual Site Model

The Preliminary Conceptual Site Model (PCSM) presented *Section 2.8* and discussed in *Section 2.0* of this report has been revised following the GQRA in *Sections 7.0* and *8.0* above. The Revised Conceptual Site Model (CSM) is summarised in the table overleaf.

The CSM details the source-pathway-receptor linkages or potential pollutant linkages (PPL) that have been identified as relevant for the site. The GQRA details the associated level of risk relating to these potential pollutant linkages.

The CSM follows the framework outlined within CIRIA C552 (Ref. 22) which is summarised within *Appendix G*.

The 'risk rating' within the CSM refers to the risk that the source, pathway, receptor linkage or PPL is complete. Unless specifically stated it does not necessarily refer to an immediate risk and is intended to be used as a tool to assess the necessity for further assessment/investigation.

Risks presented by Unexploded Ordnance is discussed and assessed in *Section 2.5*.

Under current health and safety legislation, employers are required to carry out their own appropriate risk assessments and mitigation to protect themselves and their employees, other human receptors and the environment from potential contamination. Such risks must be adequately mitigated by law, specifically the Construction Design Management (CDM) Regulations, 2015 (Ref. 23) which require that potential risks to human health and the environment from construction activities are appropriately identified and all necessary steps taken to eliminate / manage that risk.

It has been assumed that any future construction works on site will be undertaken in compliance with these requirements. This assumption is factored into the conceptual site model. Reference should be given to the environmental testing results discussed within *Section 7.0* and presented within *Appendix C*.

Phase 2 Ground Investigation

Qualitative Risk Assessment

Generic Quantitative Risk Assessment

Detailed Quantitative Risk Assessment or; Remedial Action

- The table below represents the Second stage in the land quality risk assessment process; the Revised Conceptual Site Model following the Quantitative Risk Assessment.
- For a development site to be deemed 'suitable for use' the level of risk needs to be brought down to acceptable levels, i.e. low to very low risk. The purpose of each stage of risk assessment is ultimately to establish if there is a requirement for additional levels of assessment to be made to have sufficient confidence to support a risk characterisation or management decision, e.g. remedial action.
- In the absence of specific site data, a Generic Quantitative Risk Assessment is invariably recommended.

Conceptual Site Model			Generic Qualitative Risk Assessment			Comments	Action
Identified Source	Pathway(s)	Receptor(s)	Consequence	Likelihood of Occurrence	Risk Rating		
Limited thickness of Made Ground underlying surface covering of tarmac and rough vegetation.	Direct contact and dermal uptake, soil and dust ingestion, dust and migration inhalation (indoor & outdoor air)	Site End Users	Medium Human Health Risk	Unlikely	Low	No exceedances identified in any of the soil samples tested above 'Commercial' GAC.	No further action required.
		Construction and maintenance workers				No asbestos containing materials (ACMs) identified across the site.	
	Vertical and horizontal migration of soluble phase contamination through groundwater.	Controlled Waters (Surface Water) Nearest surface water feature is a pond 597m southeast of the site. There are no surface water abstractions within 700m.	Mild	Unlikely	Very Low	No gross contamination identified during ground investigation.	No further action required.
	Vertical and horizontal migration of soluble phase contamination through superficial deposits and bedrock.	Controlled Waters (Groundwater) Superficial: Secondary Undifferentiated Aquifer (Glacial Till) Bedrock: Secondary A Aquifer (Etruria Fm and Upper Pennine Coal Measures) There are no active potable groundwater abstraction points within 500m. The site is not within a designated Source Protection Zone.	Medium	Unlikely	Low	No gross contamination identified during ground investigation or subsequent monitoring to raise risk level identified in Phase 1 Preliminary Risk Assessment.	
Ground gas generating sources, including Made Ground, glacial till and organic rich deposits.	Ground gas & vapour migration and inhalation. Vertical and horizontal migration through existing service corridors and the underlying superficial deposits.	Site End Users	Medium Human Health Risk	Low	Low	Using the 'borehole Q _{hg} representative' scenario, due to a full data set within varying pressures, the calculated Q _{hg} for the site was 0.0256/hr l/hr for carbon dioxide, with no notably elevated CO ₂ recorded beneath the proposed building footprint. Methane concentrations below the limit of detection of the monitoring instrument for all monitoring wells beneath the proposed building footprint. Limited thicknesses of Made Ground were encountered across the site, results from CP04 suggest that these deposits are not source of gas generation. The source of the elevated concentrations of methane and carbon dioxide in WS01 from the organic rich soils is present sufficient distance from the building footprint and there is no evidence that the gas is migrating laterally through the glacial till and as such presents no risk to the development. Site is assessed as CS-1.	No gas protection measures are required for the proposed development.

9.1 Summary of Significant Pollutant Linkages

A **Low** risk rating is identified to site end-users and construction workers, from soils and dust from inhalation and ingestion in all areas of the site. No further action is required.

Soils will be suitable for re-use on site and no remediation is required as part of the development for areas of soft landscaping or on the rugby field itself.

A **Low** and **Very Low** risk rating is identified to controlled waters (Groundwater and Surface Waters) following the ground investigation, where no major sources of contamination were identified.

A **Low** risk rating is identified to site end users from ground gases arising from site soils, migrating into buildings. This corresponds to a Characteristic Gas Situation assessed as CS1. No gas protection measures are required.

10.0 Geotechnical Assessment and Recommendations

10.1 Introduction

This section will discuss the ground and groundwater conditions encountered across the site and assess their associated risks for the proposed scope of the works. Development proposals for the site include the construction of the Our League Life National Hub training facility and ancillary facilities including classrooms and an integrated spectator stand. The proposed layout is included in *Appendix A*.

Estimated building loads, provided by the structural engineer, at the time of writing indicate:

- Maximum column loads of approximately 1000kN, unfactored, excluding the ground floor slab;
- Slabs are proposed to be suspended.

Any changes in the development of designs beyond the issue of this Ground Investigation Report to the client, should be further investigated by the Construction Designer.

10.2 Geotechnical Considerations

The ground conditions site wide have been recorded to be relatively consistent, comprising tarmacadam or grass and rough vegetation surface covering overlying layers of Made Ground (up to 1.80m in thickness), underlain by cohesive glacial till, and locally granular glacial till.

Organic rich soils were encountered in WS01 which is currently located outside the development footprint of the building and in the area currently covered by tarmacadam surface car parking. Therefore, should not be an issue when considering geotechnical properties of the soils underlying the site.

Made Ground is not suitable to be able to support shallow foundations, or indeed ground bearing slabs. On this basis, it is recommended that foundations are taken below the Made Ground and any soft /loose compressible and unsuitable natural strata to the underlying stiff cohesive glacial till which are more suitable for bearing the loads of the proposed development.

The cohesive glacial till soils at depths of 53.13m AOD or deeper comprise generally stiff brown slightly sandy to sandy slightly gravelly to gravelly clay.

Site levels are different across the site, CP01, CP02, WS02 and WS03 are at levels of 56.34m AOD to 55.70m AOD. CP03, CP04, WS01 and WS04 are at levels of 57.45m AOD to 57.10m AOD. It is envisaged that a cut and fill operation might be necessary to facilitate the proposed development.

The stiff cohesive glacial till can provide an allowable bearing capacity of approx. 100kN/m² for 1m wide strip or pad foundation founded across the stiff clays at generally 1.2m bgl, unless deeper made ground or unsuitable stratum is encountered. Alternatively Allowable bearing capacity of up to 150 kN/m² at 3m bgl. This may be deeper locally, for example around WS04 where softer deposits have been

encountered overlaying the suitable firm to stiff. This allowable bearing capacity is provided, allowing for up to 25mm total settlements. Where this bearing capacity is not acceptable, consideration should be given to a deep foundation solution.

The foundations should be designed to account for the presence or removal of trees and founded at a suitable depth and a suitable distance outside the influence zone of trees, in accordance with minimum NHBC requirements.

To avoid damage from frost action, the depth to the underside of the foundation in frost susceptible ground, should be at least 450mm below finished ground level. This depth should also be used when construction is undertaken during cold weather. Alternatively, precautions should be taken to prevent freezing of the ground.

The depth of foundations and the founding stratum should be such as to give an adequate bearing capacity for the design loads.

In areas where additional Made Ground or where unsuitable natural soils are encountered (e.g. soft/organic deposits), material should be removed and replaced through its full extent with suitable, engineered fill unless alternative solutions such as piled foundations or ground improvements are adopted.

The bearing capacities will be dependent on the formation level ground conditions and the ground within the influence zone of the foundations, as well as other factors such as formation levels, foundation shapes and dimensions. All foundation formations should be inspected by a qualified geotechnical engineer to ensure suitable soils are used for construction.

10.3 Ground Floor Slabs

Based on observations onsite together with the results of laboratory tests, due to presence of Made Ground and softer unsuitable deposits, it is recommended that consideration is given to a suspended ground floor slab.

10.4 Chemical Attack on Buried Concrete

The site has been classified in accordance with BRE Special Digest 1 (Ref. 16) and laboratory testing undertaken accordingly in *Section 7.0*. Based on the laboratory test results it is considered that a Design Sulphate Class may be taken as DS-1 with an ACEC class of AC-1 for Made Ground, cohesive glacial till, and the granular glacial till.

10.5 Excavation and Support

Observations during the intrusive works and subsequent monitoring indicate that shallow soils are generally dry with likely localised perched water zones.

Groundwater cannot be discounted during shallow excavations and any excavations for foundations and services are likely to require close side support in the short term.

In accordance with Health and Safety Regulations, side support for safety purposes should be provided to all excavations which appear unstable and those more than 1.20m deep. Excavations shallower than 1.20m deep, requiring personnel access, will likely require support.

10.6 Soakaways

SA02 was tested once on 1st July 2021, and the test was recorded incomplete after 2.5 hrs as the water level had not moved from the start depth of 0.66m bgl in this time. As such, no infiltration rate was recorded in SA02. It is therefore considered that due to the incomplete test in SA02 that soakaway drainage will not be feasible in the cohesive glacial till across the site.

11.0 Conclusions & Recommendations

11.1 Conclusions

11.1.1 Ground and Groundwater Contamination

The environmental chemistry soil results have been compared with the Generic Assessment Criteria (GAC) for soils with respect to human health against the conservative '*Residential without plant update*' thresholds and '*Commercial*' thresholds as there is no specific end-use scenario relating to educational facilities. In line with exposure modelling for how GAC thresholds are generated, an educational facility of this nature would be most analogous with a '*Commercial*' setting.

No exceedances have been noted with respect to the conservative '*Residential without plant update*' and '*Commercial*' GAC thresholds as a part of the ground investigation.

No suspected asbestos containing materials (ACMs) were identified within any of the exploratory hole logs or during laboratory screening.

A **Low** risk rating is identified to site end-users and construction workers, from soils and dust from inhalation and ingestion, in all areas of the site. As such, no further action is required.

No remediation is required in areas of soft landscaping and soils on site are suitable for re-use in soft landscaping or beneath proposed development hardstanding.

A **Low** and **Very Low** risk rating is identified to controlled waters (Groundwater and Surface Waters) following the ground investigation, where no major sources of contamination were identified.

11.1.2 Ground Gas Assessment

Using the 'borehole Q_{hg} representative' scenario, due to a full data set within varying pressures, the calculated Q_{hg} for the site was 0.0256 l/hr l/hr for carbon dioxide, with no notably elevated CO_2 recorded.

Concentrations of methane, below the building footprint, were recorded below the limit of detection of the monitoring instrument throughout the monitoring period.

The site is assessed as Characteristic Gas Situation 1(CS1), no gas protection measures are required.

The site is located within a Lower Probability Radon Area (less than 1% of homes are estimated to be at or above the Action Level).

11.2 Recommendations

Based on the findings of the ground investigation, the following recommendations are made:

- 1) Should unexpected contamination be observed during construction advice should be obtained from a Geo-environmental Engineer.
- 2) Construction and maintenance workers should be provided with appropriate PPE with reference to the environmental testing results.

12.0 References

1. Curtins (2021) Phase 1 Preliminary Risk Assessment, ref. 077652-CUR-00-XX-RP-GE-001-P01
2. British Geological Survey (BGS) 1:50,000 (Solid and Drift Edition, Sheet No. 095, 2010) for Manchester.
3. Coal Authority Interactive Map Viewer [online], <http://mapapps2.bgs.ac.uk/coalauthority/home.html> (accessed August 2021).
4. CIRIA (2009) Unexploded Ordnance: A Guide for the Construction Industry (report no. C681).
5. Zetica Regional Unexploded Bomb Risk, Risk Map, <https://zeticauxo.com/downloads-and-resources/risk-maps/> (accessed August 2020).
6. Environmental Agency (2020) Land Contamination Risk Management (LCRM)
7. British Standards Institution (2011) Investigation of Potentially Contaminated Sites: Code of Practice (report no. BS10175:2011+A2:2017).
8. British Standards Institution BSI (2015+2000) Code of Practice for Site Investigations (report no. BS5930).
9. British Standards Institution (2006) Eurocode 7: Geotechnical Design (report no. BSEN1997).
10. Webster S, Grau R and Williams T. (1992) Description and Application of Dual Mass Dynamic Cone Penetrometer.
11. Highways Agency (2008) Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.
12. British Standard (2016) Methods of test for soils for civil engineering purposes. General requirements and sample preparation (report no. BS1377-1).
13. Stroud, M. a. B. F. (1975) The Standard Penetration Test and the Engineering Properties of Glacial Materials.
14. British Standard Institution BSI (2020) Code of Practice for Foundations (report no. BS8004).
15. Gibson, R. E. (1953) Experimental Determination of the True Cohesion and True Angle of Internal Friction in Clays.
16. Building Research Establishment (2005) Concrete in Aggressive Ground (Special Digest 1).
17. British Standards Institution. (2013) Guidance on Investigations for Ground Gas, Permanent Gas and Volatile Organic Compounds (VOCs) (report no. BS8576:2013).
18. Department of Environment Food and Rural Affairs (DEFRA) (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).
19. CIRIA (2007) Assessing Risks Posed by Hazardous Ground Gases to Buildings (report no. C665).
20. British Standards Institution (2015) Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (report no. BS8485:2015 +A1:2019).
21. S Wilson, G Card, S Haines (2009) Ground Gas Handbook Cathness, Scotland, Whittles Publishing.
22. CIRIA (2001) Contaminated Land Risk Assessment. A guide to good practice (report no. C552).
23. CITB (2015) Construction (Design and Management) Regulations.

Appendix A – Drawings

- Holmes Miller (2020), Concept Design (Presentation), ref. 4740-HML-XX-XX-PP-A-00001
- Curtins, Exploratory Hole Location Plan, ref. 077652.300-CUR-XX-DR-GE-80002-P01





Contents

Introduction	4	Appendix 1	
		Precedents & Examples	36
Section 1		Appendix 2	
Concept		Cost Plan	40
1.0 - Location	8		
1.1 - Site Analysis	10	Appendix 3	
1.2 - Aerial Plans	12	Risk Log	44
1.3 - Site Strategy	14		
1.4 - Building Strategy	16		
1.5 - Arrangement Plans	18		
1.6 - Massing	22		
1.7 - Material Strategy	24		
1.8 - Images	25		
Section 2			
Costs, Procurement and Programme	32		



Holmes Miller



Our League Life National – Design Concept and Development Programme

Introduction

In 2019, The RFL received an independent report, The Rugby League Dividend, which set out how RL has a *reach, visibility and value beyond its core followers to make a major contribution to health outcomes, crime reduction, improved education and employment outcomes, volunteering opportunities and improved life satisfaction.* The Our League Life Concept was borne out of this strategic ambition to capitalise on Rugby League as not just a great sport but also a vehicle for social mobility.

The proposal represents an extension of the RFL’s decision to establish the National Centre for Rugby League as the Governing Body’s new HQ from 2021 situated in Manchester’s House of Sport at the Etihad Campus. Development and design work on the project was triggered by The Big Ask Update report to the RFL Board in Feb 2020. The Our League Life National Centre also has the potential to be a manifestation of the legacy of RLWC 2021 with onsite work due to commence concurrent to the World Cup.

Our League Life will be a hub and spoke model: celebrating, expanding and rolling out existing good practice in Rugby League communities across the North of England, adding value, and providing coordination. It will deliver specialist training and learning across the Rugby League family but also make a real impact through innovative education and training for young people and the wider community in Greater Manchester.

The Hub will be the Our League Life (OLL) National Centre developed at the Grey Mare Lane site in Beswick - part of the Etihad Campus and just a few hundred metres from the National Centre for Rugby League.

After initial feasibility work and commissioning an Education & Training Plan for OLL in May 2020, the RFL appointed a Design Development Team comprising Holmes Miller Architects, Doig + Smith (Quantity Surveyors) and Bear Maximum (Project Managers) to produce a feasibility concept and design for the Our League Life National Centre by September 2020. This report summarises that design work to concept stage, with the RFL project team as Client, provides a delivery strategy and programme for realising the project to opening in May 2022.

The Time is Now: Closing the skills gap

The case for closing the skills gap for the Rugby League Heartlands in the North of England is well documented through the Northern Powerhouse Strategy:

- Significant skills gap in core Northern communities such as those in which RL is strongest
- 10 of the 11 economic sub-regions of the North have a lower GVA per job than the average for the rest of England (excluding London).
- Universal acknowledgement this gap (between the North and the rest of England) needs to narrow to allow the whole of the UK to succeed
- Greater Manchester problems with skill levels exist at both ends of the spectrum with a lower proportion of the population holding NVQ4+ qualifications than the national average and a high proportion of the population holding no qualifications at all
- Digital skills are central to strategies for the new North - for mobility and empowerment at an individual and community decision making level

As of September 2020, the case for action is surely being strengthened due to the economic and social consequences that are already emerging from the ongoing COVID-19 pandemic. Indeed, on 29th September, the Prime Minister set out plans for further investment in technical and vocational skills from 2021 which will strengthen the business case for Our League Life.

Uniquely Driving Skills and Social Mobility through Sport

In Feb 2020, the RFL developed a series of strategic objectives for the OLL Project

- Building on Rugby League’s unique position across Northern towns
- Proposed OURLEAGUE LIFE National hub linking to existing and emerging local hubs - servicing the whole RL community
- Centre of real-world skills and training experiences - with the inspiration of elite sport
- Aligned to the new industrial strategy for the North
- Nation’s first hub for skills and social mobility through sport
- Skills gap: interplay between digital and health and well-being innovation, education - through sport
- Increasing aspiration through a unique base shared by elite national players and community players and coaches, co-located with learning spaces for young people and adults who may be disengaged with traditional learning routes
- Creating community leaders

Maximising Rugby League’s proven ability to deliver a range of services beyond traditional sport into the heart of core, pivotal communities

The OLL Education and Training Plan (May 2020) recommends creating hybrid model of education and training delivery at the OLL National Centre that would partner the uniqueness of RFL’s experience and capability (through RL Learning Ltd) blended with expertise in local education institutions active at the Etihad Campus.

It emphasises the need to build strong links with and learn from the existing centre of good practice at club level and to formalise links through service level agreements that will provide a coherent framework and quality assurance systems that can be rolled out to less well served areas.

An outline curriculum offer delivered on site to Levels 2, 3 and 4 could include:

sports management, coaching, leadership, business administration, nutrition and physiology, grounds maintenance and sports facilities management, extending to Digital Marketing, PR & Communications, sports coaching, fitness programmes, leadership and motivation, health and safety, event management

The Spatial and Regeneration Context

The Manchester Eastlands Regeneration Framework (ERF) provides the context to guide investment at the Etihad Campus.

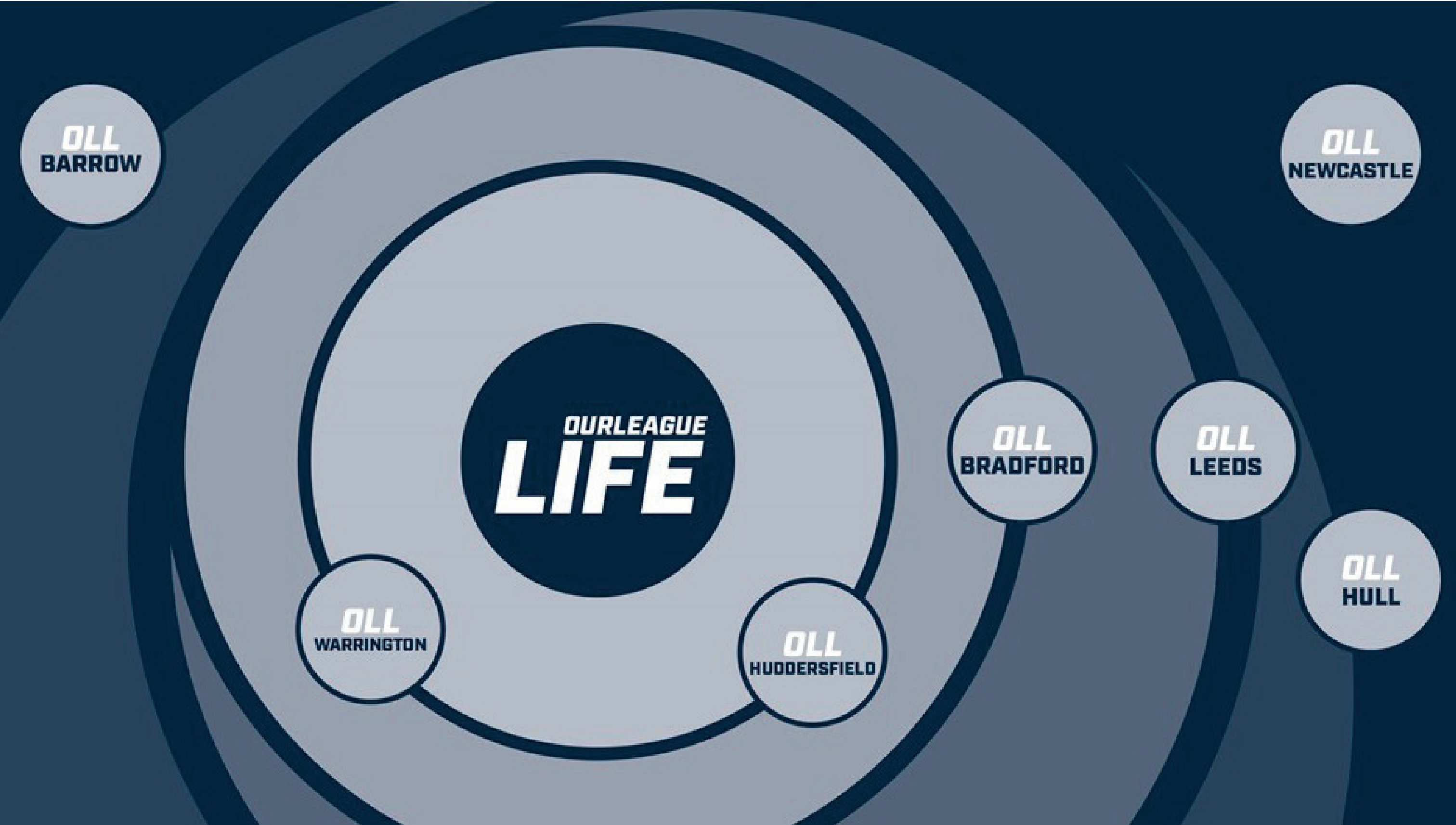
It recognises the significant opportunity to capitalise on the existing elite and community sports facilities, *the presence of a global football brand, the array of leading edge sport National Governing Bodies (NGBs) along with the talent that both trains and works for all of these organisations.* Into that framework the RFL’s Our League Life National Centre will fit alongside:

- Manchester Institute of Health and Performance
- East Manchester Leisure Centre
- Connell Coop College
- East Manchester Academy
- Manchester Regional Arena and the House of Sport for Sports NGB including the RFL
- Manchester City Etihad Stadium/Training Ground/ and Etihad Stadium
- National Cycling Centre including British Cycling
- National Squash Centre

The ERF aims to develop new commercial development opportunities centred around businesses that aim to *form a new sport, leisure and recreation economic cluster for the Manchester and the North of England. Sport would be the economic, educational and community driver for the Etihad Campus and surrounding area and at the same time integrate the wider health and well-being agendas.*

The OLL Project, alongside the relocation of the RFL headquarters provides Rugby League’s response to the East Manchester plan: making a significant contribution to *developing what in effect will be a business park anchored by a sport, leisure and recreation economic cluster.... which will be unique.*

The site, discussed in detail in following sections, for Our League Life National will be in Grey Mare lane in Beswick, with the RL National Centre less than 500 metres away. The site forms the Southern the edge of the Etihad Campus and is bounded by East Manchester Academy to the North and East Manchester Leisure Centre to the East. The former Beswick Local Shopping Centre sits on the site which also provides existing car parking utilisable on match days and a good quality full grass rugby pitch. The ERF identifies the site and pitch for the development of Rugby League with further masterplanning for additional mixed use development (retail and housing development to the South and North East).

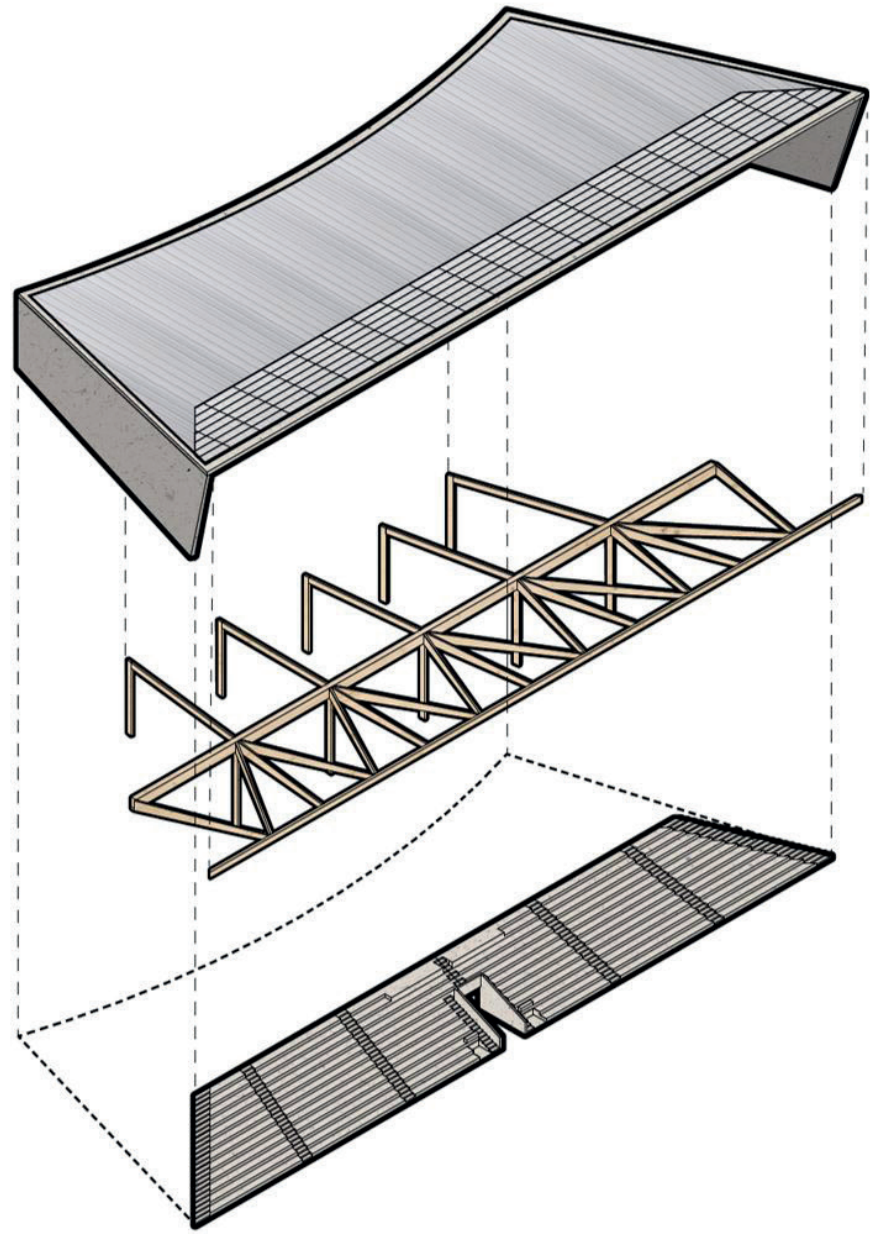




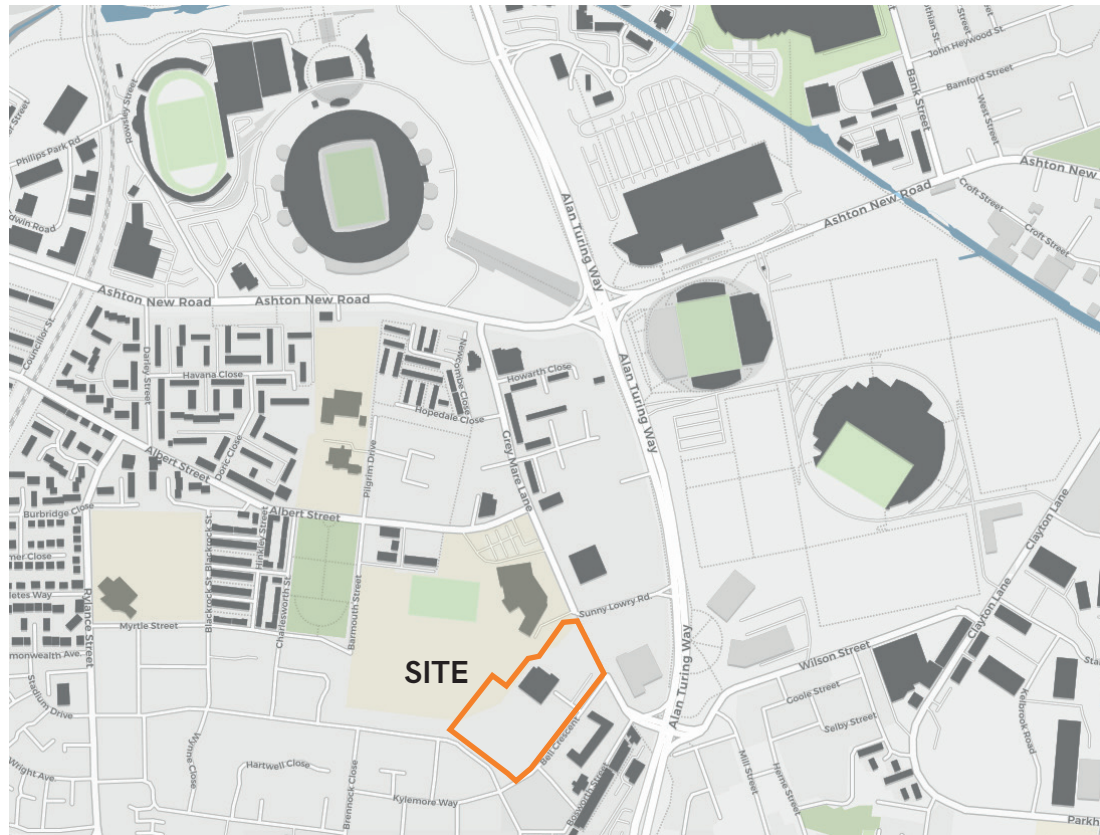
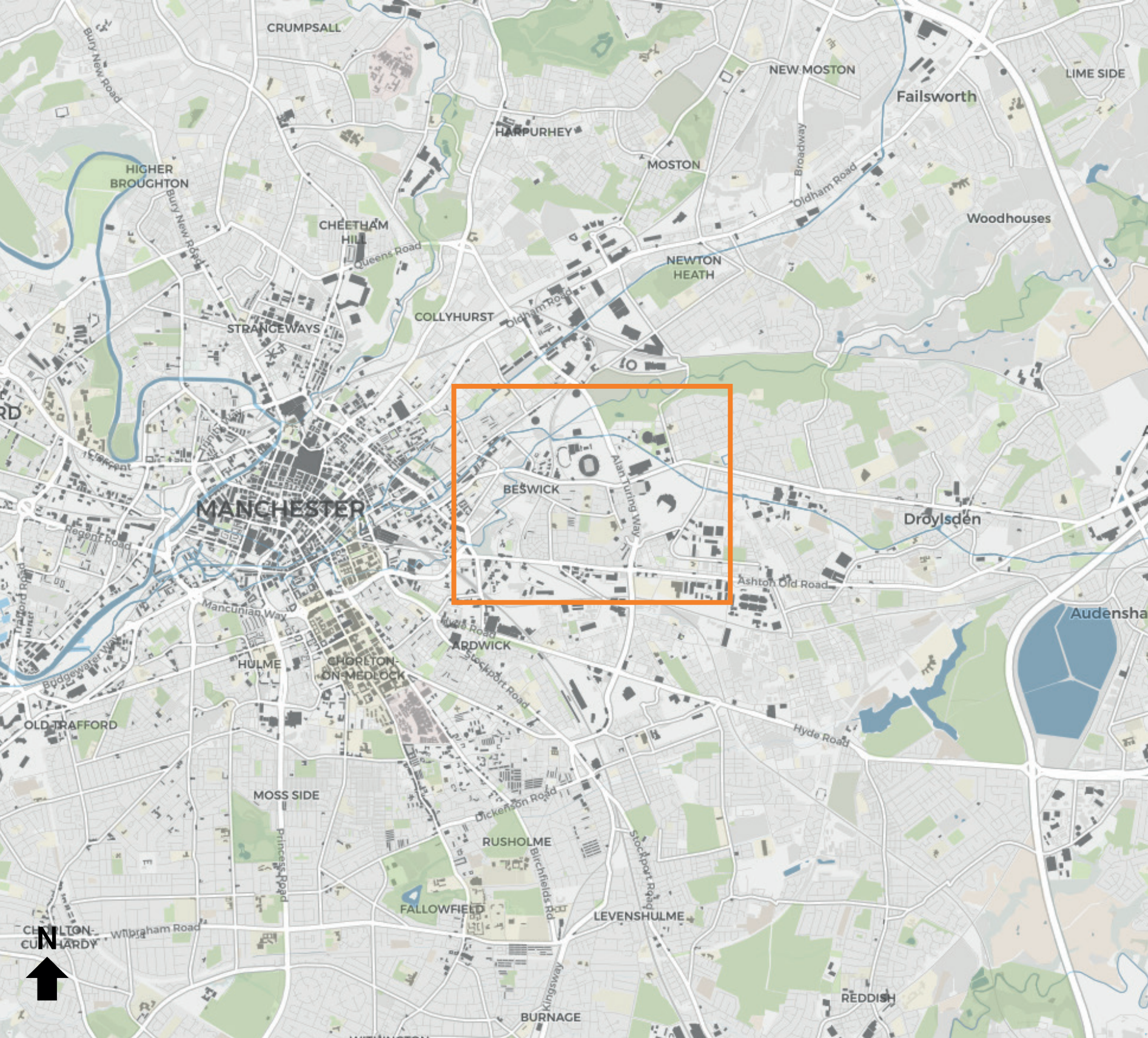
Key design aspirations included:

- The design should express the **character** and atmosphere of the East Manchester regeneration and create a distinctive **sense of place**
- Creating **flexible, sustainable, resilient**, and dynamic space that are stimulating for teaching and learning and in line with the aspirations of the staff, learners, and community
- The design should aim to be **uplifting**, airy and inspiring with maximised use of natural, sustainable materials and where possible low carbon, recycled and toxin free
- Maximised **natural ventilation** and daylight throughout, with careful consideration to ensure superior levels of comfort throughout
- Designing a building that will deliver improved social and economic outcomes, that will be a legacy to the community, with communal facilities that will enable ownership and **local & national pride**.
- Creating a **secure** environment for both staff & learners and ensure all users feel safe in their new environment
- Health & Wellbeing Design Perspective: sense of belonging within the community, **quality spaces** and wider environment, improved air quality in an urban environment and promotion of a healthy diet. Linking **health and wellbeing** to sustainable living to help address the climate change, the design should utilise the building and its context to promote this.

Design Charter



1.0 Location



1.1 Site Analysis



Site Boundary

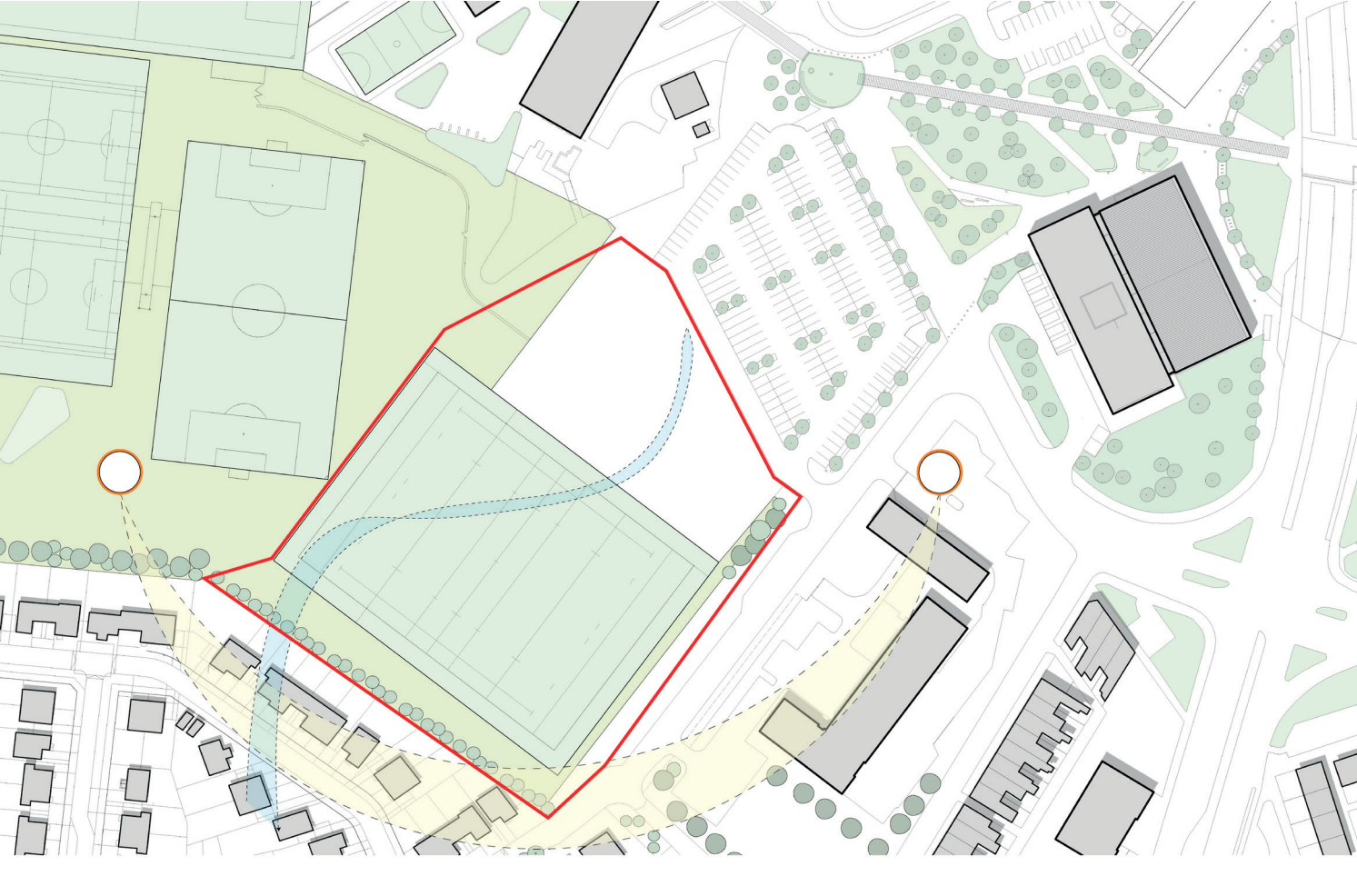
In order to provide suitable sight-lines to the pitch, avoid steep embankments to the SE and maintain an appropriate distance from adjacent housing it is expected that extending the NW site boundary edge would be beneficial.



Access

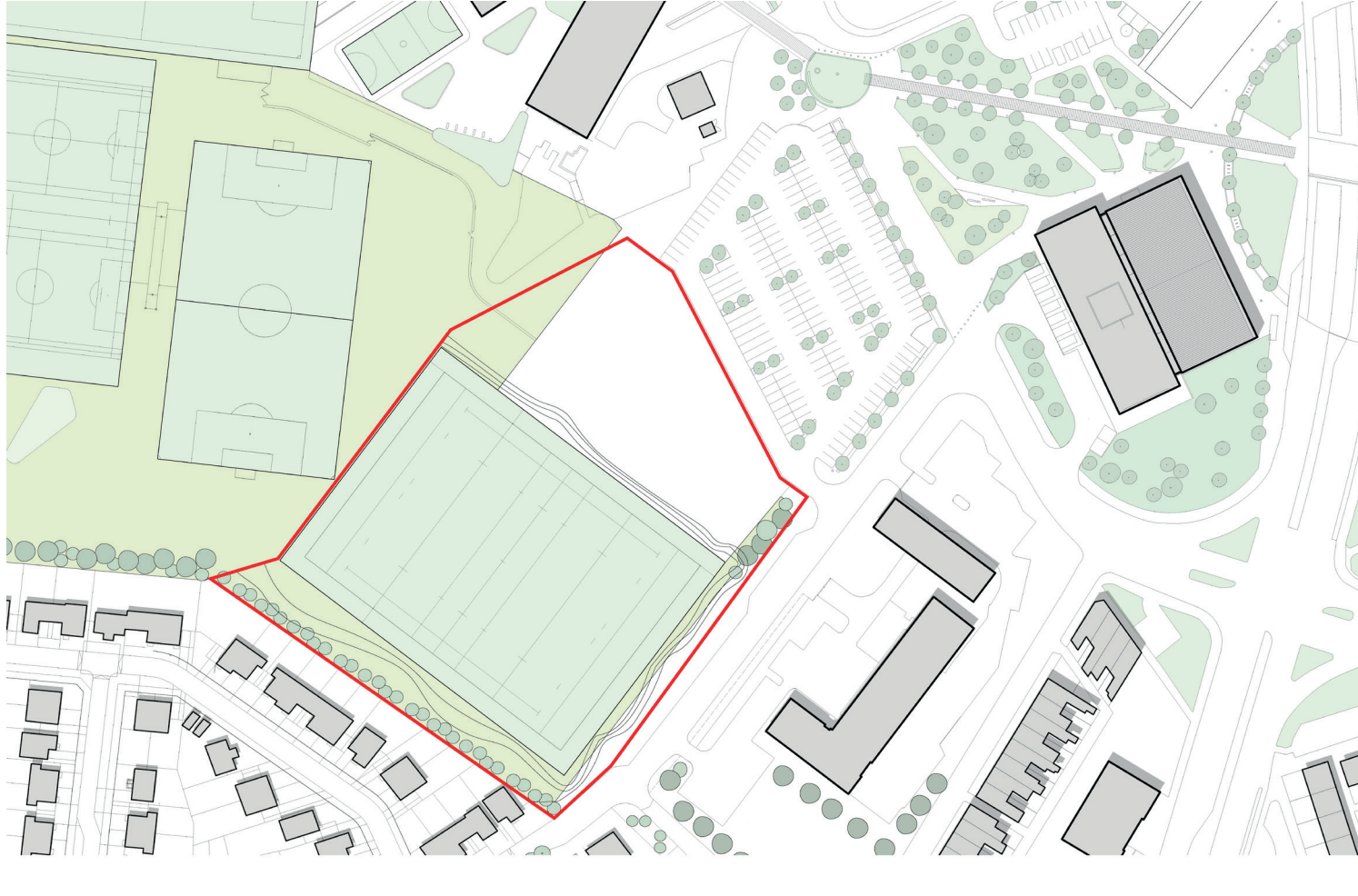
Vehicular access to the existing carpark is via Kirkstead Close off of Bell Crescent. A new lay-by should be incorporated along the edge to provide accessible drop-off as well as access for deliveries, maintenance and emergency vehicles.

Primary pedestrian access is from the newly landscaped Grey Mare Lane, linking connections from the Ethad and Beswick campus to the North. Pedestrians can also access the site from Bell Crescent.



Environment

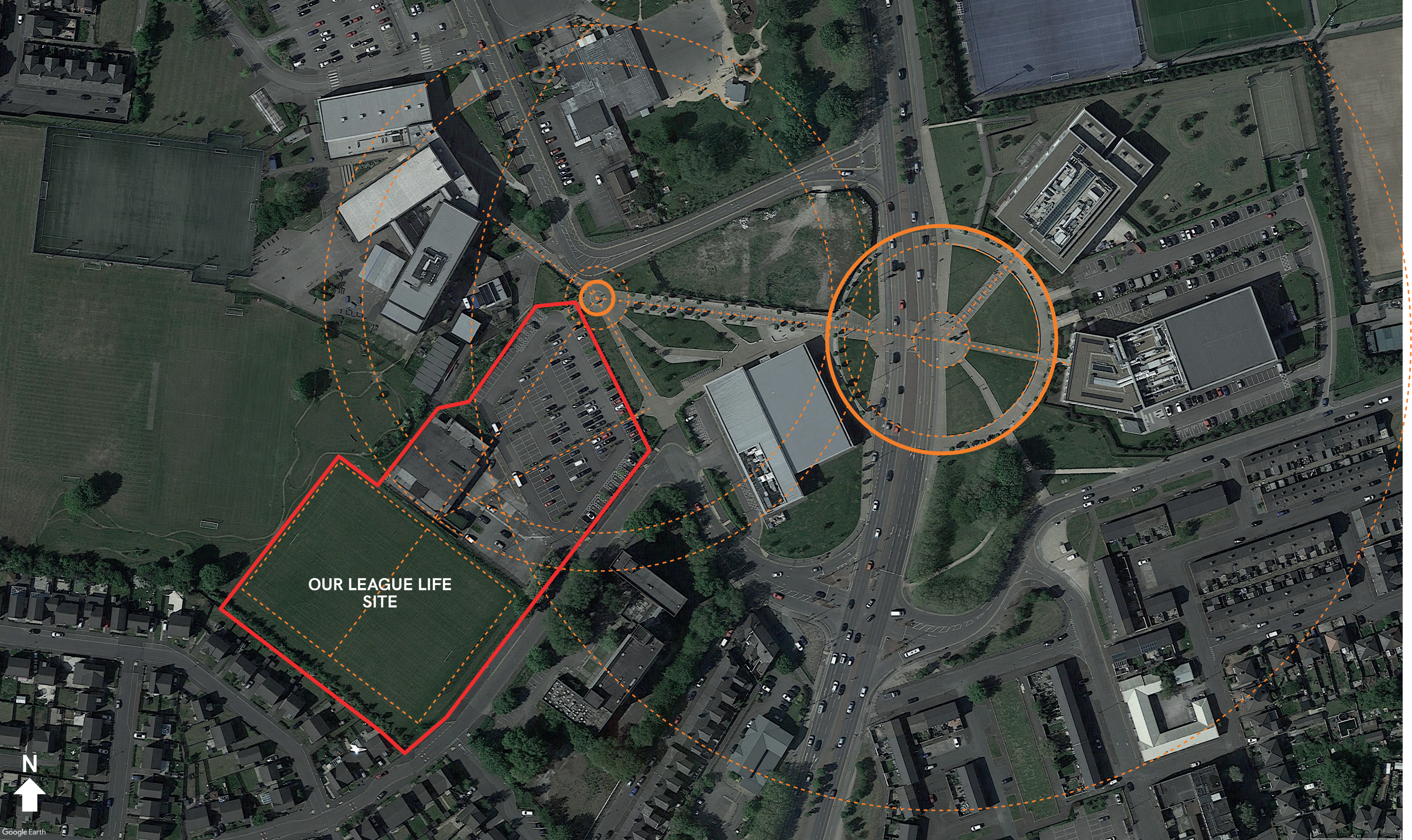
With a NW-SE pitch orientation, the development will need to consider issues such as; evening sun orientation, low winter sun angles and SW prevailing winds. Roof and envelope designs will take cognisance of these constraints.



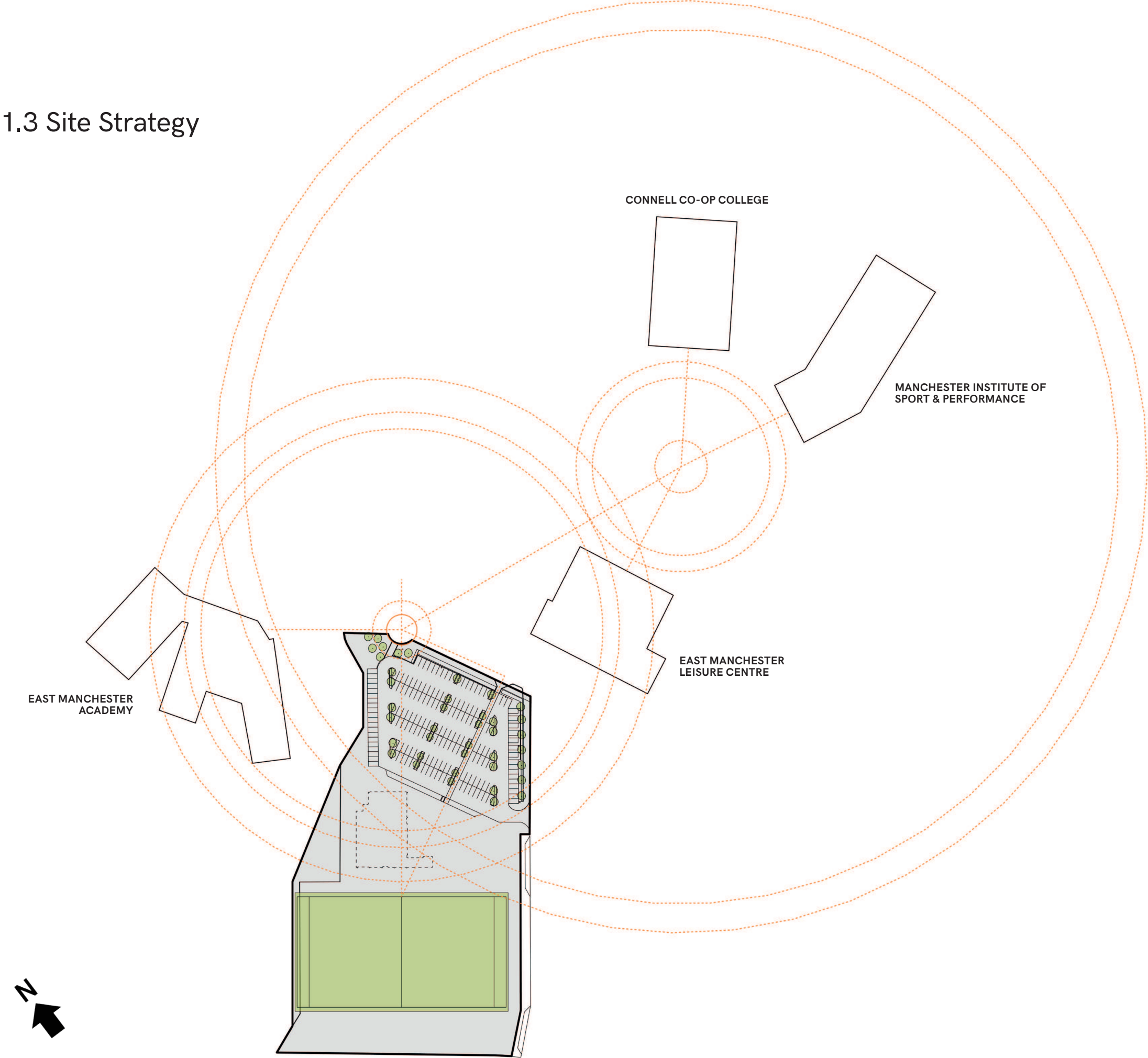
Topography

The existing sports pitch sits a few meters above the surrounding Bell Crescent, Grey Mare Lane carpark and residential properties to the South. A grass embankment slopes from the fence line along site boundary up to the pitch level.

1.2 Aerial Plans



1.3 Site Strategy

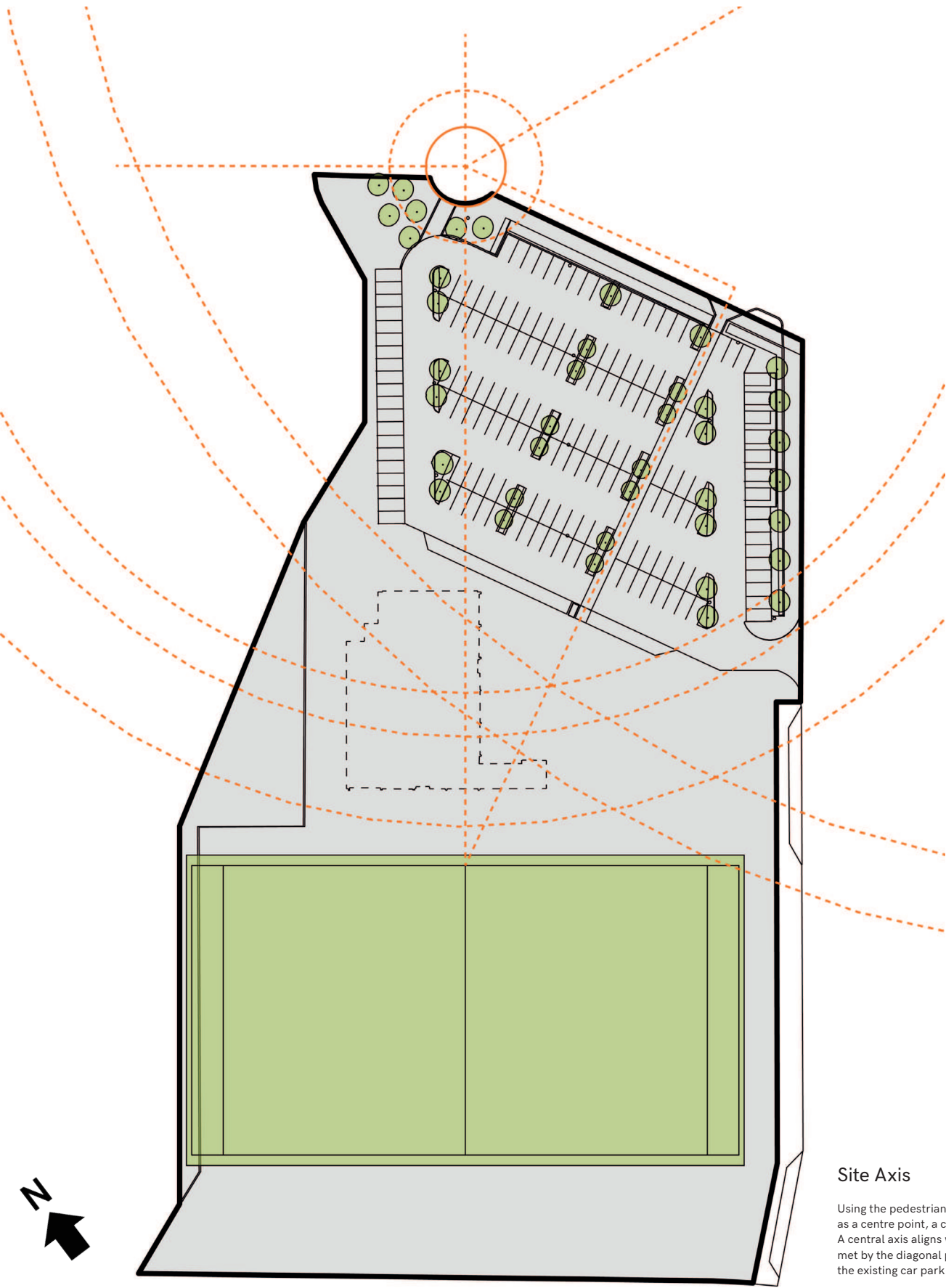


Campus Masterplan

The Etihad Campus, developed on former industrial land including the site of Bradford Colliery, has seen major advancements since the 2002 Commonwealth Games and has since become an iconic development with some state-of-the-art sporting facilities.

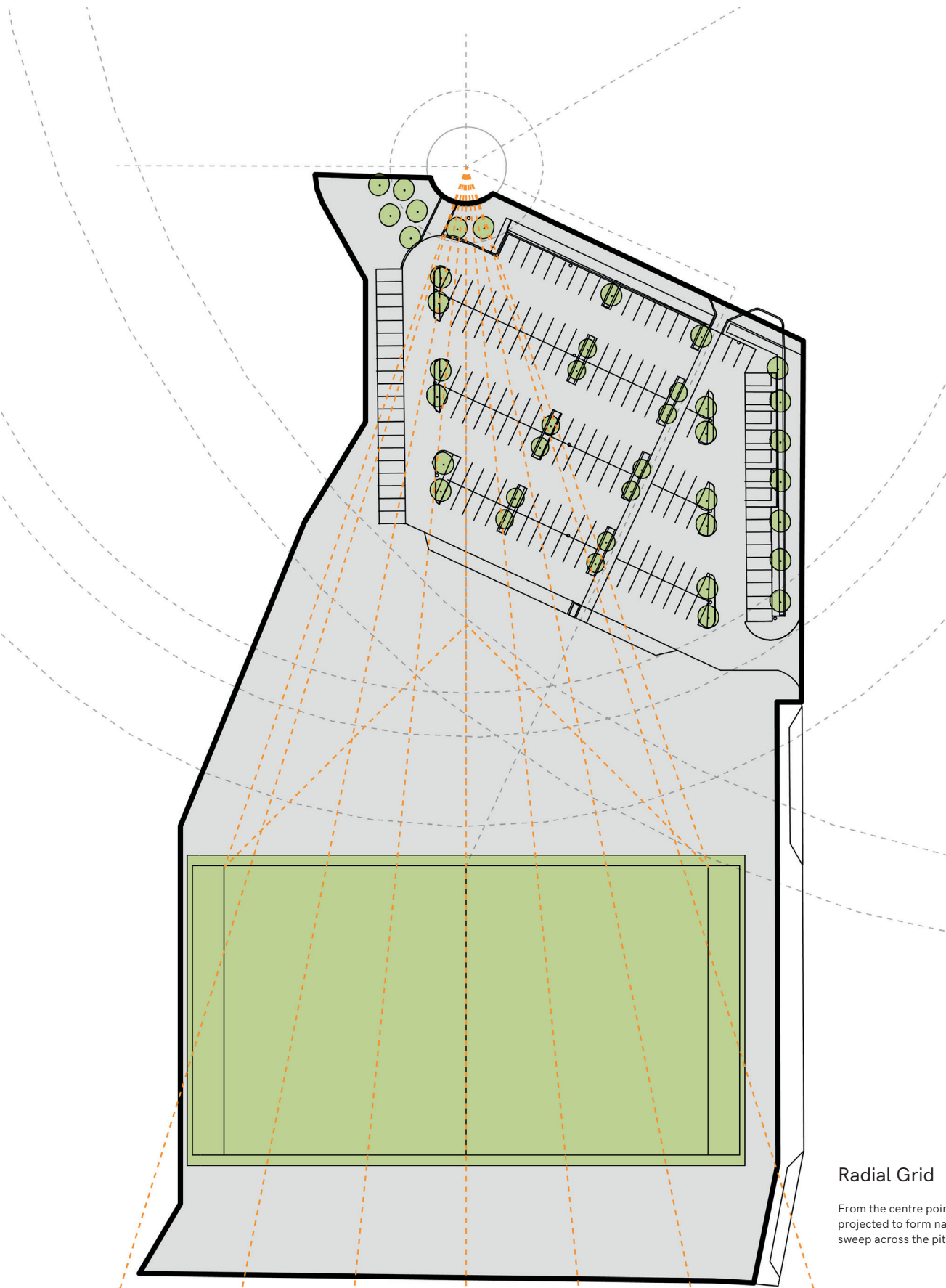
Evolution of the Circus

The evolution of the circus links together the entire area, from the Etihad Stadium and National Cycling Centre to MCFC training facilities and centre of the Beswick Community Hub. The new OurLeague Life National Hub aims to continue the success of this theme.



Site Axis

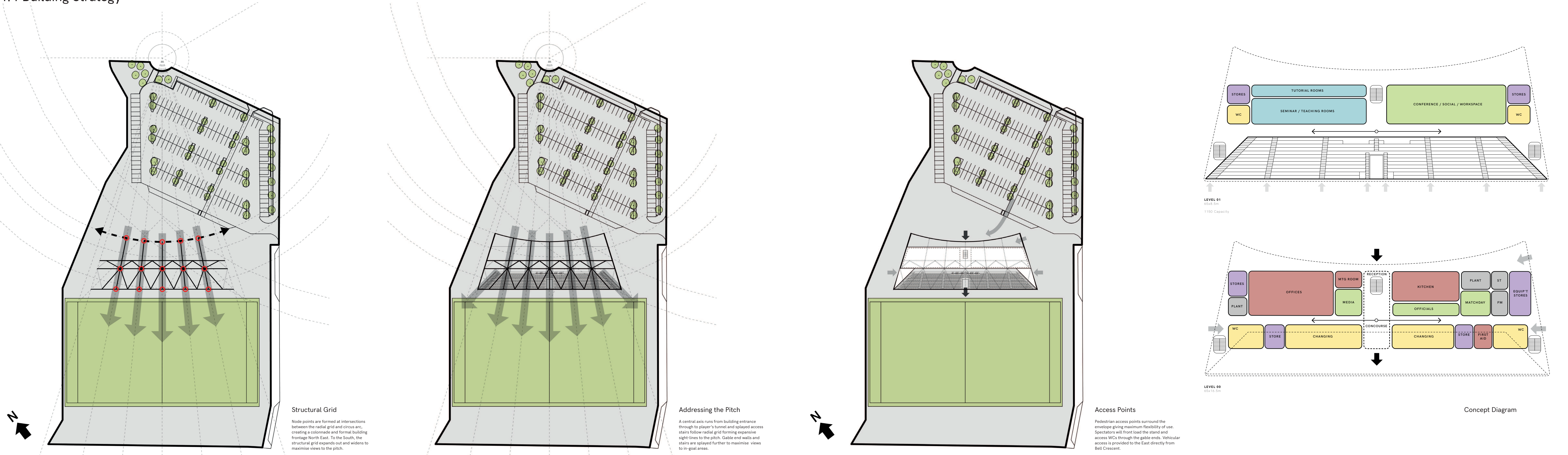
Using the pedestrian circus on Grey Mare Lane as a centre point, a circular array is projected. A central axis aligns with the pitch which is met by the diagonal pedestrian axis through the existing car park.



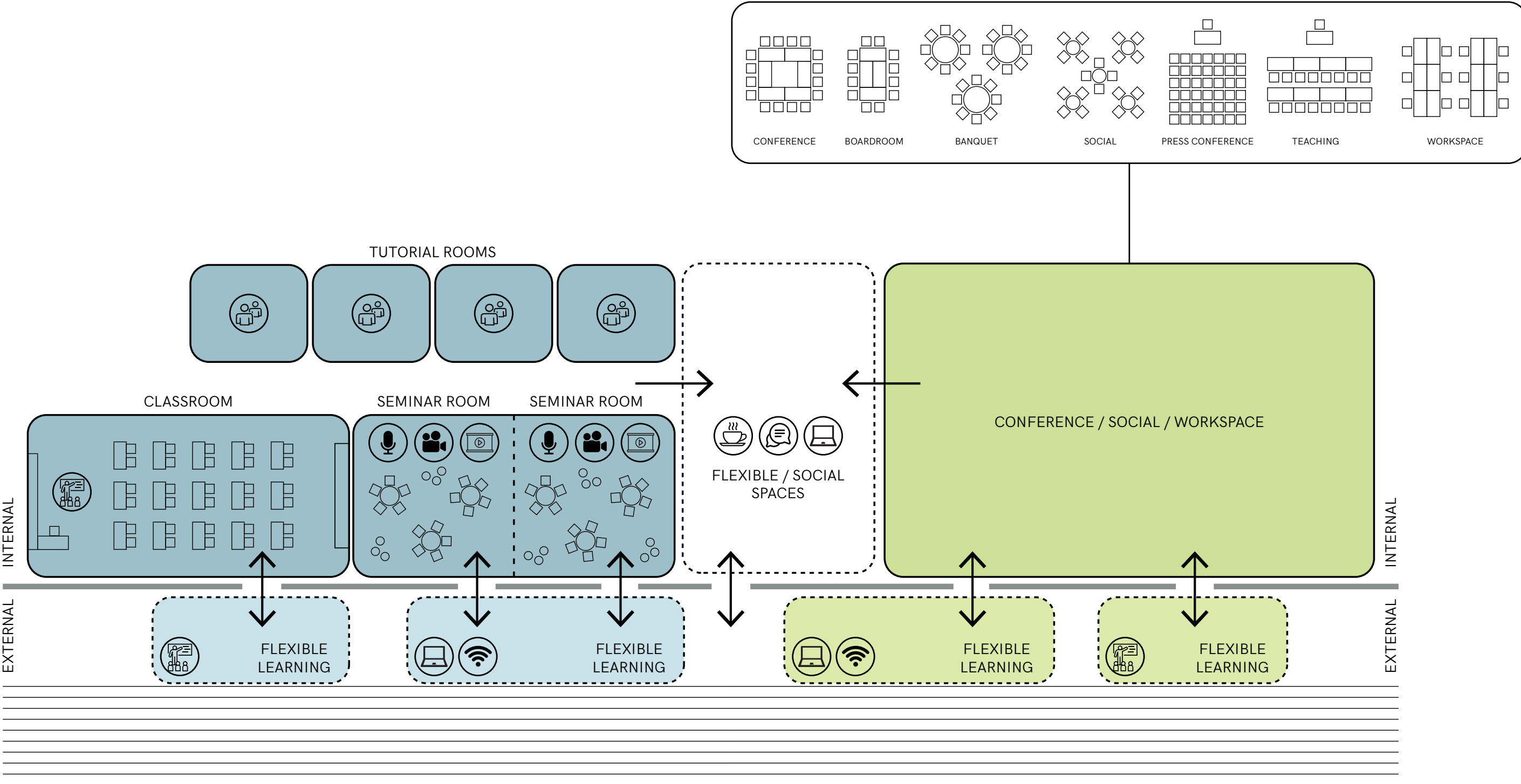
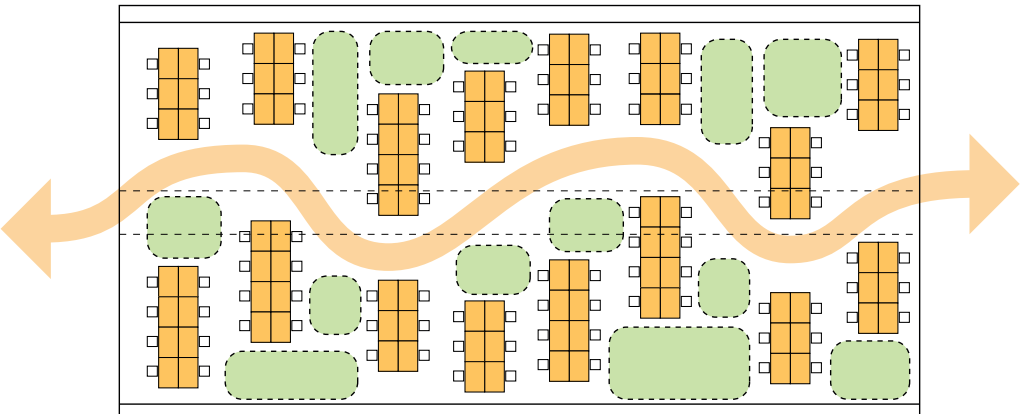
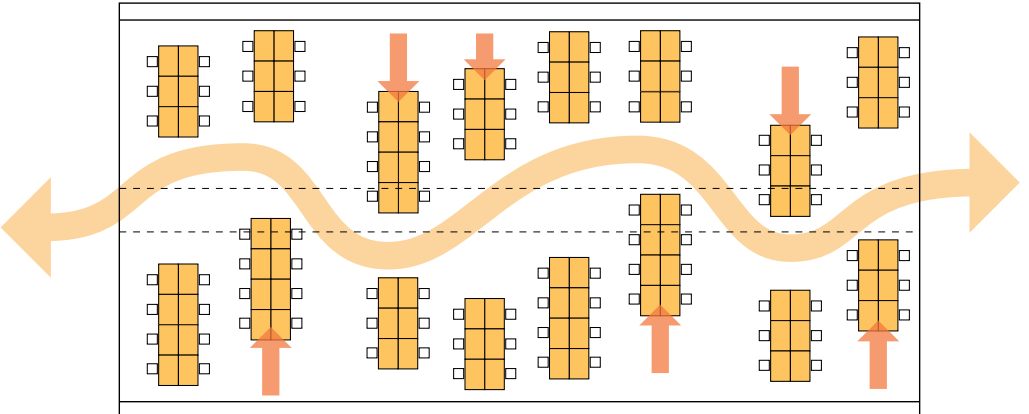
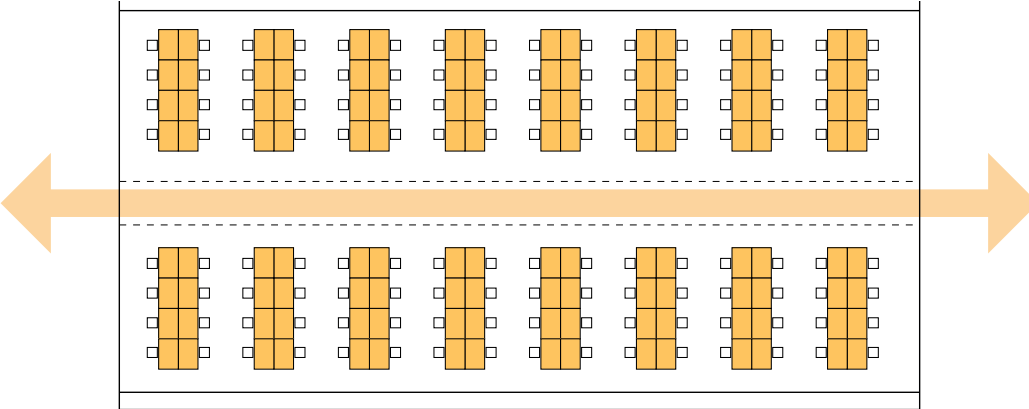
Radial Grid

From the centre point, a radial grid is projected to form natural sight-lines which sweep across the pitch.

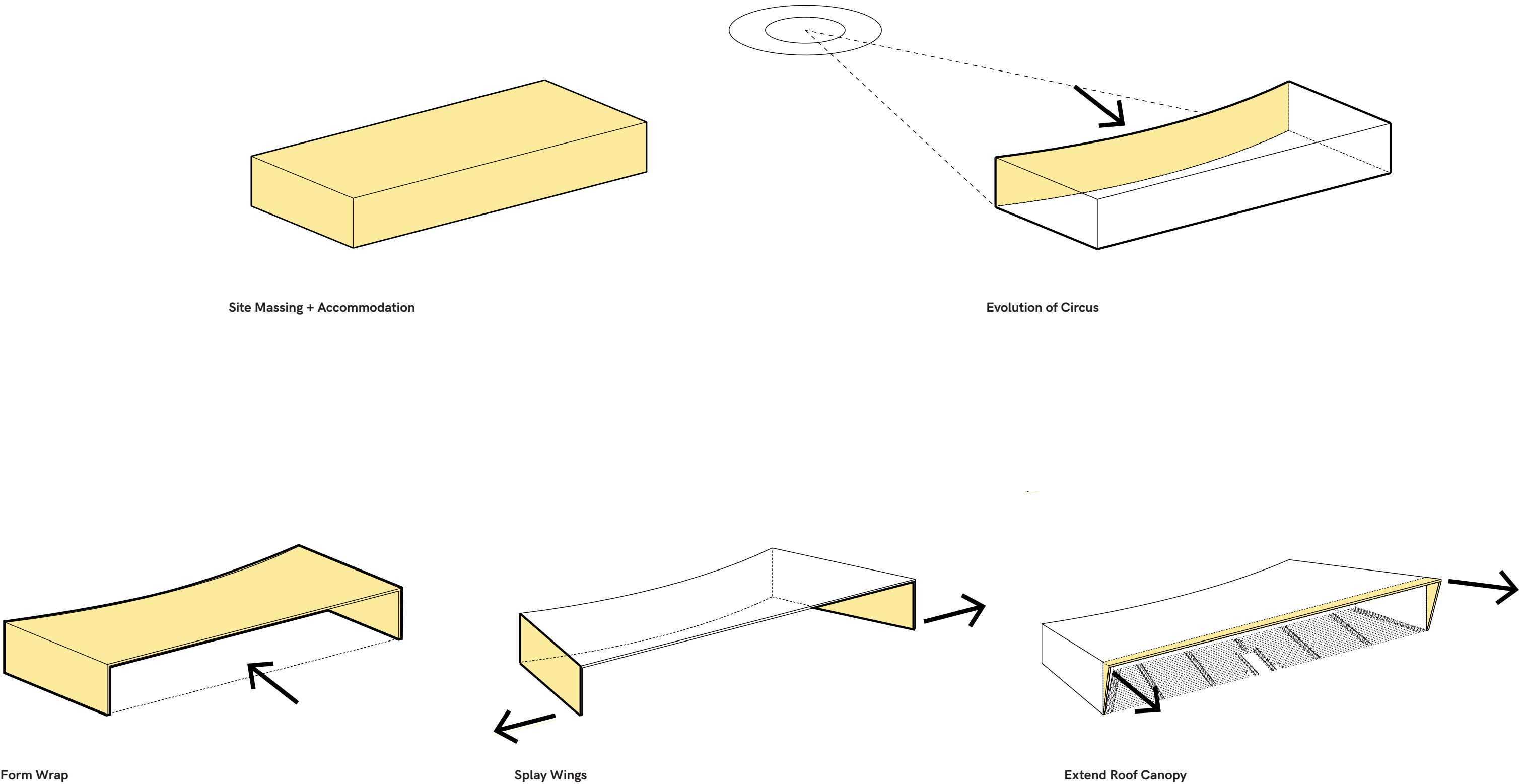
1.4 Building Strategy



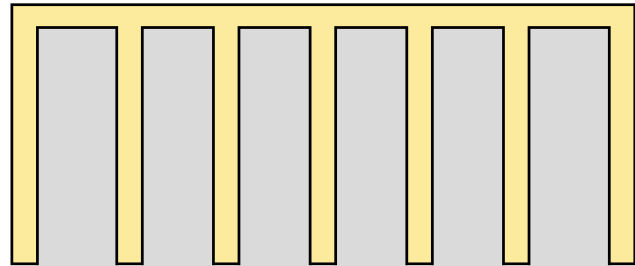




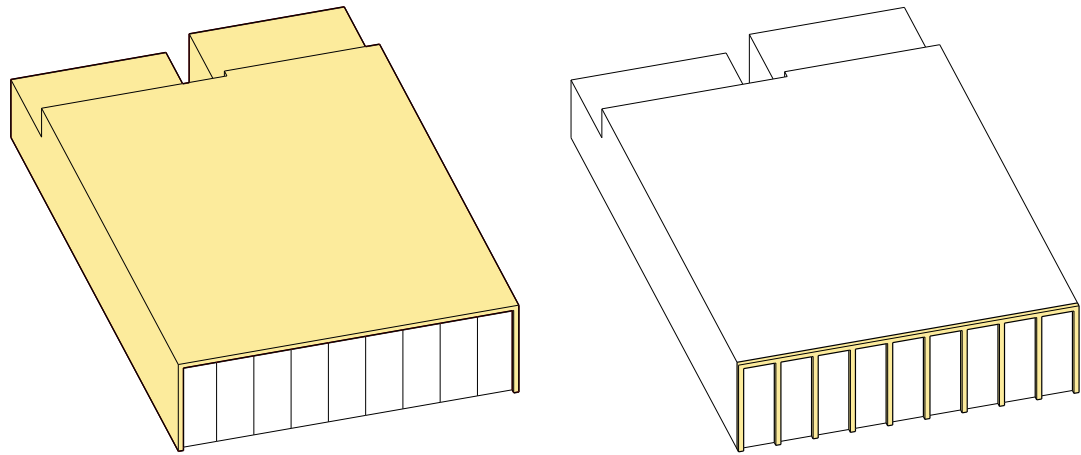
1.6 Massing



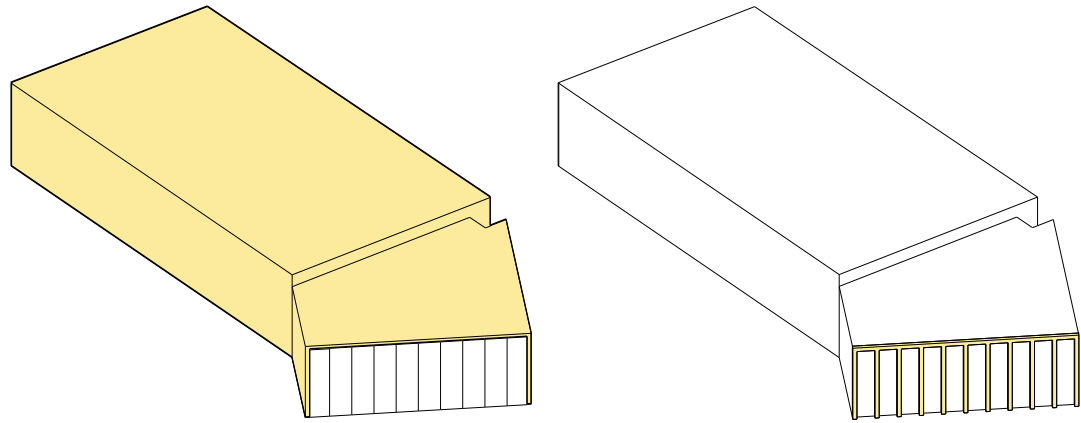
Wrap



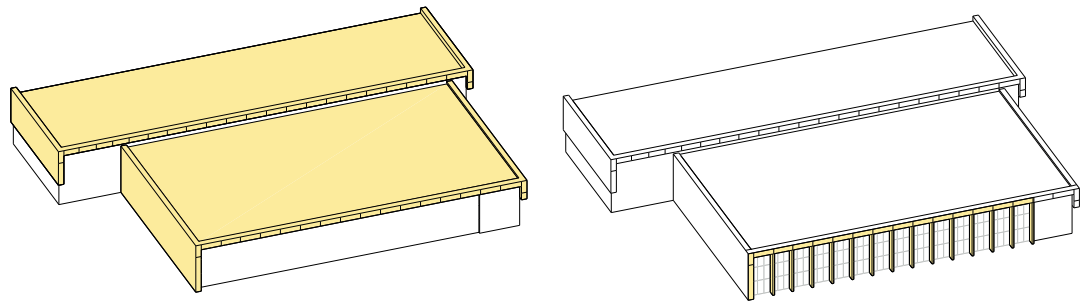
Grand Order



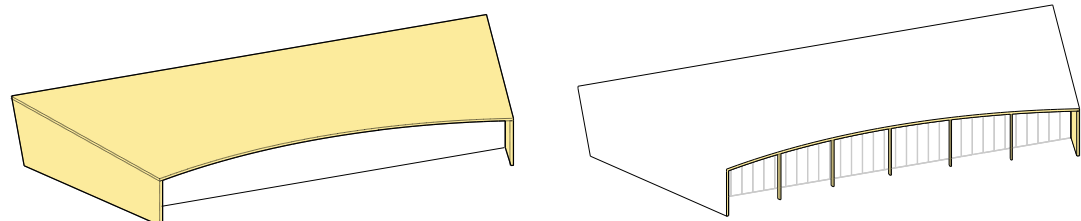
01 Connell Co-op College



02 Manchester Institute Of Health & Performance

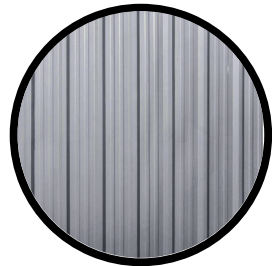
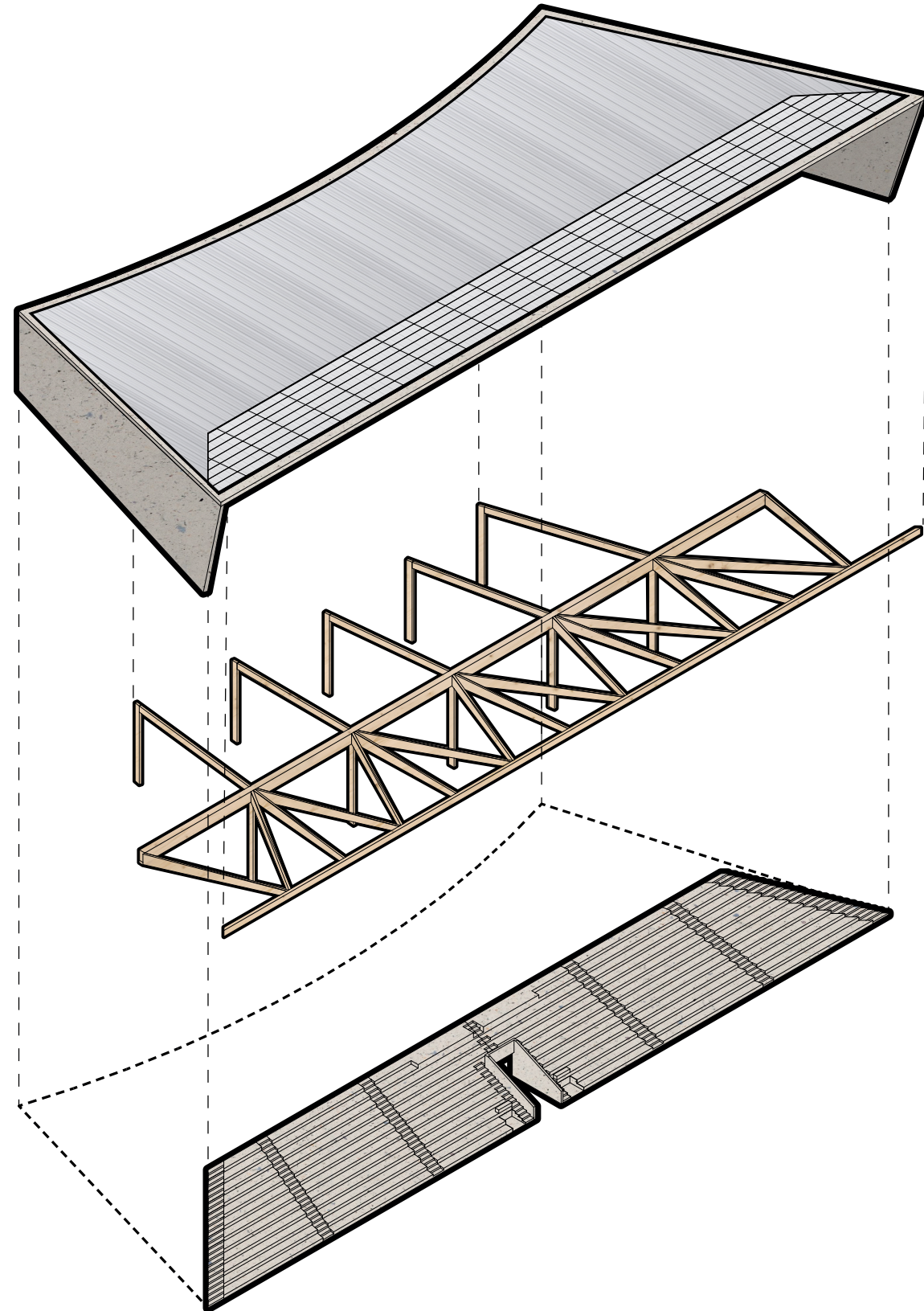


03 East Manchester Leisure Centre



04 RFL Hub

1.7 Material Strategy



ROOF:
**TRAPEZOIDAL METAL /
POLYCARB**

- LIGHTWEIGHT
- DURABLE
- EFFICIENT
- COST EFFECTIVE



Emerald Headingley Stadium
DLA Architecture



ENVELOPE:
PRE-CAST CONCRETE

- ROBUST
- DURABLE
- MONOLITHIC
- NON-COMBUSTIBLE
- PROTECTIVE



Stadium Saetre
Baito Architects



STRUCTURE:
GLULAM TIMBER

- SOFT + WARM
- MORE TACTILE
- SUSTAINABLE
- AESTHETICS
- FIRE PERFORMANCE



Stade De Soccer de Montréal
Saucier + Perrotte architects + Hughes Condon Marler Architects



PLINTH:
PRE-CAST CONCRETE

- ROBUST
- DURABLE
- MONOLITHIC
- NON-COMBUSTIBLE
- HEAVILY TRAFFICKED



Philippe Mahut Stadium
Barthélémy Griño Architects









2.0 Costs, Procurement and Programme

Costs Plan Analysis

Cost planning at feasibility stage largely relies on Benchmark information, Gross Internal Floor Area (GIFA), and thoughts on form and material specification. The current level of design on OLL Concept affords more robust costings enabling a more rational cost envelope to work within.

The Design Team and Client have carried out some Value Management activities even at this feasibility stage; around the areas of facility size, number of seats, the accommodation requirements and the layout, and the palette of materials proposed for use.

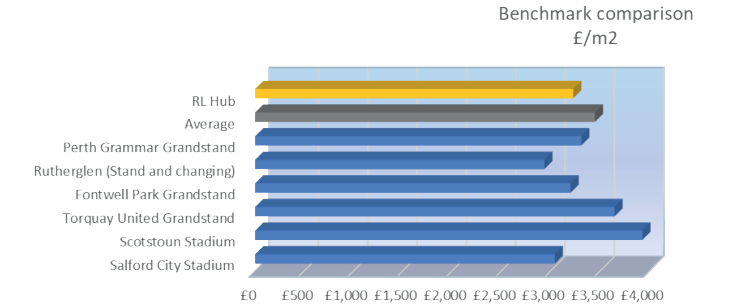
The full cost plan is included in Appendix 2 with a summary provided below:

SUMMARY	£
MEASURED WORKS	4,570,000
MAIN CONTRACTOR’S PRELIMS/OHP	630,000
PROJECT/DESIGN TEAM FEES	470,000
OTHER DEV’P/PROJECT COSTS	0
RISKS	570,000
INFLATION	160,000
TOTAL	6,400,000



VFM Benchmarking

The Cost Plan includes a section on benchmarking against other selected stadia BCIS analyses. The project specifics and abnormals have been considered in the comparison below. At £3,224m2, OLL sits within the right cost region of comparison projects.



Risk Analysis

Construction projects are inherently risky and the management of risk is a critical activity in any project. Having risk within a project is not the issue but the failure to properly identify and manage those risks can prove key to project failure.

The full Risk Log developed at this stage is included in Appendix 3.

At feasibility stage it is usual to take a general, broad brush, approach to addressing risk concerns. But, in line with the design, the costs, and the project context, the Design team have been able to consider some wider project issues and have identified, scored and considered over 50 project specific risk items. These are divided between the following Risk Headings;

- PD** Project delivery – wider issues, not necessarily related to construction project aspects
- O** Organisational interfaces – Issues with Stakeholders, both internal and external
- D** Design – issues with how the design meets the brief and other aspects
- E** Existing Site conditions – the likelihood of issues within the ground affecting the project
- S** Statutory Consents – planning consents and the like, and how the project meets requirements
- C** Commercial – largely meeting budgetary constraints and how this may impact our approach
- CR** Construction – a number of early thoughts on aspect of the build
- OT** Others – includes consideration of impacts of COVID-19

The risks have been scored on a 5x5 matrix: Likelihood x Impact = Overall score

The analysis below indicates that there are key risks to focus on particularly under the headings of Project Delivery, Organisational Interfaces and Commercial.

Risk Appetite

A risk management strategy may not seek to eradicate ALL risks but instead be developed to match the Client’s own stand point. Further work to assess the Client’s appetite for risk in relation to OLL is required.

At this stage it is appropriate to take a reasonably conservative approach to risk, but as the stages develop this position may be tempered and adjusted by elements of the project crystallising; becoming further understood and therefore less likely to change.

Mitigated	Activities put in place to offset the effect of a potential risk transpiring (e.g. early surveys)
Accepted	A risk is identified, acknowledged and maintained in its form without other action
Transferred	Strategy ensures that those who are best placed to deal with the Risk take ownership
Eliminated	Execute action which deals with risk and is therefore removed from project consideration

Procurement

Managing the Procurement approach for any construction project is a fundamental requirement and successfully navigating this is a significant contributor to project success. It is the understanding of the key Client drivers that set each project apart. For the OLL Project this includes having a number of desired outcomes which go far beyond building an asset and handing over the keys in 2022.

At its very basic level, procurement strategising must take account of the Client’s preferences or requirements under the triangular headings of:

- **TIME**
- **COST**
- **QUALITY**



With considerations of the client’s appetite for RISK also included.

The Design Team have already considered some of the factors that might dictate how OLL is delivered and have formulated a context for how the procurement strategy can develop.

Whilst the following development stages would interrogate and amplify the strategy further, making key recommendations, even at this Concept stage it is worth thinking about each of the key headings and picking up on the significant factors.

TIME

Consideration	Issue	Potential resolution
Key milestones	RWC2021, and the legacy thereafter	Events linking the construction of Hub and RWC2021, highlighting the community and training aspects of the project
Loss of time due to loss of control of development	Funders impose others as “Developer”, leading to loss of control over programme	Ensure control is maintained by actively operating in the Developer role and proceeding on this basis from outset
Suitable Development programme	Requires an expedient design and development programme to align with RWC2021 aspiration above	Appropriate appointments of Design/Development team to meet a prospective construction start date of early Autumn 2021
Appropriate Construction Programme	Too short, Contractor pressure; Too long, Additional costs and reputation in regards delivery	Suitable contractors considered
Protracted Procurement exercise	Open Tendering requiring adherence to OJEU/Public Procurement guidelines potentially prohibitive to meet other timescales	Utilisation of pre-existing procurement vehicles (Frameworks) that already meet a number of client criteria

COST

Consideration	Issue	Potential resolution
Value for Money	What manner of design and procurement is able to not only deliver VFM, but also evidence that it has been attained	Will largely require Client setting of “VALUE OBJECTIVES”, but set these early and measure against these at each stage. Incorporate into Procurement strategy approach.
Capital cost expenditure versus revenue and operational costs	Review where increased capital costs are best allocated to reduce or remove operational costs and the like	Items such as enhanced fabric considerations, flexible design, renewable energy, and the like get considered and incorporated (to what degree?)
Funding availability	Funding models dictate how procurement is approached	Seek earliest understanding of what bearing funding has on approach and incorporate in to considerations
Spend to save	Willingness to spend, potentially abortive, costs on highlighted risk areas to ensure later stages and construction are developed on a basis of understanding	Dependent on appetite for risk, seek to undertake early investigations for items such as ground structural conditions, UXO, ground gasses, etc.
Sponsorship	Understand what opportunities are available and how the procurement may be affected by this	Develop a sponsorship framework at an early stage to understand how this may impact on procurement strategy.

QUALITY

Consideration	Issue	Potential resolution
Design Quality	The understanding and transformation of Client requirements in to the design and how this is managed	Appoint appropriate, experienced, team.
Consider early engagement with suitable contractor for key areas of design (MEP for example)	Funders impose others as “Developer”, leading to loss of control over programme	Ensure control is maintained by actively operating in the Developer role and proceeding on this basis from outset
Societal Quality	Project has to deliver fundaments of RL social mobility agenda	Align all actions (design, procurement, construction) with measurable delivery aspects that track against the SM agenda.
Construction Quality	Appointment of inappropriate constructor leads to poor quality	Use pre-selected Contractors with appropriate experience.
Selection based on key quality criteria (Delivery Team, QA, H&S, CB) alongside Cost (weighting 60/40 or the like)	Open Tendering requiring adherence to OJEU/Public Procurement guidelines potentially prohibitive to meet other timescales	Utilisation of pre-existing procurement vehicles (Frameworks) that already meet a number of client criteria
Training delivery Quality	That the project misses the opportunity to provide the best training space possible	Engage appropriate team to address this (including Contractor); test that it is meeting objectives at each design stage.
Reputational Quality	That the project fails in key areas and leads to RL reputation being tarnished or catastrophically damaged	Understand all stakeholder aspirations, align requirements with same and ensure Procurement approach meets these.

Initial Procurement Recommendations

At this stage, the Team have formulated an appraisal exercise to underpin the procurement process:

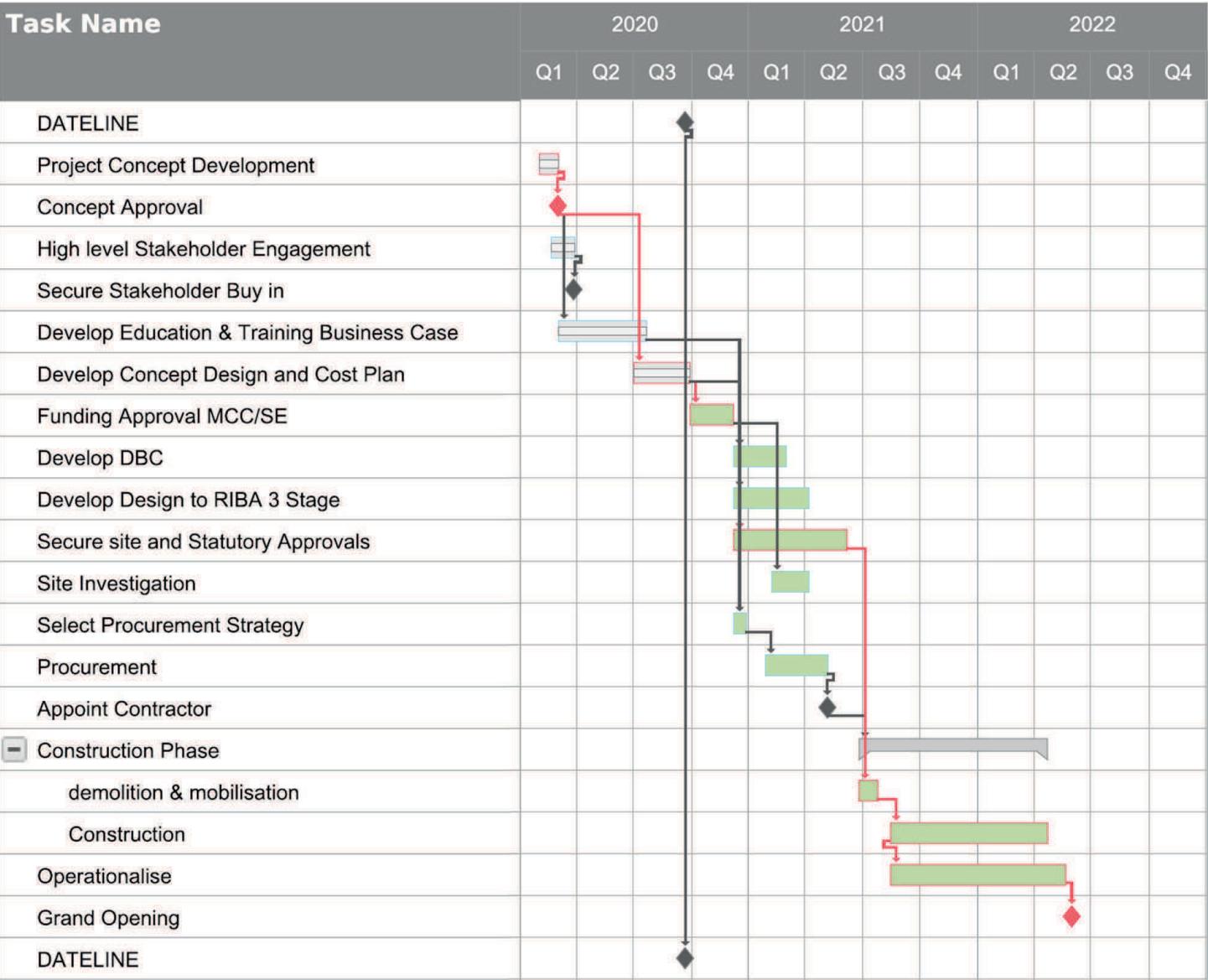
- Understand funding approach. Do Public funds place limitations on the preferred development model?
- Investigate how Design and Development Team are appointed to ensure continuity with no delay in development programme. The tight design programme for OLL could easily be derailed by confused or especially restrictive requirements imposed.
- Formulate Procurement strategy that aligns with development and design programmes. With a completion date of late Spring 2022, TIME is likely to be a critical factor informing the procurement strategy.
- Engagement with Stakeholder plan to ensure no disconnection in what the procurement strategy is aiming to achieve.
- Balance the key criteria to understand the procurement method best suited to this project; Traditional, Design & Build, single stage, 2-stage, or a collaborative / early engagement / partnered model.
- Assess the accessibility and suitability of available frameworks to meet required schedule of project and quality. Consider NW Construction HUB, or Procure North West((PNW), both having suitable, experienced, Contractors.
- Seek to ensure flexibility in prescribed competitive selection criteria (Cost/Quality) split to meet Societal, Community, and Training agendas.
- Develop a scored matrix which provides a recommendation on procurement approach.

Programme and Position at September 2020

A summary high level programme for the delivery of OLL National is shown below. In keeping with this report, it focusses on the construction element of the project although there are additional workstreams for business and financial planning, curriculum modelling, delivery and staffing,

At the start of 2020, a timetable was established so see the OLL National Centre centre open in late Spring 2022. As this would entail work commencing on site in Autumn 2021, it enables OLL National to provide a real and substantial legacy for the RL World Cup as well as naturally following on and maintaining the momentum of RFL opening the new National Rugby League Centre in the preceding Summer. A ‘soft’ opening will enable building and staffing systems to be tested before the first major student intake in September 2022.

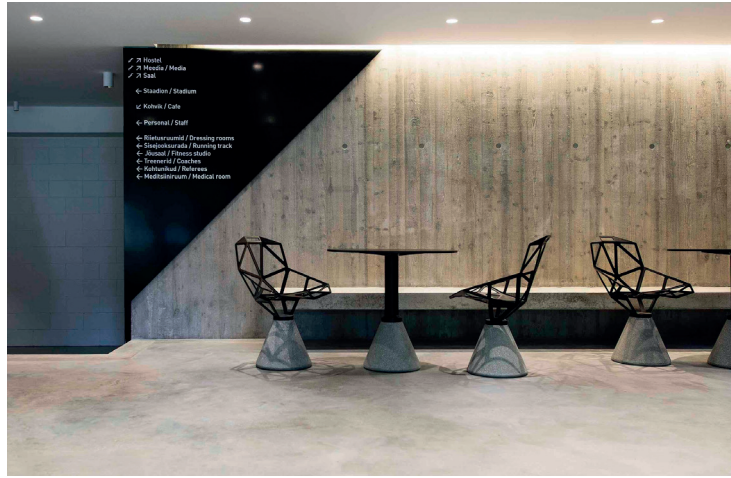
Despite COVID-19 restricting access to the site, stakeholders and key information, significant progress in developing the concept has been achieved to date in 2020. However, there is substantial additional work required in terms of design, land assembly, funding packages, and procurement to facilitate building works commencing in Autumn 2021. Whilst all this is achievable it will require all the key stakeholders to be fully on board with the project as soon as possible.



Project: Pärnu Stadium
Architect: Kamp Arhitektid
Location: Pärnu, Estonia

Project: Stadium Sastre
Architect: Baito Architectes
Location: Six-Fours-les-Plages, France

Example 1 - 1500 seats / 2500m2



Example 2 - 500 seats / 900m2



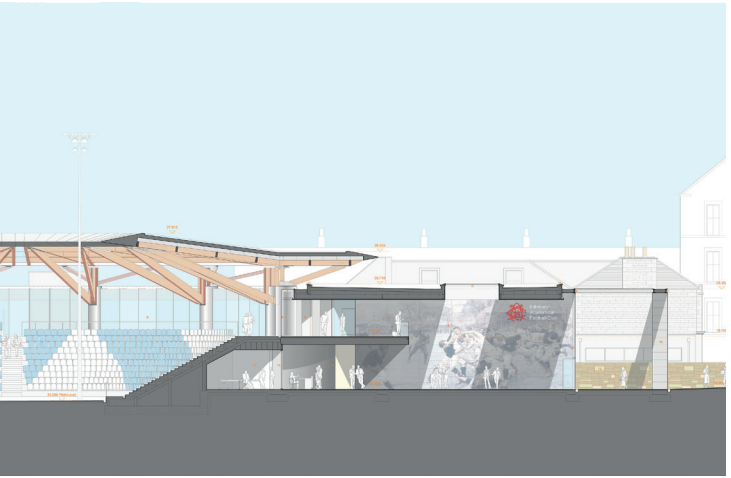
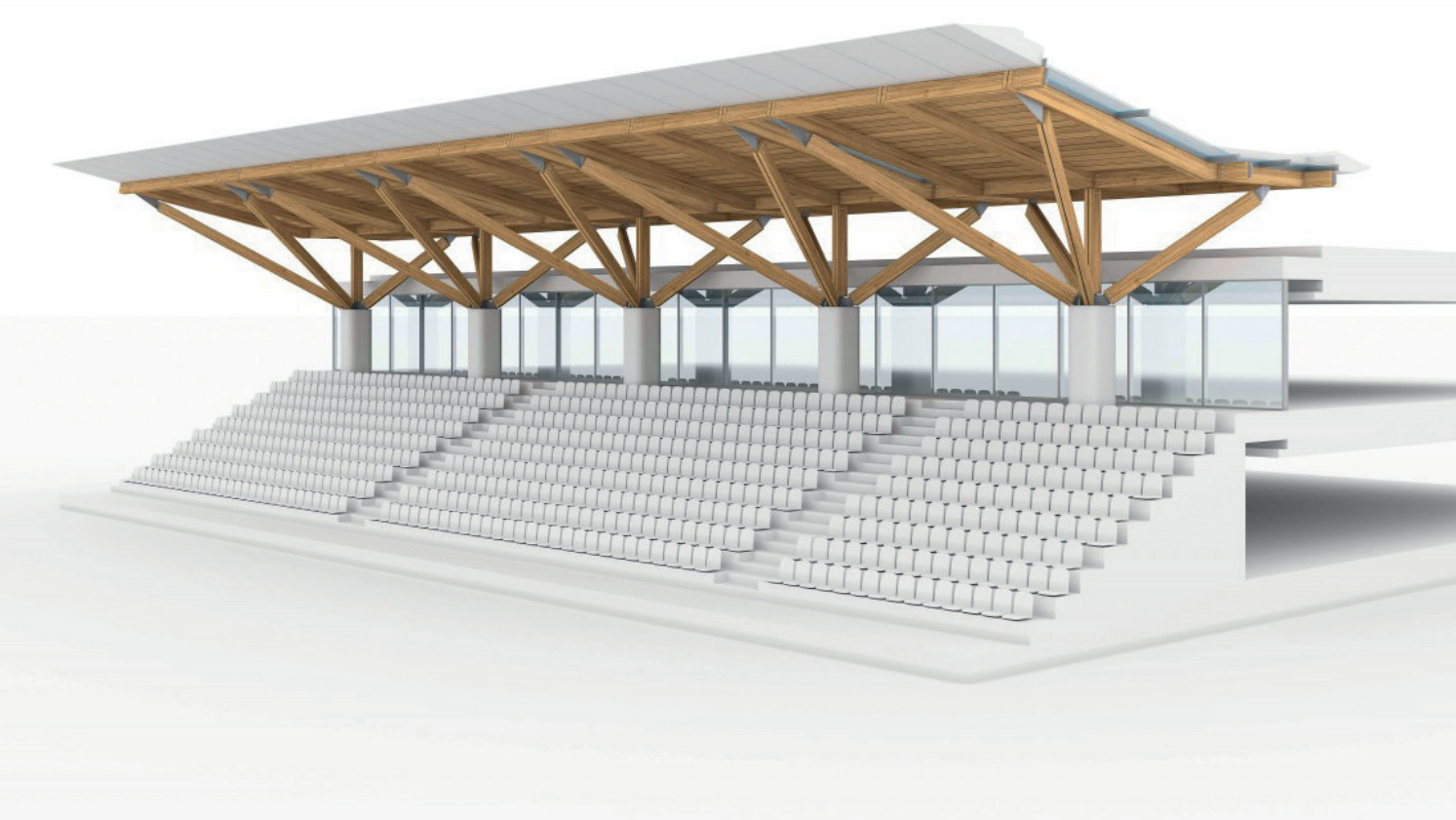
Project: Stade Philippe Mahut
Architect: Barthélémy Griño
Location: Fontainebleau, France

Project: Edinburgh Accies Stadium and Ground
Architect: Michael Laird
Location: Edinburgh, Scotland

Example 3 - 750(approx) seats / 1000m2



Example4 - 5000 seats



OurLeague Life National Hub
Feasibility Cost Plan
07 September 2020



Executive Summary

The estimated construction cost of the works is:	£	6,400,000	Excluding VAT
The Gross Internal Floor Area, (GIFA), is measured as:		1,985 m2	
The resulting cost per m2 GIFA is:	£	3,224	Excluding VAT

Specific exclusions

The following items are currently excluded from the above cost estimate.
The estimate of costs exclude Prelims, OH&P etc. and would require further development.

Hybrid upgrade to Pitch; current grass pitch appears in suitable condition	£	600,000
Works to existing car park and interface to new facilities concourse area. Currently assumes that this will be undertaken by others.	£	197,000
Sustainable measures such as; Grey water recycling; <i>subject to extents</i>	£	80,000

Basis of Cost Estimate

The estimate is based on the following outline design information received on or before 31st August 2020:

- Architect : Holmes Miller outline proposals
- Structural : As discussions and benchmark information
- MEP : As discussions and benchmark information

The following items are excluded from cost estimate: it is recommended that an appropriate allowance is maintained by the Client for these:

- Value Added Tax
- The impact of restrictions due to COVID-19 or the like
- Client Internal and development costs (To be advised)
- Demolition and site clearance of existing building on site; assumed by others
- Dealing with Asbestos or extensive contamination in the ground
- Refer also to specifically noted exclusions above*

Programme

Key programme dates for the Project are advised as between 2Q21 and 3Q22

Anticipated Project Risks

At this stage a **10%** allowance has been made, reflecting feasibility nature of the position.
Whilst no specific Risks have been identified presently, we advise;

- Presence of Asbestos or ground contamination
- Existing infrastructure is incompatible with requirements (i.e. new substation required)
- Full extents of MEP requirements as yet to be determined
- Potential additional constraints of the location (e.g. Security)
- The interface with local School activities
- Dealing with local residents, users and students
- Potential additional ground improvements to existing pitch
- Requirement for piling or ground improvement for substructure

Project risks should be identified, monitored, assessed and managed on an iterative basis.

Elem	ELEMENTAL SUMMARY	£/M2	SUB TOTAL/ £	TOTAL / £	Notes
MEASURED WORKS		2,303		4,571,879	
1	Substructure	128	£ 254,800		
2	Superstructure	1,024	£ 2,033,017		
3	Internal Finishes	111	£ 219,343		
4	FFE	200	£ 397,070		
5	Services	550	£ 1,091,750		
6	Complete Buildings/Building Units	0	£ -		
7	Work to Existing Buildings	0	£ -		
8	External Works	262	£ 520,900		
9	Facilitating Works	28	£ 55,000		
SUB TOTAL: BUILDING WORKS		2,303		4,571,879	
10	MAIN CONTRACTOR'S PRELIMS	253	11%	502,907	
10.1	Employer's Requirements				
10.2	Main Contractor's Cost Items				
11	MAIN CONTRACTOR'S OH&P	64	2.5%	126,870	
11.1	Main Contractor's Overheads				
11.2	Main Contractor's Profit				
SUB TOTAL: BUILDING, PRELIMS & OVERHEADS		2,620		5,201,655	
12	PROJECT/DESIGN TEAM FEES	236	9%	468,149	
12.1	Consultant's Fees				
12.2	Main Cont. Pre-construction Fees				
12.3	Main Contractor's Design Fees				
13	OTHER DEV'P/PROJECT COSTS				Excluded
13.1	Other Development Costs incurred by the Client - To be advised				
14	RISKS	286	10%	566,980	
14.1	Design Development Risks				
14.2	Construction Risks				
14.3	Employer Change Risks				
14.4	Employer Other Risks				
15	INFLATION	79	2.50%	155,920	
15.1	Tender Inflation				
15.2	Construction Inflation				
OUTLINE COST INCLUDING INFLATION		3,221		6,392,704	To 3Q21

Element	Works	Q	U	R	£	Notes
1	Substructure				254,800.00	£128 /m²
	General allowance for foundation and ground floor construction	1,960 m2		130	254,800.00	Measured area
	Excludes requirement for piling or the like					
2	Superstructure				2,033,016.50	£1,024 /m²
2.1	Frame					same basis; enhanced rate
	Allowance for Steel Frame requirements					
	Based on 65kg/m2; 60% of overall requirements	77 T		2,500	193,537.50	
	Allowance for Glulam Frame feature requirements					
	Based on 65kg/m2 (for comparative purposes); 40% of overall requirements	52 T		2,900	149,669.00	
2.2	Upper floors					
	General allowance for internal accommodation	830 m2		100	83,000.00	
	Raked Concrete seating area and outdoor circulatory spaces	770 m2		185	142,450.00	
2.3	Roof					
	Roof Type RF01 - Trapezoidal Aluminium					
	Insulated	1,228 m2		135	165,780.00	including parapets
	Uninsulated	357 m2		100	35,700.00	including parapets
	Roof Type RF02 - Trapezoidal Polycarbonate	643 m2		75	48,225.00	including parapets
2.4	Stairs and Ramps					
	Internal stairs					
	Main stair at entry; 2 flights, dog-leg	1 nr		12,500	12,500.00	
	e/o for feature finish		allow		2,500.00	
	Circulatory Stairs; 2 flights, dog-leg	2 nr		15,000	30,000.00	
2.5	External Walls					
	Precast Concrete; including support structure, insulation etc	838 m2		400	335,200.00	
	Cladding panels to return of flank walls; including support structure, insulation etc	490 m2		300	147,000.00	
	Metal cladding panels; including support structure, insulation etc	292 m2		300	87,600.00	
	Curtain Walling; including support structure etc; Front façade	281 m2		550	154,550.00	
	Curtain Walling; unitised glazing; including support structure etc; Pitch façade	194 m2		450	87,300.00	
	e/o for door requirements; single	3 nr		600	1,800.00	
	e/o for door requirements; double	3 nr		1,000	3,000.00	

Element	Works	Q	U	R	£	Notes
2.6	Windows and external doors					
	Revolving Door; main entry	1 nr		27,500	27,500.00	
	External doors; Double	5 nr		1,800	9,000.00	
2.7	Internal Walls and Partitions					
	Partitions generally	2,080 m2		90	187,200.00	
	Folding acoustic partition	21 m2		500	10,500.00	
	Balustrades and the like					
	Internal; metal	9 m		160	1,440.00	
	Internal; glazed	7 m		425	2,975.00	
	External to terrace	71 m		450	31,950.00	
	Handrails and the like					
	Internal; metal	76 m		140	10,640.00	
2.8	Internal Doors					
	Internal doors including ironmongery					
	Double	9 nr		1,400	12,600.00	
	Single	56 nr		900	50,400.00	
	Pocket doors to Accessible WC	3 nr		2,000	6,000.00	
	Roller shutter to kitchen	1 nr		3,000	3,000.00	
3	Internal Finishes				219,342.50	£111 /m²
	Review of extents and manner of finishes to be undertaken once further information is available					average rate
3.1	Wall Finishes	1,985 m2		25	49,625.00	
3.2	Floor Finishes	1,886 m2		50	94,287.50	
	assumes some areas without finish (5% reduction)					
3.3	Ceiling Finishes	1,588 m2		35	55,580.00	
	assumes some open ceilings (20% reduction)					
	Decoration	1,985 m2		10	19,850.00	
4	FFE				397,070.00	£200 /m²
	Review of extents and manner of furniture and signage to be undertaken once further information is available					GIFA rate
	Benchmark data used meantime	1,985 m2		170	337,450.00	
	Enhanced to include the likes of kitchen, servery, additional teaching aids, etc.					
	Seats to Raked concrete podium	1,084 nr		55	59,620.00	

Element	Works	Q	U	R	£	Notes
5	Services				1,091,750.00	£550 /m²
	Review of extents and manner of services to be undertaken once further information is available					
	Adjusted Benchmark data used meantime	1,985 m2	550		1,091,750.00	GiFA rate
	Client has noted aspiration for some sustainable measures. The allowance above includes for prospectively allowing the use of Air Source Heat Pumps for primary heat source. This allowance would be insufficient for considering Ground Source Heat Pump provision (due to requirements of ground works) even if ground conditions afforded this opportunity (ground conditions TBC)					
	Current allowance excludes specific Renewable aspects such as <i>Grey water recycling</i> or <i>electrical generation through PV</i> . Refer to excluded costs in executive summary.					
6	Complete Buildings/Building Units				0.00	£0 /m²
	No works assumed					
7	Work to Existing Buildings				0.00	£0 /m²
	Demolition of existing retail units and surrounding external space noted in Facilitating works, but excluded					
	Existing parking retained; works of improvement included in External Works					

Element	Works	Q	U	R	£	Notes
8	External Works				520,900.00	£262 /m²
	Works to Existing Car Park, including alterations to surfacing to tie in to campus and new drop off areas					Excluded; assumed this will be delivered by others
	New concourse around new facility	2,000 m2	80		160,000.00	allow
	This limits the works to the immediate vicinity of the new building as it is anticipated this will be dealt with by others. Refer to excluded costs in executive summary.					
	External fencing and security measures	310 m	190		58,900.00	allow
	Ball stop fencing (additional to existing)	60 m	200		12,000.00	allow
	Works to Pitch					
	Hybrid; upgrade existing pitch				Excluded	Refer to excluded costs in executive summary.
	Enhancement to surface for standing areas				50,000.00	allowance
	Equipment requirements				15,000.00	allowance
	Floodlighting				80,000.00	allowance
	Utilities and connections					
	Electric	Allow			25,000.00	
	Gas	Allow			30,000.00	
	Water	Allow			35,000.00	
	Telecoms	Allow			20,000.00	
	Drainage	Allow			35,000.00	
9	Facilitating Works				55,000.00	£28 /m²
	Demolition of existing retaill units and surrounding external space				Excluded	Advised as by others
	Additional site clearance requirements	Allow			25,000.00	
	Levelling / soils management / imported fill	Allow			30,000.00	
1-9. MEASURED WORKS TOTAL					4,571,879.00	

BENCHMARK INFORMATION							
As at 3Q2020							
Benchmark information from comparators in BCIS Analyses							
	BCIS Ref	28867	24752	28764	26727	25001, 25002	23691
	Name	Salford City Stadium	Scotstoun Stadium	Torquay United Grandstand	Fontwell Park Grandstand	Rutherglen (Stand and changing)	Perth Grammar Grandstand
							Average
Works Elements							
1	Substructure	150	345	237	123	339	421
2	Superstructure	814	1,276	1,453	919	671	992
3	Internal Finishes	118	188	180	175	165	273
4	FFE	277	108		278	70	181
5	Services	512	512	710	753	758	558
6	Complete Buildings/ Building Units						
7	Work to Existing Buildings						
8	External Works	622	549	171	244		296
9	Facilitating Works						
	MAIN CONTRACTOR'S PRELIMS and OH&P	200	503	479	343	597	211
	Total	2,694	3,481	3,231	2,836	2,600	2,932
Note: Outlier data (considered too low or too high) removed for benchmark purposes							
For comparison; add							
10% design fees	269	348	323	284	260	293	306
Inflation to 3Q21 (at 2.5%)	74	96	89	78	72	81	84
Direct comparative to scheme estimate	3,037	3,925	3,643	3,197	2,932	3,306	3,445
RL HUB							
As current cost estimate							3,224

AREA SCHEDULE	GIFA / ft2	GIFA / m2	Notes
Applicable areas only as noted			
Ground and First Floors			
Level 00		1,174 m2	
Level 01		811 m2	
			including advised reduction
Sub Total:	21,367 ft2	1,985 m2	
TOTAL GROSS INTERNAL FLOOR AREA, (GIFA)			
	21,367 FT2	1,985 M2	

RISK and ISSUE LOG

RISK LOG - STAGE 1 Feasibility				
Project Description	RL Hub - Stadium			Project
Situated at	Manchester			Funding
				TBC
Risk Consultant(s)	Dean Carrick - Doig+Smith, Rob Rimmer - Bear Maximum			Last updated
				07/10/2020

Likelihood scored:

1- unlikely
2 - remote
3 - possible
4 - likely
5- almost certain

Impact scored:

1- negligible
2 - minor
3 - moderate
4 - major
5- catastrophic

					Risk score					
Risk ref	Risk Cause	Risk description	Risk Type	Risk Consequence	Likelihood	Impact	Overall score	Risk Owner	Actions planned / Treatment to mitigate	Current status
PROJECT DELIVERY										
PD1	Funding not secured	Project is reliant on external funding to move forward	Reputational	Project terminated	3	5	15	CLIENT AND CONSULTANT TEAM	Secure funder commitment through engagement	Open
PD2	Failure to secure site	Site is not provided FOC as anticipated	Reputational Financial	Project delayed; additional funding required	3	4	12	CLIENT AND CONSULTANT TEAM	Secure MCC's commitment to providing site	Open
PD3	Project delivery does not meet Programme / Cost / Quality aspirations	Factors conspire to delay, add costs, or reduce the design aspirations meaning concept is not delivered	Reputational	Not delivered to RFL requirements or in line with noted timings	3	4	12	CLIENT AND CONSULTANT TEAM	Feasibility development gains early approval, followed by clear programme for development, procurement and delivery	Open
PD4	Failure to attract suitable and related activities to enhance viability	Anticipated use and activity does not meet aspirations and therefore project viability is lessened.	Reputational Financial	Perception that the facility is a "white elephant" and does not attract use	2	5	10	CLIENT AND CONSULTANT TEAM	Establish market, early marketing, agreements for 'routing' business in place in line with education & training. Have alternative use fall back plan	Open
PD5	Failure to establish coherent partnerships with education delivery partners	Partnerships unavailable or fail; no appetite to engage from potential partners	Reputational Financial	Failures in quality delivery and inefficiencies across key objectives	3	5	15	CLIENT AND CONSULTANT TEAM	Early engagement to seek commitment and undertake to conclude SLA's	Open
PD6	Constraints of "waterfall fund"	Constraints placed on delivery model from the terms of the fund applied	Multiple	Delivery cannot be achieved or changes the Client aspirations significantly	3	3	9	CLIENT AND CONSULTANT TEAM	Review and respond on likely terms	Open
PD6	Constraints of other potential capital funding	Availability of funding is diminished or Constraints placed on delivery model from the terms of the fund applied	Multiple	Delivery cannot be achieved or changes the Client aspirations significantly	3	3	9	CLIENT AND CONSULTANT TEAM	Review capital funding availability and restrictions and Review and respond on likely terms	Open
PD7	Procurement Frustration	Procurement procedure dictated by other constraints	Programme Commercial	Procurement makes project more complex, programme longer and increases costs	3	4	12	CLIENT AND CONSULTANT TEAM	Review Procurement approach on a staged basis. Develop procurement plan early; seek stakeholder and funder buy-in.	Open

RISK and ISSUE LOG

					Risk score					
Risk ref	Risk Cause	Risk description	Risk Type	Risk Consequence	Likelihood	Impact	Overall score	Risk Owner	Actions planned / Treatment to mitigate	Current status
ORGANISATIONAL INTERFACES										
O1	Site agreements with local school(s) and Education authorities	Proposal require corner of existing education facility. Negotiations with multiple stakeholders may prove challenging.	Programme	Delivery cannot be achieved or is delayed by required re-design etc.	3	4	12	CLIENT AND CONSULTANT TEAM	Early and appropriate engagement with relevant stakeholders. Prepare potential alternative design arrangement.	Open
O2	Interface with OLL national <i>spokes</i>	Educational aspects of Our League Life National training elsewhere is threatened or diminished	Reputational	Reluctance to use or operate in new central training facility	4	4	16	CLIENT	Engagement with existing OLL training deliverers; manage "Hub and Spoke" arrangement appropriately	Open
O3	Demand for training limited	Anticipated use of facility for training is less; means viability of facility is questioned Business plan	Reputational	Does not meet key requirements; funding limited	2	4	8	CLIENT AND CONSULTANT TEAM	Training feasibility study expanded or more focused on key delivery aspects.	Open
O4	Lack of Etihad Campus Stakeholder engagement/buy-in	Lack of support from MCC / Sport England cofunder, Regeneration organisation. Does not meet Strategic framework compliance requirements.	Reputational	Lack of support means project is not viable and is not delivered.	2	5	10	CLIENT AND CONSULTANT TEAM	Feasibility should comply / close out. Maintain ongoing support for scheme	Open
DESIGN										
D1	Design does not meet Client Aspiration	Poor or ill conceived feasibility is considered poor by Client	Design	Poor perception by Client	0	0	0	DESIGN TEAM	Design meets aspiration at Feasibility	Closed
D2	Client Variations	Client driven variations/design changes are required that impact on cost and programme	Multiple	Increased costs Delay to programme	2	4	8	CLIENT	Later stages to have change control implemented	Open
D4	Stakeholder Inputs	Input from external stakeholders at inopportune times	Multiple	Negative impact on costs / programme	3	4	12	CLIENT	Extensive stakeholder engagement to be undertaken. Monitor during construction.	Open
D5	Design Freeze	Inability to achieve design freeze at key stages	Multiple	Negative impact on costs / programme	3	4	12	CLIENT AND CONSULTANT TEAM	Design Freeze milestones to be programmed and monitored	Open
D6	Sustainability / Energy Aspirations	Scheme unable to meet Client aspirations in regards sustainability	Reputational	Project won't meet wider aspirations	3	3	9	DESIGN TEAM	Monitor in next stages	Open
D7	Beswick Masterplan Content	Surrounding development not compatible with OLL National	Multiple	Viability of OLL negatively impacted	1	4	4	CLIENT AND CONSULTANT TEAM	Influence ERF plans as appropriate	Open
D8	Beswick Masterplan delivery	Adjacent works not delivered in time to support OLL	Commercial	Viability and security of OLL negatively impacted	2	4	8	CLIENT AND CONSULTANT TEAM	Understand MCC/East Manchester gateway programme	Open
D9	Pedestrian Access	Routes become complex or do not align with masterplan	Multiple	Wider landscape costs not met by external providers	2	3	6	DESIGN TEAM	Monitor in next stages	Open
D10	Overly complex design interfaces	Complex design means significant costs are induced, not understood in earlier stages	Design Commercial	Buildability issues and increased costs	2	4	8	DESIGN TEAM	Design taking cognisance of requirements.	Open
D11	Design Development	The Design exceeds budget constraints as stages progress	Design Commercial	Design becomes unaffordable	2	4	8	DESIGN TEAM	Stage cost checks and close liaison between Design Team, PM and Qs	Open
D12	Building Functionality / flexibility / adaptability	The design does not meet functional requirements, allow for future flexibility or adaption to future uses	Design Commercial	Design does not meet key objectives or meeting these proves unaffordable	2	3	6	DESIGN TEAM	Staged reviews of objectives and design / costs in relation	Open

RISK and ISSUE LOG

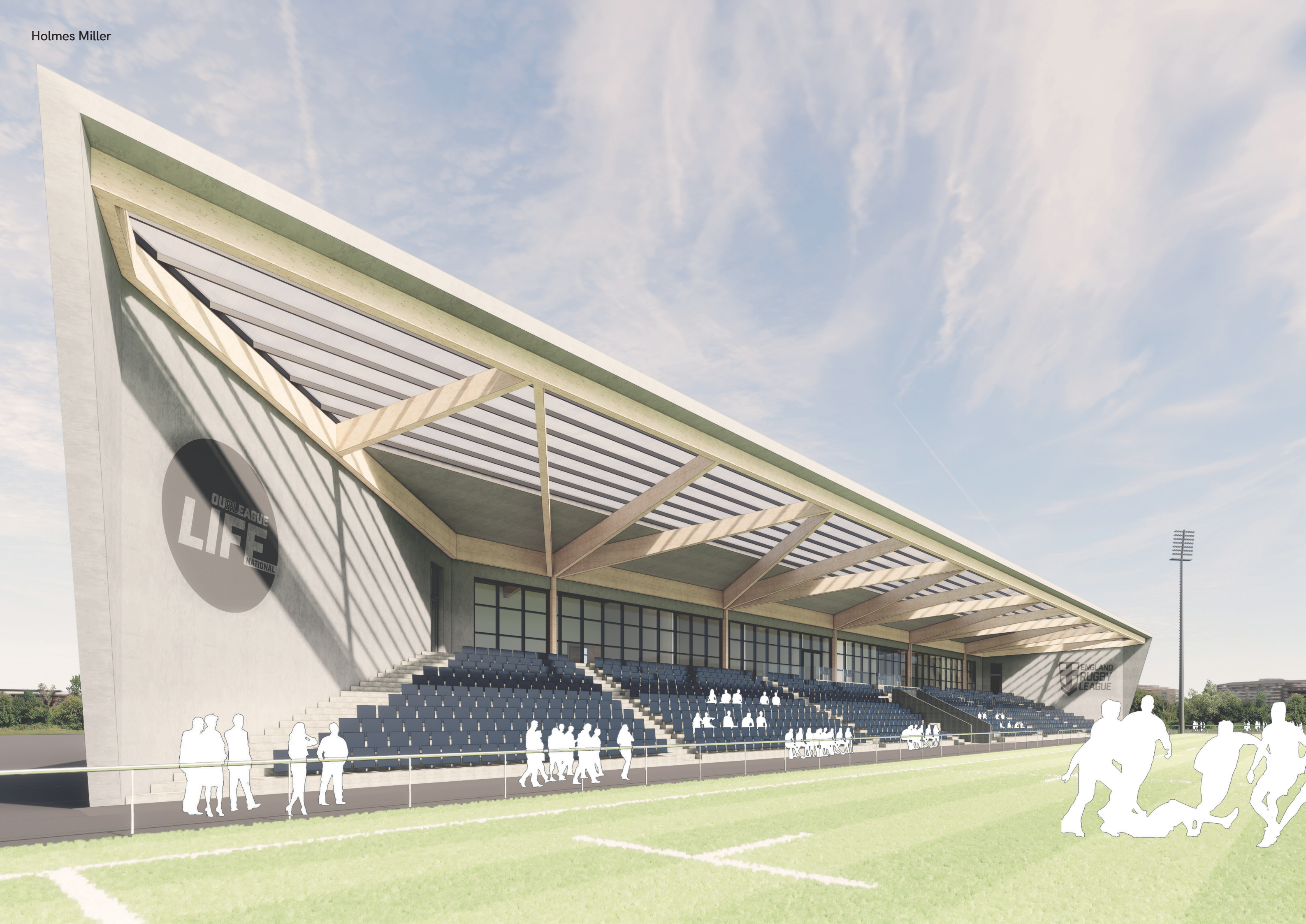
					Risk score					
Risk ref	Risk Cause	Risk description	Risk Type	Risk Consequence	Likelihood	Impact	Overall score	Risk Owner	Actions planned / Treatment to mitigate	Current status
EXISTING SITE CONDITIONS										
E1	Demolition	Demolition of existing structures proves more complex than anticipated from provided information, or is not completed by external party	Construction, Programme, Commercial	Negative impact on costs / programme	3	3	9	CLIENT AND CONSULTANT TEAM	Seek agreement on Demolition by others	Open
E2	Existing Drainage / Foundations	Existing foundations/drainage infrastructure not removed during separate Demolition Contract may impact on Construction	Construction, Programme	Negative impact on costs / programme	2	3	6	EXTERNAL	To be addressed with external party	Open
E3	Archaeology	Archaeological discoveries detected during SI works	Programme	Delay to programme	2	3	6	CLIENT AND CONSULTANT TEAM	Early surveys etc. Works in the area already tend to mitigate likelihood.	Open
E4	UXO	Unexploded ordnance detected during SI works	Overall	Risk to life if not dealt with correctly	2	4	8	CLIENT AND CONSULTANT TEAM	Early surveys etc. Works in the area already tend to mitigate likelihood.	Open
E5	Poor Bearing Capacity / ground conditions	SI works determine the existing ground to have poor bearing capacity requiring substructure re-design	Design, Commercial	Impact on design Increased costs	3	4	12	CLIENT AND CONSULTANT TEAM	Early surveys etc.	Open
E6	Contamination	SI works determine additional contamination requiring remediation	Design, Commercial	Impact on design Increased costs	3	3	9	CLIENT AND CONSULTANT TEAM	Early surveys etc.	Open
E7	Ground Gas	SI works determine additional measures required to deal with Ground gas, beyond what is anticipated	Commercial	Increased costs	3	3	9	CLIENT AND CONSULTANT TEAM	Early surveys etc.	Open
E8	Groundwater	SI works determine groundwater level to be above the lowest level of construction. This includes issues arising from rugby pitch drainage solution (groundwater)	Commercial	Increased costs	2	3	6	CLIENT AND CONSULTANT TEAM	Early surveys etc.	Open
E9	Asbestos	Asbestos to be removed as part of the Demolition works. Residual Asbestos Risk	Programme	Potential for delay if more onerous than anticipated	3	3	9	CLIENT AND CONSULTANT TEAM	Early surveys etc.	Open
E10	Ecology	Aspects of local ecology and response to this in the design or construction	Mutiple	Potential to cause additional programme and costs and mean changes to design	2	3	6	CLIENT AND CONSULTANT TEAM	Early surveys etc. Works in the area already tend to mitigate likelihood.	Open
E11	Utilities	New utility connections will be part of the scope, but prove more complex than anticipated	Multiple	Impact on programme, costs and design	3	3	9	CLIENT AND CONSULTANT TEAM	Early engagement with Utility providers	Open
E12	Existing Utilities - disconnections	Utility disconnections will be facilitated and organised within demolition contract; but casue issues with Construction	Programme	Impact on programme if utility disconnections cannot happen in time	3	3	9	CLIENT AND CONSULTANT TEAM	Early engagement with separate demolition undertaker	Open

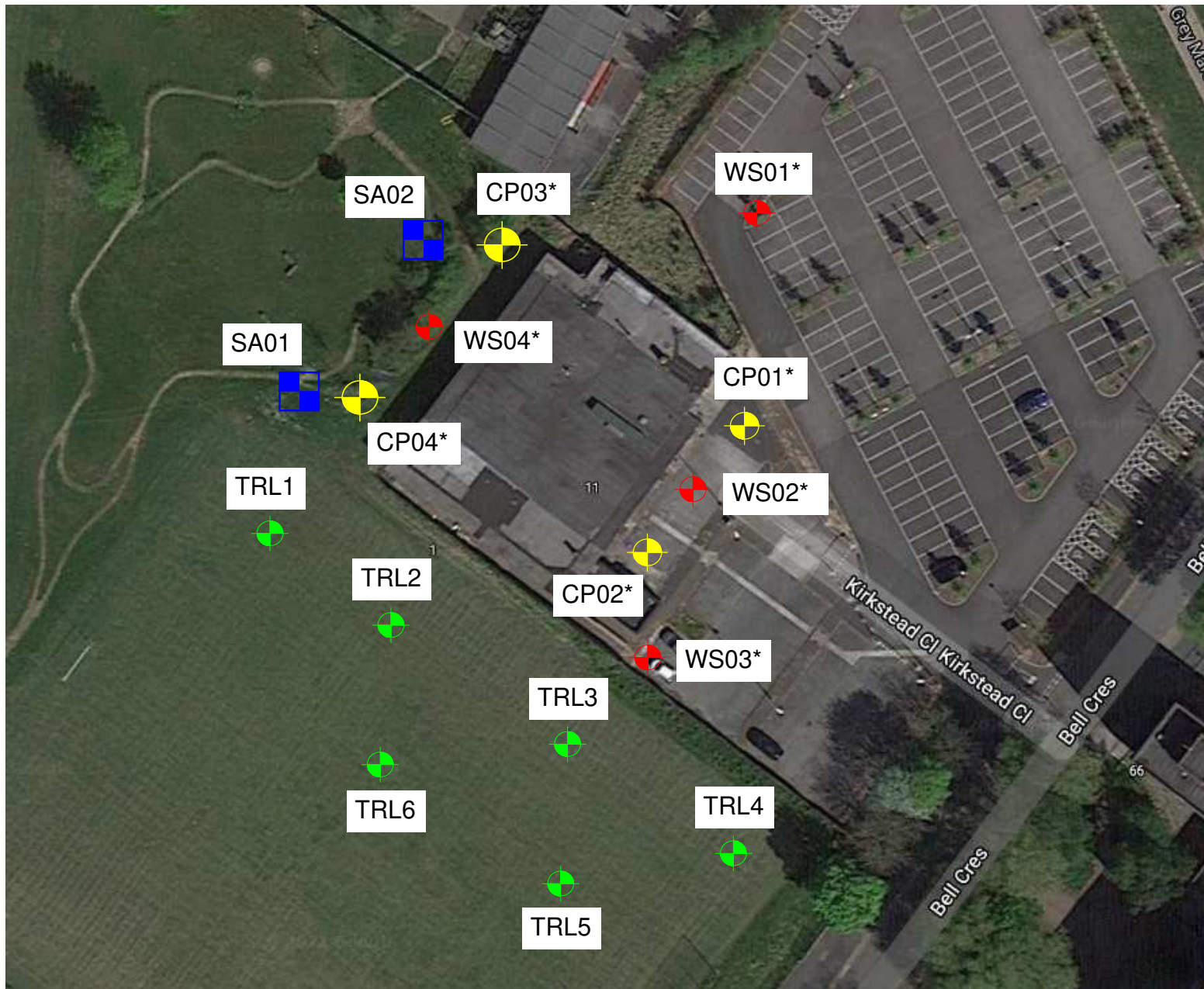
RISK and ISSUE LOG

					Risk score					
Risk ref	Risk Cause	Risk description	Risk Type	Risk Consequence	Likelihood	Impact	Overall score	Risk Owner	Actions planned / Treatment to mitigate	Current status
STATUTORY CONSENTS										
S1	Planning conditions generally	Planning conditions mean the response has to change designs or increase costs; This maty include considerations of additional noise or glare from increase of and change of use.	Design, Commercial	Impact on design and costs	2	4	8	CLIENT AND CONSULTANT TEAM	Early engagement with Planning department	Open
S2	Planning	Parking requirements Electric parking space requirements?	Design, Commercial	Impact on design and costs	2	3	6	CLIENT AND CONSULTANT TEAM	Early engagement with Planning department	Open
S3	Planning	Fire tender access	Design	Impact on design	2	3	6	CLIENT AND CONSULTANT TEAM	Early engagement with appropriate agencies. Design approach understands requirements	Open
COMMERCIAL										
C1	Meeting the budget	Market conditions, uncontrolled change, or other factors increase projected costs	Commercial	Impact on costs; becomes unaffordable	3	4	12	CONSULTANT TEAM	Cost reviews as design stages progress; change control implementation. Designers and QS relationship to ensure no uncontrolled design/scope increase	Open
C2	Scope changes / increase	Client requested changes, following Contract Execution	Multiple	Impact on programme and costs	2	3	6	CLIENT	Dealt with in Accordance with the Contract, or via Change Control procedure. Contract selection may determine approach (JCT/NEC)	Open
C3	Scope changes / increase	Contractor proposed changes, following Contract Execution	Multiple	Impact on programme and costs	2	3	6	CONTRACTOR	Contractor to review provided information and "Alternative Tender" proposals; Changes would require change control protocol.	Open
C4	Procurement of appropriate Contractor	Contractor procurement proves problematic or selected Contractor proves to be inappropriate	Multiple	Impact on reputation, quality, programme and costs	3	4	12	CONSULTANT TEAM	Rigorous, value based, procurement exercise followed by appropriate use of procurement vehicles; including "sustainable" or societal procurement objectives	Open

RISK and ISSUE LOG

Risk ref	Risk Cause	Risk description	Risk Type	Risk Consequence	Risk score			Risk Owner	Actions planned / Treatment to mitigate	Current status
					Likelihood	Impact	Overall score			
CONSTRUCTION										
CR1	Close proximity to residential properties.	Complaints from residents about noise, nuisance.	Multiple	Negative publicity. Reputation	2	2	4	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR2	Limited site access.	Access arrangements mean site activities are restricted or rearranged	Construction	Potential Programme and cost impact	2	3	6	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR3	Pedestrian / Vehicular Segregation	Adequate segregation not allowed for during construction - must ensure clear separation throughout construction	Construction	Risk to life if not dealt with correctly	1	5	5	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR4	Access	Parking restrictions cannot be obtained required to allow large vehicles	Construction, Programme	Impact on construction, programme and costs	2	4	8	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR5	Protection of Pitch	Protection of existing Pitch (within the Works, but will require segregation)	Commercial	Impact on construction, programme and costs	3	3	9	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR6	Dealing with Surface water	Surface water to be controlled during the works programme, including that from the works to the Rugby pitch	Construction, Programme	Impact on construction, programme and costs	2	3	6	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR7	Site Security	Site security proves inadequate during the works, leading to issues around costs, programme and local relations	Construction, Programme	Impact on construction, programme and costs	2	3	6	CONTRACTOR	Contractor to review provided information and account for potential Risk in their Tender.	Open
CR8	Contractor failure	Main Contractor or key parts of supply chain go out of business or prove unable to deliver project	Multiple	Impact on delivery, programme, cost and reputations	1	4	4	CLIENT AND CONSULTANT TEAM	Use of trusted framework approach should minimise this due to track record of framework contractors and their supply chain	Open
OTHER										
OT1	COVID-19 / PANDEMIC	COVID like event again disrupts construction or delivery programme	Programme, Commercial	Impact on programme and costs	2	4	8	CLIENT AND CONSULTANT TEAM	Consider how a COVID event is to be dealt with within the programme methodology	Open
OT2	Vandalism and the like to operational facility	Vandalism to facility means that the perception of same is diminished leading to problematic relationships with users	Commercial and reputational	Impact on facility perception, use and running costs	3	3	9	CLIENT AND CONSULTANT TEAM	Design to respond to concerns on potential vandalism. Considerations of local engagement and security once facility opens	Open





-  CABLE PERCUSSIVE BOREHOLE
-  WINDOW SAMPLE BOREHOLE LOCATION
-  SOAKAWAY TEST
-  TRL PROBES
-  INSTALLED

Rev:	Description:	Date:	By:	Chkd:
------	--------------	-------	-----	-------



Curtins Consulting Ltd,
Merchant Exchange, 17-19 Whitworth Street West, Manchester, M1 5WG
t: 0161 236 2394
e: manchester@curtins.com
www.curtins.com

Structures - Civils - Environmental - Infrastructure - Transport Planning - Sustainability - Expert Advisory Services
Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status:

INFORMATION

Project:

MANCHESTER SPORTS HUB

Drg Title:

EXPLORATORY HOLE LOCATION PLAN

Scale: NTS	Size: A3	First Issue: 08/07/21	Drawn: PN	Checked: JJ
----------------------	--------------------	---------------------------------	---------------------	-----------------------

Drg No: 077652.300-CUR-XX-DR-GE-80002	Rev: P01
---	--------------------

© This drawing is the copyright of Curtins Consulting Ltd

Appendix B – Exploratory Hole Logs

- Cable Percussive Borehole Logs CP01 – CP04
- Window Sample Borehole Logs WS01 – WS04
- Soakaway Trial Pit Logs SA01 – SA02



Borehole Log

Borehole No.

CP01

Sheet 1 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 56.34

Scale
1:40

Client: Holmes Miller

Dates: 28/06/2021 - 28/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	56.24		MADE GROUND: Tarmac.	
		0.40	ES		0.50 0.60	55.84 55.74		MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse brick, tarmac, concrete, sandstone, mudstone. Occasional cobbles of concrete and sandstone. (SUBBASE)	
		1.20 1.20 - 1.65	D	N=16 (2,2/3,4,5,4)				MADE GROUND: Brick cobbles. Recovered as sandy cobbles. Stiff, brown mottled blueish grey, slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium sandstone, mudstone and quartzite.	1
		2.00 2.00 - 2.45	D	N=22 (4,5/7,4,5,6)	2.00	54.34		Stiff, brown mottled grey, slightly silty slightly gravelly CLAY. Gravel is subangular to subrounded, fine to medium sandstone and mudstone.	2
		3.00 - 3.45	U						3
		3.50	D						
		4.00 4.00 - 4.45	D	N=24 (4,4/4,6,7,7)					4
		5.00 - 5.45	U						5
		5.50	D						
		6.00 6.00 - 6.45	D	N=27 (6,6/6,7,7,7)					6
		7.50 7.50 - 7.95	D	N=20 (2,3/4,5,5,6)	7.50	48.84		Stiff, brown, slightly sandy slightly gravelly CLAY. Gravel is subangular to subrounded, fine to medium sandstone and mudstone. 100mm thick, brown sand band at 7.5m bgl.	8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP01

Sheet 2 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 56.34

Scale
1:40

Client: Holmes Miller

Dates: 28/06/2021 - 28/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		9.00 - 9.45	U	N=26 (8,6/5,5,8,8)	10.40	45.94			9
		9.50	D						
		10.00 10.00 - 10.45	D					Dense, reddish brown, fine to medium SAND.	10
					11.00	45.34		End of borehole at 11.00 m	11
									12
									13
									14
									15
									16

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP02

Sheet 1 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 56.20

Scale
1:40

Client: Holmes Miller

Dates: 29/06/2021 - 29/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.10			0.10	56.10		MADE GROUND: Tarmac.	
		0.80			0.80	55.40		MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to coarse. Gravel is subangular to subrounded, fine to coarse brick, tarmac, concrete, sandstone, mudstone. Occasional cobbles of sandstone. (SUBBASE)	
		1.00	ES		1.10	55.10		MADE GROUND: Firm, blackish brown, sandy gravelly clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, sandstone and mudstone.	1
		1.20	D	N=10 (1,1/2,3,2,3)					
		1.20 - 1.65							
		2.00							
		2.00 - 2.45	D	N=17 (3,3/4,4,4,5)					2
		3.00							
		3.00 - 3.45	D	N=19 (3,4/3,4,5,7)					3
		4.00 - 4.45	U						4
		4.50	D						
		5.00			5.00	51.20		Stiff, orangish brown, sandy CLAY. Sand is fine to medium.	5
		5.00 - 5.45	D	N=24 (4,4/5,5,6,8)					
		6.50 - 6.95	U					Becoming very sandy from 6.5m to 7.0m bgl.	6
		7.00	D						7
		8.00 - 8.45	U		8.00	48.20		Continued on next sheet	8

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP02

Sheet 2 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 56.20

Scale
1:40

Client: Holmes Miller

Dates: 29/06/2021 - 29/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		8.50	D					Stiff, slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to medium, subangular mudstone.	9
		9.50 9.50 - 9.95	D	N=50 (9,7/9,12,13,16)	10.20	46.00		50mm thick, red sand band at 9.5m bgl. Becoming very stiff from 9.50m bgl.	10
								End of borehole at 10.20 m	11
									12
									13
									14
									15
									16

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP03

Sheet 1 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 57.10

Scale
1:40

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.80	ES		0.80	56.30		Long grass over MADE GROUND: Brown, slightly clayey slightly gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, crushed concrete, sandstone, mudstone and quartzite.	
		1.20			1.10	56.00		MADE GROUND: Soft, blackish brown, slightly gravelly sandy clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, tarmac, quartzite, mudstone, coal and sandstone.	1
		1.20 - 1.65	D	N=9 (1,2/1,3,3,2)	1.50	55.60		MADE GROUND: Firm, orangish brown mottled blueish grey, slightly silty slightly gravelly slightly cobbly clay. Gravel is subangular to subrounded, fine to coarse tarmac, brick, mudstone, quartzite, sandstone and coal. Cobbles of sandstone.	2
		2.00							
		2.00 - 2.45	D	N=20 (3,3/4,5,5,6)					
		3.00							
		3.00 - 3.45	D	N=20 (2,3/3,4,5,8)					3
		4.00 - 4.45	U						4
		4.50	D						
		5.00							5
		5.00 - 5.45	D	N=21 (3,4/4,5,5,7)					
		6.00 - 6.95	U						6
		7.00	D					50mm thick, brown sand band at 6.95m bgl.	7
		8.00 - 8.45	U		7.50	49.60		Stiff, brown, slightly gravelly sandy CLAY. Sand is fine. Gravel is subangular to subrounded, fine to medium mudstone, sandstone and quartzite.	8

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP03

Sheet 2 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 57.10

Scale
1:40

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		8.50	D						9
		9.50 9.50 - 9.95	D	N=35 (3,4/5,7,6,17)	9.90 10.25	47.20 46.85		Dense, orangish brown, slightly gravelly clayey SAND. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium mudstone and sandstone. End of borehole at 10.25 m	10 11 12 13 14 15 16

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP04

Sheet 1 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 57.13

Scale
1:40

Client: Holmes Miller

Dates: 01/07/2021 - 01/07/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.60				56.53		Long grass over MADE GROUND: Brown, slightly clayey slightly gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, crushed concrete, sandstone, mudstone and quartzite.	1	
		1.20		N=6 (1,1/1,1,2,2)				MADE GROUND: Soft, blackish brown, slightly gravelly slightly cobbly sandy clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, tarmac, quartzite, mudstone, coal and sandstone. Cobbles of sandstone. Pockets of greyish brown clayey sand from 1.0m to 1.5m bgl.		
		1.50	ES							
		1.80	D		1.80	55.33		Firm, orangish brown mottled blueish grey, slightly sandy gravelly CLAY. Gravel is subangular to subrounded, fine to coarse mudstone, quartzite, sandstone and coal.	2	
		2.00		N=12 (2,3/3,3,3,3)						
		2.00 - 2.45	D							
		3.00		N=18 (2,3/3,4,5,6)					3	
		3.50	D							
		4.00		N=29 (5,5/6,6,8,9)	4.00	53.13		Stiff, gravelly CLAY. Gravel is subangular to subrounded, fine to medium, mudstone, sandstone and coal.		
		4.00 - 4.45	D							
		5.00		N=22 (5,4/5,5,6,6)					5	
		5.00 - 5.45	U							
		5.50	D							
		6.00 - 6.45	D						6	
		7.50		N=18 (3,3/4,4,5,5)						
		7.50 - 7.95	D							
									8	

Continued on next sheet

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

CP04

Sheet 2 of 2

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
CP

Location: Kirkstead Close, Beswick

Level: 57.13

Scale
1:40

Client: Holmes Miller

Dates: 01/07/2021 - 01/07/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		9.00 - 9.45	U	N=35 (3,6/10,11,8,6)	10.45	46.68			9
		9.50	D						
		10.00 10.00 - 10.45	D						10
								End of borehole at 10.45 m	11
									12
									13
									14
									15
									16

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

WS01

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
WS

Location: Kirkstead Close, Beswick

Level: 57.45

Scale
1:25

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES	N=15 (1,1/4,4,4,3)	0.20	57.25		Rough vegetation over MADE GROUND: Brown, slightly gravelly slightly cobbly clayey sand with frequent rootlets. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, concrete, sandstone, mudstone and quartzite. Cobbles of brick and concrete.	1
		0.50			0.50	56.95		MADE GROUND: Light brown and white, sandy gravel. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse concrete, brick, mudstone, sandstone and quartzite. (SUBBASE)	
		0.80			0.80	56.65		MADE GROUND: Soft, brown, slightly silty slightly gravelly sandy clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium, brick, sandstone, mudstone and quartzite.	
		1.20			1.30	56.15		MADE GROUND: Whitish brown, sandstone and concrete cobbles. Recovered as sandy gravel.	
		2.00	D	N=4 (0,0/1,1,1,1)	2.00			Firm, dark brown, slightly sandy gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium mudstone, sandstone and quartzite.	2
		2.30			2.30	55.15		Very soft from 2.0m bgl.	
		2.50			2.50			Very soft, blackish brown, fibrous, slightly sandy clayey PEAT. Sand is fine. High organic content and vegetation matter. Slight organic odour.	
		2.70			2.70	54.75		Loose, blackish brown, clayey SAND. Sand is fine. Occasional vegetation matter. Slight organic odour.	
		2.80	D	N=11 (0,0/7,1,1,2)	2.80	54.65		Soft, brown and black, slightly silty slightly peaty sandy CLAY. Sand is fine. Occasional vegetation matter. Slight organic odour.	3
		3.00			3.00			Soft, brown and black, slightly silty slightly peaty sandy CLAY. Sand is fine. Occasional vegetation matter. Slight organic odour.	
		3.50			3.50	53.95		Becoming silty at 3.2m bgl.	
		3.70			3.70	53.75		Firm, orangish brown, gravelly CLAY. Gravel is subangular, fine to medium mudstone.	
		4.00			4.00	53.45		Firm, brown, slightly silty gravelly CLAY. Gravel is subangular, fine to medium mudstone.	
								End of borehole at 4.00 m	4
									5

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole collapsed from 4.0m to 3.0m bgl after drilling. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

WS02

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
WS

Location: Kirkstead Close, Beswick

Level: 56.14

Scale
1:25

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15	ES		0.15	55.99		MADE GROUND: Tarmac.	1
		0.40			0.40	55.74		MADE GROUND: Orangish brown, slightly clayey slightly cobbly gravelly sand. Sand is fine to coarse. Gravel is angular to subrounded, fine to coarse brick, concrete, mudstone, sandstone and quartzite. Cobbles of sandstone.	
		0.70			0.70	55.44		MADE GROUND: Brick cobbles. Recovered as sandy slightly gravelly cobbles.	
		1.20	D	N=14 (2,2/3,3,4,4)	1.20			Firm, orangish brown mottled grey, slightly gravelly CLAY. Gravel is subangular, fine to medium mudstone.	2
		2.00			2.00			Stiff from 2.0m bgl.	
		2.50			2.50			Becoming slightly silty from 2.1m to 2.3m bgl.	
		3.00	D	N=24 (3,3/5,5,7,7)	3.00			Stiff, orangish brown, slightly gravelly CLAY. Gravel is angular to subangular, fine to medium mudstone and sandstone.	3
		4.00			4.00			Band of sandstone gravel from 2.80 to 3.0m bgl.	
		4.42			4.42			Very stiff from 4.0m bgl.	
								End of borehole at 4.42 m	5

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

WS03

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
WS

Location: Kirkstead Close, Beswick

Level: 55.70

Scale
1:25

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15			0.15	55.55		MADE GROUND: Tarmac.	
								MADE GROUND: Whitish brown, slightly silty sandy gravel. Sand is fine to coarse. Gravel is subangular, fine to coarse concrete, sandstone and mudstone. (SUBBASE)	
		0.70			0.70	55.00		MADE GROUND: Orangish brown and black, slightly clayey very gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, mudstone, sandstone and quartzite.	
		1.00			1.00	54.70		Stiff, orange mottled brown, slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium mudstone, sandstone and quartzite.	
		1.20	ES	N=18 (2,3/4,4,5,5)					
		1.20							
		1.80	D						
		2.00		N=28 (4,5/5,7,7,9)					
		2.20			2.20	53.50		Stiff, orangish brown, slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular, fine to medium mudstone, sandstone and quartzite.	
		3.00		N=50 (8,8/50 for 250mm)				Very stiff from 3.0m bgl.	
		3.40			3.40	52.30		End of borehole at 3.40 m	5

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Borehole Log

Borehole No.

WS04

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652

Co-ords: -

Hole Type
WS

Location: Kirkstead Close, Beswick

Level: 57.10

Scale
1:25

Client: Holmes Miller

Dates: 30/06/2021 - 30/06/2021

Logged By
TW

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.50	ES		0.80	56.30		Long grass over MADE GROUND: Brown, slightly clayey slightly gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, crushed concrete, sandstone, mudstone and quartzite.	1
		1.20		N=7 (1,1/1,2,2,2)	1.40	55.70		Soft, blueish grey, slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is subangular, fine to medium mudstone and sandstone.	
		2.00		N=19 (3,3/4,5,5,5)	2.30	54.80		Firm, brown, slightly gravelly very sandy CLAY. Sand is fine to coarse. Gravel is subangular to surrounded fine to medium of siltstone to sandstone.	
		2.80	D		3.00	54.10		Stiff, orangish brown and blueish grey, slightly gravelly CLAY. Gravel is subangular to subrounded, mudstone, sandstone and coal.	3
		3.00		N=50 (7,7/50 for 285mm)	3.44	53.66		Very stiff, orangish brown and blueish grey, slightly gravelly CLAY. Gravel is subangular to subrounded, mudstone, sandstone and coal.	
								End of borehole at 3.44 m	4
									5

Remarks

Service inspection pit hand excavated from GL to 1.20m. No groundwater encountered. Borehole installed with ground water/gas monitoring installation.





Trial Pit Log

Trialpit No

SA01

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652Co-ords: -
Level: 57.07Date
01/07/2021

Location: Kirkstead Close, Beswick

Dimensions
(m):

3.2

Depth
1.50

1.6

Scale
1:20Logged
TW

Client: Holmes Miller

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.30	56.77		Long grass over MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, crushed concrete, sandstone, mudstone and quartzite.
							MADE GROUND: Soft, brown sandy gravelly clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, sandstone, mudstone and quartzite.
				0.70	56.37		Orange mesh membrane encountered at 0.6m bgl.
				0.90	56.17		MADE GROUND: Orange, slightly clayey slightly gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse, brick, concrete, mudstone, sandstone, coal and quartzite.
				1.20	55.87		MADE GROUND: Firm, dark brown, slightly cobbley sandy gravelly clay. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, metal, plastic, concrete, mudstone and sandstone. Cobbles of concrete and sandstone.
				1.50	55.57		MADE GROUND: Concrete.
							End of pit at 1.50 m

1

2

3

4

Remarks: Trial pit area scanned for services. No groundwater encountered. Concrete obstruction encountered at 1.40m and 1.50m bgl. Excavation backfilled with arisings.

Stability: Open and stable throughout excavation.





Trial Pit Log

Trialpit No

SA02

Sheet 1 of 1

Project Name: Manchester Sports Hub

Project No.
077652Co-ords: -
Level: 57.68Date
01/07/2021

Location: Kirkstead Close, Beswick

Dimensions
(m):

2.2

Client: Holmes Miller

Depth
1.50

0.7

Scale
1:20Logged
TW

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20	57.48		Long grass over MADE GROUND: Brown, slightly clayey gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse brick, crushed concrete, sandstone, mudstone and quartzite.
				0.50	57.18		MADE GROUND: Orange, slightly clayey slightly gravelly sand. Sand is fine to medium. Gravel is subangular to subrounded, fine to coarse, brick, mudstone, sandstone, coal and quartzite. <i>Orange mesh membrane encountered at 0.4m bgl.</i>
				1.50	56.18		Stiff, orangish brown mottled blueish grey, slightly sandy gravelly CLAY. Sand is fine to medium. Gravel is subangular to subrounded, fine to medium mudstone, sandstone and quartzite.
							End of pit at 1.50 m

Remarks: Trial pit area scanned for services. No groundwater encountered. Infiltration test conducted after excavation completed. Excavation backfilled with arisings.

Stability: Open and stable throughout excavation.



Appendix C – Chemical Laboratory Testing Results

Envirolab, Environmental Chemistry Analysis Results, Soils:

- Final Analytical Test Report Ref. 21-07316-1

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/07316
Issue Number: 1
Date: 12 July, 2021

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: EBMA/Matthew Holroyd/Tommy Walker
Project Name: Manchester Sports Hub
Project Ref: 077652
Order No: EBMA2955
Date Samples Received: 02/07/21
Date Instructions Received: 05/07/21
Date Analysis Completed: 12/07/21

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Michael Knight
Laboratory Manager

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/1	21/07316/2	21/07316/3	21/07316/4	21/07316/5	21/07316/6	21/07316/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP01	CP02	WS01	WS02	WS03	WS03	WS04			
Depth to Top	0.40	1.00	0.70	0.60	0.80	1.20	0.50			
Depth To Bottom	0.50	1.10	0.80	0.70	0.90	1.30	0.60			
Date Sampled	28-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3A	6A	4AB	4AB	3A	4AE			
% Stones >10mm _A	39.8	<0.1	4.6	25.0	10.2	<0.1	12.9	% w/w	0.1	A-T-044
pH _D ^{M#}	8.26	8.13	8.35	8.29	8.11	8.26	8.05	pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.01	0.06	0.02	0.07	0.38	0.07	0.04	g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	0.7	1.7	1.6	1.0	3.0	1.5	9.1	% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	<1	<1	2	2	16	1	11	mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	mg/kg	1	A-T-027s
Cadmium _D ^{M#}	<0.5	0.8	1.0	<0.5	0.9	1.1	1.1	mg/kg	0.5	A-T-024s
Copper _D ^{M#}	4	31	33	17	37	34	69	mg/kg	1	A-T-024s
Chromium _D ^{M#}	5	39	39	13	22	42	17	mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-040s
Lead _D ^{M#}	17	56	30	80	193	15	233	mg/kg	1	A-T-024s
Mercury _D	0.82	<0.17	0.38	1.32	1.15	<0.17	0.74	mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	6	40	43	13	17	50	24	mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1	<1	<1	<1	<1	<1	mg/kg	1	A-T-024s
Zinc _D ^{M#}	18	75	92	44	152	81	155	mg/kg	5	A-T-024s

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/1	21/07316/2	21/07316/3	21/07316/4	21/07316/5	21/07316/6	21/07316/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP01	CP02	WS01	WS02	WS03	WS03	WS04			
Depth to Top	0.40	1.00	0.70	0.60	0.80	1.20	0.50			
Depth To Bottom	0.50	1.10	0.80	0.70	0.90	1.30	0.60			
Date Sampled	28-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3A	6A	4AB	4AB	3A	4AE			
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD	NAD	NAD	NAD	NAD	NAD			A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A	N/A	N/A	N/A	N/A	N/A			A-T-045

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/1	21/07316/2	21/07316/3	21/07316/4	21/07316/5	21/07316/6	21/07316/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP01	CP02	WS01	WS02	WS03	WS03	WS04			
Depth to Top	0.40	1.00	0.70	0.60	0.80	1.20	0.50			
Depth To Bottom	0.50	1.10	0.80	0.70	0.90	1.30	0.60			
Date Sampled	28-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3A	6A	4AB	4AB	3A	4AE			
PAH-16MS										
Acenaphthene _A ^{M#}	<0.01	<0.01	0.27	0.34	0.01	<0.01	0.49	mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	<0.02	<0.02	0.36	0.33	0.05	<0.02	0.84	mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	0.06	<0.04	0.66	0.65	0.17	<0.04	2.51	mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.07	<0.04	0.54	0.67	0.16	<0.04	2.47	mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.07	<0.05	0.58	0.72	0.23	<0.05	2.66	mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	<0.05	<0.05	0.24	0.37	0.12	<0.05	1.11	mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	<0.07	<0.07	0.21	0.24	0.09	<0.07	0.96	mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	0.06	<0.06	0.67	0.65	0.23	<0.06	2.51	mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	<0.04	<0.04	0.06	0.07	<0.04	<0.04	0.26	mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	0.10	<0.08	1.60	1.99	0.42	<0.08	5.08	mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	<0.01	<0.01	0.20	0.10	0.03	<0.01	0.35	mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.05	<0.03	0.25	0.38	0.11	<0.03	1.28	mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	<0.03	<0.03	0.35	<0.03	<0.03	<0.03	0.18	mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	<0.03	<0.03	1.62	0.49	0.15	<0.03	3.33	mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	0.11	<0.07	1.40	1.61	0.36	<0.07	4.54	mg/kg	0.07	A-T-019s
Total PAH-16MS _A ^{M#}	0.52	<0.08	9.01	8.61	2.13	<0.08	28.6	mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/1	21/07316/2	21/07316/3	21/07316/4	21/07316/5	21/07316/6	21/07316/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP01	CP02	WS01	WS02	WS03	WS03	WS04			
Depth to Top	0.40	1.00	0.70	0.60	0.80	1.20	0.50			
Depth To Bottom	0.50	1.10	0.80	0.70	0.90	1.30	0.60			
Date Sampled	28-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21			
Sample Type	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES	Soil - ES			
Sample Matrix Code	4AB	3A	6A	4AB	4AB	3A	4AE			
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1	<1	2	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	<1	<1	<1	26	<1	<1	<1	mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	1	1	2	178	3	<1	3	mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	1	1	3	170	22	1	5	mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	16	12	48	60	15	6	34	mg/kg	1	A-T-055s
Total Aliphatics _A	19	15	54	435	41	7	42	mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	<1	<1	<1	<1	<1	<1	2	mg/kg	1	A-T-055s
Aro >C10-C12 _A	<1	<1	3	9	<1	<1	3	mg/kg	1	A-T-055s
Aro >C12-C16 _A	<1	1	8	84	3	<1	18	mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	1	2	13	89	13	1	70	mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	10	9	51	50	33	6	213	mg/kg	1	A-T-055s
Total Aromatics _A	12	12	75	232	49	7	305	mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	30	27	129	667	90	14	347	mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	mg/kg	0.01	A-T-022s

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/8	21/07316/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP03	CP04								
Depth to Top	0.80	1.50								
Depth To Bottom	0.90	1.60								
Date Sampled	30-Jun-21	01-Jul-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	6AB	6ADE								
% Stones >10mm _A	3.5	14.3						% w/w	0.1	A-T-044
pH _D ^{M#}	8.23	8.13						pH	0.01	A-T-031s
Sulphate (water sol 2:1) _D ^{M#}	0.05	0.06						g/l	0.01	A-T-026s
Cyanide (total) _A ^{M#}	<1	<1						mg/kg	1	A-T-042sTCN
Phenols - Total by HPLC _A	<0.2	<0.2						mg/kg	0.2	A-T-050s
Organic matter _D ^{M#}	5.6	4.6						% w/w	0.1	A-T-032 OM
Arsenic _D ^{M#}	8	9						mg/kg	1	A-T-024s
Boron (water soluble) _D	<1.0	<1.0						mg/kg	1	A-T-027s
Cadmium _D ^{M#}	1.1	1.1						mg/kg	0.5	A-T-024s
Copper _D ^{M#}	62	55						mg/kg	1	A-T-024s
Chromium _D ^{M#}	35	27						mg/kg	1	A-T-024s
Chromium (hexavalent) _D	<1	<1						mg/kg	1	A-T-040s
Lead _D ^{M#}	144	134						mg/kg	1	A-T-024s
Mercury _D	0.46	1.31						mg/kg	0.17	A-T-024s
Nickel _D ^{M#}	43	28						mg/kg	1	A-T-024s
Selenium _D ^{M#}	<1	<1						mg/kg	1	A-T-024s
Zinc _D ^{M#}	165	156						mg/kg	5	A-T-024s

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/8	21/07316/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP03	CP04								
Depth to Top	0.80	1.50								
Depth To Bottom	0.90	1.60								
Date Sampled	30-Jun-21	01-Jul-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	6AB	6ADE								
Asbestos in Soil (inc. matrix)										
Asbestos in soil [#]	NAD	NAD								A-T-045
Asbestos ACM - Suitable for Water Absorption Test? _D	N/A	N/A								A-T-045

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/8	21/07316/9						Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP03	CP04								
Depth to Top	0.80	1.50								
Depth To Bottom	0.90	1.60								
Date Sampled	30-Jun-21	01-Jul-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	6AB	6ADE								
PAH-16MS										
Acenaphthene _A ^{M#}	0.25	0.20						mg/kg	0.01	A-T-019s
Acenaphthylene _A ^{M#}	0.01	0.02						mg/kg	0.01	A-T-019s
Anthracene _A ^{M#}	0.38	0.30						mg/kg	0.02	A-T-019s
Benzo(a)anthracene _A ^{M#}	1.03	0.71						mg/kg	0.04	A-T-019s
Benzo(a)pyrene _A ^{M#}	0.82	0.61						mg/kg	0.04	A-T-019s
Benzo(b)fluoranthene _A ^{M#}	0.93	0.68						mg/kg	0.05	A-T-019s
Benzo(ghi)perylene _A ^{M#}	0.36	0.27						mg/kg	0.05	A-T-019s
Benzo(k)fluoranthene _A ^{M#}	0.32	0.24						mg/kg	0.07	A-T-019s
Chrysene _A ^{M#}	1.05	0.72						mg/kg	0.06	A-T-019s
Dibenzo(ah)anthracene _A ^{M#}	0.07	0.06						mg/kg	0.04	A-T-019s
Fluoranthene _A ^{M#}	2.45	1.66						mg/kg	0.08	A-T-019s
Fluorene _A ^{M#}	0.18	0.14						mg/kg	0.01	A-T-019s
Indeno(123-cd)pyrene _A ^{M#}	0.41	0.31						mg/kg	0.03	A-T-019s
Naphthalene _A ^{M#}	0.17	0.12						mg/kg	0.03	A-T-019s
Phenanthrene _A ^{M#}	1.53	1.17						mg/kg	0.03	A-T-019s
Pyrene _A ^{M#}	2.15	1.50						mg/kg	0.07	A-T-019s
Total PAH-16MS_A^{M#}	12.1	8.71						mg/kg	0.01	A-T-019s

Envirolab Job Number: 21/07316

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07316/8	21/07316/9								
Client Sample No										
Client Sample ID	CP03	CP04								
Depth to Top	0.80	1.50								
Depth To Bottom	0.90	1.60								
Date Sampled	30-Jun-21	01-Jul-21								
Sample Type	Soil - ES	Soil - ES								
Sample Matrix Code	6AB	6ADE								
TPH CWG										
Ali >C5-C6 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C6-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Ali >C8-C10 _A	<1	<1						mg/kg	1	A-T-055s
Ali >C10-C12 _A ^{M#}	1	<1						mg/kg	1	A-T-055s
Ali >C12-C16 _A ^{M#}	4	<1						mg/kg	1	A-T-055s
Ali >C16-C21 _A ^{M#}	5	2						mg/kg	1	A-T-055s
Ali >C21-C35 _A ^{M#}	19	28						mg/kg	1	A-T-055s
Total Aliphatics _A	29	31						mg/kg	1	A-T-055s
Aro >C5-C7 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C7-C8 _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
Aro >C8-C10 _A	1	<1						mg/kg	1	A-T-055s
Aro >C10-C12 _A	14	1						mg/kg	1	A-T-055s
Aro >C12-C16 _A	51	6						mg/kg	1	A-T-055s
Aro >C16-C21 _A ^{M#}	140	26						mg/kg	1	A-T-055s
Aro >C21-C35 _A ^{M#}	299	83						mg/kg	1	A-T-055s
Total Aromatics _A	505	117						mg/kg	1	A-T-055s
TPH (Ali & Aro >C5-C35) _A	534	148						mg/kg	1	A-T-055s
BTEX - Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Toluene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - Ethyl Benzene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - m & p Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
BTEX - o Xylene _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s
MTBE _A [#]	<0.01	<0.01						mg/kg	0.01	A-T-022s

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	21/07316
Project:	Manchester Sports Hub	Date Received:	05/07/2021 (am)
Clients Project No:	077652	Cool Box Temperatures (°C):	15.4

NO DEVIATIONS IDENTIFIED with respect to sampling dates or containers received.

Note: If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3 (for water samples $5 \pm 3^{\circ}\text{C}$), ISO 18400-120:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

End of Report

Appendix D – Geotechnical Analysis Results

Envirolab Geotechnical Analysis Results, Soils

- Final Test Report Ref. 21-07324 geotech

IFA Geotechnical Analysis Results, Soils

- Final Test Report Ref. 21-07324-1

DCP Test Results and Graphs, Soils

F.A.O.

Final Test Report - 2280626 / 1

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Originating Client: Envirolab

Originating Reference: 21/07324

Date Sampled: Not Given

Date Scheduled: 07/07/2021

Date Testing Started: 14/07/2021

Date Testing Finished: 28/07/2021

Previous Reports		Amendments	Date Issued

Amendments:

Authorised By:



Paul Cathcart
Laboratory Manager

Report Issue Date: 28/07/2021

Page: 2



Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 3

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP01	3.00	U	Brown slightly sandy CLAY

Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		208.39		
Diameter (mm)		102.94		
Moisture Content (%)		17.1		
Bulk Density (Mg/m ³)		2.14		
Dry Density (Mg/m ³)		1.83		
Membrane Thickness (mm)		0.2		
Membrane Type		Latex		
Rate of Strain (%/min)		1.44		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	30	60	120
	Axial Strain (%)	5	7	12
	Membrane Corr. (kPa)	0.3	0.3	0.5
	Deviator Stress ($\sigma_1 - \sigma_3$)f (kPa)	360	428	507
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)$ f (kPa)	180	214	254
	Mode of Failure	Plastic		

$\phi_u = 0$

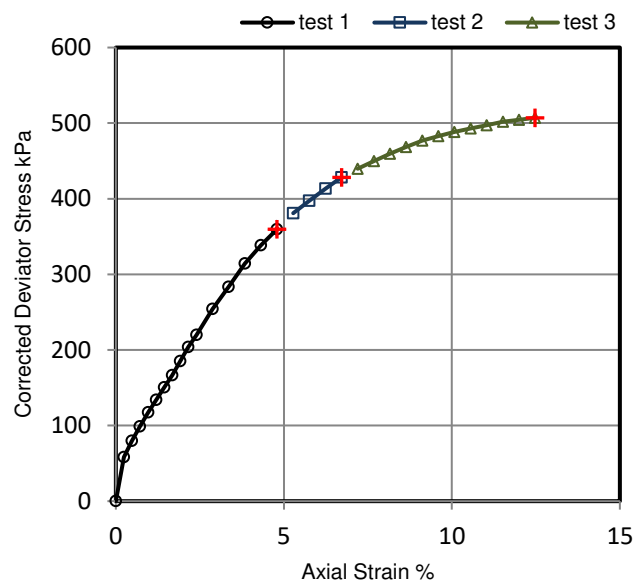
Average c_u 216 kPa

Linear Regression

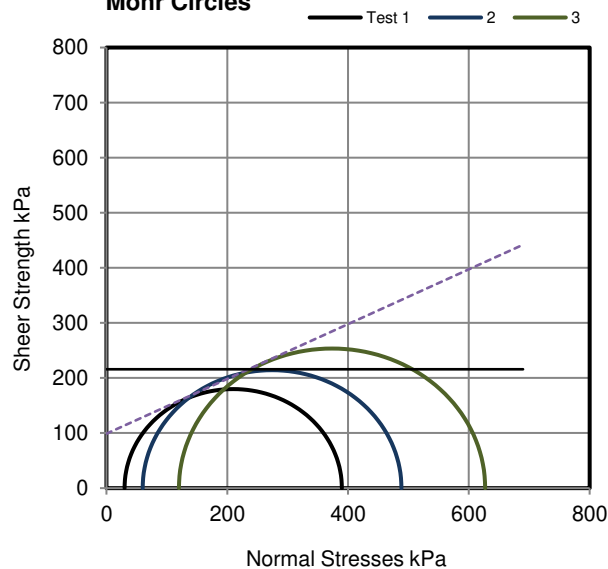
ϕ_u 26.4 °

c_u 99 kPa

Deviator Stress v Axial Strain



Mohr Circles



Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



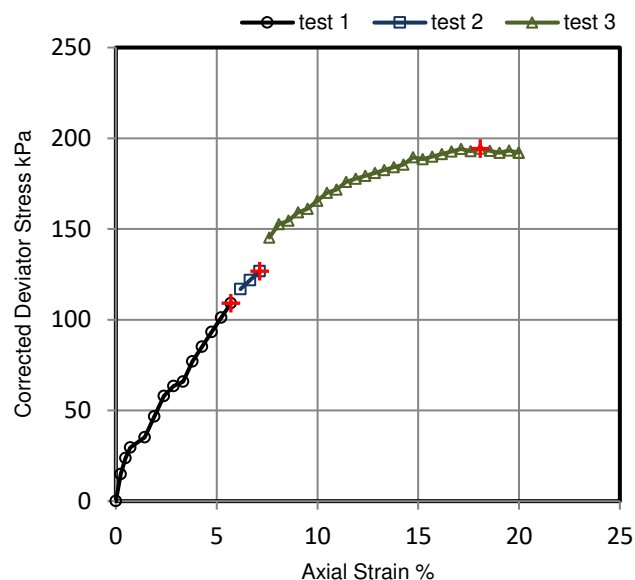
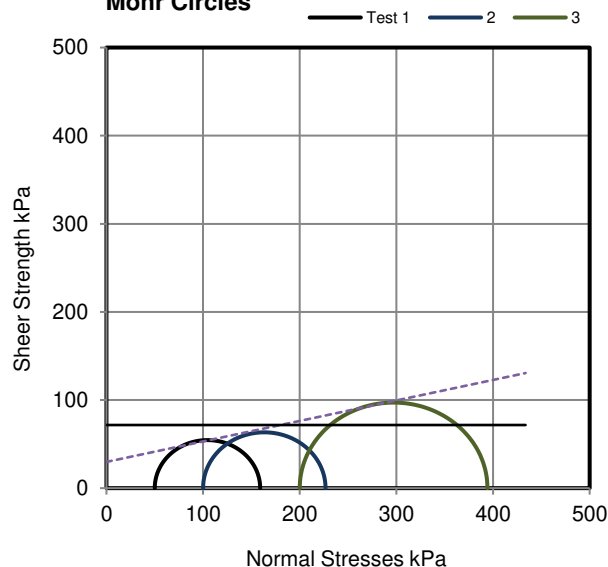
**Site:** Manchester Rugby Sports Hub**Job Number:** 2280626**Client:** Envirolab**Page:** 4**Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test**

Borehole / Trial Pit	Depth (m)	Sample	Description
CP01	5.00	U	Brown slightly sandy CLAY

Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		210.24		
Diameter (mm)		102.56		
Moisture Content (%)		16.8		
Bulk Density (Mg/m ³)		2.11		
Dry Density (Mg/m ³)		1.81		
Membrane Thickness (mm)		0.2		
Membrane Type		Latex		
Rate of Strain (%/min)		1.43		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	50	100	200
	Axial Strain (%)	6	7	18
	Membrane Corr. (kPa)	0.3	0.3	0.7
	Deviator Stress ($\sigma_1 - \sigma_3$)f (kPa)	109	127	194
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)f$ (kPa)	55	63	97
	Mode of Failure	Plastic		

 $\phi_u = 0$ Average c_u 72 kPa

Linear Regression

 ϕ_u 13.1 ° c_u 30 kPa**Deviator Stress v Axial Strain****Mohr Circles**

Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 5

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP01	9.00	U	Brown slightly sandy CLAY

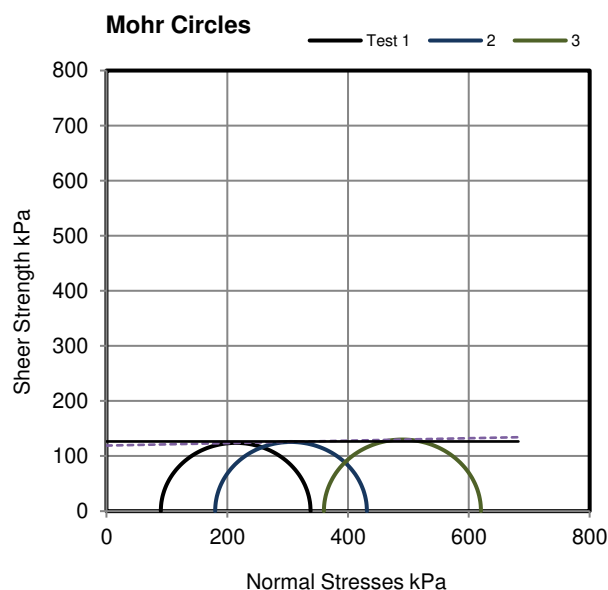
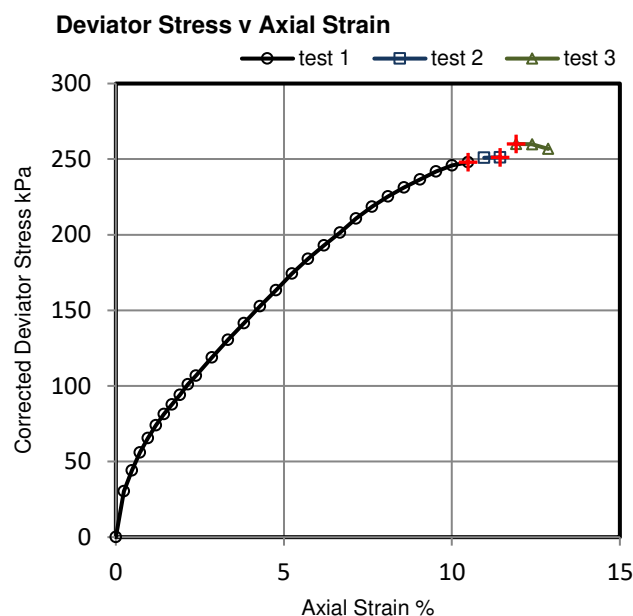
Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		209.81		
Diameter (mm)		103.13		
Moisture Content (%)		13.7		
Bulk Density (Mg/m ³)		2.03		
Dry Density (Mg/m ³)		1.79		
Membrane Thickness (mm)		0.3		
Membrane Type		Latex		
Rate of Strain (%/min)		1.91		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	90	180	360
	Axial Strain (%)	10	11	12
	Membrane Corr. (kPa)	0.7	0.7	0.7
	Deviator Stress ($\sigma_1 - \sigma_3$)f (kPa)	248	251	260
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)f$ (kPa)	124	126	130
	Mode of Failure	Compound		

 $\phi_u = 0$

Average c_u 127 kPa

Linear Regression

 ϕ_u 1.3 °

 c_u 119 kPa


Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 6

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP02	4.00	U	Brown slightly sandy, slightly silty CLAY

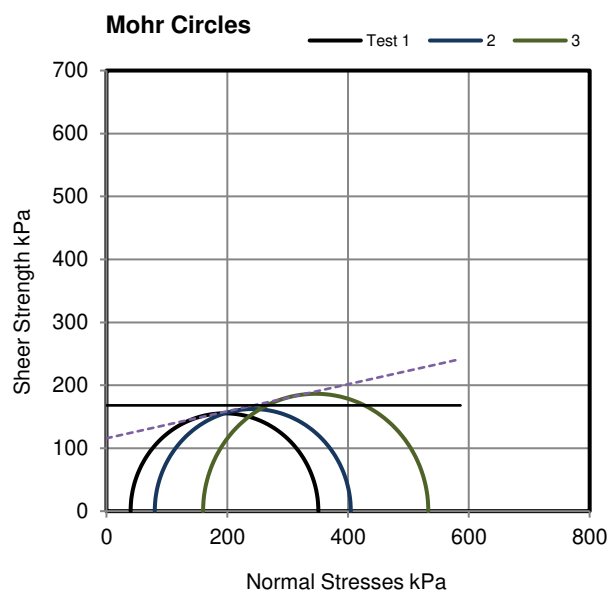
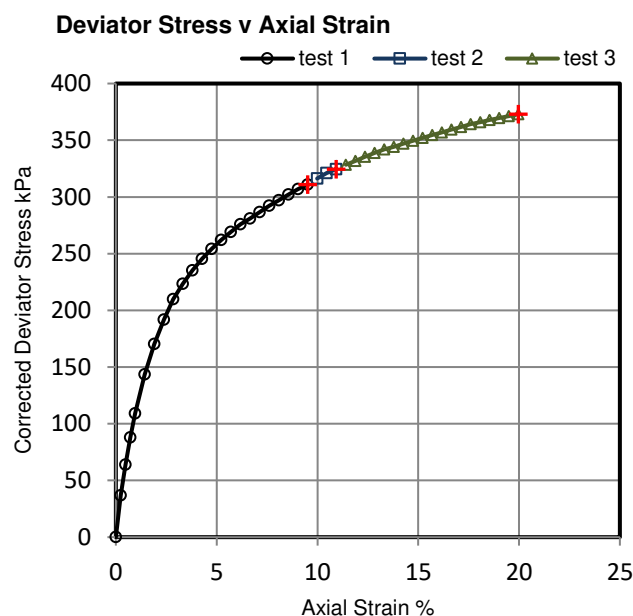
Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	80		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		210.33		
Diameter (mm)		102.70		
Moisture Content (%)		17.7		
Bulk Density (Mg/m ³)		2.09		
Dry Density (Mg/m ³)		1.78		
Membrane Thickness (mm)		0.35		
Membrane Type		Latex		
Rate of Strain (%/min)		1.90		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	40	80	160
	Axial Strain (%)	10	11	20
	Membrane Corr. (kPa)	0.7	0.8	1.3
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	311	325	373
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	155	162	186
	Mode of Failure	Plastic		

 $\phi_u = 0$

Average c_u 168 kPa

Linear Regression

 ϕ_u 12.1 °

 c_u 116 kPa


Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 7

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP02	6.50	U	Brown slightly gravelly, slightly sandy, slightly silty CLAY

Initial Sample	Original Length (mm)	400		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		209.06		
Diameter (mm)		102.43		
Moisture Content (%)		11.7		
Bulk Density (Mg/m ³)		1.79		
Dry Density (Mg/m ³)		1.61		
Membrane Thickness (mm)		0.35		
Membrane Type		Latex		
Rate of Strain (%/min)		1.91		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	65	130	260
	Axial Strain (%)	15	16	20
	Membrane Corr. (kPa)	1.0	1.1	1.3
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	443	455	487
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	221	227	244
	Mode of Failure	Plastic		

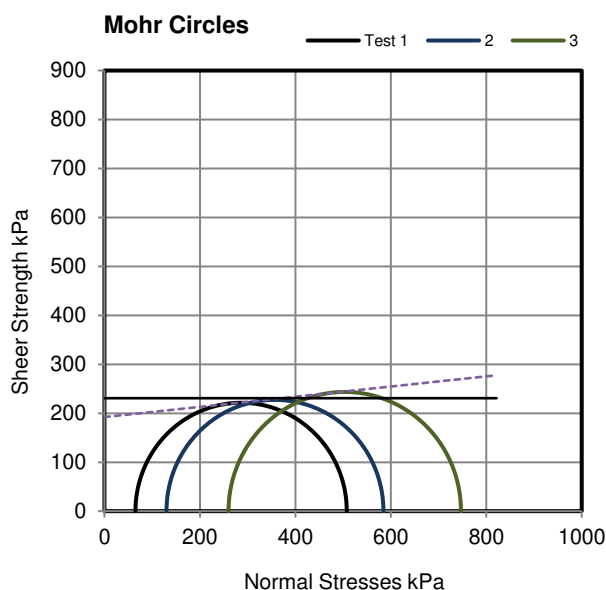
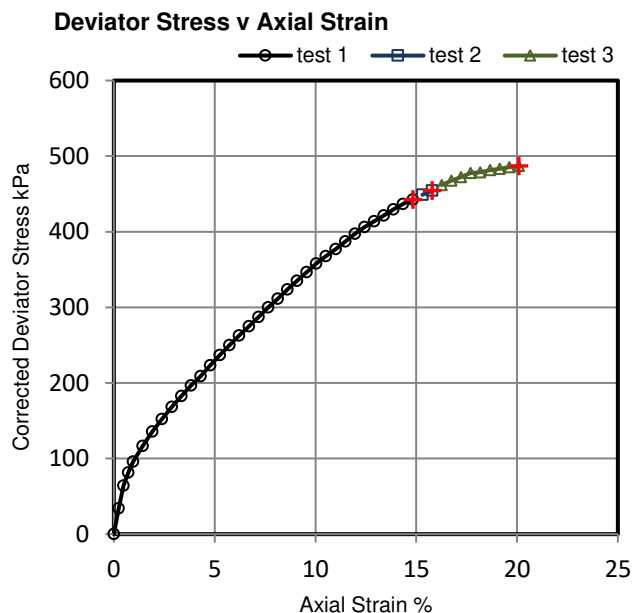
$\phi_u = 0$

Average c_u 231 kPa

Linear Regression

ϕ_u 5.9 °

c_u 192 kPa



Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 8

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP02	8.00	U	Brown slightly gravelly, slightly sandy, slightly silty CLAY

Initial Sample	Original Length (mm)	390		
	Depth from Top (mm)	25		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		209.52		
Diameter (mm)		103.19		
Moisture Content (%)		15.1		
Bulk Density (Mg/m ³)		2.13		
Dry Density (Mg/m ³)		1.85		
Membrane Thickness (mm)		0.37		
Membrane Type		Latex		
Rate of Strain (%/min)		1.91		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	80	160	320
	Axial Strain (%)	14	15	20
	Membrane Corr. (kPa)	1.0	1.1	1.4
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	251	262	284
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	126	131	142
	Mode of Failure	Plastic		

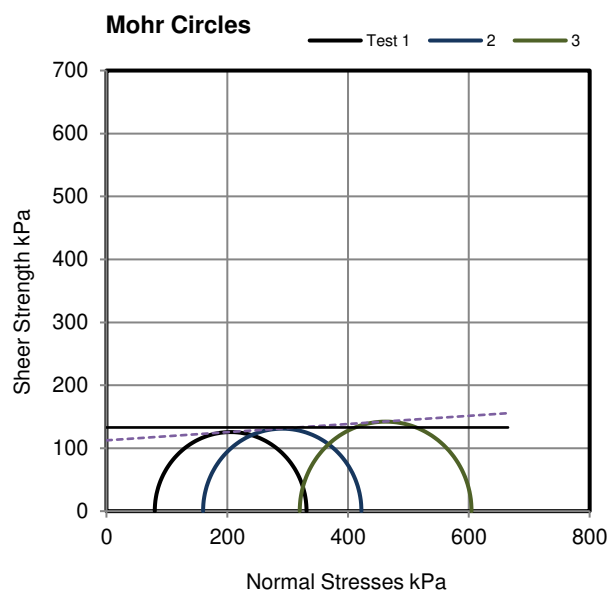
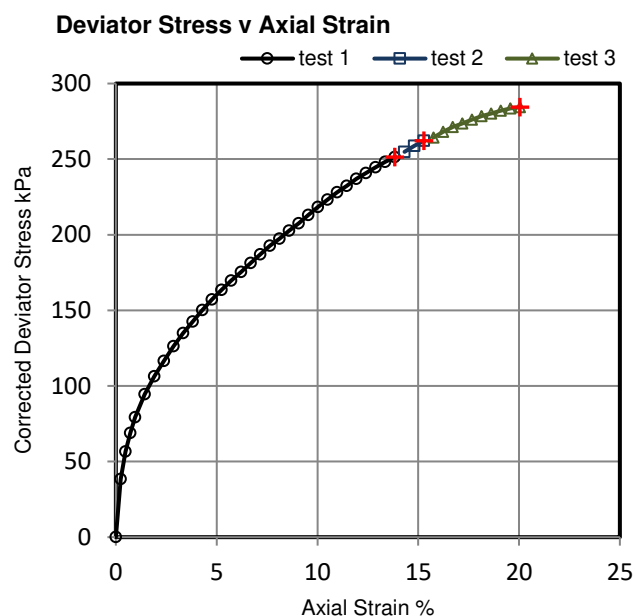
$\phi_u = 0$

Average c_u 133 kPa

Linear Regression

ϕ_u 3.7 °

c_u 113 kPa



Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 9

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP03	4.00	U	Brown slightly sandy, slightly silty, CLAY

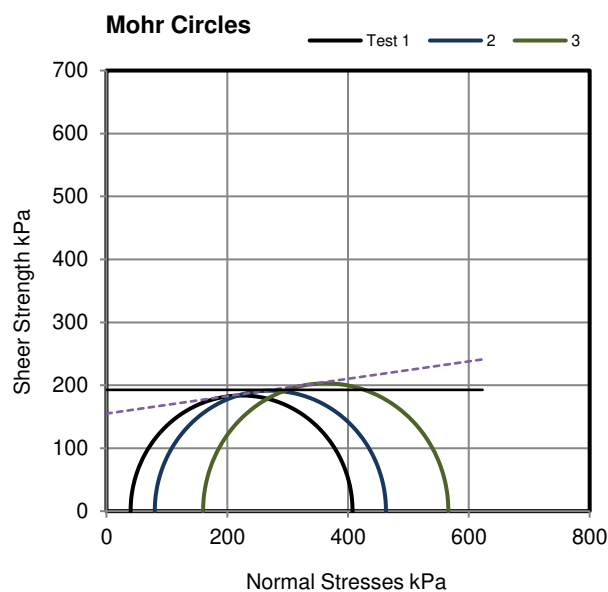
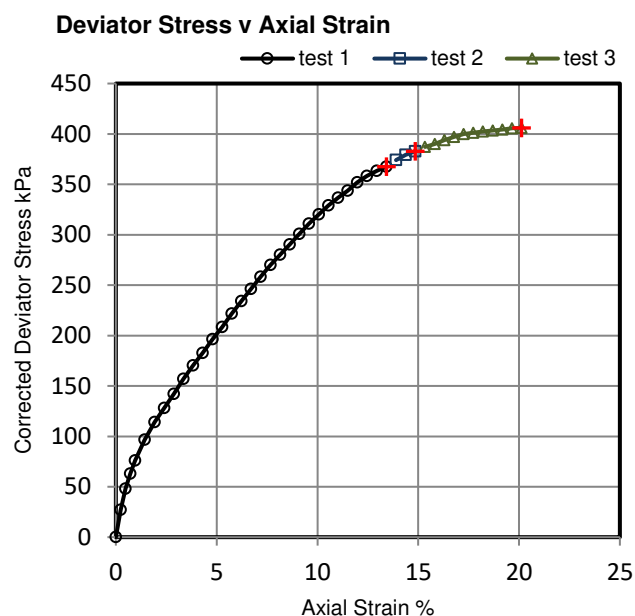
Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	100		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		208.69		
Diameter (mm)		103.72		
Moisture Content (%)		16.8		
Bulk Density (Mg/m ³)		2.09		
Dry Density (Mg/m ³)		1.79		
Membrane Thickness (mm)		0.35		
Membrane Type		Latex		
Rate of Strain (%/min)		1.92		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	40	80	160
	Axial Strain (%)	13	15	20
	Membrane Corr. (kPa)	0.9	1.0	1.3
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	367	383	406
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	184	191	203
	Mode of Failure	Plastic		

 $\phi_u = 0$

Average c_u 193 kPa

Linear Regression

 ϕ_u 7.9 °

 c_u 155 kPa


Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 10

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP03	6.50	U	Brown slightly sandy, slightly silty CLAY

Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		209.24		
Diameter (mm)		104.50		
Moisture Content (%)		13.9		
Bulk Density (Mg/m ³)		2.10		
Dry Density (Mg/m ³)		1.85		
Membrane Thickness (mm)		0.34		
Membrane Type		Latex		
Rate of Strain (%/min)		1.91		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	60	120	240
	Axial Strain (%)	13	16	20
	Membrane Corr. (kPa)	0.9	1.0	1.3
	Deviator Stress ($\sigma_1 - \sigma_3$)f (kPa)	207	224	249
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)f$ (kPa)	104	112	124
	Mode of Failure	Plastic		

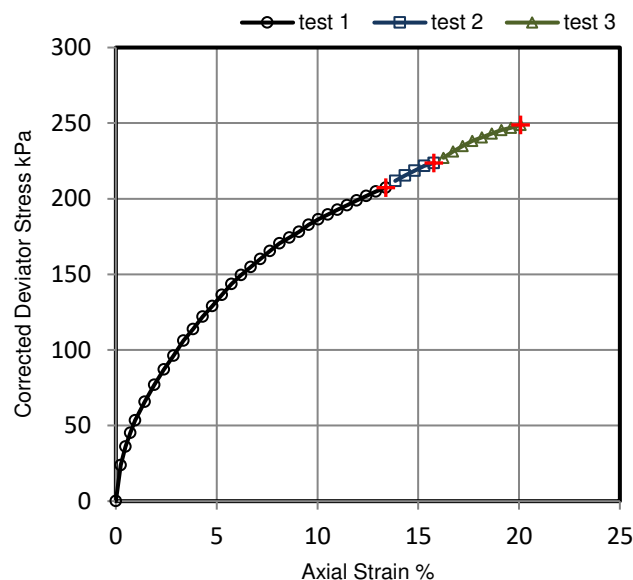
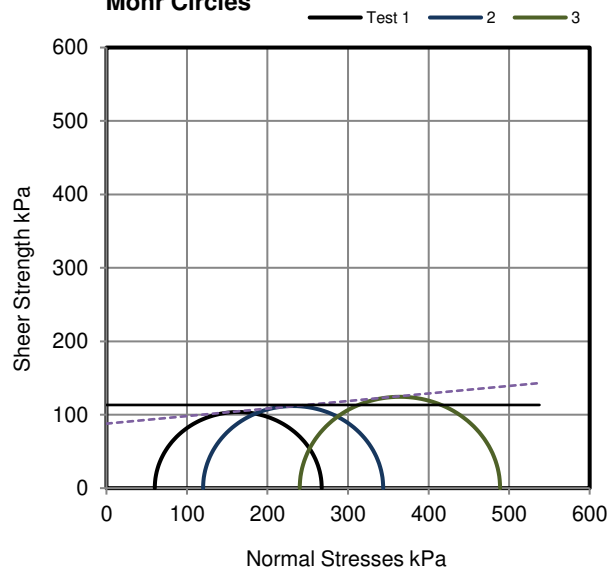
 $\phi_u = 0$

Average c_u 113 kPa

Linear Regression

 ϕ_u 5.9 °

 c_u 88 kPa

Deviator Stress v Axial Strain

Mohr Circles


Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 11

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP03	8.00	U	Brown slightly sandy, slightly silty CLAY

Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		206.85		
Diameter (mm)		103.16		
Moisture Content (%)		20.1		
Bulk Density (Mg/m ³)		2.11		
Dry Density (Mg/m ³)		1.76		
Membrane Thickness (mm)		0.38		
Membrane Type		Latex		
Rate of Strain (%/min)		1.93		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	80	160	320
	Axial Strain (%)	13	14	20
	Membrane Corr. (kPa)	1.0	1.0	1.4
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	230	238	271
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	115	119	135
	Mode of Failure	Plastic		

$\phi_u = 0$

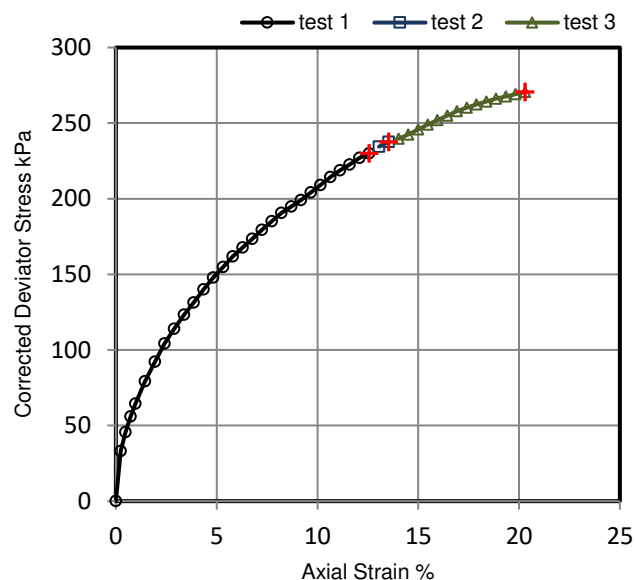
Average c_u 123 kPa

Linear Regression

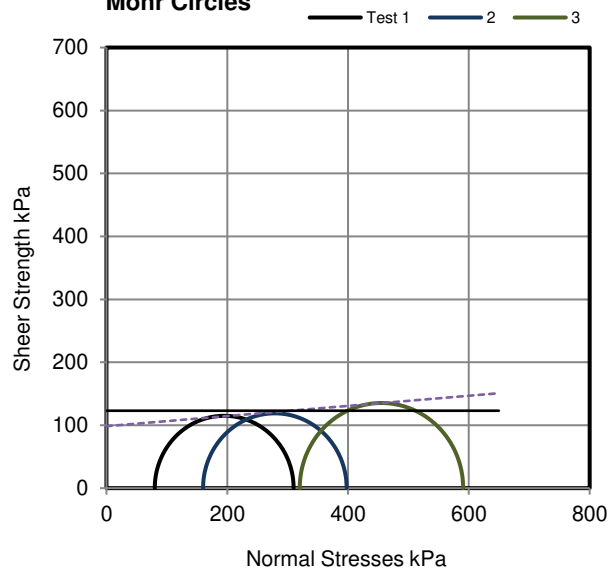
ϕ_u 4.6 °

c_u 98 kPa

Deviator Stress v Axial Strain



Mohr Circles



Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 12

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP04	5.00	U	Brown slightly gravelly, slightly sandy, slightly silty CLAY

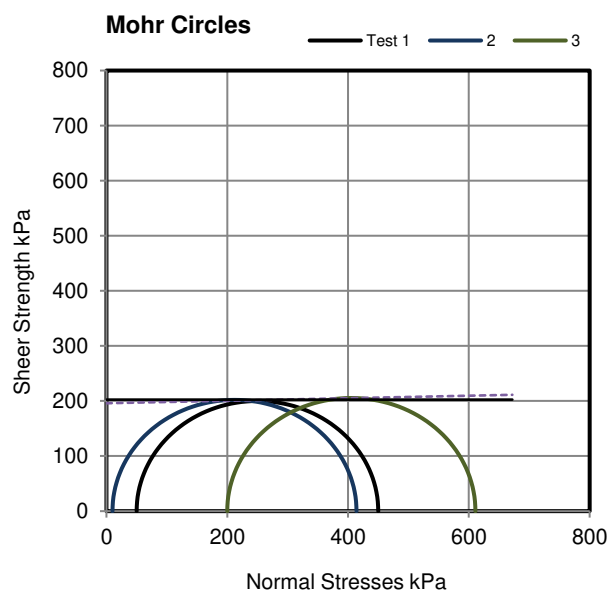
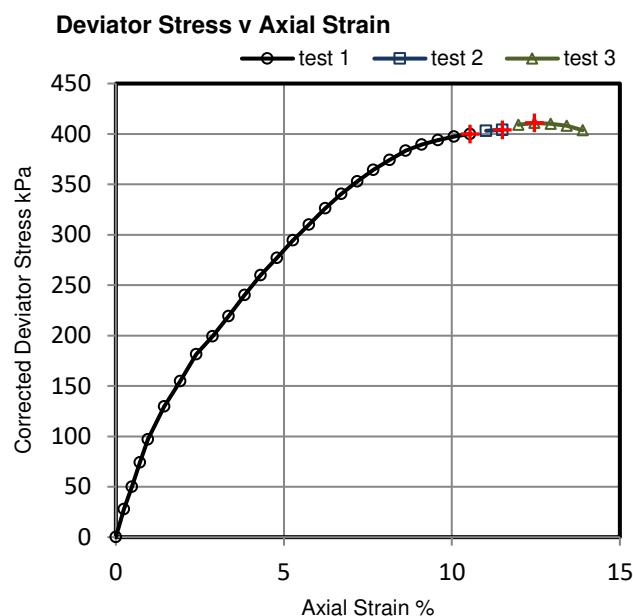
Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	50		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		208.71		
Diameter (mm)		101.64		
Moisture Content (%)		16.7		
Bulk Density (Mg/m ³)		2.19		
Dry Density (Mg/m ³)		1.87		
Membrane Thickness (mm)		0.36		
Membrane Type		Latex		
Rate of Strain (%/min)		1.92		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	50	10	200
	Axial Strain (%)	11	11	12
	Membrane Corr. (kPa)	0.8	0.9	0.9
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	400	404	411
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	200	202	205
	Mode of Failure	Plastic		

 $\phi_u = 0$

Average c_u 202 kPa

Linear Regression

 ϕ_u 1.3 °

 c_u 196 kPa


Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



Site: Manchester Rugby Sports Hub

Job Number: 2280626

Client: Envirolab

Page: 13

Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - Multistage test

Borehole / Trial Pit	Depth (m)	Sample	Description
CP04	9.00	U	Brown slightly gravelly, slightly sandy, slightly silty CLAY

Initial Sample	Original Length (mm)	450		
	Depth from Top (mm)	10		
	Condition	Undisturbed		
	Orientation	Vertical		
Length (mm)		209.41		
Diameter (mm)		104.23		
Moisture Content (%)		13.1		
Bulk Density (Mg/m ³)		2.17		
Dry Density (Mg/m ³)		1.92		
Membrane Thickness (mm)		0.34		
Membrane Type		Latex		
Rate of Strain (%/min)		1.91		
Test Results	Stage Number	1	2	3
	Cell Pressure (kPa)	90	180	360
	Axial Strain (%)	13	14	19
	Membrane Corr. (kPa)	0.9	0.9	1.2
	Deviator Stress ($\sigma_1 - \sigma_3$) _f (kPa)	467	480	525
	Undrained Shear Strength, $c_u = \frac{1}{2}(\sigma_1 - \sigma_3)_f$ (kPa)	234	240	262
	Mode of Failure	Plastic		

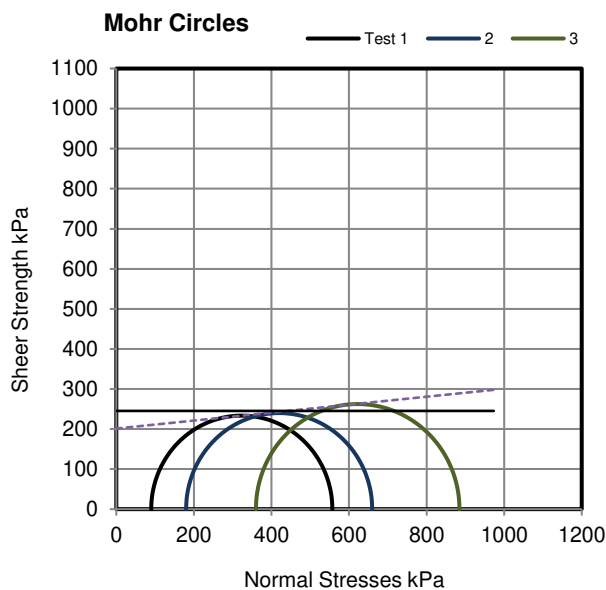
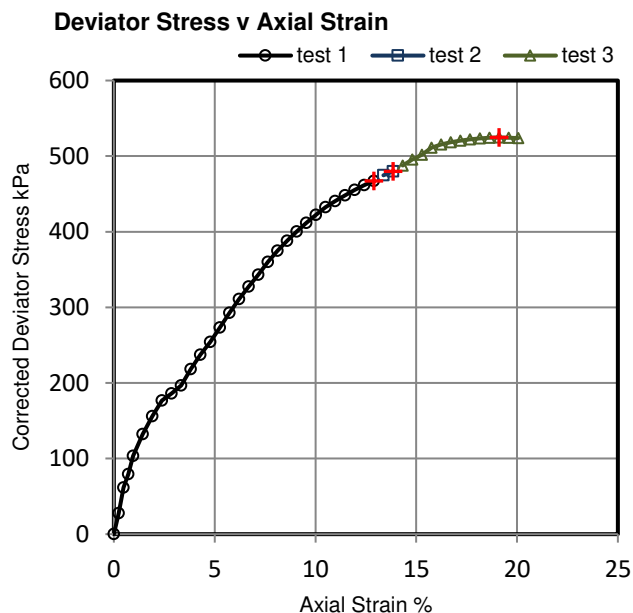
$\phi_u = 0$

Average c_u 245 kPa

Linear Regression

ϕ_u 5.7 °

c_u 201 kPa



Mohr circles and their interpretation is not covered by BS1377. These are provided for information only.

Method of Preparation: BS 1377:PT1:1990:8.3 Preparation of undisturbed samples for testing or
BS 1377:PT1:1990:7.7.5.2 Preparation of disturbed samples for testing

Method of Test: BS 1377:PT2:1990:7.2 Determination of density by linear measurement.
BS 1377:PT7:1990:9.4 Determination of undrained shear strength in triaxial compression with
multistage loading and without measurement of pore pressure (Definitive method)

Result reported relates only to the sample tested.



Final Test Report - 2280626 / 1

Site: Manchester Rugby Sports Hub

Job Number: 2280626

Originating Client: Envirolab

All opinions and interpretations contained within this report are outside of our Scope of Accreditation.

This test report shall not be reproduced, except in full and only with the written permission of Ian Farmer Associates Ltd.

Samples will be retained for 28 days from date of issue of the final test report before being disposed of, unless we receive written instruction to the contrary.

Report Issue Date: 28/07/2021

FINAL ANALYTICAL TEST REPORT

Envirolab Job Number: 21/07324
Issue Number: 1

Date: 29 July, 2021

Client: Curtins Consulting (Manchester)
Merchant Exchange
17-19 Whitworth Street
Manchester
UK
M1 5WG

Project Manager: Matthew Holroyd/Tommy Walker
Project Name: Manchester Sports Hub
Project Ref: 077652
Order No: EBMA2956
Date Samples Received: 03/07/21
Date Instructions Received: 05/07/21
Date Analysis Completed: 29/07/21

Prepared by:


Melanie Marshall
Laboratory Coordinator

Approved by:


Richard Wong
Client Manager

Envirolab Job Number: 21/07324

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07324/1	21/07324/2	21/07324/3	21/07324/4	21/07324/5	21/07324/6	21/07324/7	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP01	CP01	CP01	CP02	CP02	CP02	CP03			
Depth to Top	3.00	5.00	9.00	4.00	6.50	8.00	4.00			
Depth To Bottom	3.45	5.45	9.45	4.45	6.95	8.45	4.45			
Date Sampled	28-Jun-21	28-Jun-21	28-Jun-21	29-Jun-21	29-Jun-21	29-Jun-21	30-Jun-21			
Sample Type	Soil - U	Soil - U	Soil - U	Soil - U	Soil - U	Soil - U	Soil - U			
Sample Matrix Code										
Multistage Shear Strength in triaxial cell without measurement of pore pressure (1x 100mm diameter s _A)	Appended	Appended	Appended	Appended	Appended	Appended	Appended			Subcon IFA

Envirolab Job Number: 21/07324

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07324/8	21/07324/9	21/07324/10	21/07324/11	21/07324/12	21/07324/13	21/07324/14	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP03	CP03	CP04	CP04	CP02	CP04	CP01			
Depth to Top	6.50	8.00	5.00	9.00	1.20	2.00	3.50			
Depth To Bottom	6.95	8.45	5.45	9.45	1.65	2.45				
Date Sampled	30-Jun-21	30-Jun-21	01-Jul-21	01-Jul-21	29-Jun-21	01-Jul-21	28-Jun-21			
Sample Type	Soil - U	Soil - U	Soil - U	Soil - U	Soil - D	Soil - D	Soil - D			
Sample Matrix Code					3B	3A	3			
% Stones >10mm _A	-	-	-	-	<0.1	<0.1	<0.1	% w/w	0.1	A-T-044
pH BRE _D ^{M#}	-	-	-	-	8.35	8.40	8.48	pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	-	-	-	-	69	31	<10	mg/l	10	A-T-026s
Multistage Shear Strength in triaxial cell without measurement of pore pressure (1x 100mm diameter s _A	Appended	Appended	Appended	Appended	-	-	-			Subcon IFA

Envirolab Job Number: 21/07324

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07324/15	21/07324/16	21/07324/17	21/07324/18	21/07324/19	21/07324/20	21/07324/21	Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP04	CP01	CP02	CP03	CP01	CP03	WS02			
Depth to Top	4.00	5.50	7.00	8.50	10.00	2.00	2.50			
Depth To Bottom	4.45				10.45	2.45				
Date Sampled	01-Jul-21	28-Jun-21	29-Jun-21	30-Jun-21	28-Jun-21	30-Jun-21	30-Jun-21			
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D			
Sample Matrix Code	3A	3	5	5	3A					
% Stones >10mm _A	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	% w/w	0.1	A-T-044
pH BRE _D ^{M#}	8.54	8.36	8.44	8.59	8.44	-	-	pH	0.01	A-T-031s
Sulphate BRE (water sol 2:1) _D ^{M#}	16	16	35	19	30	-	-	mg/l	10	A-T-026s
4 point Liquid & Plastic Limit by Cone Penetrometer _A [#]	-	-	-	-	-	Appended	Appended			Subcon IFA
Moisture Content of Soil (Oven Dried Method) _A [#]	-	-	-	-	-	Appended	Appended			Subcon IFA

Envirolab Job Number: 21/07324

Client Project Name: Manchester Sports Hub

Client Project Ref: 077652

Lab Sample ID	21/07324/22	21/07324/23	21/07324/24	21/07324/25	21/07324/26	21/07324/27		Units	Limit of Detection	Method ref
Client Sample No										
Client Sample ID	CP02	CP02	CP04	CP03	CP02	CP02				
Depth to Top	3.00	4.50	5.50	7.00	8.50	9.50				
Depth To Bottom	3.45					9.95				
Date Sampled	29-Jun-21	29-Jun-21	01-Jul-21	30-Jun-21	29-Jun-21	29-Jun-21				
Sample Type	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D	Soil - D				
Sample Matrix Code										
4 point Liquid & Plastic Limit by Cone Penetrometer _A [#]	Appended	Appended	Appended	Appended	Appended	Appended				Subcon IFA
Moisture Content of Soil (Oven Dried Method) _A [#]	Appended	Appended	Appended	Appended	Appended	Appended				Subcon IFA

REPORT NOTES

General

This report shall not be reproduced, except in full, without written approval from Envirolab.

The results reported herein relate only to the material supplied to the laboratory.

The residue of any samples contained within this report, and any received with the same delivery, will be disposed of six weeks after initial scheduling. For samples tested for Asbestos we will retain a portion of the dried sample for a minimum of six months after the initial Asbestos testing is completed.

Analytical results reflect the quality of the sample at the time of analysis only.

Opinions and interpretations expressed are outside the scope of our accreditation.

If results are in italic font they are associated with an AQC failure, these are not accredited and are unreliable.

A deviating samples report is appended and will indicate if samples or tests have been found to be deviating. Any test results affected may not be an accurate record of the concentration at the time of sampling and, as a result, may be invalid.

The Client Sample No, Client Sample ID, Depth to Top, Depth to Bottom and Date Sampled were all provided by the client.

Soil chemical analysis:

All results are reported as dry weight (<40°C).

For samples with Matrix Codes 1 - 6 natural stones, brick and concrete fragments >10mm and any extraneous material (visible glass, metal or twigs) are removed and excluded from the sample prior to analysis and reported results corrected to a whole sample basis. This is reported as '% stones >10mm'.

For samples with Matrix Code 7 the whole sample is dried and crushed prior to analysis and this supersedes any "A" subscripts.

All analysis is performed on the sample as received for soil samples which are positive for asbestos or the client has informed asbestos may be present and/or if they are from outside the European Union and this supersedes any "D" subscripts.

TPH analysis of water by method A-T-007:

Free and visible oils are excluded from the sample used for analysis so that the reported result represents the dissolved phase only.

Electrical Conductivity of water by Method A-T-037:

Results greater than 12900µS/cm @ 25°C / 11550µS/cm @ 20°C fall outside the calibration range and as such are unaccredited.

Asbestos:

Asbestos in soil analysis is performed on a dried aliquot of the submitted sample and cannot guarantee to identify asbestos if only present in small numbers as discrete fibres/fragments in the original sample.

Stones etc. are not removed from the sample prior to analysis.

Quantification of asbestos is a 3 stage process including visual identification, hand picking and weighing and fibre counting by sedimentation/phase contrast optical microscopy if required. If asbestos is identified as being present but is not in a form that is suitable for analysis by hand picking and weighing (normally if the asbestos is present as free fibres) quantification by sedimentation is performed. Where ACMs are found a percentage asbestos is assigned to each with reference to 'HSG264, Asbestos: The survey guide' and the calculated asbestos content is expressed as a percentage of the dried soil sample aliquot used.

Predominant Matrix Codes:

1 = SAND, 2 = LOAM, 3 = CLAY, 4 = LOAM/SAND, 5 = SAND/CLAY, 6 = CLAY/LOAM, 7 = OTHER, 8 = Asbestos bulk ID sample.

Samples with Matrix Code 7 & 8 are not predominantly a SAND/LOAM/CLAY mix and are not covered by our BSEN 17025 or MCERTS accreditations, with the exception of bulk asbestos which are BSEN 17025 accredited.

Secondary Matrix Codes:

A = contains stones, B = contains construction rubble, C = contains visible hydrocarbons, D = contains glass/metal,

E = contains roots/twigs.

Key:

IS indicates Insufficient Sample for analysis.

US indicates Unsuitable Sample for analysis.

NDP indicates No Determination Possible.

NAD indicates No Asbestos Detected.

N/A indicates Not Applicable.

Superscript # indicates method accredited to ISO 17025.

Superscript "M" indicates method accredited to MCERTS.

Subscript "A" indicates analysis performed on the sample as received.

Subscript "D" indicates analysis performed on the dried sample, crushed to pass a 2mm sieve

Please contact us if you need any further information.

Envirolab Deviating Samples Report

Units 7&8 Sandpits Business Park, Mottram Road, Hyde, SK14 3AR
Tel. 0161 368 4921 email. ask@envlab.co.uk

Client:	Curtins Consulting (Manchester), Merchant Exchange, 17-19 Whitworth Street , Manchester, UK, M1 5WG	Project No:	21/07324
Project:	Manchester Sports Hub	Date Received:	05/07/2021 (am)
Clients Project No:	077652	Cool Box Temperatures (°C):	15.0

NO DEVIATIONS IDENTIFIED with respect to sampling dates or containers received.

Note: If, at any point before reaching the laboratory, the temperature of the samples has breached those set in published standards, e.g. BS-EN 5667-3 (for water samples $5 \pm 3^{\circ}\text{C}$), ISO 18400-120:2017, then the concentration of any affected analytes may differ from that at the time of sampling.

Envirolab Analysis Dates

Lab Sample ID	21/07324/1	21/07324/2	21/07324/3	21/07324/4	21/07324/5	21/07324/6	21/07324/7	21/07324/8	21/07324/9	21/07324/10	21/07324/11	21/07324/12
Client Sample No												
Client Sample ID/Depth	CP01 3.00-3.45m	CP01 5.00-5.45m	CP01 9.00-9.45m	CP02 4.00-4.45m	CP02 6.50-6.95m	CP02 8.00-8.45m	CP03 4.00-4.45m	CP03 6.50-6.95m	CP03 8.00-8.45m	CP04 5.00-5.45m	CP04 9.00-9.45m	CP02 1.20-1.65m
Date Sampled	28/06/21	28/06/21	28/06/21	29/06/21	29/06/21	29/06/21	30/06/21	30/06/21	30/06/21	01/07/21	01/07/21	29/06/21
A-T-026s												09/07/2021
A-T-031s												08/07/2021
A-T-044												08/07/2021

Lab Sample ID	21/07324/13	21/07324/14	21/07324/15	21/07324/16	21/07324/17	21/07324/18	21/07324/19	21/07324/20	21/07324/21	21/07324/22	21/07324/23	21/07324/24
Client Sample No												
Client Sample ID/Depth	CP04 2.00-2.45m	CP01 3.50m	CP04 4.00-4.45m	CP01 5.50m	CP02 7.00m	CP03 8.50m	CP01 10.00-10.45m	CP03 2.00-2.45m	WS02 2.50m	CP02 3.00-3.45m	CP02 4.50m	CP04 5.50m
Date Sampled	01/07/21	28/06/21	01/07/21	28/06/21	29/06/21	30/06/21	28/06/21	30/06/21	30/06/21	29/06/21	29/06/21	01/07/21
A-T-026s	09/07/2021	09/07/2021	09/07/2021	09/07/2021	09/07/2021	09/07/2021	09/07/2021					
A-T-031s	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021					
A-T-044	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021	08/07/2021					

Lab Sample ID	21/07324/25	21/07324/26	21/07324/27
Client Sample No			
Client Sample ID/Depth	CP03 7.00m	CP02 8.50m	CP02 9.50-9.95m
Date Sampled	30/06/21	29/06/21	29/06/21
A-T-026s			
A-T-031s			
A-T-044			

The above dates are the analysis completion dates, please note that these are not necessarily the date that the analysis was weighed/extracted.

End of Report

Obstruction encountered at 0.704m bgl. TRL01 stopped at 0.704m bgl.

TRL01

Depth (m)	Blow Count
0.05	0
0.10	1
0.15	2
0.20	3
0.25	4
0.30	5
0.35	6
0.40	7
0.45	8
0.50	9
0.55	10
0.60	11
0.65	12
0.70	13
0.75	14
0.80	15
0.85	16
0.90	17
0.95	18
1.00	19
1.05	20
1.10	21
1.15	22
1.20	23
1.25	24
1.30	25
1.35	26
1.40	27
1.45	28
1.50	29
1.55	30
1.60	31
1.65	32
1.70	32
1.75	32
1.80	32
1.85	32
1.90	32
1.95	32
2.00	32

Depth (m)	Estimated CBR1 (%)	Estimated CBR2 (%)
0.1	12.5	14.5
0.2	11.5	13.5
0.3	12.5	14.5
0.4	11.5	13.5
0.5	10.5	12.5
0.6	4.5	4.5
0.7	0.5	0.5

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.

Date of Test:	01-Jul-21
Operator:	TW/MH
Soil type:	Made Ground
Soil condition:	Unsaturated

TRL02

Depth (m)	Blow Count
0.0	0
0.05	2
0.1	5
0.15	8
0.2	12
0.25	15
0.3	18
0.35	22
0.4	25
0.45	28
0.5	32
0.55	35
0.6	38
0.65	42
0.7	45
0.75	48
0.8	52
0.85	55
0.9	58
0.95	62
1.0	65

Depth (m)	Estimated CBR1 (%)	Estimated CBR2 (%)
0.1	10.0	10.0
0.2	12.0	12.0
0.3	25.0	28.0
0.4	15.0	18.0
0.5	12.0	15.0
0.6	10.0	12.0
0.7	12.0	15.0
0.8	10.0	12.0
0.9	8.0	10.0
1.0	10.0	12.0

October 2020

APPENDIX X - RESULTS OF DYNAMIC CONE PENETROMETER (DCP) TESTING



Project:	Manchester Sports Hub	
Project No.	B077652	
Test No.	TRL03	

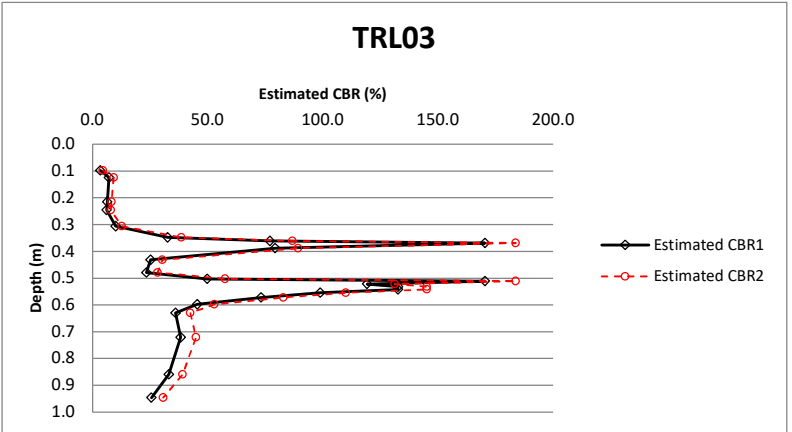
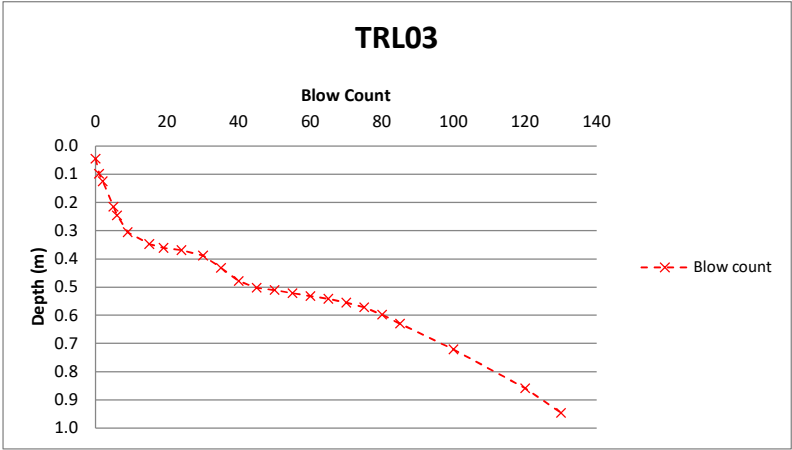
Date of Test:	01-Jul-21
Operator:	TW/MH
Soil type:	Made Ground
Soil condition:	Unsaturated

Blow count	Penetration (mm)	Penetration (m)	Penetration Index (DPI) mm/blow	log DPI	log CBR	Estimated CBR1 (%) ¹	log CBR	Estimated CBR2 (%) ²
0	45	0.045						
1	98	0.098	53.0	1.724	0.529	3.4	0.657	5
2	125	0.125	27.0	1.431	0.857	7	0.967	9
5	215	0.215	30.0	1.477	0.806	6	0.919	8
6	246	0.246	31.0	1.491	0.790	6	0.904	8
9	306	0.306	20.0	1.301	1.003	10	1.105	13
15	348	0.348	7.0	0.845	1.513	33	1.587	39
19	361	0.361	3.3	0.512	1.887	77	1.939	87
24	369	0.369	1.6	0.204	2.231	170	2.264	184
30	388	0.388	3.2	0.501	1.899	79	1.951	89
35	432	0.432	8.8	0.944	1.402	25	1.482	30
40	479	0.479	9.4	0.973	1.370	23	1.451	28
45	503	0.503	4.8	0.681	1.697	50	1.760	58
50	511	0.511	1.6	0.204	2.231	170	2.264	184
55	522	0.522	2.2	0.342	2.076	119	2.118	131
60	532	0.532	2.0	0.301	2.123	133	2.162	145
65	542	0.542	2.0	0.301	2.123	133	2.162	145
70	555	0.555	2.6	0.415	1.995	99	2.041	110
75	572	0.572	3.4	0.531	1.865	73	1.918	83
80	598	0.598	5.2	0.716	1.658	46	1.723	53
85	630	0.630	6.4	0.806	1.557	36	1.628	42
100	721	0.721	6.1	0.783	1.583	38	1.652	45
120	859	0.859	6.9	0.839	1.520	33	1.593	39
130	946	0.946	8.7	0.940	1.408	26	1.487	31

- Notes:
- 1. CBR calculated based on Webster et al, 1992.
 - 2. CBR calculated based on DMRB, 2008.
 - 3. CBR values less than 2.5% highlighted in red and bold. Soils unsuitable in pavements.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.



Project:	Manchester Sports Hub	
Project No.	B077652	
Test No.	TRL04	

Date of Test:	01-Jul-21	
Operator:	TW/MH	
Soil type:	Made Ground	
Soil condition:	Unsaturated	

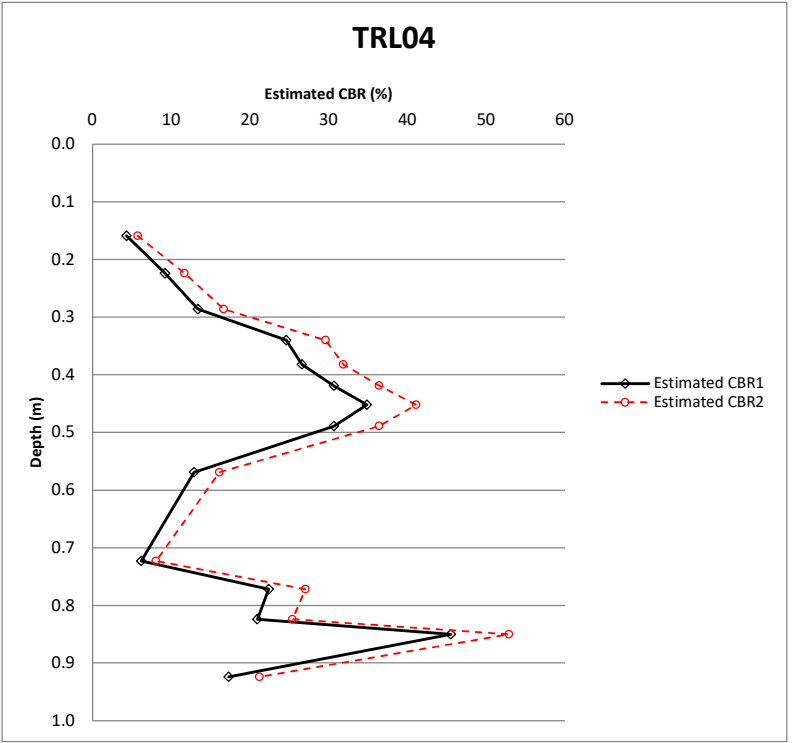
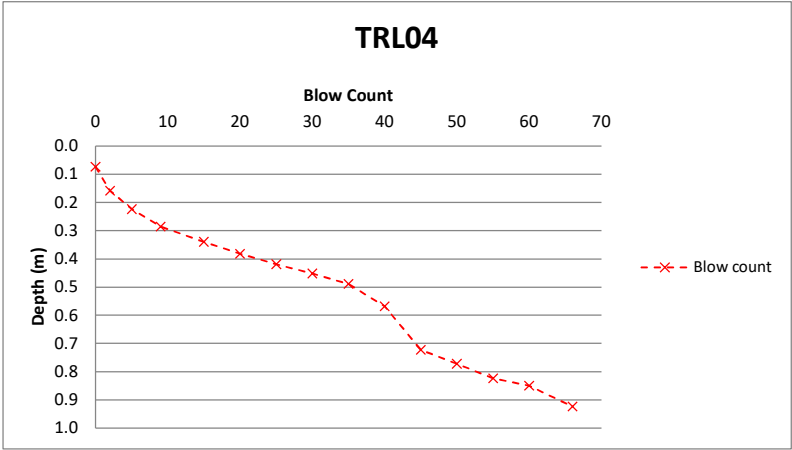
[illegible]

Notes:

1. CBR calculated based on Webster et al, 1992.
2. CBR calculated based on DMRB, 2008.
3. CBR values less than 2.5% highlighted in red and bold. Soils unsuitable in pavements.

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.



Date of Test:	01-Jul-21
Operator:	TW/MH
Soil type:	Made Ground
Soil condition:	Unsaturated.

TRL05

Blow Count

Depth (m)

---x--- Blow count

Depth (m)	Blow Count
0.05	5
0.10	10
0.15	12
0.20	15
0.25	20
0.30	25
0.35	30
0.40	35
0.45	40
0.50	45
0.55	50
0.60	55
0.65	60
0.70	65
0.75	70
0.80	75
0.85	80
0.90	85
0.95	90

Depth (m)	Estimated CBR1 (%)	Estimated CBR2 (%)
0.1	10	10
0.2	15	15
0.3	20	25
0.4	35	40
0.5	30	35
0.6	25	30
0.7	15	20
0.8	10	15
0.9	10	15

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.

Date of Test:	01-Jul-21
Operator:	TW/MH
Soil type:	Made Ground
Soil condition:	Unsaturated.

TRL06

Blow Count

Depth (m)

—x— Blow count

Depth (m)	Blow Count
0.05	10
0.08	15
0.10	20
0.12	25
0.15	30
0.20	40
0.25	50
0.30	60
0.35	70
0.40	80
0.45	90
0.50	100
0.55	110
0.60	120
0.65	130
0.70	140
0.75	150
0.80	160
0.85	170
0.90	180
0.95	190
1.00	200

Depth (m)	Estimated CBR1 (%)	Estimated CBR2 (%)
0.1	10	10
0.2	10	10
0.3	10	10
0.4	10	10
0.5	10	10
0.6	10	10
0.7	80	80
0.8	80	80
0.9	80	80
1.0	80	80

Reference:

- Webster S, Grau R and Williams T. 1992. Description and Application of Dual Mass Dynamic Cone Penetrometer. Dept of Army Waterways Equipment Station, Instruction rpt GL-92-3.
- Highways Agency, 2008. Design Manual for Roads and Bridges (DMRB), Data for Pavement Assessment. HD29/08.

Appendix E – Ground Gas and Groundwater Monitoring Results

- Gas Monitoring Results Visits 1 – 6

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS
 Tel: 0121 643 4694
 Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project: Manchester Sports Hub **Date:** 19/07/2021
Job Number: B077652 **Visit:** 1
Client: Holmes Miller **Weather:** Sunny, hot
Barometric State: Falling **Ground Conditions:** Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1014	-0.2	-0.1	0.0	0.0	3.4	3.4	4.9	0	0	1.80	3.10	1
WS02	1013	0.2	0.2	0.0	0.0	0.5	0.5	21.0	0	0	0.45	3.94	
WS03	1013	30.3	0.0	0.0	0.0	0.4	0.4	18.9	0	0	0.95	3.00	
WS04	1014	53.9	7.3	0.0	0.0	2.1	2.1	18.4	0	0			
CP01	1013	0.1	0.0	0.0	0.0	0.9	0.9	18.5	0	0	10.64	10.93	
CP02	1013	0.0	0.0	0.0	0.0	1.6	1.6	5.3	0	0	10.01	10.11	
CP03	1014	0.0	0.0	0.0	0.0	0.9	0.7	15.9	0	0	8.45	10.20	
CP04	1014	0.0	0.0	0.0	0.0	0.0	0.0	21.8	0	0	Dry	1.50	

Notes

1 - Bung stuck in pipework, cannot monitor groundwater

Logged by

SH

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS
 Tel: 0121 643 4694
 Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project:	Manchester Sports Hub	Date:	28/07/2021
Job Number:	B077652	Visit:	2
Client:	Holmes Miller	Weather:	Showers
Barometric State:	Falling	Ground Conditions:	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1001	0.0	0.0	0.2	0.1	2.8	2.8	10.8	0	0	-	-	3
WS02	1001	0.1	0.0	0.0	0.0	0.5	0.5	20.4	0	2	-	-	3
WS03	1001	19.3	0.2	0.0	0.0	0.5	0.5	18.60	0	9	-	-	1
WS04	1002	40.3	0.2	0.0	0.0	2.4	2.4	17.30	0	6	-	-	2
CP01	1001	0.0	0.0	0.0	0.0	0.5	0.5	19.70	0	1	-	-	3
CP02	1001	0.0	0.0	0.0	0.0	0.2	0.2	19.7	0	0	-	-	3
CP03	1002	0.1	0.0	0.0	0.0	0.3	0.1	20.7	0	0	-	-	3
CP04	1000	0.0	0.0	0.0	0.0	0.0	0.0	21.3	0	1	-	-	3

Notes

- Flow fell to steady state over appoximatly 2 minutes.
- Flow fell to 0.8 l/hr almost instananesously then fell to steady state.
- Dip meter not working, groundwater not monitored.

Logged by

NF

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS
 Tel: 0121 643 4694
 Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project:	Manchester Sports Hub	Date:	09/08/2021
Job Number:	B077652	Visit:	3
Client:	Holmes Miller	Weather:	Cloudy
Barometric State:	Rising	Ground Conditions:	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1005	0.0	0.0	0.0	0.0	0.6	0.5	19.8	0	0	1.53	3.10	1
WS02	1005	-2.5	-0.2	0.0	0.0	1.0	0.8	19.9	0	0	0.32	3.94	
WS03	1006	-5.9	0.0	0.0	0.0	0.6	0.6	19.6	0	1	0.68	3.05	
WS04	1003	27.4	0.0	0.0	0.0	2.8	2.8	16.5	0	8	-	-	
CP01	1005	0.0	0.0	0.0	0.0	0.7	0.7	19.7	0	0	9.55	10.94	
CP02	1006	0.0	0.0	0.0	0.0	0.2	0.2	20.4	0	0	10.02	10.05	
CP03	1004	0.0	0.0	0.0	0.0	0.6	0.4	19.7	0	0	9.20	10.22	
CP04	1003	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0	0	1.50	1.54	

Notes

1 Bung stuck in pipe

Logged by

RT

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS
 Tel: 0121 643 4694
 Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project:	Manchester Sports Hub	Date:	23/08/2021
Job Number:	B077652	Visit:	4
Client:	Holmes Miller	Weather:	Showers
Barometric State:	Rising	Ground Conditions:	Damp

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1024	0.0	0.0	0.0	0.0	1.3	1.2	17.0	1	0	1.78	3.10	1
WS02	1027	0.0	0.0	0.0	0.0	0.7	0.5	20.4	1	0	0.41	3.95	
WS03	1027	0.0	0.0	0.0	0.0	0.5	0.4	20.0	0	0	0.73	3.04	
WS04	1026	27.4	0.0	0.0	0.0	2.4	2.4	17.2	0	6	-	-	
CP01	1026	0.0	0.0	0.0	0.0	0.7	0.5	19.7	2	0	9.70	11.00	
CP02	1027	0.0	0.0	0.0	0.0	0.0	0.0	20.9	0	0	10.02	10.20	
CP03	1027	0.0	0.0	0.0	0.0	0.5	0.4	19.9	0	0	9.20	10.22	
CP04	1027	0.0	0.0	0.0	0.0	0.0	0.0	21.5	0	0	1.50	1.55	

Notes

1 Bung stuck in pipe

Logged by

RT

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS
 Tel: 0121 643 4694
 Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project:	Manchester Sports Hub	Date:	15/09/2021
Job Number:	B077652	Visit:	5
Client:	Holmes Miller	Weather:	Sunny
Barometric State:	Steady	Ground Conditions:	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1015	-0.4	0.0	0.0	0.0	6.1	6.1	4.3	0	0	1.93	3.10	1
WS02	1015	-0.4	0.0	0.0	0.0	0.6	0.5	20.2	1	0	0.54	3.95	1
WS03	1015	0.1	0.0	0.0	0.0	0.2	0.2	20.4	1	0	0.90	3.04	2
WS04	1015	-1.1	-0.8	0.0	0.0	3.2	3.2	15.0	1	4	0.66	2.95	1
CP01	1015	0.1	0.1	0.0	0.0	0.7	0.4	20.0	1	0	10.09	11.00	
CP02	1015	0.0	0.0	0.0	0.0	0.1	0.1	20.9	0	0	10.01	10.20	
CP03	1015	-0.9	-0.8	0.0	0.0	0.3	0.2	20.3	0	0	9.23	10.22	1
CP04	1015	0.1	0.1	0.0	0.0	0.1	0.1	20.3	0	0	1.52	1.55	

Notes

- 1 Flow fell to steady state over appoximately 20 seconds.
 2 Flow fell to steady state almost instananesously.

Logged by

TW

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Curtins

2 The Wharf, Bridge Street, Birmingham, B1 2JS

Tel: 0121 643 4694

Email: birmingham@curtins.com



GAS MONITORING LOG SHEET

Project:	Manchester Sports Hub	Date:	22/09/2021
Job Number:	B077652	Visit:	6
Client:	Holmes Miller	Weather:	Cloudy, breezy
Barometric State:	Falling	Ground Conditions:	Dry

Borehole Reference	Barometric Pressure mb	Flow l/hr		Methane %		Carbon Dioxide %		Oxygen %	Hydrogen Sulphide ppm	Carbon Monoxide ppm	Water Level m bgl	Borehole Base m bgl	Note
		Max	SS	Max	SS	Max	SS						
WS01	1021	0.0	0.0	0.0	0.0	6.1	6.1	6.3	0	0	1.97	3.10	
WS02	1021	0.0	0.0	0.0	0.0	0.8	0.8	19.8	0	0	0.49	3.95	
WS03	1020	6.8	0.0	0.0	0.0	0.4	0.4	20.4	0	0	0.94	3.06	1
WS04	-	-	-	-	-	-	-	-	-	-	-	-	2
CP01	1021	0.0	0.0	0.0	0.0	1.5	1.2	19.1	0	0	10.19	11.05	
CP02	1020	0.0	0.0	0.0	0.0	1.3	1.2	17.0	0	0	10.02	10.24	
CP03	-	-	-	-	-	-	-	-	-	-	-	-	2
CP04	-	-	-	-	-	-	-	-	-	-	-	-	2

Notes

- Flow fell to steady state over 30sec
- Could not access boreholes

Logged by

SH

1% gas volume = 10,000 ppm

Flow rate, methane and carbon dioxide reported as 'maximum' (max) and 'steady state' (SS) readings.

All other gases recorded at 'steady state' unless otherwise stated

Appendix F – GAC Screening Thresholds

Curtins GAC Thresholds for 1.0% SOM.

Adopted Soil Generic Assessment Criteria
Sandy loam with 1% SOM



Contaminants	Residential <u>with</u> home grown produce	Residential <u>without</u> home grown produce	Allotments	Commercial	Public open space near residential housing POS _{resi}	Public park POS _{park}
Metals						
Beryllium	1.7	1.7	35	12	2.2	63
Boron	290	11,000	45	240,000	21,000	46,000
Cadmium	10⁽¹³⁾ 22	85⁽¹³⁾ 150	1.8 3.9	230 410	120 220	560 880
Chromium III	910	910	18,000	8,600	1,500	33,000
Chromium VI	6 21	6 21	1.8 170	33 49	7.7 21	220 250
Lead	200	310	80	2,300	630	1,300
Mercury (<i>elemental</i>)	1	1	26	26	16	26⁽⁸⁾ [30]
Mercury (<i>inorganic</i>)	170	240	80	3600	120	240
Nickel	130 ⁽¹⁰⁾	180 ⁽¹⁰⁾	53 ⁽¹¹⁾	980 ⁽¹⁰⁾	230	800
Vanadium	410	1200	91	9000	2000	5000
Copper	2400	7100	520	68000	12000	44000
Zinc	3700	40000	620	730000	81000	170000
Semi-Metals and non-metals						
Arsenic	32⁽¹²⁾ 37	35⁽¹²⁾ 40	43⁽¹²⁾ 49	640⁽¹²⁾ 640	79 79	170 170
Antimony		550		7500	1500	3300
Selenium	350	600	120	13000	1100	1800
Inorganic chemicals						
Cyanide	34	34	34	34	34	34
Organic contaminants						
Aliphatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₆	42	42	730	3200	570000	95000
EC ₆₋₆ - EC ₈	100	100	2300	7800	600000	150000
EC ₈₋₈ - EC ₁₀	27	27	320	2000	13000	14000
EC ₁₀₋₁₀ - EC ₁₂	130	130	2200	9700	13000	21000
EC ₁₂₋₁₂ - EC ₁₆	1100	1100	11000	59000	13000	25000
EC ₁₆₋₁₆ - EC ₃₅	65000	65000	260000	1600000	250000	450000
EC ₃₅₋₃₅ - EC ₄₄	65000	65000	260000	1600000	250000	450000
Aromatic risk banded hydrocarbons - TPHCWG method						
EC ₅₋₅ - EC ₇	70	370	13	26000	56000	76000
EC ₇₋₇ - EC ₈	130	860	22	56000	56000	87000
EC ₈₋₈ - EC ₁₀	34	47	8.6	3500	5000	7200
EC ₁₀₋₁₀ - EC ₁₂	74	250	13	16000	5000	9200
EC ₁₂₋₁₂ - EC ₁₆	140	1800	23	36000	5100	10000
EC ₁₆₋₁₆ - EC ₂₁	260	1900	46	28000	3800	7600
EC ₂₁₋₂₁ - EC ₃₅	1100	1900	370	28000	3800	7800
EC ₃₅₋₃₅ - EC ₄₄	1100	1900	370	28000	3800	7800
Aliph + Arom EC >44-70	1600	1900	1200	28000	3800	7800
Aromatic						
Benzene	0.08	0.3	0.017	28	72	90
Ethyl benzene	65	170	16	520⁽⁸⁾ [17000]	520⁽⁸⁾ [24000]	520⁽⁸⁾ [17000]
Toluene	120	610	22	860⁽⁸⁾ [59000]	860⁽⁸⁾ [56000]	860⁽⁸⁾ [87000]
Xylene ⁽⁹⁾	41	53	28	480⁽⁸⁾ [69000]	480⁽⁸⁾ [41000]	480⁽⁸⁾ [17000]
Phenol	180	310	66	760⁽¹⁴⁾ (31000)	760⁽¹⁴⁾ (10000)	760⁽¹⁴⁾ (7600)
Polycyclic Aromatic Hydrocarbons (PAH)						
Naphthalene	2.3	2.3	4.1	190	4900	1200
Acenaphthylene	170	2900	28	83000	15000	29000
Acenaphthene	210	3000	34	84000	15000	29000
Fluorene	170	2800	27	63000	9900	20000
Phenanthrene	95	1300	15	22000	3100	6200
Anthracene	2400	31000	380	520000	74000	150000
Fluoranthene	280	1500	52	23000	3100	6300
Pyrene	620	3700	110	54000	7400	15000
Benz(a)anthracene	7.2	11	2.9	170	29	49
Chrysene	15	30	4.1	350	57	93
Benzo(b)fluoranthene	2.6	3.9	0.99	44	7.1	13
Benzo(k)fluoranthene	77	110	37	1200	190	370
Benzo(a)pyrene	2.2	3.2	0.97	35	5.7	11
Indeno(123cd)pyrene	27	45	9.5	500	82	150
Dibenzo(ah)anthracene	0.24	0.31	0.14	3.5	0.57	1.1
Benzo(ghi)perylene	320	360	290	3900	640	1400
Chlorinated Aliphatic Hydrocarbons						
Vinyl chloride	0.00064	0.00077	0.00055	0.059	3.5	4.8
Trichloroethene (TCE)	0.016	0.017	0.041	1.2	120	70
1,1,1,2 Tetrachlorethane	1.2	1.5	0.79	110	1400	1500
Tetrachlorethane (PCE)	0.18	0.18	0.65	19	1400	810
1,1,1 Trichlorethane	8.8	9	48	660	140000	57000

Notes

- All values above are in mg/kg
- Numbers in bold are SGVs or GAC that are derived based on SGV report input parameters, numbers in italics are S4ULs, numbers in bold-italics are based on EIC/AGS/CL:AIRE numbers & input parameters and underlined numbers are C4SLs
- Soil organic matter (SOM) is assumed to be 1% - DEFAULT VALUE
- Soil type is assumed to be sandy loam - DEFAULT SOIL TYPE
- For residential, the building type is conservatively assumed to be a small terrace house where the development includes bungalows change to more conservative bungalow setting in computer model
- For commercial, the building type is conservatively assumed to be a pre 1970s office building, where the proposed development comprises houses, flat with living spaces changes setting in model accordingly
- For classrooms consider increasing the dust loading factor in the 'Soil and Building Data' of the CLEA 1.04 model from 50 to 100µg m⁻³
- Based on vapour saturation limit as suggested by EA / [] model value
- Lowest of o-, m- and p-xylene
- Based on comparison of inhalation exposure with inhalation TDI
- Based on comparison of oral, dermal, and inhalation exposure with the oral TDI
- Based on a comparison of oral and dermal soil exposure with oral Index Dose only
- Averaged over and based on lifetime exposure
- Based on critical concentration for skin irritation in humans arising from contact with phenol in aqueous solution (number in brackets based on health effects following long term exposure for illustration)
- NA: Not applicable

Appendix G – Risk Assessment Methodology

The site-specific risk assessment, presented in this report, follows the principle of establishing whether there is a viable linkage between a contaminant source to a potential receptor, via an exposure pathway.

The risk assessment corresponds with the total site area and incorporates both descriptive (qualitative) and, where available, numerical (quantitative) lines of evidence.

Risk assessment is the process of collating known information on a hazard or set of hazards to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore, the presence of contaminant source on a site does not necessarily mean there is a risk.

The risk assessment considers the likelihood of an event taking place (accounting for the presence of the source and receptor and the viability of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment, the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	Medium	Mild	Minor
Probability (Likelihood)	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low Likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

Phase 2 Ground Investigation

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to an ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in an ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a <i>high probability</i> that <i>severe harm</i> could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	<i>Harm is likely to arise</i> to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	<i>It is possible</i> that without appropriate further action <i>harm could arise</i> to a designated receptor. It is relatively <i>unlikely</i> that any such harm would be <i>severe</i> , and if any harm were to occur it is <i>more likely</i> that such harm would be <i>relatively mild</i> .
Low Risk	<i>It is possible</i> that <i>harm could arise</i> to a designated receptor from an identified hazard. It is <i>likely</i> that, at worst, if any harm was realised any effects would be <i>mild</i> .
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

Our Locations

Birmingham

2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol

Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cambridge

50 Cambridge Place
Cambridge
CB2 1NS
T. 01223 631 799
cambridge@curtins.com

Cardiff

3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas

Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin

11 Pembroke Lane
Dublin 2
D02 CX82
Ireland
T. +353 1 507 9447
dublin@curtins.com

Edinburgh

1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow

Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal

Units 24 & 25 Riverside Place
K Village
Lound Road
Kendal
LA9 7FH
T. 01539 724 823
kendal@curtins.com

Leeds

Ground Floor
Rose Wharf
78-80 East Street
Leeds
LS9 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool

51-55 Tithebarn Street
Liverpool
L2 2SB
T. 0151 726 2000
liverpool@curtins.com

London

40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester

Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham

56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com