

Geo-Environmental Investigation & Assessment

For a site referred to as

UoM Decant Project

Undertaken for

The University of Manchester

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Revision Status / History

Rev	Date	Issue / Purpose/ Comment	Prepared	Checked	Authorised
-	19/02/2024	First Issue	TJS	TPB	SCS
A	22/05/2024	Additional investigations.	TPB	SCS	SCS

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Executive Summary

Site Location	The site is located immediately east of the Arthur Lewis building, centred on NGR 384479E, 396723N with an approximate postcode of M13 9PL.
Development Proposals	The project is to comprise the construction of a new three-storey building of modular design.
Ground Conditions	Ground conditions comprise made ground to depths of between 1.10m and 2.00mbgl, underlain by glaciofluvial deposits to depths of between 2.65 and 3.45mbgl where completely weathered sandstone of the Chester Formation extend to a maximum proven depth of 3.90mbgl.
Site Preparation and Earthworks	No significant earthworks are anticipated. Risks from relict foundations and floor slabs are considered low, but cannot be fully discounted. Any existing asphalt/concrete hardstanding and below ground foundations removed as part of the clearance work, subject to appropriate screening and crushing, will be suitable for re-use as bulk fill beneath hard cover areas. It is anticipated that existing services would need to be diverted to accommodate the building footprint.
Foundations	New structures could be supported on traditional spread foundations constructed within the medium dense or firm/stiff glaciofluvial deposits encountered at depths of up to 2.00mbgl and designed on a net allowable bearing pressure of 125kN/m² to reduce differential settlements to tolerable limits. Such foundations would need to be adequately reinforced to take account of potential differential settlements resulting from variable ground conditions. Alternatively, the new structure could be piled, with piles taken down through the made ground and glaciofluvial deposits into the underlying sandstone of the Chester Formation. Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions. New floor slabs should be constructed as suspended.
External Pavements	New road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 3% in made ground.
Concrete Classification	The typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for concrete at the site are DS-1 and AC-2z respectively.
Soakaways	Soakaways are not considered to be a feasible drainage option for the site.
Ground Contamination	In consideration of the chemical test results and proposed end use, it is concluded that the shallow soils do not pose a significant or widespread risk to human health. However, asbestos in the form of chrysotile, amosite and crocidolite fibres have been detected in 7no samples at a concentration of <0.001% weight/weight. Where surfaced with buildings and hardstanding following site development there will be no mechanism for a direct contact pollution linkage. However, new landscaped areas is surfaced by imported capping. This will comprise a minimum 150mm of topsoil and 200mm sub-soil. Notwithstanding the above, all groundworks within made ground soils should be undertaken under a watching brief with any ACM so encountered being segregated for removal to landfill. Such segregation operations would then need to incorporate specific control measures. The risk to controlled waters is Very Low with no specific remedial measures encountered.
Ground Gas	No specific gas protection is required for the proposed development.
Waste Soils	For preliminary guidance based on the current information, it is possible that made ground may be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal. It will be the responsibility of the waste producer to undertake further testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

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1.0 INTRODUCTION

Appointment

- 1.1 WML Consulting has been commissioned by The University of Manchester to undertake a Phase 2 Geoenvironmental investigation and Assessment of a site at a site referred to as the UoM Decant Project located immediately east of the Arthur Lewis Building.

Proposed Development

- 1.2 The project is to include the construction of a new three-storey building of modular design to be used as a teaching facility.
- 1.3 A proposed development plan is presented on drawing 5668-HMA-MS2-ZZ-DR-A-0101_P02, dated September 2023, in Appendix 01.

Objective

- 1.4 The objective of the ground investigation and assessment was to provide geotechnical recommendations for construction design purposes together with a geo-environmental risk assessment in terms of possible ground contamination.
- 1.5 To achieve the objective, the following tasks were undertaken:
- Design a Phase 2 Ground Investigation in accordance with the Environment Agency, Land Contamination Risk Management (LCRM), Updated June 2023.
 - Characterise the ground conditions in terms of geology, soil geotechnical parameters and ground contamination from information provided by the ground investigation.
 - Provide recommendations regarding suitable foundations, floor slabs and new pavement construction, together with any other geotechnical considerations that could affect possible future development.
 - Determine a ground conceptual model for the site so as to undertake a ground contamination Generic Quantitative Risk Assessment (GQRA).

Scope

- 1.6 It has been indicated that a Phase 1 Desk Study is not required for the site, therefore a review of publicly available environmental setting information has been carried out as part of this investigation.
- 1.7 The ground investigation comprised the formation of window sample probeholes undertaken with reference to BS5930:2015 + A1:2020 Code of Practice for Ground Investigation and BS10175:2011 together with A2:2017, "Investigation of Potentially Contaminated Sites - Code of Practice" except where superseded by EN ISO 22475-1:2021 "Geotechnical Investigation and Testing - Sampling Methods and Groundwater Measurements. Part 1: Technical Principles for the Sampling of Soil, Rock and Groundwater".
- 1.8 Geotechnical soil testing was undertaken in general accordance with guidelines provided in BS1377:1990 – Parts 1-9, "Method of Test for Soils for Civil Engineering Purposes". Samples for chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175: 2011 and A2:2017).

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The site comprises a rectangular plot of land within the University of Manchester Oxford Road campus, on grass adjacent to the Arthur Lewis Building. The site is centred on Ordnance Survey National Grid Reference 384479E, 396723N with an approximate postcode of M13 9PL.
- 2.2 The site is bounded to the north by landscaping and St Peters House, to the east by Tuer Street and terraces on Waterloo Place. To the south the site is bounded by Bridgeford Street with Jenkinson Street and the Arthur Lewis building to the west.
- 2.3 A site location plan is presented on drawing 5668-HMA-MS2-ZZ-DR-A-00001_P01, dated October 2023, in Appendix 1.

Site Description

- 2.4 The site is rectangular and roughly 0.15 hectares in area.
- 2.5 It comprises an area of grassed soft landscaping set within a surround of block paving and asphalt hardstanding.
- 2.6 Street lighting columns are present along the western eastern grass boundaries, and the Bee Network electric bike charging and storage area are located at/close to the northern boundary.
- 2.7 The site is further surrounded by asphalt and paved pedestrian pathway with grassed soft landscaping to the north and south including sporadic semi-mature and mixed species trees.

Topography and Sub-Surface Utilities

- 2.8 A topographic sub surface utilities scan undertaken by 1st Horizon and referenced PEUOM8242-07 Rev P, dated May 2023 is provided in Appendix 01.
- 2.9 The survey indicates the site is generally level, at roughly 37.25m Above Ordnance Datum (AOD), and commensurate with the surrounding area.
- 2.10 The drawing indicates the site to be underlain by several services including electricity, telecoms and several unidentified traces extend roughly north-west to south-west across the western section. The electricity and telecoms also extend roughly east to west across the site and the proposed building footprint.
- 2.11 As the area covered by both the topographic survey and utilities scan does not extend up to the eastern boundary of the site, it has been indicated that further surveys are to be undertaken.

3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

Geology

- 3.1 British Geological Survey (BGS) maps indicate the site is underlain by superficial Glaciofluvial Sheet Deposits, comprising sand and gravel possibly overlying Devensian Glacial Till deposits, typically comprising clay.
- 3.2 The superficial deposits are inferred to be underlain by Chester Formation comprising sandstone.

Radon

- 3.3 The site is not located within a Radon Affected Area as defined by the UK Health Security Agency where less than 1% of properties are above the Action Level of exposure. Therefore, radon protection measures are not necessary for new structures as described in publication BR211 by the Building Research Establishment.

Mining and Subsidence

- 3.4 The site is not located within a Development High Risk area, and there are no records of past known or probable shallow coal mine workings beneath the site.
- 3.5 In consideration of the above, and due to the underlying geology, risks of subsidence from coal mining are considered to be Very Low and can be discounted.

Environmental Setting

- 3.6 The superficial deposits beneath the site are classified as a Secondary 'A' Aquifer, which has the potential to provide significant quantities of water and which may support rivers, lakes and wetlands. The bedrock underlying the site is classified as a Principal Aquifer, which are designated by the EA as strategically important rock units that have high permeability and water storage capacity.
- 3.7 The site lies Environment Agency Source Protection Zone III – Total Catchment associated with an abstraction point approximately 1km south-west of the site.
- 3.8 The closest river is situated approximately 660m north of the site. A small watercourse, Corn Brook, is culverted approximately 20m to the north of the site.
- 3.9 There are no known active or historic landfills situated within 500m of the site.

Site History

- 3.10 The earliest available map, dated between 1840 and 1860, indicates the site was developed as residential gardens with Tuer Street extended east to west through the northern section with a row of residential terraces further north.
- 3.11 By 1890 the southern section of the site was redeveloped as an infant school which remained largely unchanged until at least 1961. By 2000 the area to the north of Tuer Street had been cleared of structures and comprised grassed amenity land. By 2009 the site had been cleared of all structures and developed into the current grassed soft landscaping.
- 3.12 The surrounding area had been developed with primarily low-rise residential buildings to the east, north, and south off Oxford Road, Tuer Street, Eagle Street and Coupland Street. By 1890, the land to the immediate south of the site had been redeveloped as a timber yard. By 2005 the low-rise buildings to the west of the site had been removed, with the Arthur Lewis building constructed around 2009 immediately west of the site.

Preliminary Contamination Risk Assessment

- 3.13 Under the proposed development scenario, pollution linkages are tentatively considered unlikely, with associated preliminary risks being assessed as very low.
- 3.14 This approach must, however, be precautionary until such time as uncertainties can be verified by appropriate site investigation.
- 3.15 Such uncertainties relate mainly to the level of contamination as a result of the site's brownfield status and the potential for ACM to be present in and on the ground resulting from previous demolition.
- 3.16 Risks from ground gas are considered to be very low unless intrusive investigations encounter significant thicknesses of made ground / or organic rich soils / peat.

4.0 SITE INVESTIGATION

Rationale

- 4.1 Intrusive investigations were undertaken to provide geotechnical parameters for structural design purposes but also to verify the preliminary site conceptual model.
- 4.2 Window sample probeholes were undertaken to provide information on near surface deposits and to obtain samples for chemical analysis. A general coverage of the site was considered appropriate although the investigation locations were also chosen so as not to impact on the existing structures and the presence of known/suspected services.
- 4.3 Chemical analysis of a general suite of contaminants was undertaken on selected samples of shallow soil to confirm the anticipated very low contamination risk.
- 4.4 In view of the previous demolition activities at the site chemical analysis included for the screening and identification of asbestos fibres.

Intrusive Works

- 4.5 Intrusive ground investigations were undertaken by LOT Geotechnics Ltd (LOT) on 2nd February 2024. These comprised the formation of 6no window sample probeholes to maximum depths of between 2.90 and 3.90 metres below ground level (mbgl).
- 4.6 A second phase of instructive investigations were undertaken by LOT Geotechnics Ltd (LOT) on 25th April 2024 in order to obtain additional samples of made ground for asbestos screening. These comprised the formation of formation of 3no windowless sample probeholes to depths of between 2.00 and 3.00 metres below ground level (mbgl) and 4no hand dug trial pits to depths of between 0.30 and 0.60 mbgl.
- 4.7 Photographs taken during the investigation are presented within Appendix 02. The exploratory hole records are presented in Appendix 03 whilst the exploratory hole locations are shown on drawing referenced 11357G-SK01, presented in Appendix 01.

Geotechnical and Chemical Testing

- 4.8 In-situ geotechnical testing was undertaken at regular intervals during the formation of the window sampling probeholes in the form of Standard Penetration Tests (SPT's). The results for this testing are presented on the descriptive logs in Appendix 03.
- 4.9 Selected soil samples were collected and scheduled for the following geotechnical and geochemical parameters:
 - Moisture Content.
 - Liquid Limit/Plastic Limit.
- 4.10 The results of geotechnical laboratory testing are presented in Appendix 04.
- 4.11 Chemical analysis was undertaken on selected soil samples for the following Contaminants of Concern (CoCs):
 - Total Arsenic, Cadmium, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc.
 - Water Soluble Boron.
 - Total Cyanide, Phenols, Sulphur, Acid Soluble Sulphate.
 - Speciated USEPA Polyaromatic Hydrocarbons (PAH).
 - Asbestos Screen and Identification (plus quantification where fibres were identified).
 - 2:1 Water/Soil Sulphate Extract, pH.

- 4.12 Additional soil samples collected during the second phase of investigations were screened for asbestos, with quantification also carried out where fibres were identified.
- 4.13 The results of chemical analysis are presented in Appendix 05.

5.0 GROUND CONDITIONS

Stratigraphy Summary

- 5.1 Ground conditions generally comprised a surface horizon of topsoil (imported) to a depth of between 0.05m and 0.15mbgl. This was underlain by made ground to depths of between 1.10m and 2.20mbgl. The made ground was locally underlain by glaciofluvial deposits to maximum depths of between 2.65 and 3.45mbgl where completely weathered sandstone of the Chester Formation extended to a maximum proven depth of 3.90mbgl.

Made Ground

- 5.2 Made ground was recorded from ground level to depths of between 1.10m and 2.20mbgl.
- 5.3 The made ground included a surface horizon of topsoil generally comprising dark brown, slightly clayey, silty, variably gravelly sand to depths of between 0.05 and 0.15mbgl.
- 5.4 The underlying made ground typically comprised dark brown, slightly silty, gravelly sand or brown, slightly silty, slightly gravelly clay. Gravel to cobble sized fragments of brick, concrete and ash were encountered in all probeholes.
- 5.5 WS02 which was located within the footprint of the former section of Tuer Street encountered no evidence of the former road formation. However occasional gravel sized fragments of asphalt were observed within the made ground matrix between 0.10 and 0.90mbgl.
- 5.6 No sample could be recovered from between 1.20m and 2.00mbgl in WS03, and poor sample recovery was recorded between 1.00m and 2.00mbgl in WS04. In both cases this is associated with cobbles blocking, or partially blocking, the sampler. As such it was not possible to determine an accurate depth for the interface between made ground and underlying natural ground in either location.
- 5.7 SPT 'N' values recorded within the made ground range between 6 and 12, indicating its variable consistency.

Relict Topsoil

- 5.8 Within WS02 a 0.20m thick horizon of relict topsoil was encountered between 1.20 and 1.40mbgl.
- 5.9 The strata comprised a black clayey sand with fine plant fibres and is considered to represent historic ground level.

Glaciofluvial Deposits

- 5.10 Glaciofluvial deposits were encountered within all of the exploratory holes, beneath the made ground from 1.20 and 2.00mbgl, and extended to maximum depths of between 2.65 and 3.45mbgl.
- 5.11 These comprised typically interbedded light greyish brown, orange brown or brown, silty, slightly sandy, slightly gravelly clay and light brown slightly clayey, silty, gravelly, variably cobbly, fine to coarse sand.
- 5.12 SPT 'N' values within the cohesive deposits generally ranged from 11 to 26, indicating a firm to stiff consistency. However, the 'N' value of 3 recorded in WS06 at 2.00mbgl, indicating a very localised soft clay is likely to be due to historic water softening at the base of the made ground.
- 5.13 SPT 'N' values within granular glaciofluvial deposits generally range between 9 and 30, indicating a loose to medium dense state of compaction.

Chester Formation

- 5.14 Strata considered to represent completely weathered sandstone of the Chester Formation were encountered beneath the glaciofluvial deposits from depths of between 2.65 and 3.45mbgl and extended to a maximum proven depth of 3.90mbgl.
- 5.15 The sandstone was weathered to the consistency of a soil and recovered as a very dense reddish-brown, fine to medium sand. The base of the probeholes terminated at the intersection with the less weathered sandstone.
- 5.16 SPT 'N' values within these deposits were consistently above 50, indicating the equivalent of a very dense state of compaction.

Geotechnical Testing

- 5.17 Geotechnical testing data from soil samples collected during the intrusive investigation are provided in the following table:-

Test	Made Ground	Glaciofluvial Deposits	Chester Formation
Natural Moisture Content	-	17.1 & 21.4%	-
Liquid Limit	-	43 & 44%	-
Plasticity Index	-	26 & 28% (Modified to 17.4 & 25.5%)	-
Atterberg Classification	-	Intermediate Plasticity	-
Sulphate (2:1 water soluble)	470 – 1580mg/kg	50 - 185mg/kg	<50mg/kg
pH	7.31 – 8.0	6.11 – 7.75	5.57

Visual/Olfactory Evidence of Contamination

- 5.18 No visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

Groundwater

- 5.19 Seepages were encountered during the formation of WS01 at 2.80mbgl and WS02 at 3.00mbgl, within or at the top of the completely weathered Chester Formation. No groundwater was observed during the formation of the remaining exploratory holes.
- 5.20 It is considered that this is likely to represent localised perched water, with true phreatic groundwater levels at depths in excess of 3.90mbgl, as no observations of water were made in other exploratory holes extended to similar depths.
- 5.21 It should be appreciated that the groundwater observations described above have been undertaken during a very short period of time. Significant variations in the long-term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

General

- 5.22 It should be appreciated that ground conditions may vary between and away from the exploratory hole positions, and that no account can be taken in this report of such variations.

6.0 GEOTECHNICAL APPRAISAL

Site Preparation

- 6.1 No significant buried structures were encountered during the investigation nor are envisaged to exist. However, the risk that remnant foundations exist cannot be fully discounted. Such will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed redevelopment. Any existing asphalt/concrete hardstanding and below ground foundations removed as part of the clearance work, subject to appropriate screening and crushing, will be suitable for re-use as bulk fill beneath hard cover areas.
- 6.2 Although no evidence of the structure of the former Tuer Street was encountered during the investigation, it cannot be discounted that this could be present elsewhere on site. Where encountered, these will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed building footprint.
- 6.3 Construction near the retained trees (external to the site boundaries) and importantly within any RPA's should be undertaken with due regard to guidance provided in BS5837:2012 'Trees in relation to design, demolition and construction – recommendations'.
- 6.4 The location of all statutory and private services will need to be established so that these do not impact on the proposed development layout. However, it cannot be discounted that existing services will need to be diverted as part of the development programme.
- 6.5 The site is relatively flat with no significant earthworks envisaged to form development platforms.

Foundations

- 6.6 Made ground and any soft / loose natural deposits should be considered unsuitable for the direct support of structural loads as they will be weak and compressible, leading to possibly unacceptable total and differential settlements.
- 6.7 New structures could be supported on traditional spread foundations constructed within the medium dense / firm and stiff or stronger glaciofluvial deposits encountered at depths of up to 2.00mbgl and designed on a net allowable bearing pressure of 125kN/m² to reduce differential settlements to tolerable limits. Such foundations would need to be adequately reinforced to take account of potential differential settlements resulting from variable ground conditions.
- 6.8 It cannot be discounted that locally foundations would need to be extended using mass concrete to take account for localised thicknesses of made ground, relict topsoil and / or any very soft incompetent glaciofluvial deposits.
- 6.9 However, in consideration of the high anticipated high loads of the structure, consideration has also been given to the use of ground improvement techniques at the site. Potential vibration effects on adjacent properties and infrastructure, combined with the presence of localised SPT 'N' values of less than 4 are likely to render the use of ground improvement by 'vibro' techniques unsuitable.
- 6.10 Alternatively, for higher loads, or where the depths of the excavations are either not practical and/or economical, the new structure could be piled, with piles taken down through the made ground and glaciofluvial deposits into the underlying sandstone of the Chester Formation.
- 6.11 Pile design should assume no side support (skin friction) for the pile sections surrounded by made ground or soft soils and may also need to be designed to withstand potentially negative skin friction effects from clay heave. Pile type, selection and design should to be undertaken in conjunction with a reputable, specialist piling contractor, ideally with experience of the local ground conditions.

- 6.12 Notwithstanding the above, consultation with a piling specialist should be undertaken to request their requirements associated with the number and required depths of cable percussive boreholes and follow-on rotary drilling to aid pile design.
- 6.13 For preliminary considerations, a pre-cast driven (end bearing) pile would minimise waste soil arisings but potential noise and vibration effects on the adjacent structures would need to be assessed to determine if this would be suitable. Therefore, a bored pile solution may be the most appropriate solution for the site.
- 6.14 If / where foundations are located in cohesive strata further consideration will also need to be given to the proximity to existing and/or removed trees. Identification of the tree species should be undertaken to determine its water demand as provided in Appendix 4.2-A of NHBC Standards 2010, Foundations, Chapter 4.2, Building Near Trees. Assessment as to the soil heave or shrinkage potential should then be undertaken in consideration of a medium volume change potential for the clay, with foundations designed to appropriate depths where such effects are envisaged.
- 6.15 Foundation construction will need to take account of any remaining and/or new services and, where they are in close proximity, may need to be taken down to beneath the lowest level of the service trench so that their structural integrity is maintained.

Floor Slabs

- 6.16 In consideration of the thickness of made ground across the development area, new floor slabs would need to be suspended.

Excavations and Groundwater

- 6.17 Excavations at the site will be feasible using conventional hydraulic plant. All excavations at the site and specifically requiring man-entry, will need adequate lateral support, or will need to be battered back to a safe angle to ensure their stability.
- 6.18 Conventional 'sump and pump' dewatering measures are anticipated to be adequate to keep excavations dry.

External Pavements

- 6.19 In consideration of the near surface ground conditions, it is recommended that new road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 3% in made ground.
- 6.20 The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation level.
- 6.21 Notwithstanding this, all formations should be proof-rolled prior to pavement construction, with any soft zones thus revealed being removed and replaced with appropriately graded and engineered granular fill. Similarly, any hard zones should be "grubbed out" to a depth of at least 600 mm below formation levels, again with any excavation thus created being in-filled with appropriately-graded and engineered granular fill.

Concrete Design

- 6.22 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive Ground). With reference to the site history, it is deemed appropriate to classify the site as "Brownfield", with respect to BRE Special Digest, assuming mobile groundwater conditions.
- 6.23 Values of 2:1 water/soil extract for sulphate within the soils ranged from <10 to 700mg/l with the average of the highest 20% of concentrations being 480mg/l.

- 6.24 Values of pH ranged from 5.57 to 8.00 indicating slightly acidic to slightly alkaline conditions.
- 6.25 On the basis of these results, the typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-2z respectively.

Drainage and Soakaways

- 6.26 In consideration of the presence of significant thicknesses of made ground and the very limited development area, on the site, soakaways are not considered to be feasible.

7.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

General

- 7.1 A review of the readily available information had concluded that the potential for exposure to ground contamination is unlikely to low leading to a very low preliminary risk.
- 7.2 No visual or olfactory evidence of significant ground contamination was recorded during the intrusive investigations.
- 7.3 However, it has been considered prudent to undertake chemical analysis of the shallow soils to confirm the low human health risk status of the site.

Human Health

- 7.4 Selected samples have been analysed for a general suite of contaminants of concern and compared against Screening Levels (SL's) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in the Environment Agencies Model Procedures for the Land Contamination Risk Management (LCRM), updated June 2023.
- 7.5 The criteria for a limited number of contaminants have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.
- 7.6 Within the document, Category 4 Screening Levels (C4SL's) are described as being more pragmatic than previous screening criteria and represent concentrations in soil that present an 'acceptable' level of risk within the context of Part 2A.
- 7.7 The National Planning Policy Framework states that 'after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990'. Therefore, by inference, the C4SL's are appropriate for use in the planning context.
- 7.8 Although the SP1010 document states that C4SL only apply for a 'sandy loam soil with 6% soil organic matter', it is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SL's have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.
- 7.9 Subsequent to SP1010, LQM/CIEH have published a document entitled 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015. In brief, the document provides updated assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance. The new screening criteria, or Suitable 4 Use Levels (S4ULs), are intended to provide a complete and updated replacement to the previous LQM/CIEH GAC of 2009. As such they are considered appropriate for use in this assessment for other contaminants not covered by C4SL's and/or for organic contaminants assuming a worst-case Soil Organic Matter (SOM) of 1% as an initial conservative assessment.
- 7.10 For each contaminant, S4UL's and C4SL's have been calculated for six land use scenarios, namely:
- Residential with homegrown produce.
 - Residential without homegrown produce.
 - Allotments.
 - Commercial.
 - Public Open Space, near residential housing.
 - Public Parks, remote from residential housing.

- 7.11 In light of the proposed development, which has no significant landscaping proposed, the SLs for a 'Commercial' end-use are considered appropriate for the assessment.
- 7.12 A table of relevant SL's are provided in Appendix 06.

Soil Test Results

- 7.13 In total 4no samples of made ground were analysed for a suite of typical Contaminants of Concern (CoC's). The Organic Matter Content (OMC) for all the samples range from 7.1% to 31.2%. It has therefore been considered appropriate to adopt the SL's relating to a 6% SOM in the generic assessment.
- 7.14 All of the results record CoC's below the reference values with no exceptions.
- 7.15 Screening for the presence of asbestos fibres was undertaken on 4no made ground samples. Asbestos fibres (loose fibres of chrysotile and crocidolite) were detected in one sample (WS05 at 0.30-0.40mbgl), which was subsequently scheduled for quantification testing. The results indicated the sample to comprise <0.001% weight/weight.
- 7.16 Subsequently, additional screening for the presence of asbestos fibres was undertaken on a further 10no made ground samples. Asbestos fibres (loose fibres of chrysotile or amosite) were detected in 6no of the additional samples, which were also scheduled for quantification testing. The results indicated all positive samples to comprise <0.001% weight/weight.

Discussion and Conclusions

Human Health

- 7.17 In consideration of the chemical test results and proposed end use, it is concluded that the shallow soils do not pose a significant or widespread risk to human health.
- 7.18 However, asbestos in the form of chrysotile, amosite and crocidolite fibres were detected in 7no samples at concentrations of <0.001% weight/weight.
- 7.19 Where surfaced with buildings and hardstanding following site development there will be no mechanism for a direct contact pollution linkage, or for any asbestos fibres to become airborne. Therefore, the risk to end-users and the general public will be negligible in such areas.
- 7.20 However, a direct contact pollution linkage will still exist in any new landscaped areas and it is recommended that made ground exposed at the surface in such areas is covered by clean sub-soil and topsoil thus removing the pollution linkage. This will normally comprise a 350mm clean cover, with a minimum 150mm thickness of topsoil and 200mm thickness of sub-soil, over the existing made ground. However, it is anticipated that the structures will be surrounded primarily by new hardstanding.
- 7.21 Notwithstanding the above, as there is a low possibility of asbestos fibres becoming airborne during site enabling and ground works, there is a perceived risk to construction workers and the general public of exposure, particularly during dry weather conditions.
- 7.22 All groundworks within made ground soils should therefore be undertaken under a watching brief with any ACM so encountered being segregated for removal to landfill. Such segregation operations should also incorporate specific control measures such as dust suppression, perimeter air monitoring and appropriate Personal Protective Equipment (PPE).

Controlled Waters

- 7.23 The closest surface watercourse to the site is situated approximately 660m north of the site and thus outside influencing distance of the site.

- 7.24 Corn Brook is culverted approximately 20m to the north of the site, and is therefore anticipated to be hydraulically isolated from perched groundwater on the site.
- 7.25 The underlying bedrock is classified as a Principal Aquifer. The site is located within an EA SPZ III, relating to an abstraction point approximately 1km south-west of the site.
- 7.26 Following development, the site will include new structures and hardstanding with a positive drainage system. This will limit downward movement of surface water and therefore the potential for leachate generation will be reduced, thus reducing the potential for mobilisation of any residual contaminants.
- 7.27 However, due to the absence of significant / or widespread sources of contamination being identified during the ground investigation, it is considered that the site poses a Very Low risk to Controlled Waters, with no specific remedial measures required.

8.0 GROUND GAS RISK ASSESSMENT

Ground Gas Conceptual Model

- 8.1 The site is not within a Radon Affected Area as defined by the UK Health Security Agency.
- 8.2 There are no known active or historic landfills situated within 500m of the site.
- 8.3 In consideration of the underlying geology, risks of shallow abandoned mine workings which could contain hazardous gases can be discounted.
- 8.4 The presence of significant thicknesses of made ground have been identified onsite, however no observations of materials with a significant organic content which may potentially generate significant concentrations of hazardous ground gas were recorded.
- 8.5 A localised thin horizon (0.2m) of relict topsoil with organic fibres present was recorded in WS02 at 1.00mbgl, which has been determined by laboratory testing to contain 11.6% soil organic matter. However, as this is not laterally persistent (this horizon was not encountered in any other exploratory holes), this is not considered to pose a significant risk of ground gas generation.

Results and Recommendations

- 8.6 In consideration of the above, the risk from ground gas generation from the site and/or migrating to the site is assessed as very low, with no further action necessary in this respect.

9.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

Excavated Soils

- 9.1 Excavation works undertaken during the development are likely to produce waste soils for which appropriate waste management will be required. Principally, and in line with current sustainability principals, any waste soils should firstly be considered for re-use where possible by incorporation into the development.
- 9.2 However, in consideration of the limited site area all site won soils will likely be surplus to requirements and will need to be removed under appropriate duty of care.
- 9.3 For preliminary guidance based on the current information, it is possible that made ground may be classified as 'Non-hazardous' with natural soils classified as 'Inert' for landfill disposal. This would need to be confirmed by the landfill operator.
- 9.4 However, if / where excavated soils were to contain significant asbestos concentrations, these may classify as 'Hazardous' if disposed to landfill.
- 9.5 It should be noted that the chemical analysis results for disposal classification are assessed against different assessment criteria to those relating to contamination risk assessment. Soils that are deemed suitable for use in terms of risk to human health and the environment may not necessary be un-contaminated and could be classified as Non-Hazardous or even Hazardous for disposal purposes.
- 9.6 In addition, for Inert and Hazardous waste disposal, allowance will need to be made for adequate Waste Acceptance Criteria (WAC) testing with appropriate consideration of the additional time and cost associated with this.
- 9.7 It will be the responsibility of the waste producer to undertake further testing and classification of any waste soils for disposal to an appropriately licenced landfill in accordance with current guidelines and Duty of Care requirements.

Imported Fill

- 9.8 Imported fill will be subject to specific quality requirements and should be accompanied by appropriate certification to confirm its suitability. Allowance should also be made for testing imported fill materials prior to placement to ensure suitability.

Water Supply Pipes

- 9.9 The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development, should these be required. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination are not anticipated.

APPENDIX 01

Drawings

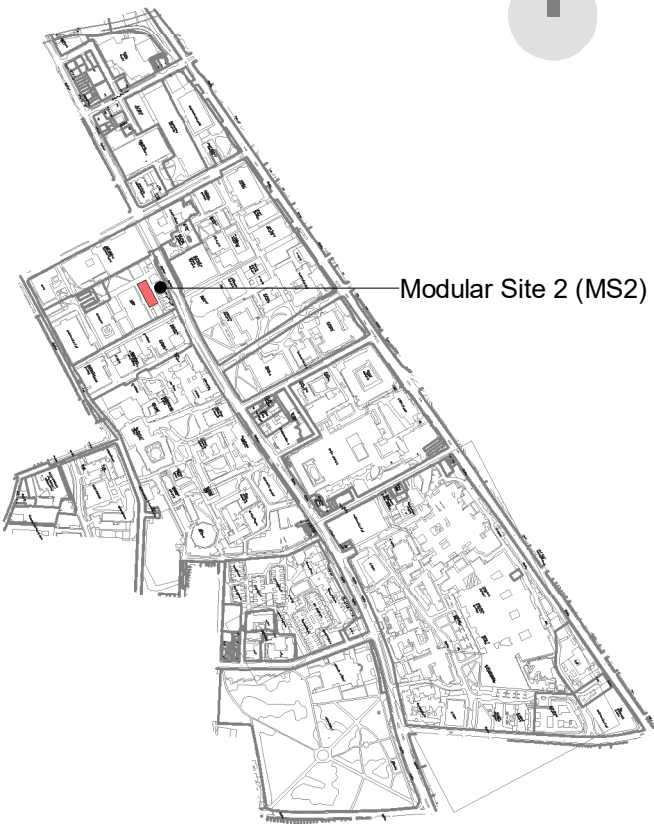
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G:\5600\5668 UoM\NZC Decant Works\1\WP\BIM\5668-HMA-MS2-ZZ-M3-A-00001_P01 - Modular Site 2.rvt



Location Plan
1 : 625 @ A1 1:1250 @ A3

- NOTES**
1. Do not scale from this drawing.
 2. All measurements are in millimetres unless stated otherwise.
 3. This drawing is to be read in conjunction with the specification and all relevant Architectural, Electrical, Mechanical and Structural drawings.
 4. (c) University of Manchester this drawing must not be reproduced without permission.
 5. Directorate of Estates and Facilities to be notified of any discrepancies.



0 25m 50m 100m
1:1250 @ A3

— Site Boundary 1142m²

P01	First Issue. Issued for Comment.	04-12-23	JL	FW
Rev	Description	Date	By	Auth



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Drawing Status

PRELIMINARY

Project
Modular Site 2 - 5668

Building Name
Modular Site 2

Building No.
TBC

Site Name
Oxford Road

Sub Site Name
Modular Site 2

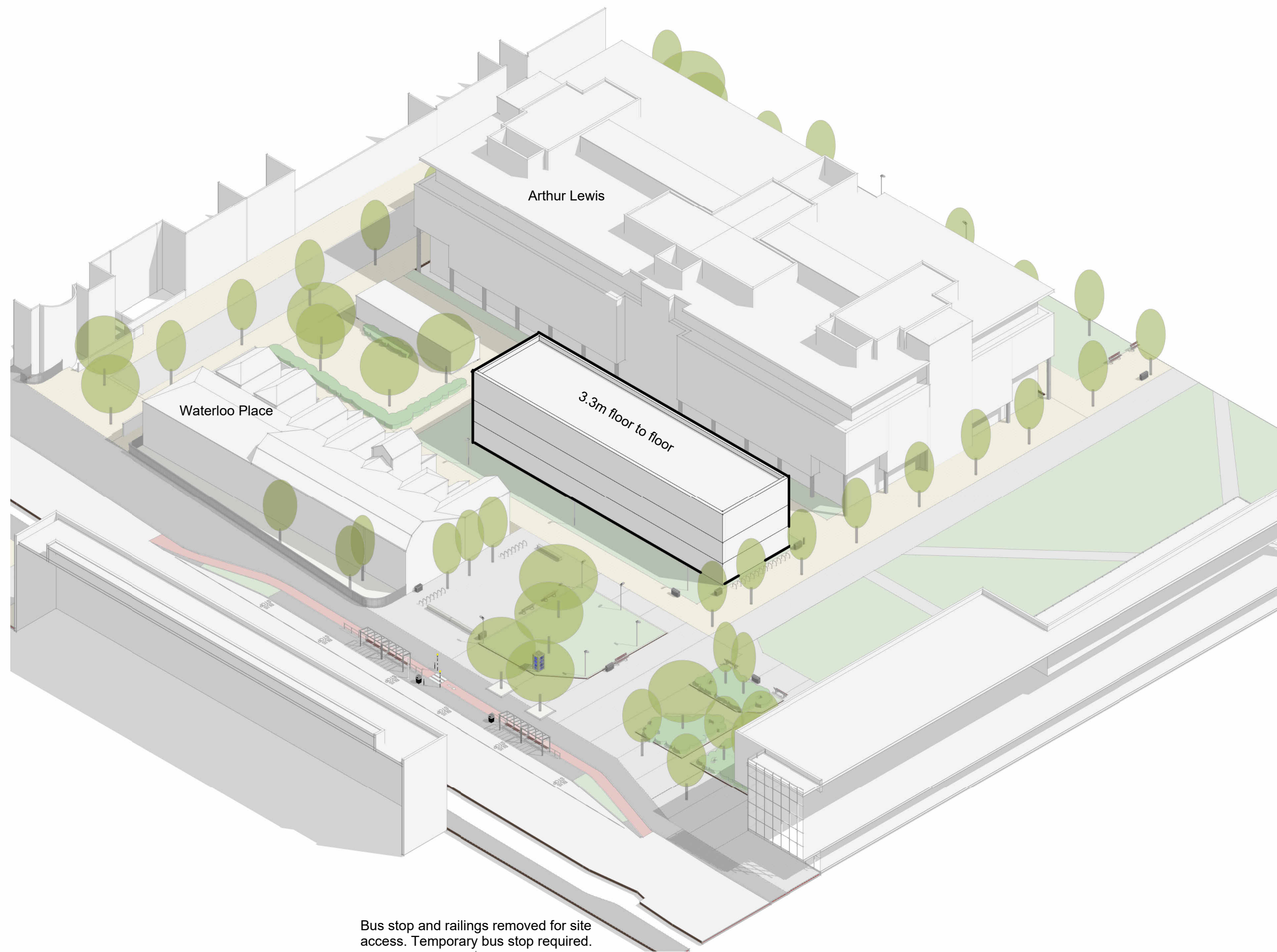
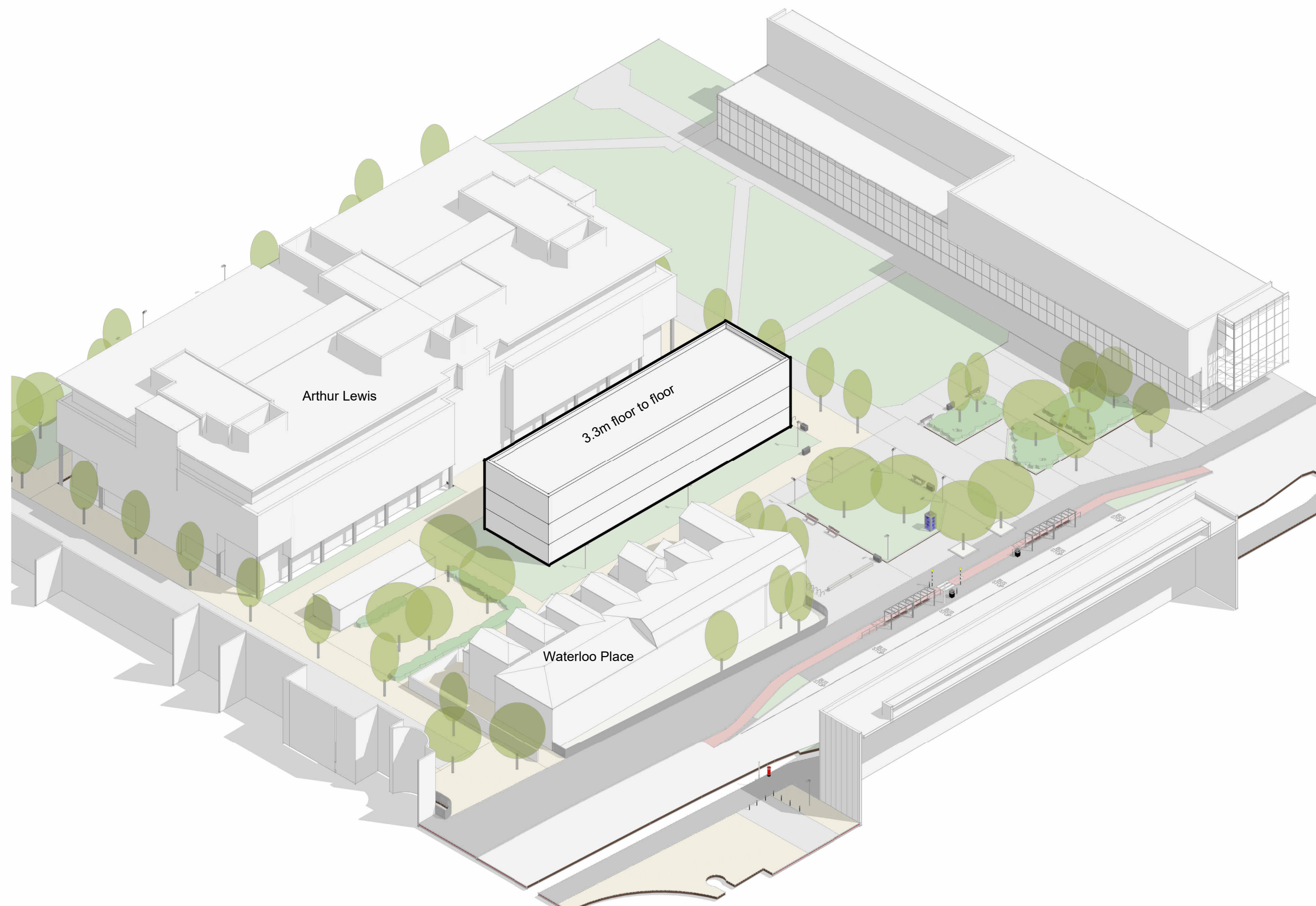
Drawing Title
Modular Site 2 Location Plan

PM	LR	Drawn	JL	Checked	FW	Authorised	HMA
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Scale @A1	Date	Date	Date	Date
1:625	25-10-2023	26-10-2023	26-10-2023	26-10-2023

Drawing Number	Revision
5668-HMA-MS2-ZZ-DR-A-00001	P01

Original Drawing Paper Size 841mm x 594mm

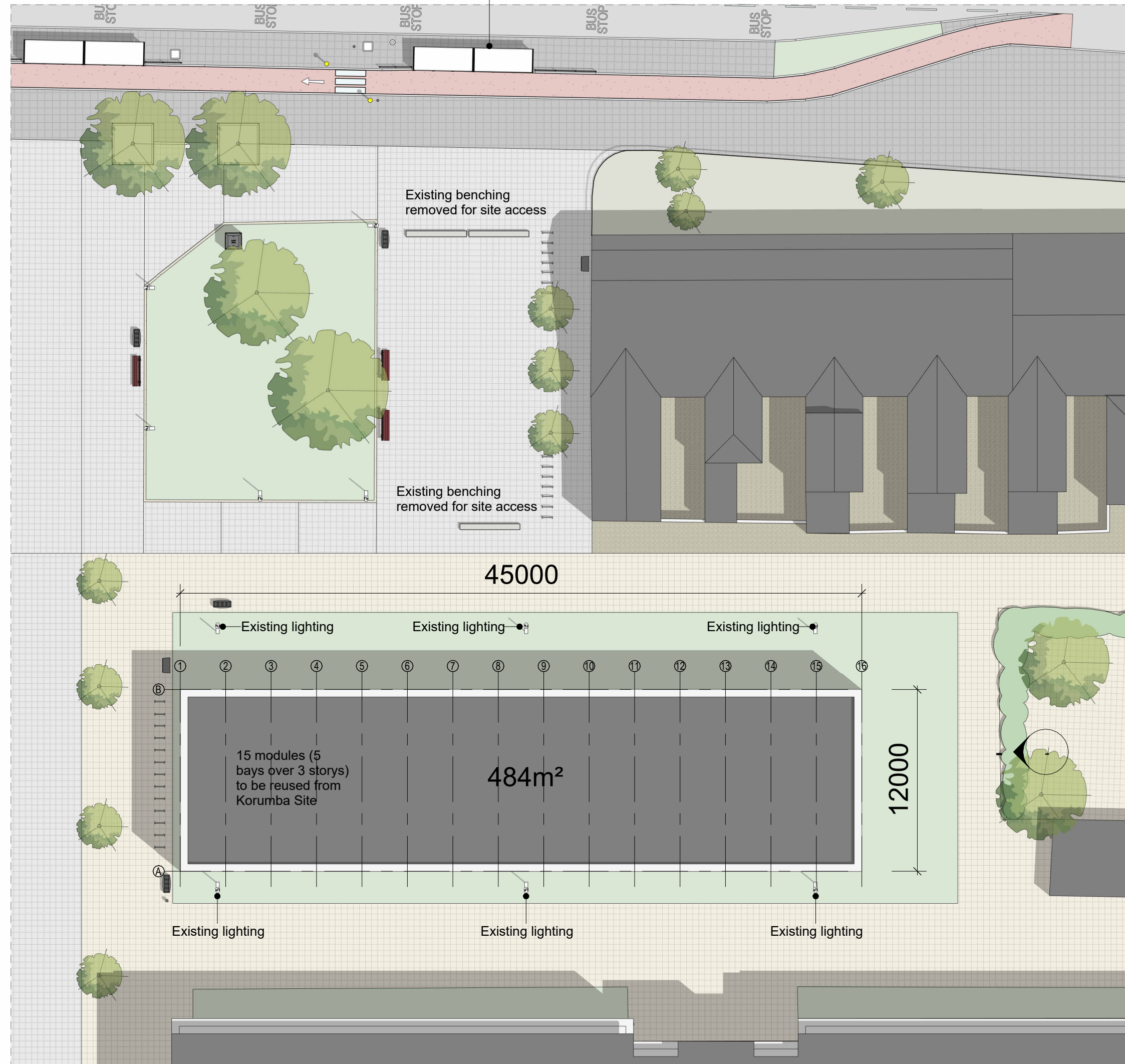


Bus stop and railings removed for site access. Temporary bus stop required.



L0 Option 01 @ 1,500

1 : 500

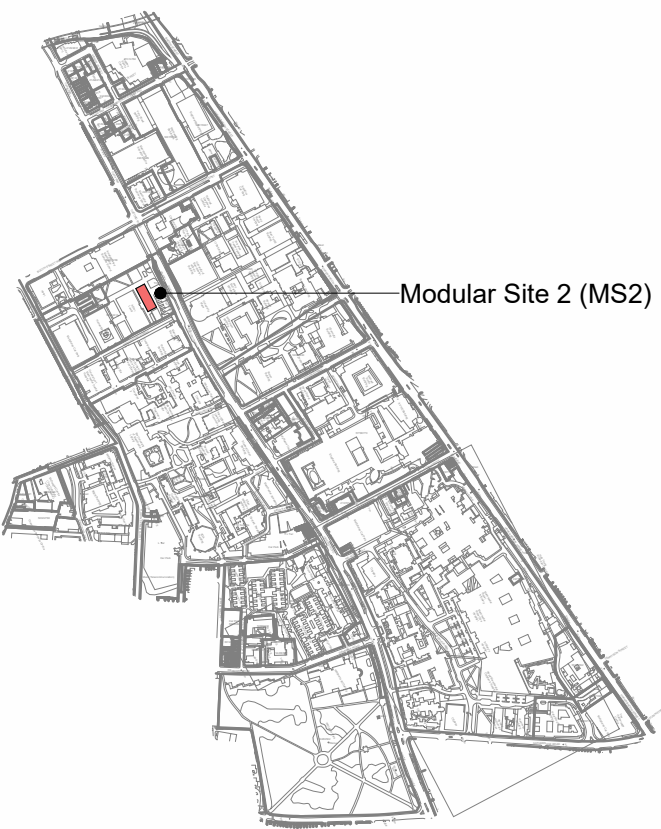


L0 Option 01 @ 1,250

1 : 250

NOTES

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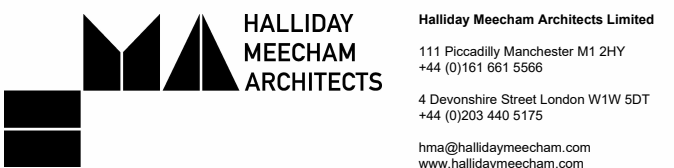


P02	L4 Removed	22-11-23	JL	FW
P01	First Issue. Issued for Comment.	25-10-23	JL	FW
Rev	Description	Date	By	Auth



The University of Manchester

Directorate of Estates and Facilities
Beyer Building
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Drawing Status
PRELIMINARY

Project
Modular Site 2 - 5668

Building Name
Modular Site 2

Site Name
Modular Site 2

Sub Site Name
To be confirmed

Drawing Title
Modular Site 2 Massing Option 01

PM
AC

Drawn
JL

Checked
FW

Authorised
HMA

Scale @A1
1:500

Date
25-10-2023

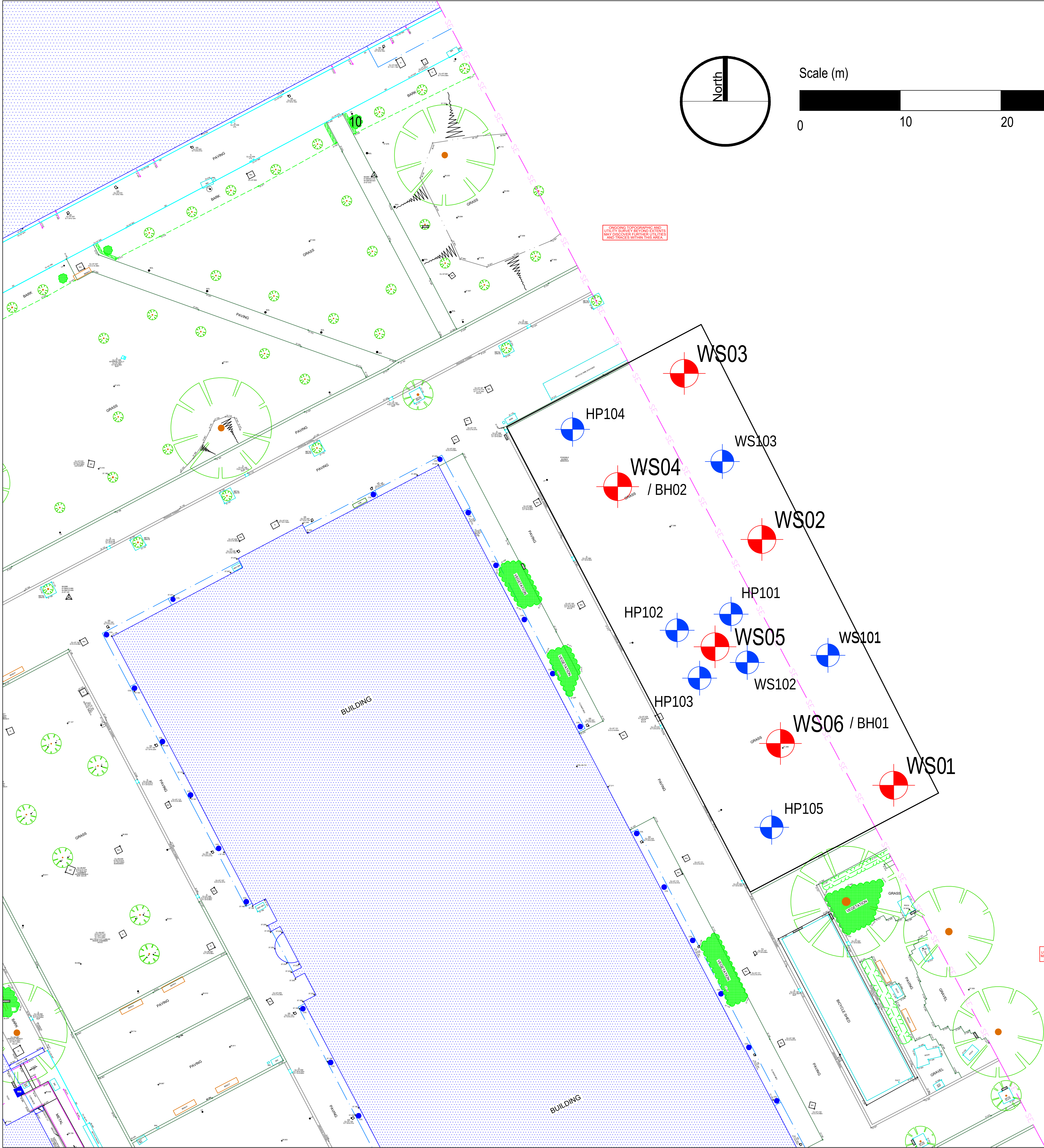
Date
25-10-2023

Date
25-10-2023

Drawing Number
5668-HMA-MS2-ZZ-DR-A-0101

Revision
P02

Original Drawing Paper Size 841mm x 594mm



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- NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
- ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
- THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

KEY

-  SITE BOUNDARY (APPROXIMATE)
-  WINDOW SAMPLING HOLES
-  ADDENDUM EXPLORATORY HOLES
-  EXTENT OF TOPOGRAPHIC / UTILITY SURVEY AREA

NOTE: SITE PLAN TAKEN FROM 1st HORIZON DRAWING 'University of Manchester - West Campus Topographic & Utility Survey', Ref. PE-UOM8242-01, May 2023. Note that the survey area does not extend to the eastern site boundary.

01	ADDITIONAL INVESTIGATION LOCATIONS	11/04/24	SCS	TPB
0	FIRST ISSUE	16/02/24	TJS	SCS
Rev.	Amendment	Date	By	Chkd

Project
UoM Decant Project

Client
THE UNIVERSITY OF MANCHESTER

Title
EXPLORATORY HOLE
LOCATION PLAN

Drawn TJS	Checked SCS	Date 05/02/24	Scale 1:200@A1
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Job No. 11357G	Drawing No. SK01 01
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APPENDIX 02

Site Investigation Photographs



Photograph 1
WS01 inspection pit arisings.



Photograph 2
WS01 drilling arisings (top to bottom, left to right) .



Photograph 3
WS02 inspection pit arisings.



Photograph 4
WS02 drilling arisings (top to bottom, left to right).



Photograph 5
WS03 inspection pit arisings.



Photograph 6
WS03 drilling arisings (top to bottom, left to right).



Photograph 7
WS04 inspection pit arisings.



Photograph 8
WS04 drilling arisings (top to bottom, left to right).