Piling Risk Assessment

Plot 9B, First Street

for

Vita Meadow Ltd



GENERAL NOTES

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Author	Rowan Brown	**Technical reviewer**	Marc Dixon
Signature		Signature	
Project manager	Marc Dixon	**Quality reviewer**	Ang Wallis
Signature		Signature	

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Where field investigations have been carried out, these have been restricted to a level of detail required to achieve the stated objectives of the work.

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1 INTRODUCTION

1.1 Commissioning

ROC Consulting was commissioned by Vita Meadows Ltd to carry out a Piling Risk Assessment for Plot 9B, First Street, Manchester (the site), in relation to proposals to redevelop the site with purpose-built student accommodation.

The project was carried out to an agreed brief as set out in the proposal email dated 22 August 2024.

1.2 Development proposals

Development drawings showing the proposed layout of the site, at the time of preparing this report, are presented within **Appendix B** and include**;** the existing site location plan (Tim Groom Architects drawing – VS9B-TGA-G100-PL-XX-95200), ground floor layout plan (Tim Groom Architects drawing – VS9B-TGA0G200-PL-00-03100) and landscape layout plan (TPM Landscape drawing – Z19B-TPM-G710-PL-XX-4645-101).

It is understood that the site is to be redeveloped with the erection of a purpose-built student accommodation (PBSA) building (Sui Generis), alongside ancillary amenity space, landscaping, secure cycle parking and other associated works; and use of Land east of River Street as a construction compound. The site will essentially be occupied by buildings and hardstanding, with limited soft landscaping at the southwestern corner of the proposed development.

It is understood that ground levels will essentially remain unchanged, and that no basement level is proposed.

The Site comprises two areas; the Proposed Development will be located entirely on ‘Plot 9b’, bound to the west by Medlock Street; to the north by land at Plot 9A of the FSDF area (currently being redeveloped into an office block of up to 9 storeys (pursuant to Planning Permission 132600/FO/2021); to the east by land at Plot 10A (currently being redeveloped into an office block of up to 13 storeys (pursuant to Planning Permission 136043/FO/2023) and to the south east by Hulme Street, and land at Plot 11 of the FSDF area (currently being redeveloped to deliver three co-living buildings of up to 45 storeys (pursuant to Planning Permission 125573/FO/2019 (as amended).

The Site also includes an area bound by the River Medlock to the north; Cambridge Street to the east; Machintosh Mills to the south and River Street and Annie Hornian Street to the west that will be used as a site compound for the construction phase of works (the ‘Construction Compound’).

Note that for the purpose of this Piling Risk Assessment only the main site area encompassing Plot 9B will be discussed as the construction compound will not be subject to piling works.

1.3 Objectives

The objective of this report is:

- to undertake an assessment of potential risks to sensitive receptors associated with piling in the context of the conceptual site model (CSM), and to determine an appropriate method of piling in accordance with Environment Agency guidance.

1.4 Scope of works

The scope of this assessment has been developed in accordance with relevant British Standards and authoritative technical guidance as referenced through the report. The assessment of the contamination status of the site is in line with the technical approach presented in Land Contamination Risk Management (LCRM) (Environment Agency, 2020) – which supersedes CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017).

A summary of the risk assessment process is in **Appendix D**.

The assessment has been carried out in conjunction with the guidance and information provided in the following Environment Agency (EA) documents: Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) and Piling in Layered Ground: Risks to Groundwater and Archaeology – Science Report SC020074/SR and Summary Document SC020074/TS (2006).

The scope of works for the assessment included the following:

- brief summary of site investigation to date
- description of site geology, hydrogeology, and soil contamination identified at the site
- description of the piling solution proposed for the development
- risk assessment for the proposed piling solution in accordance with the above guidance
- specific reference to the impact to the local groundwater regime
- where appropriate, recommendations are set out for additional works that will aid in mitigating and monitoring risk associated with piling operations.

1.5 Existing reports

The following reports detailing previous works at the site were made available for review and have been used to inform this assessment:

- ROC Consulting, Plot 9B First Street, Manchester, Phase 1 Desktop Study. Report Ref Z19B-ROC-A180-RP-XX-P1101, 2024
- ROC Consulting, Plot 9B First Street, Manchester, Phase 2 Site Investigation. Report Ref Z19B-ROC-A180-RP-XX-P2101, 2024.

The abovementioned documents should be considered in conjunction with this report. Pertinent information relating to the sites conceptual model has been summarised herein, for the purpose of discussion.

1.6 Limitations

The report has been produced by RoC Consulting for the client solely for the purposes of a review of information for the above-mentioned site. It may not be used by any person for any other purpose other than that specified without the express written permission of RoC Consulting. Any liability arising out of its use by a third party for purposes not wholly connected with the above shall be the responsibility of that party who shall indemnify RoC Consulting against all claims, costs, damages and losses arising out of such use.

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Ground conditions can change rapidly, especially in areas of made ground, however, it is assumed that the ground conditions that have been observed during previous investigations are typical and representative of the site as a whole. The ground conditions have been determined from a limited number of exploratory holes formed across the property, therefore, only a small percentage of the total area of the property has been investigated. Interpolation between exploratory holes has enabled a general picture of the subsurface conditions to be produced.

Whilst the investigation and report has been scoped in accordance with our understanding of typical regulatory authority requirements, we cannot confirm that on submission regulators may require additional in situ testing or investigation.

This report should be considered in the light of any changes in legislation, statutory requirement or industry practices that may have occurred subsequent to the date of issue.

The comments given in this report and the opinions expressed are based on the ground conditions encountered during all available stages of intrusive site work and on the results of tests made in the field and in the laboratory. However, there may be conditions pertaining to the site that have not been disclosed by investigations and therefore could not be taken into account.

This report is subject to the limitations that may be described through this document.

2 SITE SETTING

2.1 Site location

Site location details are presented in Table 1 and a site location plan is presented within **Appendix A**.

Table 1 Site location details

Site name	Plot 9B
Full site address and post code	First Street, Manchester, M1 5GG
National Grid reference (centre of site)	383808, 397305

2.2 Site description

A plan showing the site boundary and current site layout are presented within **Appendix A**. The site is located in Manchester City centre, and forms part of the wider First Street regeneration area.

The site comprises an approximately rectangular shaped parcel of vacant land, with an area of some 0.25 ha, and is bound by Hulme Street to the south, Newcastle Street to the east and the A5103 Medlock Street to the west.

The site is currently being informally used as a construction compound, associated with the construction of the adjacent Plot 9A office unit. Site cabins occupy the southwestern portion of the site, a car parking area and small electrical substation occupy the southeastern area of the site and material storage, and access routes occupy the northern area of the site.

The site is essentially level with a slightly lower level in the north associated with access routes to the adjoining Plot 9A.

2.3 Surrounding land uses

The site is located in an area of mixed commercial and residential land use, within an area which is currently subject to ongoing regeneration. Immediate surrounding land uses are described in Table 2.

Table 2 Surrounding land uses

North	Plot 9A construction site – office building
East	Plot 10B construction site – student accommodation
South	Hulme Street, with a further ongoing construction site beyond
West	A5103 Medlock Street, with demolition works beyond

3 DESK STUDY INFORMATION

3.1 Site history

The land use history of the site and surrounding area is detailed in full in the Phase 1 Desktop Study for the site (ref.: Z19B-ROC-A180-RP-XX-P1101, 2024). For the purpose of discussion within this assessment, pertinent information is summarised below.

3.1.1 On site

Earliest available historic mapping records (dated 1848) indicate the site was occupied by terraced residential housing up until the 1920s, when the site was cleared and redeveloped with a scrap yard with associated wood burner.

From the late 1940s to the early 1960s several un-named buildings were present at the site, however the use of these buildings is not known. From the early to late 1960s the site formed part of a wider rubber and waterproofing works extending to the east of the site. Mapping/insurance documents show the site comprised a coal yard with associated office building and garage.

Subsequently, records dating from 1968 indicate the site was used as a car park, before being used as a storage compound in the late 2010s.

The site comprised vacant land from 2020 to 2023 before being used as the construction compound for the adjacent Plot 9A office development.

3.1.2 Surrounding area

The site is located within an area of Manchester that has been subject to extensive historical industrial development.

The most significant industrial land uses in close proximity to the site include the Gaythorne gas works and India rubber works, located 50 m north and 80 m east of the site respectively.

A number of other potentially contaminative industrial land uses were also recorded in close proximity to the site including foundries, print works, coal yards, timber yards, tanks and engineering works.

3.2 Ground conditions

3.2.1 Published geology

Published geological records for the area (Sheet 85, Manchester) indicate the geology of the site to be characterised by the presence of Glaciofluvial Sheet Deposits comprising sand and gravel, overlying red brown sandstones of the Chester Formation.

3.2.2 Historical investigation data

The site and surrounding land associated with First Street regeneration area has been subject to a series of historic ground investigation works, as described in the Phase 2 Site Investigation Report for the site (ref.: Z19B-ROC-A180-RP-XX-P2101, 2024).

The historic ground investigation data shows that the site and surrounding area is underlain by a variable and generally significant thickness of made ground (0.80->5.45 m, generally 3-4 m), over primarily granular Glaciofluvial Sheet Deposits and cohesive Devensian Till; with the weathered sandstones of the underlying Chester Formation at a depth of between 5.10-10 m below ground level (bgl).

More recently, RoC were commissioned to undertake supplementary ground investigation works at the site in order to refine the conceptual model and identify potential constraints to development. The findings of these works are discussed in Section 4, below.

3.3 Hydrology

The nearest surface water feature is the River Medlock, located 159m to the northeast of the site. This watercourse is culverted along a section of its course, beneath the First Street regeneration area. Water quality of this receptor indicates a General Quality Assessment (GQA) Grade of “E” (poor) and a flow rate of less than 0.31 cumecs. There are no active surface water abstraction points within 500 m of the site.

The nearest discharge consent is indicated 16 m to the northeast held by United Utilities for the release of public sewage (storm overflow), the receiving water is not supplied but it is believed to be the River Medlock.

3.4 Hydrogeology

The Envirocheck Groundwater Vulnerability Map indicates the drift geology (Glaciofluvial Sheet Deposits) are classified as a Secondary A Aquifer with the underlying Chester Formation classed as a Principal Aquifer. The site is located within an Environment Agency Source Protection Zone III (Total Catchment) Source Protection Zone (SPZ). The nearest water abstraction point is indicated 424 m to the east of the site relating to water abstracted for general use at Manchester Metropolitan University.

Regional groundwater flow as indicated within Baseline Report Series 8, ‘The Permo-Triassic Sandstones of Manchester and East Cheshire’, appears to be in an east to west direction with groundwater contours indicated to be somewhere between 20 m and 30 m AOD; which is consistent with levels recorded during the site ground investigation.

4 GROUND INVESTIGATION FINDINGS

The ground investigation works undertaken and the findings thereof are described in full within the Phase 2 Site Investigation Report for the site (ref.: Z19B-ROC-A180-RP-XX-P2101, 2024). For the purpose of discussion within this assessment, pertinent information is summarised below.

4.1 Ground conditions

The ground conditions encountered during the recent Phase 2 Site Investigation were broadly in line with those described within the published literature and encountered during historic investigation works, as follows:

Table 3 Ground conditions encountered during intrusive investigation

Stratum	Base of stratum (mbgl)	Description
Made ground	1.10 to >5.45	Hardstanding or compacted crush underlain by variable cohesive and granular soils with anthropogenic inclusions of brick, ceramic, clinker, ash, concrete, glass and slate. Whole bricks were common and suggest made ground deposits on site to originate from historic demolition fill material. Localised deposits of reworked organic clay were also encountered. Groundwater strikes were recorded between 3.70 m and 3.80 mbgl.
Glaciofluvial Deposits	3.50 to 8.90	Generally encountered beneath the made ground deposits, overlying the Devensian Till; however in localised areas of deeper made ground, the Glaciofluvial Deposits were noted to be absent. The Glaciofluvial Deposits were generally described as a medium dense to dense gravelly sand, sand and gravel or sandy gravel, sporadic organic clays. Groundwater strikes were reported between 3.30 m and 4 mbgl.
Devensian Till	6.30 to 8.20	Devensian Till deposits were generally encountered beneath the Glaciofluvial Deposits, although locally were encountered directly beneath the made ground. The Till deposits were generally described as firm to stiff slightly gravelly clay. No groundwater strikes were reported within this stratum.
Chester Formation	>25.50	Very weak to weak reddish-brown sandstone with close to medium fracture spacing. Localised areas of non-intact and extremely weak rock were reported. It was not possible to accurately record groundwater strikes within the bedrock due to the drilling techniques utilised. Based on groundwater monitoring data, groundwater within the sandstone bedrock was present at depths of 7.93 m and 8.27 mbgl.

4.2 Groundwater

The ground investigation works undertaken at the site recorded two distinct groundwater bodies; perched water contained within the made ground/Glaciofluvial Deposits at a depth of 3.30 m to 4 mbgl, and groundwater contained within the sandstones of the Chester Formation at 7.97 m to 8.27 mbgl.

The presence of low permeability clays associated with the underlying Devensian Till deposits appears to be acting as an aquitard between the perched water within the overlying permeable Glaciofluvial strata, and the underlying sandstone bedrock.

4.3 Indicators of potential contamination

During the intrusive investigation works visual evidence of potential contamination was recorded in the form of black staining of the granular Glaciofluvial deposits at a depth of 3 m to 3.50 mbgl (WS102). No corresponding olfactory evidence of contamination was recorded.

A summary of legislation and policy relating to land contamination is in **Appendix C**.

4.4 Generic quantitative risk assessment (GQRA)

A total of thirteen soil samples and one groundwater sample were submitted for laboratory analysis as part of the ground investigation. The samples were scheduled for a suite of analysis synonymous with the past industrial activities onsite.

4.4.1 Human health

The assessment for this site was based on the comparison of soil chemical testing results with Generic Assessment Criteria (GAC) derived for a residential (without plant uptake) end use scenario, given the proposed development of the site with purpose-built student accommodation. Elevated concentrations of heavy metals and PAHs were identified by the assessment, as follows:

Table 4 Summary of exceedances of HH GAC

Determinand	No. tested	GAC (mg/kg)	No. of exceedances	Maximum concentration (location, depth)
Lead	13	310	7	1,990 mg/kg (WS104, 0.70 mbgl)
Beryllium	13	1.7	2	2 mg/kg (TT1, 0-0.20 mbgl)
Benzo(a)anthracene	13	11	4	20.1 mg/kg (RBH101, 0.50 mbgl)
Benzo(a)pyrene	13	5.3	6	19 mg/kg (RBH101, 0.50 mbgl)
Benzo(b)fluoranthene	13	4	8	22.50 mg/kg (RBH101, 0.50 mbgl)

Determinand	No. tested	GAC (mg/kg)	No. of exceedances	Maximum concentration (location, depth)
Dibenzo(ah)anthracene	13	0.31	11	5 mg/kg (TP103, 0.50 mbgl)
Asbestos	13	Detect	7	0.004%, chrysotile lagging (A0P6-7, 0.75 mbgl)

The results of the assessment identified the widespread presence of metals, PAH and asbestos within the shallow made ground soils with the potential to impact human health of future site users via direct contact pathways, where present. A cover system was therefore recommended for any proposed areas of soft landscaping in order to mitigate this risk; however, it is noted that risks to construction works remain plausible.

4.4.2 Ground gas

The ground gas monitoring programme undertaken as part of the Phase 2 Site Investigation identified maximum concentrations of 0.1% and 6.3% for methane and carbon dioxide, respectively. Steady state flow rates of up to 0.4l/hr were recorded.

With reference to guidance provided in BS8485:2015+A1:2019 (BS8485) “Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings” and assuming the development comprises Building Type 2 the above-mentioned worst case gas levels and borehole flow rates equate to a Gas Screening Value (GSV) 0.0252l/hr; however, given the elevated concentrations of carbon dioxide (i.e. >5%), gas protection measures commensurate with a CS-2 classification were recommended.

4.4.3 Controlled Waters

The Phase 2 Site Investigation Report identified controlled water receptors as groundwater within the underlying bedrock (Principal Aquifer) and superficial deposits (Secondary (A) Aquifer), noting that the site is located within a defined Zone III (Total Catchment) SPZ.

A sample of groundwater collected from the underlying bedrock was screened against Drinking Water Standards (DWS) and elevated concentrations of contaminants were found to be limited to sulphates, which were deemed to be naturally occurring. A single leachate test was also undertaken on a sample collected from WS105, and the screening identified no elevated concentrations of contaminants within the soil leachate with respect to the DWS. The Phase 2 report therefore concluded that a pollutant linkage associated with vertical leaching and migration of contaminants from site soils into the underlying Principal Aquifer is not currently present.

5 CONCEPTUAL SITE MODEL

In the UK land contamination is assessed using a risk-based approach taking account of the magnitude (severity of the hazard) and likelihood (probability) of occurrence. A 'receptor' is something that could be adversely affected by contamination (e.g. people, an ecological system, property or a water body). A 'pathway' is a route or means by which a receptor is or could be exposed to or affected by a contaminant. A 'contaminant source' is a hazard but it can only pose a risk to a receptor where a pathway is present. The relationship between sources, pathways and receptors are referred to as a conceptual site model. A risk can only be realised where a contaminant source, pathway and receptor are all in place, referred to as a 'pollutant or contaminant linkage'.

In accordance with current UK best practice and Environment Agency guidance with regard to piling on land affected by contamination, the potential introduction or exacerbation of environmental hazards as a result of piling at the site has been considered by this assessment in the context of the following refined conceptual model for the site.

The refined conceptual model for the site is detailed within the Phase 2 Site Investigation Report for the site (ref.: ref.: Z19B-ROC-A180-RP-XX-P2101, 2024) and summarised below for the purpose of discussion.

5.1 Sources of contamination

Sources of soil and groundwater contamination identified within the refined conceptual model for the site are presented in Table 5.

Table 5 Potential sources of soil and groundwater contamination

Potential sources	Contaminants of concern
On-site	
Current ground conditions including variable made ground	Made ground impacted with heavy metals, PAHs, and asbestos. Moderate to low ground gas generation potential, CS-2 conditions.

Whilst the site is located within an area of extensive historical industrial land use, the land surrounding the site has generally been subject to recent remediation and regeneration under the First Street scheme. Furthermore, no evidence of on-site migration of contaminants from off-site sources was identified within the sample of groundwater screened during the Phase 2 Site Investigation. As such, further consideration of off-site contamination sources was not made within the refined conceptual model for the site.

5.2 Sensitive receptors and linking exposure pathways

Sensitive receptors identified at or in the vicinity of the site that could be affected by the potential sources identified above comprise:

- current/future site users – residential users [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, inhalation of vapours from groundwater, inhalation of hazardous ground gas]
- construction workers [oral, dermal and inhalation exposure with impacted soil, soil vapour and dust/fibres, inhalation of hazardous ground gas]
- future buildings and services [direct contact with contaminated soils or groundwater and chemical attack, accumulation and explosion of hazardous ground gas]
- controlled waters - groundwater in Principal Aquifer/ source protection zone within Chester Sandstone bedrock deposits [leaching from soils/ percolation to aquifer/ lateral migration of dissolved phase etc.].

The previous investigation has shown there to be elevated levels of contaminants in soils including heavy metals and PAHs, as well as asbestos. The Phase 2 Site Investigation Report indicates that groundwater associated with the Principal Aquifer does not currently contain the contaminants that have been identified within the made ground deposits onsite; suggesting that a complete pollutant linkage between the impacted made ground and the underlying aquifer is not currently present. This has been attributed, at least in part, to the presence of low permeability clays associated with the Devensian Till acting as an aquitard above the underlying sandstone aquifer.

6 PILING RISK ASSESSMENT

6.1 Proposed piling works

The proposed development includes the construction of foundation piles to support the proposed building.

The use of conventional shallow foundations is not an option for the site, due to the anticipated loadings of the proposed building, the depth of made ground and the variability in ground conditions.

It is understood that piles will be constructed using Continuous Flight Auger (CFA) techniques; and that 750mm diameter piles are proposed to support the 32-storey tower, with 450mm diameter piles to support the 11-storey shoulder blocks.

Although the final design is to be confirmed upon appointment of a piling contractor, maximum pile lengths of between 15m to 20m are anticipated, to provide a rock socket of between 5m to 10m into the underlying bedrock.

Plans showing the proposed piling layout are presented in **Appendix B**.

6.2 Proposed piling methodology

The purpose of the Piling Risk Assessment is to ensure that the proposed piling method will not have an adverse impact by creating new pathways for the migration of contamination, considering the protection both of water resources and human health.

It is understood that a non-displacement pile method is proposed for the development, in the form of CFA piles that will be cast in-situ.

The EA's guidance document Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) states CFA piles to be the most preferrable piling methodology for sites underlain by aquifers on the basis that they are likely to pose the least risk of groundwater pollution. This is because they reduce the possibility of transporting contaminated soil from the upper layers into the aquifer and because they do not provide an easy contamination path for groundwater to reach lower strata.

6.3 EA pollution scenarios

The EA's Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention (2001) guidance considers six pollution scenarios. The advantages and disadvantages associated with the proposed CFA piling method proposed for the site have been considered in relation to the six pollution scenarios, and the results of the assessment are summarised in

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
Scenario 1 Creation of preferential pathways through a low permeability layer (an aquitard) to allow potential contamination of an underlying aquifer	The ground investigation has identified a low permeability clay layer (Devensian Till) inhibiting vertical migration of contaminants from the made ground and shallow groundwater into the underlying Principal Aquifer (Chester Formation)	Displacement of soil around the pile will be minimised by the use of CFA techniques. Concrete will be cast in-situ directly against the surrounding soils as the auger is withdrawn, with no open bore at any time. Water flow down the auger during drilling will be minimised by the continuous upward movement of soil arisings and advance of rising concrete. Contaminated made ground will be brought to the surface, and potential pathways into the underlying aquifer will be sealed.	**Very low**
Scenario 2 Creation of preferential pathways through a low permeability surface layer, allowing upwards migration of ground gas or contaminant vapours to the surface	The site has been characterised as CS2 with regard to ground gas, given that carbon dioxide concentrations in excess of 5% were recorded during the ground gas monitoring programme. Given that the source of the ground gas is the shallow made ground, there is no low permeability surface layer currently in place that would mitigate the upwards migration of ground gases. With regard to vapour intrusion, the site is considered low risk as elevated concentrations of volatile organic compounds have not been recorded during the ground investigation.	Concrete will be cast directly against soils along the pile shaft, limiting the potential for ground gas or vapour migration pathways along constructed piles. Once buildings are constructed, appropriate ground gas protection measures commensurate with a CS2 characterisation will be incorporated into the design.	**Low** Risks associated with ground gas will not be exacerbated by the proposed pile construction, and residual risk levels are considered low assuming appropriate gas protection measures are adopted.
Scenario 3 Direct contact of site workers and others with contaminated	The ground investigation and risk assessment has identified the presence of asbestos, heavy metals and	The use of non-displacement piling techniques results in the generation of arisings and potentially contaminated soils	**Low to Moderate** Risks to construction

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
soil arisings that have been brought to the surface	PAH within the shallow made ground soils at the site. Whilst risks to future site users will be managed by the implementation of a clean cover system within areas of soft landscaping, risks to construction workers remain plausible.	(including asbestos) are likely to be brought to the surface during piling operations. There is also the potential for intermixing of clean soils with the contaminated made ground during piling operations	workers should be managed by the use of appropriate site health and safety precautions and PPE along with the contractor undertaking a watching brief for asbestos containing materials within the pile arisings. A strategy should be put in place for the management of unforeseen contamination within the arisings. Consideration will also need to be given to the appropriate handling and disposal of contaminated arisings, including asbestos containing materials.
Scenario 4 Direct contact of the piles with contaminated soil or leachate causing degradation of materials	Based on the information presented within the Phase 2 Site Investigation Report, a concrete classification of DS1, AC-1 is assumed for the site.	Adequate concrete mix design in accordance with the concrete classification (DS1, AC1) is required.	**Low**

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
Scenario 5 The pushing of solid contaminants down into an aquifer during pile driving	Contaminants have been identified within the shallow made ground soils.	Not applicable – all arisings are brought to the surface when CFA piling is utilised; therefore driving any shallow contaminated made ground into the deep aquifer is avoided.	**Very low**
Scenario 6 Contamination of groundwater by wet concrete, cement paste or grout	A proportion of the pile will be formed within the made ground and superficial deposits (Glaciofluvial Deposits and Devensian Till), before being socketed into the underlying bedrock. The nearest groundwater abstraction is located 424 m east of the site, whilst groundwater flow within the sandstone is understood to be in a westerly direction.	Grout/cement only remains mobile until hardened. The volume of concrete added will be monitored during piling and the viscosity will be managed to limit loss. Any impact to groundwater, if any, will be highly localised around individual piles and is unlikely to impact the offsite groundwater abstraction, given the distance from the site and the intervening land use.	**Very low**

overleaf.

Table 6 Piling risk assessment results

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
Scenario 1 Creation of preferential pathways through a low permeability layer (an aquitard) to allow potential contamination of an underlying aquifer	The ground investigation has identified a low permeability clay layer (Devensian Till) inhibiting vertical migration of contaminants from the made ground and shallow groundwater into the underlying Principal Aquifer (Chester Formation)	Displacement of soil around the pile will be minimised by the use of CFA techniques. Concrete will be cast in-situ directly against the surrounding soils as the auger is withdrawn, with no open bore at any time. Water flow down the auger during drilling will be minimised by the continuous upward movement of soil arisings and advance of rising concrete. Contaminated made ground will be brought to the surface, and potential pathways into the underlying aquifer will be sealed.	**Very low**
Scenario 2 Creation of preferential pathways through a low permeability surface layer, allowing upwards migration of ground gas or contaminant vapours to the surface	The site has been characterised as CS2 with regard to ground gas, given that carbon dioxide concentrations in excess of 5% were recorded during the ground gas monitoring programme. Given that the source of the ground gas is the shallow made ground, there is no low permeability surface layer currently in place that would mitigate the upwards migration of ground gases. With regard to vapour intrusion, the site is considered low risk as elevated concentrations of volatile organic compounds have not been recorded during the ground investigation.	Concrete will be cast directly against soils along the pile shaft, limiting the potential for ground gas or vapour migration pathways along constructed piles. Once buildings are constructed, appropriate ground gas protection measures commensurate with a CS2 characterisation will be incorporated into the design.	**Low** Risks associated with ground gas will not be exacerbated by the proposed pile construction, and residual risk levels are considered low assuming appropriate gas protection measures are adopted.

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
Scenario 3 Direct contact of site workers and others with contaminated soil arisings that have been brought to the surface	The ground investigation and risk assessment has identified the presence of asbestos, heavy metals and PAH within the shallow made ground soils at the site. Whilst risks to future site users will be managed by the implementation of a clean cover system within areas of soft landscaping, risks to construction workers remain plausible.	The use of non-displacement piling techniques results in the generation of arisings and potentially contaminated soils (including asbestos) are likely to be brought to the surface during piling operations. There is also the potential for intermixing of clean soils with the contaminated made ground during piling operations	**Low to Moderate** Risks to construction workers should be managed by the use of appropriate site health and safety precautions and PPE along with the contractor undertaking a watching brief for asbestos containing materials within the pile arisings. A strategy should be put in place for the management of unforeseen contamination within the arisings. Consideration will also need to be given to the appropriate handling and disposal of contaminated arisings, including asbestos containing materials.
Scenario 4 Direct contact of the piles with contaminated soil or leachate causing degradation of materials	Based on the information presented within the Phase 2 Site Investigation Report, a concrete classification of DS1, AC-1 is assumed for the site.	Adequate concrete mix design in accordance with the concrete classification (DS1, AC1) is required.	**Low**

Generic pollution scenario (EA, 2001)	Site characteristics	Risk associated with use of CFA piles	Risk
Scenario 5 The pushing of solid contaminants down into an aquifer during pile driving	Contaminants have been identified within the shallow made ground soils.	Not applicable – all arisings are brought to the surface when CFA piling is utilised; therefore driving any shallow contaminated made ground into the deep aquifer is avoided.	**Very low**
Scenario 6 Contamination of groundwater by wet concrete, cement paste or grout	A proportion of the pile will be formed within the made ground and superficial deposits (Glaciofluvial Deposits and Devensian Till), before being socketed into the underlying bedrock. The nearest groundwater abstraction is located 424 m east of the site, whilst groundwater flow within the sandstone is understood to be in a westerly direction.	Grout/cement only remains mobile until hardened. The volume of concrete added will be monitored during piling and the viscosity will be managed to limit loss. Any impact to groundwater, if any, will be highly localised around individual piles and is unlikely to impact the offsite groundwater abstraction, given the distance from the site and the intervening land use.	**Very low**

7 CONCLUSION

The site is to be redeveloped with purpose-built student accommodation comprising a 32-storey tower with 11-storey shoulder blocks. Given the anticipated loadings and underlying ground conditions, the use of conventional spread foundations is not feasible for the site and the adoption of a piled solution is required.

It is understood that piles will be constructed using Continuous Flight Auger (CFA) techniques, with no bored or pre-cast driven piling required. Although the final design is to be confirmed upon appointment of a piling contractor, maximum pile lengths of between 15 m to 20 m are anticipated, to provide a rock socket of between 5 m to 10 m into the underlying bedrock.

A piling risk assessment has been prepared for the site on the basis of the scenario described above, and the six pollution scenarios recommended in the EA's guidance on piling in contaminated land were considered in the context of the site's conceptual model.

The results of the assessment indicate that CFA pilling techniques represent an applicable methodology for the scheme and would not present any significant environmental risks for the reasons outlined in site specific hazard identification; chiefly that the use of non-displacement piling techniques will not result in the formation of preferential pathways for contamination migration into the underlying aquifer.

The ground investigation and risk assessment have, however, identified the presence of asbestos, heavy metals and PAH within the shallow made ground soils at the site. Whilst risks to future site users will be managed by the implementation of a clean cover system within areas of soft landscaping, risks to construction workers remain plausible.

It is noted that the use of non-displacement piles will result in the generation of soil arisings, and this is likely to result in contaminated made ground (including asbestos) being brought to the surface. There is also the potential for intermixing of clean soils with the contaminated made ground.

Risks to construction workers should be managed by the use of appropriate site health and safety precautions and PPE along with the contractor undertaking a watching brief for asbestos containing materials within the pile arisings. A strategy should be put in place for the management of unforeseen contamination, including the presence of asbestos containing materials, within the arisings. Consideration will also need to be given to the appropriate handling and disposal of contaminated arisings, including asbestos containing materials.

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APPENDICES

Appendix A
DRAWINGS FROM ROC PHASE 2 SITE INVESTIGATION REPORT

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NOTES

- TERRA CONSULT 2017 EXPLORATORY HOLE LOCATION (XXXX)
- GEOTECHNICAL LTD 2016 EXPLORATORY HOLE LOCATION (XXXX)
- TERRA CONSULT 2019 EXPLORATORY HOLE LOCATION (XXXX)
- APPROXIMATE SITE RED LINE BOUNDARY

DRAWING NOTES:

1. TO BE READ IN CONJUNCTION WITH ROC CONSULTING PHASE 1 DESKTOP STUDY REF: 4770-ROC-ZZ-XX-RP-ES-P1-101 AND PHASE 2 SITE INVESTIGATION REPORT REF: 4770-ROC-ZZ-XX-RP-ES-P2-101.
2. EXPLORATORY HOLE LOCATIONS SHOWN AT APPROXIMATE EXTENTS.
3. EXISTING SITE LEVEL INFORMATION TAKEN FROM SURVEY OPERATIONS TOPOGRAPHICAL SURVEY REF:24F089
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VITA MEADOW LTD

PROJECT TITLE
PLOT 9B FIRST ST MANCHESTER

DRAWING TITLE
HISTORIC BOREHOLE LOCATION PLAN CURRENT SITE

DRAWING No.	REV.
4770-ROC-ZZ-XX-DR-ES-ES101	01

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- APPROXIMATE SITE BOUNDARY

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PLOT 9B FIRST ST MANCHESTER

DRAWING TITLE
HISTORIC BOREHOLE LOCATION PLAN PROPOSED SITE

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ROC WS10X — ROC WINDOW SAMPLE BOREHOLE LOCATION

ROC WS10X — ROC WINDOW SAMPLE BOREHOLE LOCATION WITH INSTALL

ROC BH10X — ROC ROTARY BOREHOLE LOCATION WITH INSTALL

APPROXIMATE SITE BOUNDARY

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PROJECT TITLE
PLOT 9B FIRST ST MANCHESTER

DRAWING TITLE
PROPOSED BOREHOLE LOCATION PLAN EXISTING SITE

DRAWING No.	REV.
4770-ROC-ZZ-XX-DR-ES-ES104	01

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ROC BH10X — ROC ROTARY BOREHOLE LOCATION WITH INSTALL

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ROC WS101
ROC RBH102
ROC WS102
ROC WS103
ROC WS104
ROC RBH101
ROC WS105
ROC WS106

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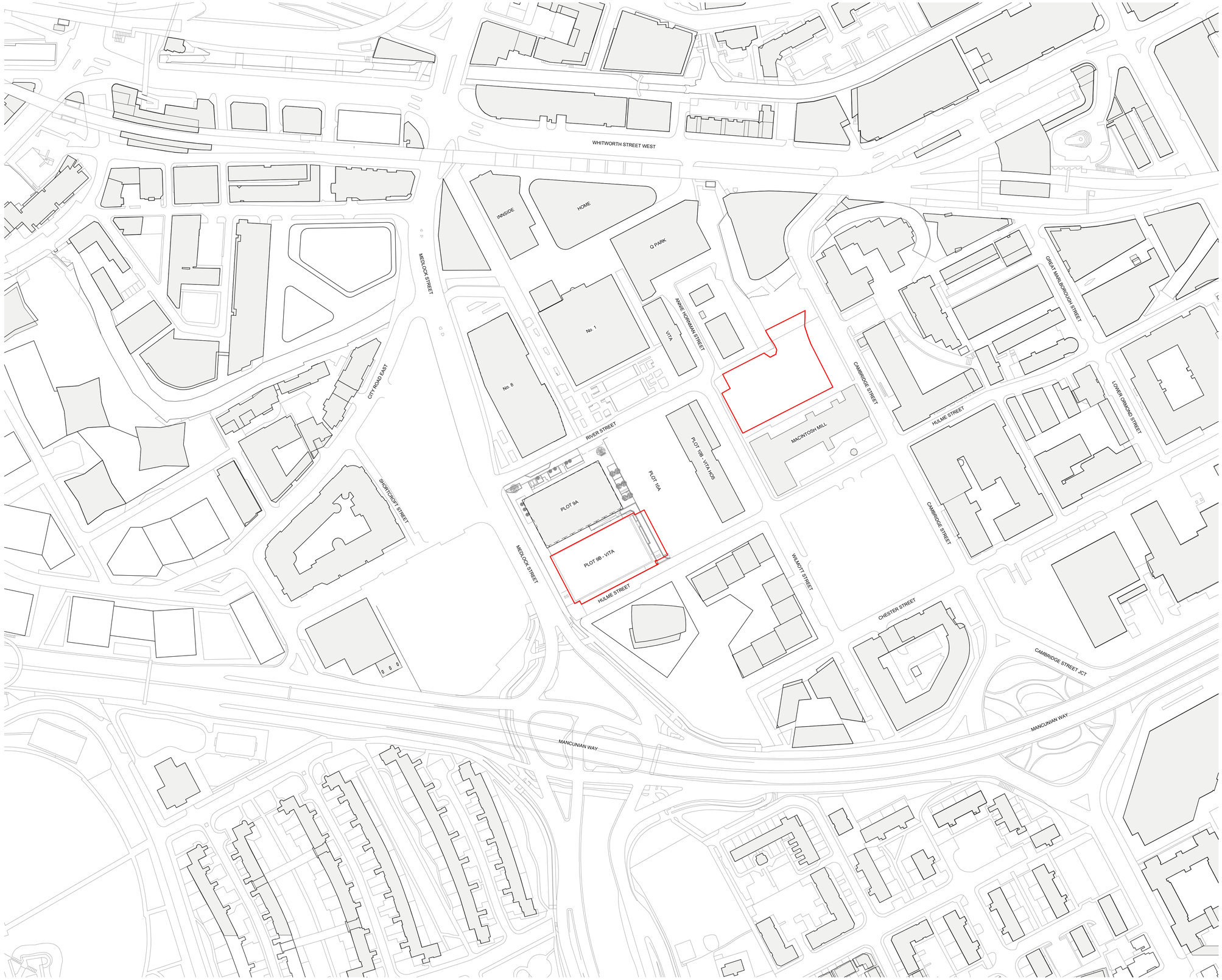
PROJECT TITLE
PLOT 9B FIRST ST MANCHESTER

DRAWING TITLE
PROPOSED BOREHOLE LOCATION PLAN PROPOSED SITE

DRAWING No.	REV.
4770-ROC-ZZ-XX-DR-ES-ES104	01

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Appendix B
PROPOSED DEVELOPMENT AND PILE LAYOUT DRAWINGS



Existing Site Plan

1 : 1250

0m 25m 50m 125 m

N

General Notes

Use figured dimensions only. Do not scale off this drawing. All dimensions must be set out and checked by the contractor on site prior to commencement of construction. Any variations between drawings and site must be reported to TGA before work proceeds.

Drawings to be read in conjunction with Architectural Specification, Structural Engineer's Drawings and Specifications, Mechanical & Electrical Engineer's Drawings and Specifications, all Supplemental Information, including but not limited to; Detailed Fire Strategy, Acoustic Report, Thermal Report & Overheating Report.

No portion of the Works to commence without acceptance of the required submittals by the Employer.

Main Contractor to submit relevant documents to building regulation and legislation approval authorities as required to comply with the Specification.

Legend and Notes

Red Line Planning Boundary

Rev	Description	Date	By
P01	First Issue	18.10.24	LS

Title
Existing Site Location Plan

Drawing No.
VS9B-TGA-G100-PL-XX-95200

Revision
P01

Status

Scale
As indicated@A1

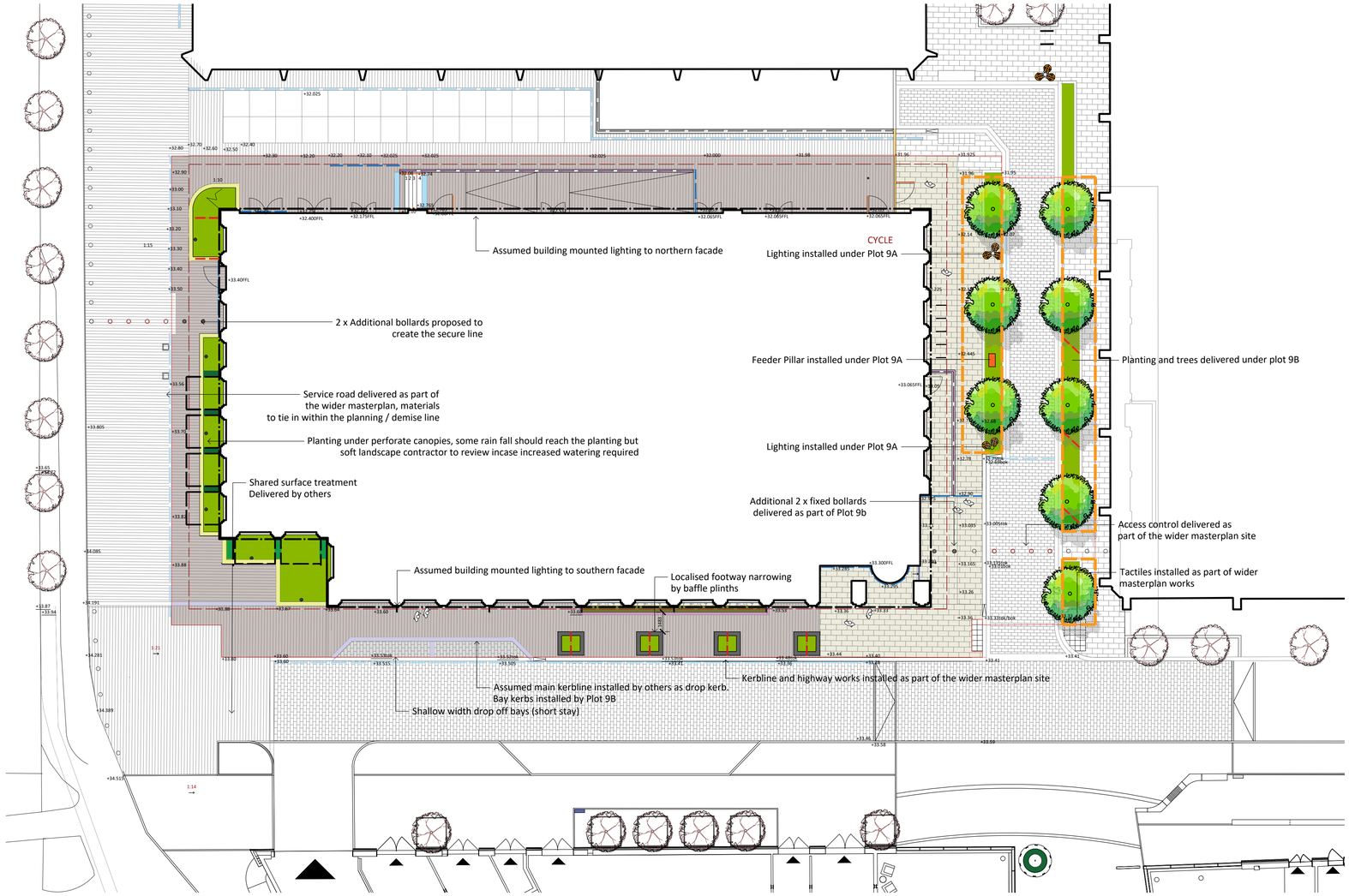
Project
Plot 9B_First Street

Client
VITA

TIM GROOM ARCHITECTS

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HARD LANDSCAPE

Established Masterplan Paving Installed Under Other Phases

Proposed Paving Type 1 - Concrete
Product: Hydro Lineo 40 by Hardscape (or similar approved)
Plan Size: 300 x 100 x 100
Colour: Standard Grey
Laying Bond: Stretcher Bond
Other: 5mm Butt jointed

Proposed Paving Type 2 - Granite Mix Setts
Product: 30% Kobra & 70% Royal White Mix by Hardscape (or similar approved)
Plan Size: 100x 300 x 63mm (depth tbc)
Finish: Flamed
Laying Bond: Stretcher Bond

Proposed Paving Type 2 - Yorkstone Flags
Product: Scoutmoor Yorkstone Flags to match existing First Street Surfacing
Plan Size: 400-900 x 300 x 63mm (depth tbc)
Finish: Sawn
Laying Bond: Min 100mm overlap

Proposed Edge Type 1 - Flush Planting Bed Surround
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 200x900x150 (depth tbc)
Finish: Flamed
Upstand: 0mm

Proposed Edge Type 2 - Raised Planting Bed Surround
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 300x900x250 (depth tbc)
Finish: Flamed
Upstand: 125mm

Proposed Edge Type 3 - Flush Kerb
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 300x900x200 (depth tbc)
Finish: Flamed
Upstand: 0mm

Proposed Edge Type 4 - Wall and Balustrade
Product: Brick clad wall to match the architecture
Laying Bond: Staggered bond
Other: Brick on Edge copings - special ends, Vertical flat bar railings (min 1.1m high)

Proposed Edge Type 5 - Steps
Product: Royal White Granite by Hardscape (or similar approved)
Plan Size: 1100x300x175mm
Finish: Flamed
Other: Contrast nosing
Other: Corduroy s/s strip tactile pavings

FURNITURE

Proposed Bollard to Match Masterplan Furniture
Product: K8 Shallow Depth Terra Neptune SIngle by Frontier Pitts LTD (or similar approved)
Class Code:V/7500/64/90:0.0
Foundation: Shallow Mount

Proposed Lighting to Match Masterplan Furniture
Product: 2/3 head Multi Woody by IGuzzini or similar approved
Height: 5m
Materials: S/S

Proposed Lighting Bollard to Match Masterplan Furniture
Product: Unknown - to match the wider masterplan palette
iWay bollard Super Comfort round 180degrees

Proposed Cycle Stands to Match Masterplan Furniture
Product: S/S or similar approved

NB Baffles: Patternation and colour tone to tie with the architectural narrative

Proposed Movable Plinth Planter with Baffle
Product: Bespoke weighted Plinth Planter with Baffle
Plinth Materials: Granite 1800w x1800l x500h
Baffle Dimension: 1800w x 2500h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Baffle - Building Entrance
Product: Bespoke
Dimension: 1100w x 3000h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Baffle - Located in Planting Beds
Product: Bespoke
Dimension: 1800w x 3000h
Other: 50% Porosity - Perforate Pattern (tbc)

Proposed Fin - Southern Building Facade
Product: Bespoke
Dimension: 500w x 1800h
Other: Perforate Pattern (tbc)

Proposed Railings and Gate
Product: To Match Wider masterplan proposals
Other: To be ascertained if part installed under Plot 9A

Indicative Drainage Channel

Drainage Channel Delivered by Others

Proposed Feeder Pillar Delivered by Another Phase

SOFT LANDSCAPE

Trees Proposed on Other Development Plots

Proposed Tree Planting
Typical Species: Tilia Cordata
Size: 25-30cm (to be viewed against Plot 9A trees)
Other: Clear Stem 2m

Proposed Ornamental Planting
5L Ornamental planting stock at 5 per m2
70mm Depth Melcourt Bark Nuggets or similar approved

Proposed Hedge Type 1
Type: Evergreen
Size: 1.2m long x 0.5m wide x 1.5m high

Proposed Hedge Type 2
Type: Evergreen
Size: 1.6m long x 0.5m wide x 1m high

Proposed Hedge Type 3
Type: Evergreen
Size: 7m long x 0.5m wide x 1m high

Proposed Below Ground Structural Tree Cells
Product: Rootspace by GreenBlue Urban or similar approved
Sizes: Modules of 0.5m x depth cells 1m

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3. This drawing is to be read in conjunction with all relevant Architects', Engineer's, Specialists, Bills of Quantities and Specifications.
4. The insertion of any firm or proprietary brand on this drawing is an indication of the class or quality required and does not exclude the use of alternative materials that are equal in performance, quality and appearance, provided that they have been approved in writing by the Landscape Architect.
5. The Contractor is responsible for accurately ascertaining the position of underground services and responding to all relevant service easement requirements.
6. All dimensions are in millimetres unless stated otherwise, for the purposes of construction this drawing must not be scaled and only written dimensions used. Written and scaled dimensions to be checked on site, any discrepancies reported prior to work commencing. IF IN DOUBT PLEASE ASK.
7. All work and materials are to be in accordance with the relevant British Standards and Code of Practice.
8. All Proprietary products are to be used strictly in accordance with the manufacturer's instructions and details.

REVISION NOTES

Rev	By	Description	Date
P2	KH	Coordinated Issue	xx/10/2024
P1	KH	First Issue	09/10/2024

Client
Vita Living

Project
First Street - Plot 9B

Description
Landscape Layout

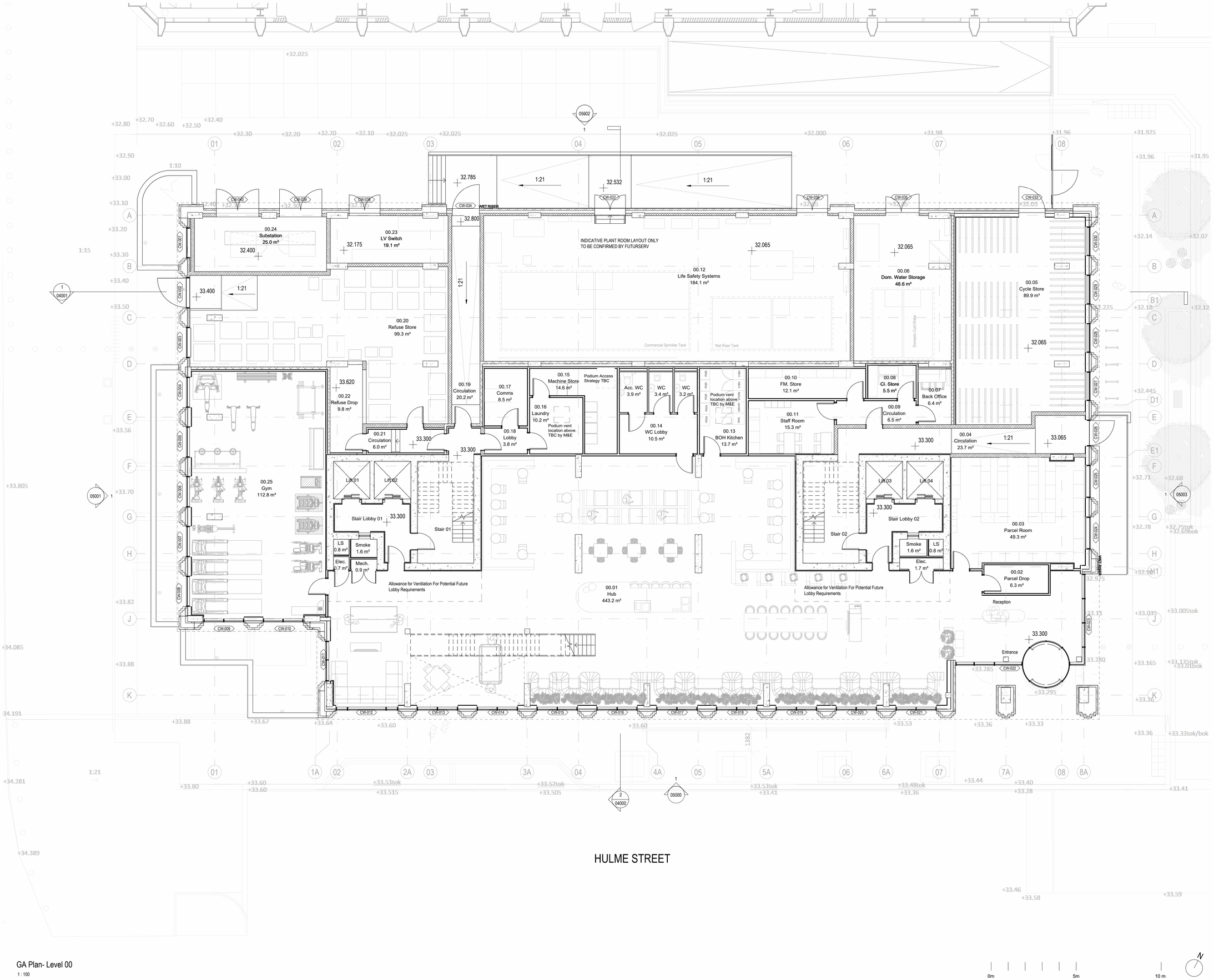
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For Information

Scale @ A1	Drawn	Checked	Date
1:200	KH	KH	09.10.2024

Drawing number
Z19B-TPM-G710-PL-XX- 4645 101

Revision
P2

tpm landscape
chartered landscape architects
address: 4th Floor Studio 10 Little Lever St Manchester M1 1HR
tel: 0161 235 0600 fax 0601 email info@tpmlandscape.co.uk



GA Plan- Level 00

1 : 100

0m 5m 10 m

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Drawings to be read in conjunction with Architectural Specification, Structural Engineer's Drawings and Specifications, Mechanical & Electrical Engineer's Drawings and Specifications, all Supplemental Information, including but not limited to; Detailed Fire Strategy, Acoustic Report, Thermal Report & Overheating Report.

No portion of the Works to commence without acceptance of the required submittals by the Employer.

Main Contractor to submit relevant documents to building regulation and legislation approval authorities as required to comply with the Specification.

Legend and Notes

To be read in conjunction with the following drawing series;

21 - External Walls
22 - Internal Walls
23 - Slab Setting Out
24 - Stairs
28 - Facade Setting Out
31 - Windows & Curtain Walling
32 - Doors
42 - Internal Finishes
68 - Fire Strategy Plans
70 - Apartment Types

1.01 / Type A / 40m² — Level . Room Number / Apartment Type (Refer to 70 Series for Types) / Area

00.03.3 / DT-003 — Door Number / Door Type

01.01 / WT-01 — Window Number / Window Type

CW-001 — Curtain Wall Numbers

Concrete column
Refer to Structural Engineers drawings

Bike Store Schedule

Description	No. of Bike Racks	No. of Bike Spaces
Sheffield Bike Stand	5	10
	5	10
Double Stacked	68	136
	68	136
Grand Total	73	146

Rev	Description	Date	By
P01	Stage 03 Preliminary Issue	01.10.24	AV
P02	Stage 04 Preliminary Issue	08.11.24	AV

Title
Detailed Plan - Level 00

Drawing No.
VS9B-TGA-G200-PL-00-03100

Revision
P02

Status
Stage 04

Scale
1 : 100@A1

Project
Plot 9B_First Street

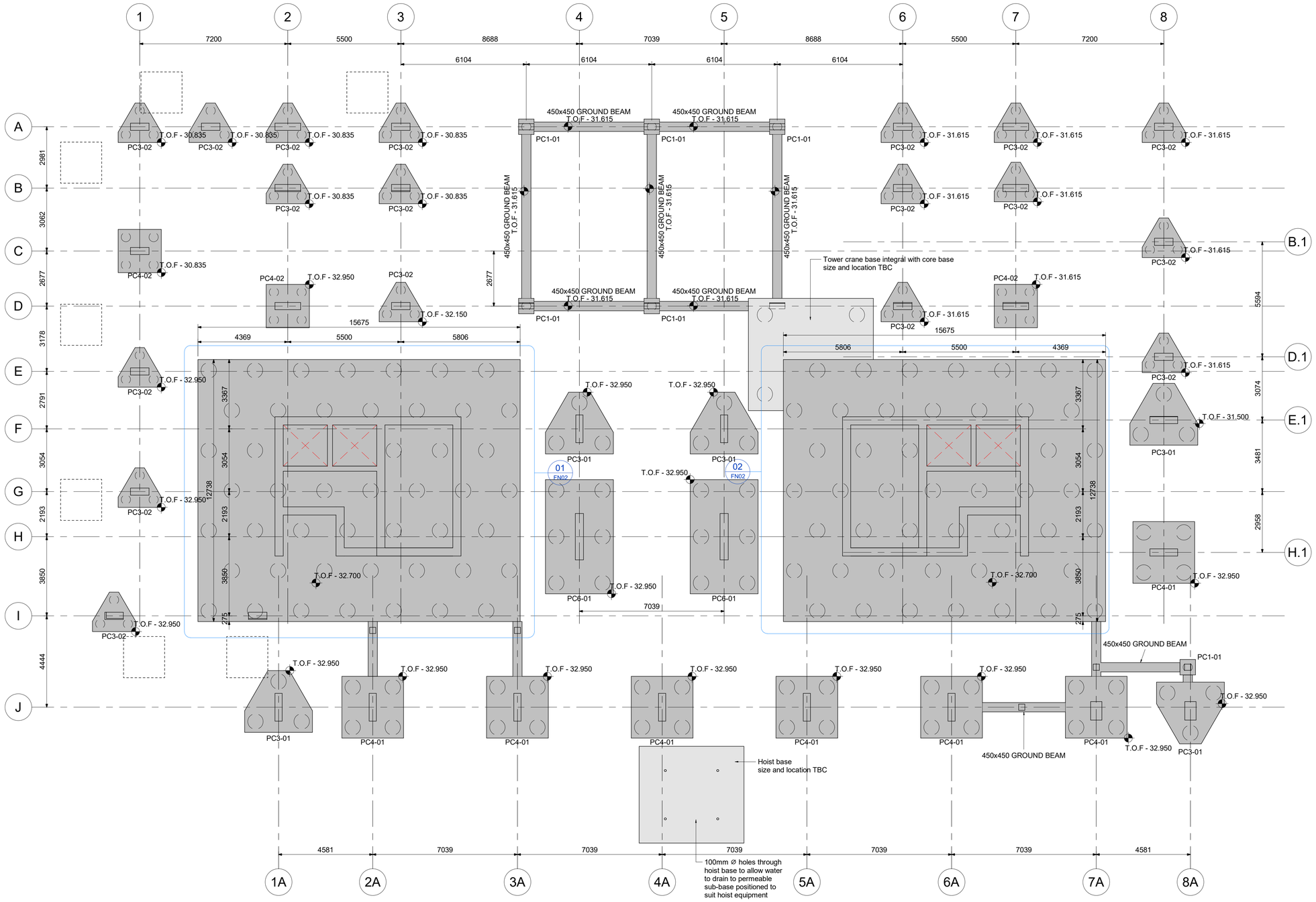
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VITA

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Eastgate, 2 Castle Street, Manchester, M3 4LZ 0161 870 1152

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00 FOUNDATION LAYOUT
1 : 100

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WORK IN PROGRESS

The information on this drawing is an optimised solution based upon external information as of 07.12.2024 . It may be subject to change through external influences such as client brief and scope changes, services BWIC, sub-contractor requirements etc. Therefore a suitable contingent approach must be applied where the information is used for strategic decision making, procurement or construction in advance of final design requirements from other designers and sub-contractors.

NOTES

1. RoC drawings are to be read in conjunction with relevant documents, specifications, architectural and services drawings, including approved builders work drawings. The contractor should notify CA of any discrepancies between the structural drawings and specifications or other drawings.
2. Do not scale from the drawings or the computer digital date. Only figured dimensions are to be used.
3. It is the responsibility of the lead consultant (architect) to check the setting out provided on these drawings and the co-ordination of the frame with the envelope & other elements of the building.
4. All dimensions are in millimetres unless noted otherwise.
5. All levels are in metres above Ordnance Datum unless noted otherwise.
6. This drawing is to be read in conjunction with General Notes Drawing. NT-01

Legend:

2000x2000x200 Temporary works foundation at slab level

REV	DATE	DETAILS	DRN	CHK
P04	02.10.2024	UPDATED TO ARCH LAYOUTS	EGP	JAS
P03	19.07.2024	DRAFT STAGE 3 ISSUE	EGP	JAS
P02	07.06.2024	FOUNDATIONS UPDATED	EGP	JAS
P01	05.06.2024	INITIAL ISSUE	EGP	JAS

DRAWING STATUS: PRELIMINARY

RIBA STAGE: DRAFT STAGE 3

RoC CONSULTING
Commercial Wharf
6 Commercial Street
Manchester M15 4PZ
T 0161 214 5390
W rocconsulting.com

DRAWN: EGP	DATE: 04.06.2024	SCALES: As indicated
CHECKED: EGP	DATE: 04.06.2024	THE ABOVE SCALES APPLY WHEN PLOTTED AT A1 SIZE -DO NOT SCALE-
APPRVD: JS	DATE: 04.06.2024	EMAIL FOR DRAWINGS: info@rocconsulting.com

CLIENT: VITA MEADOW LTD

PROJECT TITLE: PLOT 9B FIRST ST

DRAWING TITLE: FOUNDATION LAYOUT

DRAWING No.: 9B-ROC-G200-PL-XX-FN00

REV.: P04

Appendix C
SUMMARY OF LEGISLATION AND POLICY RELATING TO LAND CONTAMINATION

Part IIA of the Environmental Protection Act 1990

Part IIA of the Environmental Protection Act 1990 (Part IIA) and its associated Contaminated Land Regulations 2000 (SI 2000/227), which came into force in England on 1 April 2000, formed the basis for the current regulatory framework and the statutory regime for the identification and remediation of contaminated land. Part IIA of the EPA 1990 defines contaminated land as 'any land which appears to the Local Authority in whose area it is situated to be in such a condition by reason of substances in, on or under the land, that significant harm is being caused, or that there is significant possibility of significant harm being caused, or that pollution of controlled waters is being or is likely to be caused'. Controlled waters are considered to include all groundwater, inland waters and estuaries.

In August 2006, the Contaminated Land (England) Regulations 2006 (SI 2006/1380) were implemented, which extended the statutory regime to include Part IIA of the EPA as originally introduced on 1 April 2000, together with changes intended chiefly to address land that is contaminated by virtue of radioactivity. These have been replaced subsequently by the Contaminated Land (England) (Amendment) Regulations 2012, which now exclude land that is contaminated by virtue of radioactivity.

The intention of Part IIA is to deal with contaminated land issues that are considered to cause significant harm on land that is not undergoing development (see **Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance, April 2012). This document replaces Annex III of** Defra Circular 01/2006, published in September 2006 (the remainder of this document is now obsolete).

Planning Policy

Land contamination is often addressed via the planning process during redevelopment of sites. This approach was documented in Planning Policy Statement: Planning and Pollution Control PPS23, which states that it remains the responsibility of the landowner and developer to identify land affected by contamination and carry out sufficient remediation to render the land suitable for use. PPS23 was withdrawn early in 2012 and has been replaced by much reduced guidance within the National Planning Policy Framework (NPPF), reference ISBN: 978-1-5286-1033-9, July 2021. For sites in Wales, reference should be made to Planning Policy Wales (Welsh Government. Edition 11, February 2021).

The new framework has limited guidance on contaminated land, as follows:

Chapter 11. Making effective use of land

123. Planning policies and decisions should promote an effective use of land in meeting the need for homes and other uses, while safeguarding and improving the environment and ensuring safe and healthy living conditions. Strategic policies should set out a clear strategy for accommodating objectively assessed needs, in a way that makes as much use as possible of previously-developed or 'brownfield' land.

124. Planning policies and decisions should:

c) give substantial weight to the value of using suitable brownfield land within settlements for homes and other identified needs, and support appropriate opportunities to remediate despoiled, degraded, derelict, contaminated or unstable land.

Chapter 15. Conserving and enhancing the natural environment

180. Planning policies and decisions should contribute to and enhance the natural and local environment by:

e) preventing new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability. Development should, wherever possible, help to improve local environmental conditions such as air and water quality, taking into account relevant information such as river basin management plans; and

f) remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Ground conditions and pollution

189. Planning policies and decisions should ensure that:

a) a site is suitable for its proposed use taking account of ground conditions and any risks arising from land instability and contamination. This includes risks arising from natural hazards or former activities such as mining, and any proposals for mitigation including land remediation (as well as potential impacts on the natural environment arising from that remediation);

b) after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990; and

c) adequate site investigation information, prepared by a competent person, is available to inform these assessments.

190. Where a site is affected by contamination or land stability issues, responsibility for securing a safe development rests with the developer and/or landowner.

Water Resources Act (WRA)

The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009 updated the Water Resources Act 1991, which introduced the offence of causing or knowingly permitting pollution of controlled waters. The Act provides the Environment Agency with powers to implement remediation necessary to protect controlled waters and recover all reasonable costs of doing so.

Water Framework Directive (WFD)

The Water Framework Directive 2000/60/EC is designed to:

- enhance the status and prevent further deterioration of aquatic ecosystems and associated wetlands that depend on the aquatic ecosystems
- promote the sustainable use of water

- reduce pollution of water, especially by ‘priority’ and ‘priority hazardous’ substances
- ensure progressive reduction of groundwater pollution.

The WFD requires a management plan for each river basin be developed every six years.

Groundwater Directive (GWD)

The 1980 Groundwater Directive 80/68/EEC and the 2006 Groundwater Daughter Directive 2006/118/EC of the WFD are the main European legislation in place to protect groundwater. The 1980 Directive is due to be repealed in December 2013. The European legislation has been transposed into national legislation by regulations and directions to the Environment Agency.

Priority Substances Directive (PSD)

The Priority Substances Directive 2008/105/EC is a ‘Daughter’ Directive of the WFD, which sets out a priority list of substances posing a threat to or via the aquatic environment. The PSD establishes environmental quality standards for priority substances, which have been set at concentrations that are safe for the aquatic environment and for human health. In addition, there is a further aim of reducing (or eliminating) pollution of surface water (rivers, lakes, estuaries and coastal waters) by pollutants on the list. The WFD requires that countries establish a list of dangerous substances that are being discharged and EQS for them. In England and Wales, this list is provided in the River Basin Districts Typology, Standards and Groundwater threshold values (Water Framework Directive) (England and Wales) Directions 2010. In order to achieve the objectives of the WFD, classification schemes are used to describe where the water environment is of good quality and where it may require improvement.

Environmental Permitting Regulations (EPR)

The Environmental Permitting (England and Wales) Regulations 2016 (as amended) provide a single regulatory framework that streamlines and integrates waste management licensing, pollution prevention and control, water discharge consenting, groundwater authorisations, and radioactive substances regulation. Schedule 22, paragraph 6 of EPR 2016 states: ‘the regulator must, in exercising its relevant functions, take all necessary measures - (a) to prevent the input of any hazardous substance to groundwater; and (b) to limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater.’

Notes:

1. *The above information is provided for background but does not constitute site-specific advice*
2. *The above summary applies to England only. Variations exist within other countries of the United Kingdom.*

Appendix D
TECHNICAL BACKGROUND

H1 Desk Study

Aquifer designation and Source protection zones

Principal aquifer: layers of rock or drift deposit that have high intergranular and/or fracture permeability (usually providing a high level of water storage). They may support water supply and/or river base flow on a strategic scale.

Secondary A aquifer: 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.

Secondary B aquifer: predominantly lower permeability layers that may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

Secondary undifferentiated aquifer: it has not been possible to attribute either a category A or B to a rock type. In most cases this means that it was previously designated as both a minor and non-aquifer in different locations owing to the variable characteristics.

Unproductive' strata: low permeability with negligible significance for water supply or river base flow.

The EA generally adopts a three-fold classification of source protection zones (SPZ) surround abstractions for public water supply. The Site is situated in an area defined as follows:

- Zone 1 or the 'inner protection zone' is located immediately adjacent to the groundwater source and is based on a 50-day travel time from any point below the water table to the source. It is designed to protect against the effects of human activity and biological/chemical contaminants that may have an immediate effect on the source
- Zone 2 or the 'outer protection zone' is defined by a 400-day travel time from a point below the water table to the source. The travel time is designed to provide delay and attenuation of slowly degrading pollutants
- Zone 3 or the 'total catchment' is the area around the source within which all groundwater recharge is presumed to be discharged at the source.

Preliminary risk assessment methodology

LCRM outlines the framework to be followed for risk assessment in the UK. The framework is designed to be consistent with UK legislation and policies including planning. An outline conceptual model should be formed at the preliminary risk assessment stage that collates all the existing information pertaining to a site in text, tabular or diagrammatic form. The outline conceptual model identifies potentially complete (termed possible) contaminant linkages (contaminant–pathway–receptor) and is used as the basis for the design of the site investigation. The outline conceptual model is updated as further information becomes available, for example as a result of the site investigation.

Production of a conceptual model requires an assessment of risk to be made. Risk is a combination of the likelihood of an event occurring and the magnitude of its consequences. Therefore, both the

likelihood and the consequences of an event must be taken into account when assessing risk. ROC has adopted guidance provided in CIRIA C552 for use in the production of conceptual models.

The likelihood of an event can be classified on a four-point system using the following terms and definitions based on CIRIA C552:

- highly likely: the event 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: it is probable that an event will occur or circumstances are such that the event is not inevitable, but possible in the short term and likely over the long term
- low likelihood: circumstances are possible under which an event could occur, but it is not certain even in the long term that an event would occur and it is less likely in the short term
- unlikely: circumstances are such that it is improbable the event would occur even in the long term.

The severity can be classified using a similar system also based on CIRIA C552. The terms and definitions relating to severity are:

- 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 resources. Catastrophic damage to buildings or property. Short-term risk to an ecosystem or organism forming part of that ecosystem (note definition of ecosystem in 'Draft Circular on Contaminated Land', DETR 2000)
- medium: chronic damage to human health ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000), pollution of sensitive water resources, significant change in an ecosystem or organism forming part of that ecosystem
- mild: pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm' as defined in 'Draft Circular on Contaminated Land', DETR 2000). Damage to sensitive buildings, structures or the environment
- minor: harm, not necessarily significant, but that could result in financial loss or expenditure to resolve. Non-permanent human health effects easily prevented by use of personal protective clothing. Easily repairable damage to buildings, structures and services.

Once the probability of an event occurring and its consequences have been classified, a risk category can be assigned according to the table below.

		Consequences			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**Highly likely**	Very high	High	Moderate	Moderate/low
	Likely	High	Moderate	Moderate/low	Low
	Low likelihood	Moderate	Moderate/low	Low	Very low
	Unlikely	Moderate/low	Low	Very low	Very low

Definitions of these risk categories are as follows together with an assessment of the further work that may be required:

- very high: there is a high probability that severe harm could occur or there is evidence that severe harm is currently happening. This risk, if realised, could result in substantial liability; urgent investigation and remediation are likely to be required
- high: harm is likely to occur. Realisation of the risk is likely to present a substantial liability. Urgent investigation is required. Remedial works may be necessary in the short term and are likely over the long term
- moderate: it is possible that harm could arise, but it is unlikely that the harm would be severe and it is more likely that the harm would be relatively mild. Investigation is normally required to clarify the risk and determine the liability. Some remedial works may be required in the longer term
- low: it is possible that harm could occur, but it is likely that if realised this harm would at worst normally be mild
- very low: there is a low possibility that harm could occur and if realised the harm is unlikely to be severe.