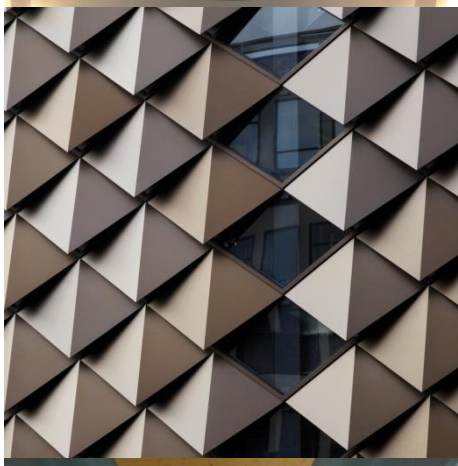
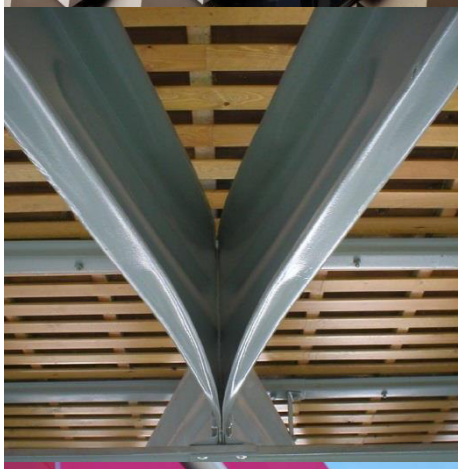








Swan House, Manchester

Piling Risk Assessment

Curtins Ref: 067266-CUR-00-XX-RP-GE-003

Revision: P02

Issue Date: 27 January 2021

Client Name: Ridge Manchester S.à r.l.

Client Address: 172 Re des Bains, L-1212 Luxembourg,

Site Address: Swan Street, Manchester, M4 5DF

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Rev	Description	Issued by	Checked	Date
V01	Issue report	SH	PDW	19 Jan 2021
V02	Update report to include reference to the Phase 1 Preliminary Risk Assessment report submitted to Planning in 2018.	SH	PDW	27 Jan 2021

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Author	Signature	Date
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Reviewed & Authorised	Signature	Date
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1.0 Introduction

Piled foundations are proposed for the development at Swan House, Swan Street, Manchester, M4 5DF. The proposed development comprises the construction of a multistorey structure of thirty one, thirteen and five storey to provide 373 no. residential apartments, 12 no. serviced apartments and a ground floor commercial unit with associated car parking. The proposed development plans are included within *Appendix A* of this document.

The aquifer underlying the site is defined as a Principal Aquifer and therefore a piling risk assessment has been produced in order to identify the risks associated with a piled foundation solution and thus satisfy the relevant planning condition.

As detailed below, the assessment of risk presented by a piled foundation solution has been identified as a specific condition to the overall development of the site (outline approval ref. 121380/FO/2018).

Condition 9: *Prior to the commencement of the development, details of the method for piling, or any other foundation design using penetrative methods, shall be submitted for approval in writing by the City Council, as Local Planning Authority. The approved details shall then be implemented during the construction of the development*

Reason: Piling or any other foundation designs using penetrative methods shall not be permitted other than with the express written consent of the Local Planning Authority, which may be given for those parts of the site where it has been demonstrated that there is no resultant unacceptable risk to groundwater.

This report has been written to address this planning condition.

1.1 Scope

This piling risk assessment provides an overview of the site's ground and groundwater conditions and considers the potential risks to groundwater associated with the selected optimum piling technique for the strata, Continuous Flight Auger (CFA) piling.

The report also identifies appropriate risk management and monitoring protocols that can be adopted to ensure any residual risk is brought within adequate and practicable limits.

1.2 References

In preparation of this report reference has been made to the following key guidance document:

- Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater & Contaminated Land Centre report NC/99/73 (EA Report 2001).

Reference is also made to the following geo-environmental reports undertaken for the site:

- Curtins (2020) Swan House Manchester Phase 1 Preliminary Risk Assessment Report, Ref. 067266-CUR-00-XX-RP-GE-001-V05.
- Curtins (2020) Swan House Manchester Pre-Demolition Phase 2 Site Investigation Report, Ref. 067266-CUR-00-XX-RP-GE-002-V02.

These reports have been issued previously to the client and the Design Team. The version of the Phase 1 PRA report submitted to Manchester City Council Planning Department to discharge relevant planning conditions is referenced:

- Curtins (2018) Swan House Manchester Phase 1 Preliminary Risk Assessment Report, Ref. 067266-CUR-00-XX-RP-GE-001-V03.

It is assumed that the Pre-Demolition Phase 2 Site Investigation report will be submitted by the project Architect or Planning Consultant to Manchester City Council along with this Piling Risk Assessment document to discharge relevant planning conditions.

2.0 The Site

This section of the report summarises the site setting, history, geology, hydrogeology, hydrology, environmental conditions and remediation measures recommended at the site with reference to the geo-environmental reports referenced previously. It is not the intention of this report to duplicate these reports, with the information below providing the background information to support the piling risk assessment and recommendations.

For further background information the full reports should be consulted.

2.1 The Site Setting

The site is centred on National Grid Reference (NGR) SJ 84502 98870 and covers an area of approximately 0.25Ha. The site location plan is presented as *Figure 2.1.*

The site is currently occupied by a three-storey building comprising warehouse and commercial premises on the ground and first floors, with a basement currently used as a storage facility extending beneath nearly the entirety of the site. Topography slopes gently westwards.

The site is surrounded by residential and commercial properties and is bound by Cable Street to the northeast; Mason Street to the southeast; Swan Street to the southwest; and Rochdale Road to the northwest.

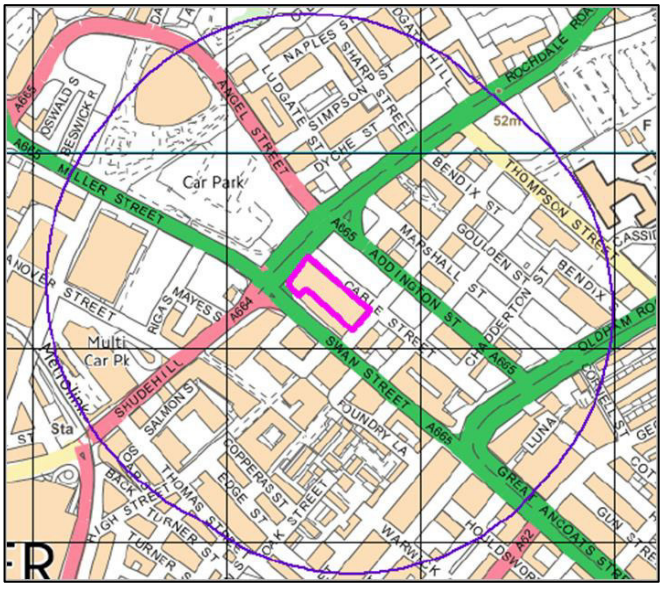


Figure 2.1: *Site Location Plan*

2.2 Site History

From the mid-19th Century to the early 20th Century, Cable Street Mill is present across most of the site with residential properties in the northwest. During WWII, ruins are noted within the general vicinity with

buildings disappeared from mapping; potentially due to bomb strikes. In the mid-20th Century to the present day the site has been used as a warehouse. The surroundings comprised mills and iron works (mid-19th to early 20th Century) and in the late 20th Century a garage was noted 10m to the southeast.

2.3 Hydrogeology and Hydrology

The site, corresponding with the underlying solid geology, is underlain by a Principal Aquifer within the bedrock (Chester Formation – sandstone) described as:

Layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, Principal aquifers are aquifers previously designated as a major aquifer.

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

There are no groundwater abstractions located within 500m of the site. The nearest groundwater abstraction point is located 720m northwest at Interbrew UK Ltd, Strangeways where groundwater is abstracted from Boreholes 1-3 and used for breweries/wine: process water and drinking, cooking, sanitary and washing.

The overlying Glacial Till (clay) superficial deposits are classified as a Secondary Undifferentiated Aquifer.

Local boreholes indicate bedrock from approximately 17.91m bgl.

The nearest surface water feature is the River Irk, 304m west of the site, flowing from northeast to southwest. It is noted to be of River Quality E (Poor).

2.4 Ground Model

The Pre-Demolition Investigation undertaken to date comprised 7 no. window sample boreholes, 4 no. undertaken at ground level and 3 no. undertaken within the existing basement.

A deeper ground investigation utilising sonic boring techniques to obtain superficial and rock cores is scheduled to commence in January 2021.

2.4.1 Made Ground

Made ground was encountered in three of the four exploratory holes undertaken at ground level (WS02-WS04). The base of the Made Ground was encountered at 1.05m bgl and 2.80m bgl in WS02 and WS03 respectively. The base of the Made Ground was not encountered in WS04 which was terminated at a depth of 3.00m bgl.

The concrete in WS02-WS04 at ground level was underlain by a layer of subbase gravel, with a slight hydrocarbon odour observed in WS02 due to a possible fuel oil spillage.

WS02 recorded deposits comprising loose black slightly silty fine and medium Sand with rare cobbles of brick to a maximum recorded depth of 1.05m bgl. WS03 recorded loose black gravelly fine to coarse Sand with anthropogenic gravels of brick, concrete, ash, clinker and slate, between 0.34m - 1.30m bgl. Similar brown and black gravelly medium and coarse Sand deposits with anthropogenic gravels of brick, concrete, clinker and metal fragments, between 0.85m - 1.13m bgl. WS04 recorded light red medium grained sandstone masonry below gravelly Sand, underlain by limestone gravel and gravels of brick, concrete and slate, to a recorded depth of 2.25m bgl.

The base of the Made Ground soils in WS03 and WS04 recorded very soft brown sandy slightly gravelly Clay with fine fragments of sandstone, coal and rare brick at depths of 1.30m to 2.80m bgl and 2.25m to 2.70m bgl, respectively. Between 2.70m - 3.00m bgl WS04 recorded very soft dark greyish brown Clay with rare plant/wood fragments, where a slight organic odour was noted. Dynamic probing suggests the base of the soft clay was encountered at approximately 4.10m bgl.

2.4.2 Natural Deposits

Superficial Soils

The investigation encountered cohesive superficial soils all exploratory holes, except for WS04 and WS05, where the window sample boreholes could not be progressed through Made Ground soils, or concrete obstructions. The maximum thickness of superficial soils was not confirmed in the Pre-Demolition investigation.

WS06 and WS07 in the basement recorded concrete overlaying cohesive superficial deposits.

Deposits typically comprise stiff brown with rare to occasional grey mottling slightly sandy slightly gravelly Clay with localised bands of firm sandy slightly gravelly Clay. Gravels typically comprise fine and medium, angular to subrounded sandstone and coal.

2.4.3 Groundwater

Groundwater was not recorded within the shallow window sample boreholes, although clay deposits within WS03 and WS07 (2.80m and 4.60m below surface level (bgl) respectively) were recorded as wet or damp. Subsequent groundwater level monitoring identified groundwater at depths of between 1.23m to 2.73m bgl.

The water levels recorded within the shallow monitoring wells installed within the superficial soils are indicative of perched water.

2.5 Contamination Risk Assessments and Remediation

A programme of environmental chemistry testing was undertaken on soil samples obtained of the Made Ground (8no.) and natural soils (5no.). Samples were tested for a broad suite of contamination as identified in the Phase 2 report. Contamination risk assessments and recommendations undertaken by Curtins are summarised below.

Insufficient water was available within the window sample boreholes installed as a part of the Pre-Demolition Phase 2 to allow groundwater testing at that time.

2.5.1 Soils

The environmental chemistry results were compared with Generic Assessment Criteria for soils with respect to human health for a '*Commercial*' end use for a 2.5% SOM. No exceedances were identified.

No asbestos containing materials (ACMs) were identified during the investigation works and no asbestos fibres was positively identified in any of the soil samples analysed.

2.5.2 Controlled Waters

The risk to the nearest surface water feature was considered to be low given the distance (304m west) and poor river water quality (E).

Due to the presence of a Principal Aquifer beneath the site, and likely piled foundation solution to be adopted, it is proposed to collect groundwater samples from the sonic boreholes during the January 2021 investigation.

The results of laboratory analysis of groundwater will be assessed against EU Drinking Water Standards. In the absence of WFD EQSs, WHO Water Standards will be been utilised.

2.5.3 Ground Gas

Six monitoring visits were completed between 25th September 2018 and 21st January 2019.

Carbon Dioxide (CO_2) was recorded in peak concentrations of between 0.3% $^{v}/_{v}$ and 5.4% $^{v}/_{v}$. The greatest concentrations were consistently recorded in WS02 where concentrations ranged between 4.3% $^{v}/_{v}$ and 5.4% $^{v}/_{v}$, elsewhere concentrations ranged between 0.3% $^{v}/_{v}$ and 2.1% $^{v}/_{v}$.

The '*borehole*' Q_{hg} for the development site was derived recording a maximum Q_{hg} of 0.032l/hr for carbon dioxide, using a maximum steady state air flow rate of 0.6l/hr and carbon dioxide concentration of 5.4% $^{v}/_{v}$ (WS02), corresponding with a Characteristic Situation 1 (CS-1) ground gas regime.

No gas protection measures were therefore considered necessary.

2.5.4 Aggressive Ground Conditions

The site has been classified in accordance with BRE Special Digest 1. Based on the laboratory test results it was considered that a Design Sulphate Class may be taken as DS-2 with an ACEC class of AC-2 within Made Ground.

A Design Sulphate Classes and ACEC classes of DS-1 and AC-1 are considered appropriate for the Superficial deposits from the testing undertaken as a part of the Pre-Demolition Investigation.

3.0 Piling Risk Assessment

At the current design stage, the adoption of CFA piles to approximately 30m to 35m depth socketed into bedrock (sandstone) anticipated at around 25m depth below existing ground level is considered to be the optimum piling solution for the ground conditions and proposed building loading. This method has been selected with consideration of minimal ground vibration, as well as groundwater protection aspects.

CFA piles essentially involve driving a large auger into the ground, with soils within the radius of the auger brought to surface and replaced with concrete on withdrawal of the auger. The displacement of the surrounding ground is governed by the speed of rotation of the auger relative to the speed of vertical penetration. Theoretically, it is possible to adjust the speeds so that the volume of soils displaced laterally and removed as arisings is equal to the volume of concrete placed.

Within the EA Report (2001), the six Source-Pathway-Receptor scenarios are identified as:

1. *Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer;*
2. *Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of landfill gas, soil gas or contaminant vapours to the surface;*
3. *Direct contact of site workers and others with contaminated soil arising which have been brought to the surface;*
4. *Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration);*
5. *The driving of solid contaminants down into an aquifer during pile driving; and*
6. *Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.*

This piling risk assessment tabulated overleaf address aspects 1, 4, 5 and 6 above only, in keeping with the objectives of this report (assessing the risk to groundwater). Other aspects should be appropriately dealt with through engineering design and suitable on-site management. The risk assessment methodology follows that presented in *Appendix C.*

TABULATED RISK ASSESSSMENT: CFA Piles

Aspect	Potential Consequence	Potential Probability	Potential Risk	Risk Management Options Available	Resultant Risk
1. Creation of preferential pathways, through a low permeability layer (an aquitard), to allow potential contamination of an underlying aquifer.	**Medium** Pollution of sensitive water resources in groundwater. Site overlies a Principal Aquifer associated with the Chester Formation.	**Unlikely** • Limited Made Ground contamination identified; • Risk to groundwater considered to be Moderate / Low, with groundwater samples from the proposed Rotary boreholes to be collected and tested. • CFA piling method essentially self-sealing with concrete and therefore no resultant pathway.	**Low**	Not required.	**Low**
4. Direct contact of the piles or engineered structures with contaminated soil or leachate causing degradation of pile materials (where the secondary effects are to increase the potential for contaminant migration).		**Low Likelihood** • Soluble sulphate concentrations in soils generally meet a Design Sulphate class of DS2 AC-2 for made ground soils and DS1 AC-1 for natural soils.	**Moderate / Low**	Use of suitably sulphate resistant concrete for all substructures.	**Low**
5. The driving of solid contaminants down into an aquifer during pile driving.		**Low Likelihood** Above considerations, plus: • Low likelihood as arisings brought to surface in CFA method, with speed of auger rotation to be matched with downward force to avoid driving soils down.	**Moderate / Low**	Speed of auger rotation needs to be matched with downward force to avoid driving soils down.	**Low**
6. Contamination of groundwater and, subsequently, surface waters by concrete, cement paste or grout.		**Low Likelihood** Above considerations.	**Moderate / Low**	Cement content of the concrete will need to be closely monitored so that this in itself does not 'bleed' into groundwater.	**Low**

4.0 Summary and Recommendations

The risk assessment presented herein has concluded that there is a low risk to contamination of groundwater beneath the site from the use of CFA piling, providing that the following risk management measures are put in place:

- *Speed of auger rotation needs to be matched with downward force to avoid driving soils down; and*
- *Cement content of the concrete will need to be closely monitored so that this in itself does not 'bleed' into groundwater.*
- *Suitable sulphate resistant concrete should be used for all substructures to remain in contact with made ground soils meeting a DS-2 DS class and AC-2 ACEC class in accordance with BRE Special Digest 1:2005 Concrete in Aggressive Ground guidance.*

The following considerations should also be taken into account:

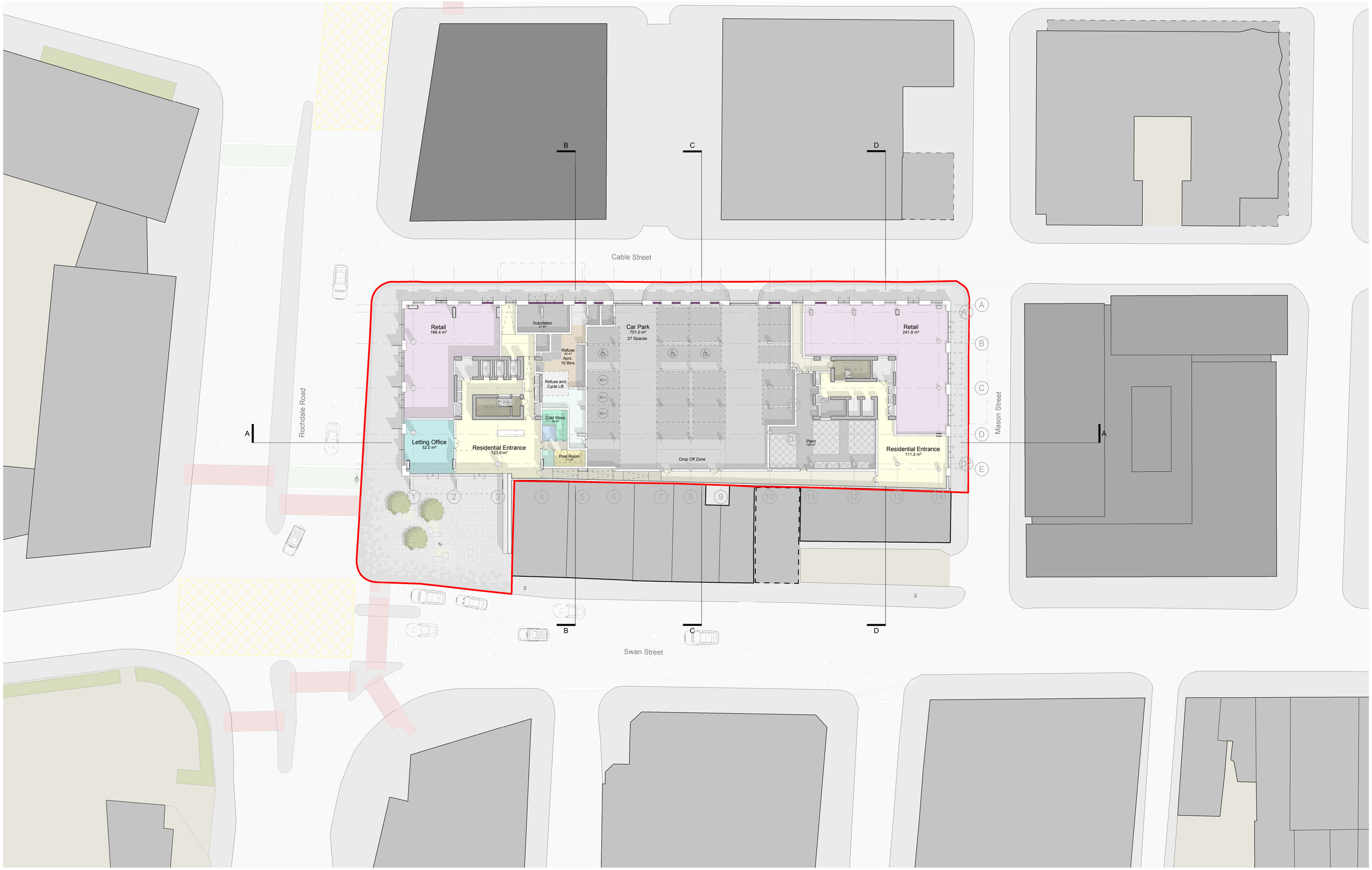
- *The piling contractor should prepare and submit relevant method statements for approval prior to piling works commencing;*
- *Where arisings are generated, they should be classified, handled and disposed of in compliance with relevant best practice and regulatory requirements;*
- *The piling contractor should make allowance for the provision of appropriate PPE; and*
- *In the event of uncovering any areas of unexpected contamination during the piling works, including odorous or stained soils, works should be ceased with the advice of the appointed environmental consultant sought immediately.*

This document should be forwarded to the Planning Authority for discharge of the relevant planning condition before piling works commence to disclose that there is a very low risk to groundwater from the proposed use of CFA piling on site.

In the event that the piling technique is changed from CFA piles or significant unexpected contamination is determined in the sonic borehole investigation, the Piling Risk Assessment will be updated and resubmitted.

Appendix A – Drawings

- Development Plans
- Curtins Exploratory Hole Location Plan



This drawing is copyright
Do not scale off dimensions.

All dimensions to be checked on site by contractor.

Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

Scale Bar 1:250 @ A1

0.5 1 2 5 10m

NORTH

Rev	Date	Description
00	2018-07-06	Issued for Planning
01	2018-07-25	Updated landscaping proposals

Project Title
Swan House
2 Rochdale Road
Manchester

Status
Planning Issue

Drawing Title
General Arrangement Plan
Ground Level 00

Job No
10133

Scale
1:500 @ A3
1 : 250@ A1

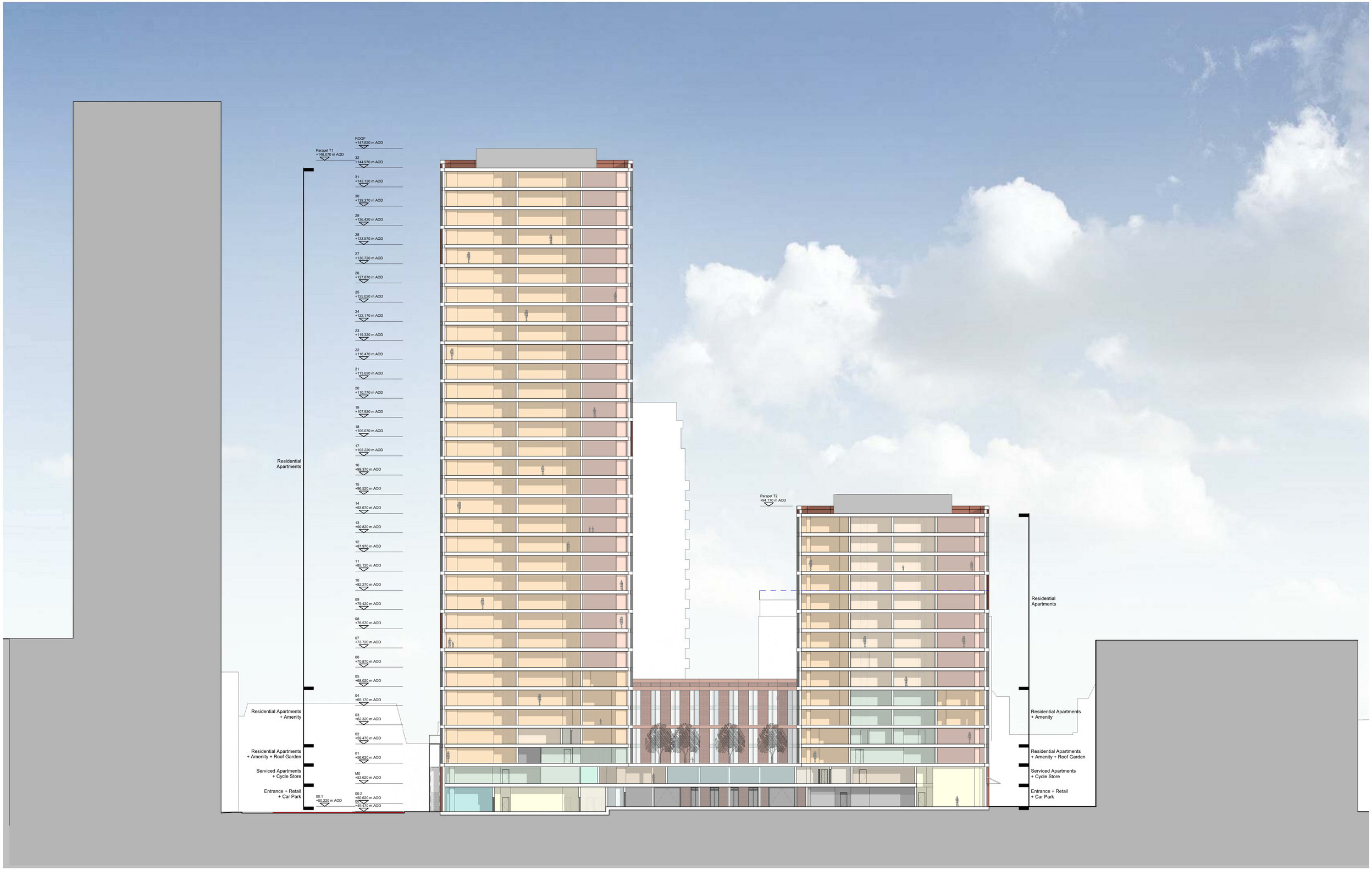
Date
Jun 2018

SHP Drawing Code
10133-Z1- 00 - PL - A - B5D8-G200-0001

Revision
01

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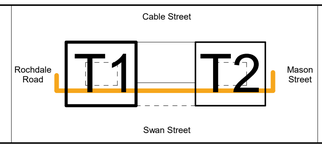
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Do not scale off dimensions.

All dimensions to be checked on site by contractor.

Contractor to report any dimensional discrepancies, errors or omissions prior to commencing on site.

Scale Bar 1:250 @ A1

.5 1 2 5 10m



Rev	Date	Description
00	2018-07-06	Issued for Planning
01	2018-07-25	Updated landscaping proposals
02	2018-12-17	Additional storey per tower and level 03_04 layout amendments



Project Title
Swan House
2 Rochdale Road
Manchester

Status
Planning Issue

Drawing Title
General Arrangement Section
A-A

Job No
10133

Scale
1:250@ A1
1:500 @ A3

Date
Jun 2018

SHP Drawing Code
10133-Z1-AA-SC-A-B5D8-G200-0001

Revision
02

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Window Sample Borehole Location

* Denotes borehole drilled in basement

All boreholes were followed on by dynamic probing with the exception of WS05.

All boreholes were installed with the exception of WS06.

Rev:	Description:	Date:	By:	Chkd:

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Birmingham - Bristol - Cardiff - Douglas - Edinburgh - Kendal - Leeds - Liverpool - London - Manchester - Nottingham

Status: INFORMATION

Project: Swan House

Drg Title: Exploratory Hole Location Plan

Scale:	Size:	First Issue:	Drawn:	Checked:
NTS	A3	21/03/19	JB	SH

Drg No: 067266-CUR-00-XX-DR-GE-002-V01

Rev: /

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Appendix B – Exploratory Hole Logs

- Curtins Exploratory Hole Logs

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M1 5WG

Borehole Log

Borehole No.
WS01
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level: 50.90	Scale 1:50
Client: Foundation Real Estate		Dates: 13/09/2018 - 13/09/2018	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.28	50.62		MADE GROUND: CONCRETE.
					0.34	50.56		MADE GROUND: Reddish brown medium SAND.
		0.55 - 0.65	ES		0.47	50.43		MADE GROUND: CONCRETE.
		1.00		N=17 (2,2/4,4,4,5)				Stiff brown mottled grey sandy slightly gravelly CLAY. Gravel is fine, angular to subrounded sandstone and coal. Rare medium gravel of sandstone and coal.
		1.70 - 2.00	D					
		2.00		N=24 (2,3/5,5,7,7)				
		3.00		N=24 (2,4/4,6,7,7)				
		3.50	D					*Rare grey mottling from 3.40m bgl.*
		4.00		N=22 (2,3/4,5,6,7)				
		4.70 - 5.00	D		4.60	46.30		Stiff brown sandy CLAY. Rare gravel of fine and medium subangular to subrounded sandstone.
					5.00	45.90		End of borehole at 5.00 m

Remarks
Borehole undertaken in loading bay from existing ground level. Ground level estimated from previous GPR survey. Hand dug service clearance pit to 1.20m bgl. No groundwater encountered. Dynamic Probe follow on to 7.00m bgl. Downhole magnetometery conducted by UXO specialist. Borehole cleared for UXO to a maximum depth of 7.00m bgl.

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Manchester
M1 5WG

Borehole Log

Borehole No.
WS02
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level: 51.00	Scale 1:50
Client: Foundation Real Estate		Dates: 14/09/2018 - 14/09/2018	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.35	ES		0.31	50.69		MADE GROUND: CONCRETE.
					0.35	50.65		MADE GROUND: Very loose dark greyish brown slightly clayey fine SAND. Slight hydrocarbon odour (Possible fuel oil).
		0.70	ES		0.49	50.51		MADE GROUND: CONCRETE.
		1.00		N=21 (2,4/4,5,6,6)	1.05	49.95		MADE GROUND: Loose black slightly silty fine and medium SAND. Rare subangular to subrounded cobble of brick.
		1.05 - 1.30	ES					*Rare pockets of red sand (Weathered brick).*
		1.80 - 2.00	D					Stiff brown with grey mottling slightly sandy slightly gravelly CLAY. Gravel is fine and medium angular to subrounded sandstone and coal.
		2.00		N=25 (2,4/5,6,7,7)				
		3.00		N=25 (2,4/5,6,7,7)	3.00	48.00		Stiff brown with occasional light brown and grey mottling sandy slightly gravelly CLAY. Gravel is fine, subangular to subrounded sandstone and coal.
								Rare gravel from 3.50m bgl.
		3.80 - 4.00	D					
		4.00		N=15 (2,2/3,3,4,5)				
					5.00	46.00		End of borehole at 5.00 m

Remarks
Borehole undertaken in loading bay from existing ground level. Ground level estimated from previous GPR survey. Hand dug service clearance pit to 1.20m bgl. No groundwater encountered. Dynamic Probe follow on to 7.00m bgl. Downhole magnetometery conducted by UXO specialist. Borehole cleared for UXO to a maximum depth of 7.00m bgl.

AGS

Curtins
Merchant Exchange,
17 - 19 Whitworth Street West,
Manchester
M1 5WG

Borehole Log

Borehole No.
WS03
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level: 51.10	Scale 1:50
Client: Foundation Real Estate		Dates: 13/09/2018 - 14/09/2018	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.15	50.95		MADE GROUND: CONCRETE.
					0.19	50.91		MADE GROUND: Reddish brown medium SAND.
		0.40	ES		0.34	50.76		MADE GROUND: CONCRETE.
		1.00		N=4 (0,0/0,1,2,1)				MADE GROUND: Loose black gravelly fine to coarse SAND. Gravel is fine to coarse angular to subrounded brick, concrete, ash, clinker, slate, rare coal, and sandstone.
					1.30	49.80		MADE GROUND: Very soft brown slightly sandy slightly gravelly CLAY. Gravel is fine angular to subrounded brick, coal and sandstone.
		1.70	ES					
		2.00		N=2 (0,0/0,0,1,1)				
	▼				2.80	48.30		Firm brown sandy slightly gravelly CLAY. Gravel is fine and medium subangular to rounded sandstone.
		3.00	ES					
		3.00		N=15 (3,3/3,3,4,5)	3.20	47.90		Stiff brown with grey mottling sandy slightly gravelly CLAY. Gravel is fine sandstone and coal.
		4.00		N=20 (2,3/3,4,6,7)				
		4.80 - 5.00	D		5.00	46.10		End of borehole at 5.00 m

Remarks
Borehole undertaken in loading bay from existing ground level. Ground level estimated from previous GPR survey.
Hand dug service clearance pit to 1.20m bgl. Groundwater encountered at 2.80m bgl. Dynamic Probe follow on to 7.00m bgl.
Downhole magnetometery conducted by UXO specialist. Borehole cleared for UXO to a maximum depth of 7.00m bgl.

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Manchester
M1 5WG

Borehole Log

Borehole No.
WS04
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level: 51.10	Scale 1:50
Client: Foundation Real Estate		Dates: 13/09/2018 - 13/09/2018	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					0.13	50.97		MADE GROUND: CONCRETE.
		0.30	ES		0.24	50.86		MADE GROUND: Light brownish grey and black GRAVEL of concrete and tarmac.
					0.31	50.79		
		0.70	ES		0.47	50.63		MADE GROUND: Reddish brown medium SAND.
					0.85	50.25		MADE GROUND: CONCRETE.
					1.13	49.97		MADE GROUND: Brown and black gravelly medium and coarse SAND. Gravel is fine to coarse angular to subangular brick, concrete and clinker. rare metal fragments. Localised clay pockets.
		1.35		N=30 (1,5/9,7,7,7)	1.35	49.75		
		1.40 - 1.70	ES					MADE GROUND: Light red medium grained SANDSTONE.
		2.00		N=5 (3,3/3,1,1,0)				MADE GROUND: Limestone GRAVEL (Drillers Description).
					2.25	48.85		MADE GROUND: Red sandy GRAVEL. Gravel is fine to coarse angular to subrounded brick, concrete and slate.
		2.40 - 2.70	ES					
		2.70 - 3.00	ES		2.70	48.40		MADE GROUND: Very soft brown sandy slightly gravelly CLAY. Gravel is fine to medium sandstone and coal. (Reworked).
					3.00	48.10		MADE GROUND: Very soft dark greyish brown sandy slightly gravelly CLAY. Rare blackened plant/wood fragments. Slight organic odour. (Reworked).
								End of borehole at 3.00 m

Remarks

Borehole undertaken in loading bay from existing ground level. Ground level estimated from previous GPR survey.
Hand dug service clearance pit to 1.20m bgl. Possible brick wall encountered between 1.35m - 2.25m bgl. Deviation of window sampler within Made Ground deposits prevented progression of borehole. Borehole terminated at 3.00m bgl. No groundwater encountered. Dynamic Probe follow on to 4.50m bgl.
Downhole magnetometery conducted by UXO specialist. Borehole cleared for UXO to a maximum depth of 4.50m bgl.

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Borehole Log

Borehole No.
WS05
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level:	Scale 1:50
Client: Foundation Real Estate		Dates: 10/09/2018 - 10/09/2018	Logged By SH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND: CONCRETE.
					1.17			End of borehole at 1.17 m

Remarks
Borehole undertaken within basement.
Hand dug service clearance pit to 1.20m bgl. Possible pad foundation identified. Borehole terminated at 1.17m bgl. No groundwater encountered.

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Borehole Log

Borehole No.
WS06
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level:	Scale 1:50
Client: Foundation Real Estate		Dates: 10/09/2018 - 11/09/2018	Logged By SH/MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.30	ES		0.25			MADE GROUND: CONCRETE.
		1.00		N=25 (3,4/5,6,6,8)				Stiff brown with grey mottling sandy slightly gravelly CLAY.
		2.00		N=17 (3,3/3,4,4,6)				
		3.00		N=21 (3,3/4,5,6,6)				
		3.00 - 3.25	D					
					3.50			Firm brown sandy CLAY. Slightly damp.
					3.80			Stiff brown sandy CLAY.
		4.00		N=20 (3,4/4,5,5,6)				
					4.20			Stiff brown sandy CLAY. Rare gravel of fine sandstone and coal.
		4.70 - 4.90	D					
					5.00			End of borehole at 5.00 m

Remarks
Borehole undertaken within basement.
Hand dug service clearance pit to 1.20m bgl. No groundwater encountered. Dynamic Probe follow on to 7.00m bgl.

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Borehole Log

Borehole No.
WS07
Sheet 1 of 1

Project Name: Swan House, Manchester	Project No. B067266.201	Co-ords: -	Hole Type WS
Location: Cable Street, Manchester		Level:	Scale 1:50
Client: Foundation Real Estate		Dates: 11/09/2018 - 12/09/2018	Logged By MH

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		0.40 - 0.50	ES		0.31			MADE GROUND: CONCRETE.
		1.00		N=23 (2,3/5,5,6,7)				Stiff dark brown with occasional dark grey mottling slightly sandy slightly gravelly CLAY. Gravel is fine, angular to rounded sandstone and coal.
		1.90 - 2.00	D					
		2.00		N=20 (2,3/4,5,5,6)				
		3.00		N=17 (2,3/4,4,4,5)				
		3.80 - 4.00	D		3.90			Firm dark brown with rare light brown mottling sandy slightly gravelly CLAY. Rare light brown mottling. Gravel is fine subangular sandstone.
		4.00		N=13 (2,1/2,3,4,4)				*Deposits recorded as wet between 4.60m - 4.80m bgl.*
					5.00			End of borehole at 5.00 m

Remarks
Borehole undertaken within basement.
Hand dug service clearance pit to 1.20m bgl. No groundwater encountered. Dynamic Probe follow on to 7.00m bgl.

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Appendix C – Risk Assessment Rationale

The qualitative risk assessment of environmental harm is designed to establish connecting links between a hazardous source to a potential receptor via an exposure pathway.

The qualitative risk assessment corresponds with the proposed piling operations on site.

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

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

By considering where a viable pathway exists which connects a source with a receptor the risk assessment in Section 3.0 and Table A4.1 identifies where pollutant linkage exists. If there is no pollutant linkage there is no risk and only where a pollutant linkage is established does the risk assessment, consider the level of risk.

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

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

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

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

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

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

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

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

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

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

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

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