



Sauchiehall Street, Glasgow

Desk Study and Preliminary Risk Assessment

Project No: 541974




Client: Fusion Glasgow Devco Ltd.

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1 INTRODUCTION

This report was prepared by Structural Soils Ltd (SSL) on the instructions of Shear Design Ltd. (the Engineer) on behalf of Fusion Glasgow Devco Ltd. (the Client) at the site of 172 Sauchiehall Street, in Glasgow. The purpose of the work was to obtain information for a proposed 17 storey student accommodation block with ground-floor retail units.

The scope included a desk study and Preliminary Risk Assessment which included research into the past uses of the site and its surrounding area, with regards its physical, historical and environmental setting. The report identifies potential issues at the site leading to the production of a Conceptual Site Model (CSM) which considers both geoenvironmental and geotechnical aspects including other pertinent ground hazards which could affect the development.

This desk study has been prepared in accordance with CLR11 Model Procedures for Land Contamination – and in general accordance with BS 10175: 2011 + A2 2017 (BSI, 2017). SSL notes that CLR11 has now been withdrawn in England and replaced by Land Contamination Risk Management (LCRM) (Environment Agency, 2023). However, it is not yet known whether this is to be adopted by the Scottish Government/ SEPA, who have advised that CLR11 should continue to be referenced in the meantime.

All information, comments and opinions given in the desk study in this report are based on the information obtained. The information search cannot be exhaustive and there may be records that have not come to light. There may also be circumstances at the site that are not documented.

This report was prepared by SSL for the sole and exclusive use of Fusion Glasgow Devco Ltd. in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded. No liability will be accepted after a period of 6 years from the date of the report.

1.1 Information Sources

The following sources of information have been used in the preparation of this report.

- Extracts of available historical Ordnance Survey (OS) maps covering the period from 1883 to 2021 which are presented in Appendix B.
- An Envirocheck report produced by Landmark for an area up to 1 km from the centre of the site which is reproduced in Appendix B. The Envirocheck report is compiled from the database of information maintained by various statutory bodies listed within Appendix B. It also includes a series of maps showing the approximate position of the listed data together with details on geology, ground workings, mining and extraction, borehole records and estimated background soil chemistry.
- The Coal Authority, CON29M - Non-Residential Coal Mining Report (Ref: 51002966963001), *Marks & Spencer, 172 Sauchiehall Street, Glasgow, Glasgow City, G2 3EE*
- 1st Line Defence, March 2022, Preliminary UXO Risk Assessment (Ref: PA15197-00), *172 Sauchiehall Street, Glasgow*

- British Geological Survey, Radon Report (Ref: BGS_325156/32722), 541856 – *Sauchiehall Street, Glasgow*
- The Scottish Environmental Protection Agency (SEPA) and British Geological Survey (BGS) websites.
- SEPA, Water hub available at <https://www.sepa.org.uk/data-visualisation/water-environment-hub/>

2 SITE DETAILS

2.1 Location and Topography

The site is located at 172 Sauchiehall Street within Glasgow, 500 m north of Glasgow Central Railway Station (see Site Location Map in Appendix A). The British National Grid Reference of the site is NS 587 658. The site is set at an elevation of approximately 43 m above Ordnance Datum (AOD). The site surroundings consist of commercial, academic, public and residential buildings within a well-developed area of central Glasgow.

The rectangular site is approximately 65 m by 50 m in size with its long axis orientated northeast to southwest and was previously occupied by a three-storey Marks & Spencer clothing store with a Scottish Power sub-station located in the building near its northeast corner. Positioned in the middle of a block of commercial properties, the site is bounded to the northwest by an Argos store and Boots chemist store, to the southeast by an offices and souvenir store, to the northeast by Renfrew Street and to the southwest by pedestrianised Sauchiehall Street.

A walkover survey was undertaken on 16 March 2022. This identified that the ground surrounding the site slopes gently down towards the east resulting in the ground floor of the building forming a partial basement cut into slope. Consequently, access from Renfrew Street to the northeast is approximately 2 m above the existing floor of the store whilst access from Sauchiehall Street is up to 0.50 m below shop floor level.

A shutter door present off Renfrew Street at the northeast corner of the building secures a large loading area. The concrete floor within the loading area slopes down from Renfrew Street southward towards a set of goods lifts which drop down approximately 1 m to shop floor level. Gas mains pipes and the fire sprinkler system were observed within a cupboard in this area along with two diesel tanks of indeterminate volume. In a room adjacent to the loading bay is an electricity sub-station with plant seated on a clean and seemingly intact concrete floor slab.

Within a stockroom on the first floor of the building is a disused diesel powered back-up electrical generator with integral fuel tank. Minor fluid leaks from the diesel engine were apparent in a drip tray, but the floor area surrounding the plant appeared clean. On the roof of the building is a current back up diesel generator along with refrigeration and ventilation units. Lift motor rooms are present on each floor of the building and on the roof. All motor room floors looked clean with no evidence of spills from maintenance. Suspected asbestos was not identified during this walkover but it was noted during the safety brief that asbestos has been used heavily in the service areas of the building.

2.2 History of Site and Surrounding Area

2.2.1 Historic Mapping

A search of Ordnance Survey maps was undertaken to establish the land-use history of the site and surroundings. Extracts of the maps that are discussed below can be found in Appendix B of this report. Unless otherwise stated, all quoted distances are measured from the site boundary that is marked on the maps.

TABLE 1 :SUMMARY OF HISTORICAL MAP DATA			
Dates	Scale	Significant features, changes and developments:	
		On site	In surroundings [distance(m)]
1859-1861	1:10,560 & 1:2,500	Site occupied by a <i>Timber Yard</i> to the north, probable residential buildings to the south and <i>Wellington Arcade</i> along its eastern side.	Surrounding predominantly occupied by residential and commercial buildings. <i>Cabinet Works</i> present 30 m to the NE. <i>Timber Yard</i> present 40 m to E. <i>Timber, Soap, Iron</i> and <i>Chemical Works</i> present 260 m to NE. <i>Buchanan Street Railway Station</i> located 320 m to E.
1890-1896	1:10,560, 1:2,500 & Insurance Plan	<i>Timber Yard</i> no longer present having been replaced with a builders yard. Redevelopment of probable residential buildings to south as <i>Waverly Hotel</i> . <i>Public House</i> present at southern corner of site.	<i>Instrument Manufactory</i> adjacent to west site margin. Tramlines present along Sauchiehall Street adjacent to site. <i>Tramway Depot</i> 70 m to NW.
1932-1934	1:10,560 & 1:2,500	Multiple structures on former timber yard demolished and replaced by four buildings.	No significant changes.
1950-1966	1:10,000, 1:2,500 & 1:1,250	Entire site redeveloped as probable commercial premises in present day configuration	No significant changes.
1973-1985	1:10,000 & 1:1,250	No significant changes.	<i>Shopping Centre</i> present adjacent to E and 20 m to S. Tramlines no-longer present along Sauchiehall Street. Widespread demolition of residential and commercial properties present >20 m N. <i>Hotel</i> and <i>Car Parks</i> constructed 20 m to N. <i>Depots</i> present 225 m to NE. <i>Buchanan Street Railway Station</i> replaced by <i>Omnibus Station</i> .
1991-1999	1:10,000 & 1:1,250	No significant changes.	<i>Car Parks</i> redeveloped as <i>Royal Scottish Academy of Music and Drama</i> .
2006	1:10,000 & 1:2,500	No significant changes.	No significant changes.
2021	1:10,000	No significant changes.	No significant changes.

Note: N = north, S = south, E = east, W = west.

2.2.2 Planning History

Planning records held by Glasgow City Council pertaining to the site and available online date from 1993, when permission was granted to Marks & Spencer PLC for shopfront alterations (Ref: 93/02469/DC).

Subsequent planning consents of note are referenced in the following:

TABLE 2 :SUMMARY OF PLANNING HISTORY DATA	
Dates	Details
1995	Ref: 95/01573/DC Alterations to shop frontage, formation of new door to rear, introduction of louvred window to rear and additional plant at third floor level and roof level (Granted subject to conditions).
1998	Ref: 98/00032/DC Erection of water tank on roof (Granted subject to conditions).
2001	Ref: 01/02532/DC Erection of refrigeration unit on store roof (Granted subject to conditions).
2003	Ref: 03/00778/DC Installation of refrigeration plant on roof (Granted subject to conditions).

2.2.3 Petroleum Licence Search

A petroleum licence search was commissioned from Glasgow City Council as shown in Appendix B and this did not identify any records of petroleum storage on the site.

2.2.4 Summary of Site History

The earliest maps from 1859-1861 show the site to be located in a mixed residential – commercial area and was occupied by a Timber Yard to the north, probable residential buildings to the south and Wellington Arcade along its eastern margin. In the late 1890's, the site of the timber yard had been replaced with multiple structures used as a builders' yard, whilst the possible residential buildings on the southern portion were replaced by the Waverly Hotel. In the 1930's, the structures in the builders' yard were demolished prior to the construction of a further four buildings. The final phase of redevelopment occurred in the 1950's when the site was cleared and redeveloped taking on its present-day configuration.

3 PHYSICAL SETTING

3.1 Geology

Information on the geology of the site was obtained from the following sources published by the British Geological Survey (BGS):

- BGS maps:
 - Superficial Geology (sheet 30E, scale 1:50,000, published 1994).
 - Bedrock Geology (sheet 30E, scale 1:50,000, published 1993).
- The BGS digital geology map, which utilises the most up to date names for geological units (www.bgs.ac.uk/data).
- The BGS Lexicon of Named Rock Units, which provides typical descriptions for most geological units (www.bgs.ac.uk/lexicon).

The geological maps show the north-eastern corner of the site to be underlain by made ground; whilst glaciomarine sediments comprising silt and clays and glacial diamicton deposits comprising boulders and gravels in a sandy silty clay matrix outcrop across the remainder of the site. BGS borehole records for the nearby Royal Conservatoire of Scotland building located 30 m to the north-east of the site indicate made ground in the area to extend to an approximate depth of 11 m. Boreholes situated around Bath Street approximately 90 m south of the site show boulder clay deposits extend to a similar depth of approximately 10 m. It is likely that the glacial diamicton underlies the glaciomarine deposits.

The BGS superficial map sheet records the made ground as an area of fill or man-made and natural material in excavations. Any prior excavations pre-date the historic maps procured as a part of this study. Inspection of the BGS historic borehole records from within the area of made ground indicate that it is generally granular in the near surface, and generally fine grained soils at depth with fragment of brick. Locally coarse sandstone gravel is reported at the base as possible or presumed made ground.

The made ground and superficial deposits are underlain by the Upper Limestone Formation of the Clackmannan Group which comprises cyclic units of sandstone, mudstone, limestone and seatrocks. Boreholes in the area show the bedrock immediately beneath the superficial deposits to comprise grey and brown sandstone. The geological map shows the Upper Limestone Formation to be dipping down to the southeast at approximately 15° and is underlain by the Limestone Coal Formation.

The BGS online maps portal provides access to scans of almost all maps produced by the BGS since 1932. An extract of the most recent available scanned maps for the site are included below:



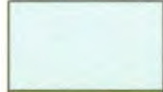
Superficial Geology



Made Ground: man-made and natural materials on original ground surface



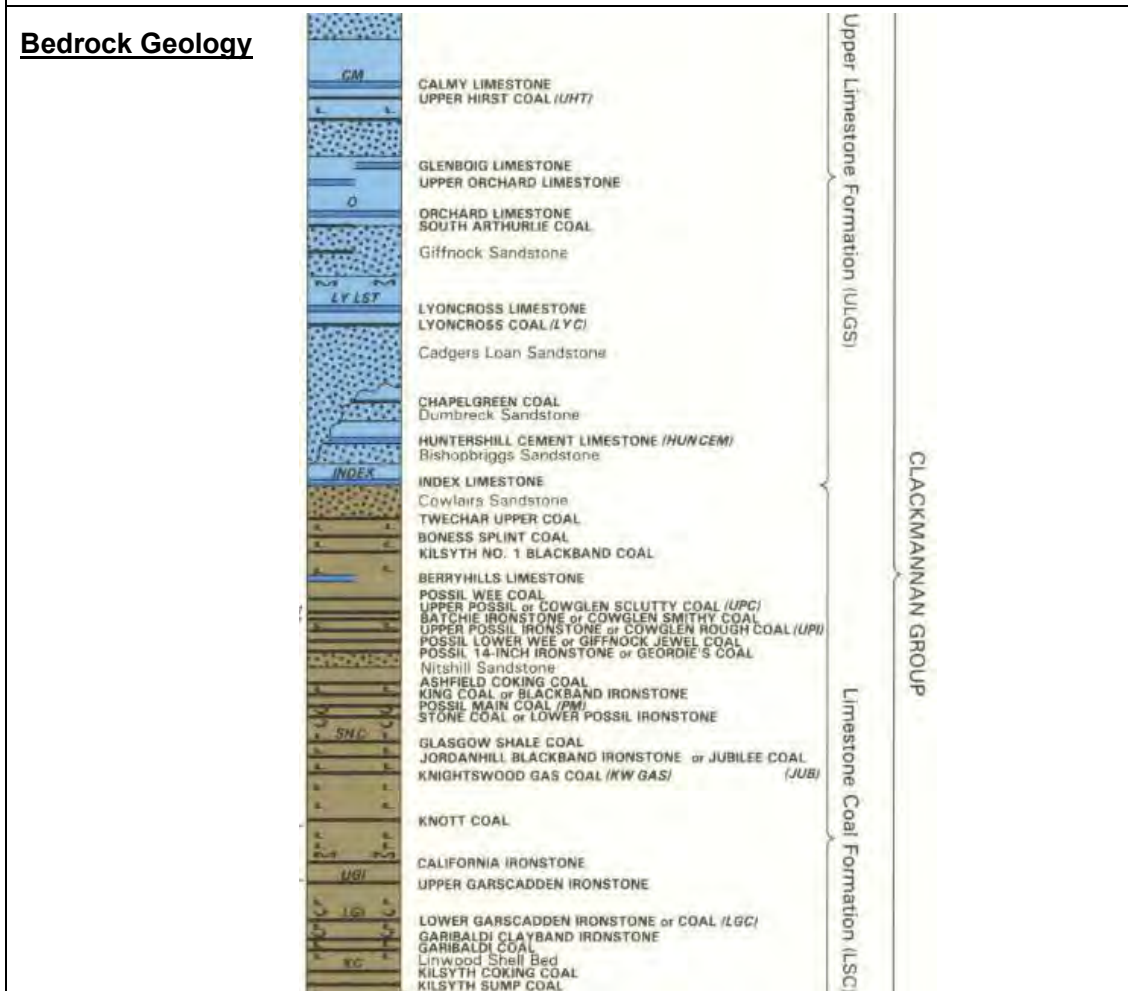
Made Ground: Fill of man-made and natural materials in excavations



Glaciomarine Deposits: intertidal and subtidal clay and silt



Glacial Diamictons: till of lodgement or deformation type, boulders and stones in a hard to stiff sandy silty clay matrix.



Note: Above images contain British Geological Survey materials ©NERC [2022].

3.2 Geological Hazards

According to the Envirocheck report the site is within an area where the risk of the various geological hazards are categorised as follows.

TABLE 3 : SUMMARY OF GEOLOGICAL HAZARDS	
Hazard	Risk Category
Non-coal mining area	Rare
Collapsible Ground subsidence	Very Low
Running Sand	Low
Compressible ground subsidence	Moderate
Landslip	Very Low
Swelling and shrinkable clay	No Hazard
Ground dissolution	No Hazard

Note: The definition of Low / Medium / High risk for each category is given in the Envirocheck report.

The presence or absence of these hazards, and their significance if present would normally be determined by completing a suitable ground investigation.

3.3 Mining, Extraction and Natural Cavities

The Envirocheck Report does not record any mineral sites or natural cavities within 1 km of the site but indicates the site to lie within an area which may be affected by coal mining activity and as such recommends obtaining a coal mining report to better understand the risks at and close to the site.

A CON29M coal mining report (Ref: 51002966963001) has been obtained from The Coal Authority for the site which is included in Appendix B. The report states that no past opencast or underground mining is recorded at the site and no mine entries are recorded within 20 m. The Coal Authority has not received a subsidence damage notice or claim for any property within 50 m of the site since 31 October 1994 and no records exist of mine gas emissions requiring action. The report identifies that reserves of coal exist in the local area which could be worked at some time in the future however the property is not in an area likely to be affected by any planned future underground coal mining.

Although not recorded in the database search, is it considered likely that the area of infilled land recorded on the BGS mapping and partially underlying the site is likely to be infilled workings.

3.4 Hydrogeology and Hydrology

3.4.1 Aquifer Designation

The BGS aquifer productivity report has been consulted and indicates that:

- The glaciomarine deposits and glacial diamicton are regarded as 'not significant aquifers' due to their low permeability. However, sand and gravel bands within these

units may allow limited groundwater flow, particularly where the glacial diamicton is fissured.

- Within the Clackmannan Group, groundwater can be move by intergranular or fracture flow. Typically much of the groundwater flow is through fractures (bedding planes, joints and faults). These rocks are classified as a moderate productivity aquifers (borehole yields of 1 to 10 l/s).

3.4.2 Groundwater Vulnerability

The BGS groundwater vulnerability report has been consulted (OR/15/002) and the groundwater vulnerability within the bedrock beneath the site is assigned to Vulnerability Class 1 (Only vulnerable to conservative pollutants in the long term when continuously and widely discharged /leached) due to the anticipated presence of >5m of silts and clays in both the superficial deposits and in the made ground.

3.4.3 Groundwater Quality

Groundwater bodies are classified by SEPA under the Water Framework Directive, whereby water bodies in Scotland are classed as High, Good, Moderate, Poor or Bad. A search of SEPA's online database was conducted regarding the groundwater quality beneath the site and identified the Glasgow and Motherwell groundwater body to be situated beneath the entirety of the site. This groundwater was given a water quality of 'Poor'. The reasons for this classification are impacts on water flows and level due to pressure from business water abstraction, and impacts on water quality from legacy pollution relating to mining or quarrying and from past land contamination.

3.4.4 Anticipated Groundwater flow and direction

Groundwater beneath the site is expected to be present within the Upper Limestone Formation, and as the site sits at an elevation of around 30 m AOD, Groundwater may be in excess of the 15 m depth and controlled by the elevation of the River Clyde. Based on the geological mapping this is expected to be a semi-confined aquifer and it is expected be recharged by precipitation which infiltrates the ground in the vicinity of the site.

Nearby boreholes records indicate localised areas of perched groundwater to be present within the made ground and upon the superficial deposits.

The closest down hydraulic gradient surface water body to the site is the River Clyde located approximately 1 km to the south. Groundwater is likely to be in continuity with this feature.

3.5 Ground Gas

3.5.1 Radon

A Radon Report (Ref: BGS_325156/32722), has been obtained from the British Geological Survey for the site which is included in Appendix B. According to the report the site is not in a radon affected area as defined by the UK Health Security Agency (UKHSA) and no radon protection measures are required for new buildings or extensions to existing ones.

3.5.2 Coal Measures

The geological maps indicate the shallowest coal seam, the Upper Possil or Cowglen Smithy Coal (UPC) of the Limestone Coal Formation, is present approximately 250 m below the site. This coal seam is considered too deep to pose a plausible risk of ground gas migration to the site.

3.5.3 Made Ground

Made ground present at the site is likely to comprise of construction materials associated with the previous buildings at the site and made and natural infill materials used to backfill a former excavation as indicated by the geological map. These soils may contain ash and other organic material such as timber which may generate methane and carbon dioxide at low rates as they decay.

3.6 Archaeology / Ecology

No archaeological or ecological consultation has been undertaken for this study.

3.7 Unexploded Ordnance (UXO)

A preliminary UXO risk assessment has been undertaken by 1st Line Defence for the site to which reference should be made (see Appendix B).

Their report summarises that no evidence was found within the bomb mapping and written records held in-house to indicate that the site and its immediate environs were bombed. Glasgow bomb damage mapping also does not record any damage to the site or structures in the vicinity.

The report concludes that the risk from UXO on site is not considered to be elevated above the background level for Glasgow and no further research is recommended for the site.

3.8 Utilities

The site and surrounding area are likely to contain underground services; a copy of the utility data has not been provided by the Client at the time of writing this report.

4 ENVIRONMENTAL SETTING

4.1 Environmental Data

Environmental features such as landfills, groundwater abstraction points, etc, are detailed in the Landmark Envirocheck report that can be found in Appendix B of this report. 'Notable' features in these data sets are listed below.

TABLE 4 : SUMMARY OF SIGNIFICANT ENVIRONMENTAL DATA					
Data Types Showing <u>Notable</u> Issues	No. of <u>Notable</u> Listings (or Yes/No) and Distance (m) from Site				Details of <u>Notable</u> Listings
	On site	0-250	250-500	>500	
AGENCY AND HYDROLOGICAL					
BGS Flooding Susceptibility	Yes	Yes	Yes	-	Potential for groundwater flooding of property situated below ground level.
Discharge Consents	-	-	-	5	Nearest: Scottish Grain Distillers Ltd. North Canal Bank Street, 777 m to NE.
Local Authority Pollution Prevention and Controls (and enforcements)	-	-	-	11	Nearest: Robeslee Concrete Ltd. (Blending Cement), 666 m to S.
Nearest Surface Waters	-	Yes	-	-	191 m to NW.
Registered Radioactive Substances	-	1	5	19	Nearest: Christie's Scotland Ltd. Bath Street, 123 m to SW.
River Quality	-	-	-	2	Nearest: Forth & Clyde Canal (River Quality C), 606 m to NE.
WASTE					
Potentially Infilled Land (Non-Water)	-	-	-	2	Nearest: 571 m to E.
Potentially Infilled Land (Water)	-	-	-	7	Nearest: 604 m to N.
Treatment and Disposal Sites	-	-	-	1	Albert Works, Washington Street (Scrapyard), 1000 m to SW.
HAZARDOUS SUBSTANCES					
Control of Major Accident Hazards Sites (COMAH)	-	-	-	1	Scottish Power Plc., 894 m to S.

TABLE 4 : SUMMARY OF SIGNIFICANT ENVIRONMENTAL DATA					
Data Types Showing Notable Issues	No. of <u>Notable</u> Listings (or Yes/No) and Distance (m) from Site				Details of <u>Notable</u> Listings
	On site	0-250	250-500	>500	
Explosives Sites	-	-	-	1	Clydeport Ltd. Port of Glasgow, 887 m to S.
INDUSTRIAL LAND USE					
Fuel Station Entries	-	-	-	3	Nearest: Elmbank Service Station, 581 m to W.
Contemporary Trade Directory Entries	-	57	108	373	Nearest: James Blake & Co. (Inactive), 9 m to N
SENSITIVE LAND USE					
None Identified					

Note: N = north, S = south, E = east, W = west.

4.1.1 Summary of Environmental Data

Available data indicates the site to be located in a predominantly commercial – residential area within central Glasgow. There is little within the environmental data to suggest significant potential sources of contamination on site or in the immediate surrounding area.

5 GEOTECHNICAL ASSESSMENT

5.1 Anticipated Ground Model and Potential Hazards

The natural ground consists of glaciomarine sediments, which infill an irregular surface of the underlying glacial diamicton ('Boulder Clay').

The glaciomarine sediments are of variable lithology and include sandy clay, silty clays and sands and gravels. Where they are proved in boreholes to the south and south-west of the site, they are mostly gravelly sands, and are generally 2m thick or less, thinning out against boulder clay. One borehole recorded SPT N values of 13 at 1.0 m and 15 at 2.0 m.

The underlying boulder clay is generally described as stiff or very stiff, and laboratory tests recorded on some borehole logs proved undrained strengths of 112 to 131 kPa.

To the north-west of the site the superficial deposits are absent, and instead there is a significant thickness of Made Ground, which rests directly on bedrock. This coincides with the area of made ground shown on the geological mapping (section 3.1 above). The made ground is described as soft to firm sandy clay with some gravel, brick, and organic 'patches'. Undrained strengths of 24 to 37 kPa are recorded on the borehole logs.

The underlying bedrock is expected to be the Upper Limestone Formation and is generally encountered approximately 10 to 15 m below current ground levels, but locally is somewhat shallower (only 4.0m). The bedrock surface is thus irregular. The rock is described as greyish white weathered sandstone. Most boreholes terminated within a metre or so of the bedrock surface, but several boreholes drilled for a cable tunnel proved sandstones to 30 – 40 m depth. Some coal laminae and seat earths are noted.

The groundwater table is expected to be encountered within the superficial deposits.

The main hazard is the presence of an extensive area of thick made ground to the north-east of the site consisting of soft gravelly clays. It is not certain whether this made ground extends under the site or not, so the shallow ground conditions are uncertain and would need to be proved by investigation at the site itself.

5.2 Potential Foundation Options – Main Building

Although the general outline of the development is available no details of the foundation loads have been provided, but given that the proposed development is a 19-23 storey building it may safely be assumed that piled foundations would be required.

These would need to be progressed through the made ground and any glaciomarine and glacial diamicton deposits, to be founded within the sandstones of the Upper Limestone Formation. The piling method would need to be able to penetrate any obstructions in the pile, and socket into the underlying sandstone, so it is assumed bored piles would be used. None of the borehole logs from the vicinity of the site give any strength or fracture data for the sandstones, so no assessment can be made of the design parameters for piles.

5.3 Potential Foundation Options – Minor Structures

Due to the variability of the ground, it is not possible to advise on foundations for shallow structures. To the south-west natural medium dense sands and stiff clays are present at shallow depth, and pad or strip foundations could be possible. To the north-east are several metres of soft clay fill, so shallow foundations would not be used. The present proposals do not include any minor structures.

5.4 Further Investigation

To provide sufficient information for foundation design, a detailed investigation is required. This would need to include sufficient coverage to trace where the edge of the infilled ground crosses the site, and deep rotary boreholes with full logging of fractures and lithology and laboratory and/or in-situ testing to derive parameters for design of what will be heavily loaded piles. The groundwater level should also be determined. Any investigation for geotechnical purposes would be in conjunction with the required geoenvironmental investigation outlined below.

Any investigation prior to demolition of the existing buildings would be difficult and expensive.

6 GEOENVIRONMENTAL ASSESSMENT

6.1 Initial Conceptual Model

The information presented in Sections 2, 3 and 4 has been used to compile an initial conceptual model. The identified potential sources of contamination, associated contaminants and receptors have been considered with plausible pathways that may link them. The resulting potential pollutant linkages are considered in Section 6.2. The risk classification has been estimated in accordance with information in Appendix B.

6.1.1 Summary of Potential Contamination Sources

Potential source and their associated contaminants of concern are summarised in the table below.

TABLE 5 :SUMMARY OF POTENTIAL SOURCES AND CONTAMINANTS	
On Site	Contaminants of Concern
General: Contamination in the made ground or natural soils associated with the previous structures.	Heavy metals and asbestos from construction/demolition debris PAH from historic burning of fuel/wastes Petroleum hydrocarbons – lubricating oils and fuels from storage/maintenance of plant Ground gas from biodegradation of organic materials
Point sources: Diesel Tanks Electricity Sub-station Plant Rooms – boiler, generators, lift motors	Petroleum hydrocarbons – Diesel/heating oil PCBs in dielectric fluids

A plan of the potential contamination sources is shown in Appendix A.

6.1.2 Summary of Potential Receptors

Considering the setting of the site and the proposed redevelopment, sensitive receptors are considered to include:

- future site occupants
- adjacent site users
- potable water supply pipes
- groundwater in wider aquifer body

Please note that construction workers have not been identified in the conceptual model as receptors because risks are considered to be managed through health and safety procedures including CDM regulations.

6.1.3 Pathways

Pathways that could result in a potentially complete pollutant linkage include:

- direct contact (soil and dust ingestion, dust inhalation and dermal contact)
- inhalation of ground gas
- inhalation of hydrocarbon vapour
- permeation of plastic water supply pipes
- leaching
- lateral and vertical migration of gas, vapour or dissolved phase contamination

6.1.4 Data Gaps and Uncertainty

The ground conditions have been inferred but are not known unless a site investigation is undertaken.

Although attempts have been made to identify potential sources of contamination, there may be sources or incidents, such as pollution events, that have not been recorded in the historical and environmental records consulted as part of this investigation.

6.2 Preliminary Risk Assessment

6.2.1 Risk Estimation for Potentially Complete Pollutant Linkages

The potentially complete pollutant linkages are detailed above with the estimated risk associated with each. The risk classification has been undertaken in accordance with CIRIA C552, with a summary of the relevant section being included in Appendix B.

TABLE 6 : PRELIMINARY RISK ASSESSMENT

Linkage	Potential source	Contaminants of potential concern	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
1	Contaminated made ground and natural soils associated with the construction and demolition of former and existing buildings onsite, localised storage, use and maintenance of machinery, fuel storage tanks.	Toxic metals, polycyclic aromatic hydrocarbons (PAH), petroleum hydrocarbons, PCBs	Future site users - ground floor commercial (retail), upper floors residential (student accommodation)	Oral, dermal and inhalation exposure	Unlikely	Medium	Low	The footprint of the proposed building will cover the entirety of the site and the concrete floor slab will prevent future site users from coming into contact with near surface soils.
2			Adjacent site users - commercial		Unlikely	Medium	Low	Adjacent site users are unlikely to come into contact with site soil following completion of the development. Risks can be managed during construction via good working practices during periods of dry weather including damping down to avoid airborne dust.
3			Potable water pipes	Direct contact with contaminated soils & permeation into pipes	Low likelihood	Mild	Low	If organic contaminants are present in made ground, water supply pipes may come into contact.
4			Water environment receptors within underlying aquifer	Leaching from soils/ percolation to aquifer/ lateral migration	Unlikely	Medium	Low	The footprint of the proposed building will cover the entirety of the site thereby limiting the potential for infiltration and subsequent leaching of any contaminants from the near surface soils to the underlying aquifer whilst limiting vertical migration of contaminants into the soil or laterally through the soil.
5		Asbestos	Future site users - ground floor commercial (retail), upper floors residential (student accommodation)	Inhalation of asbestos fibres	Unlikely	Medium	Low	The former structures and existing building on-site were constructed between the 1930's and 1950s when asbestos was widely used in construction. Details of the former structures are not known with certainty, but it is possible that asbestos may be present locally within the soils in this area. The footprint of the proposed building will cover the entirety of the site and the concrete floor slab will prevent future site users from encountering

TABLE 6 : PRELIMINARY RISK ASSESSMENT

Linkage	Potential source	Contaminants of potential concern	Potential receptor	Possible pathway	Likelihood	Severity	Potential risk	Justification
								near surface soils, and therefore asbestos fibres if present.
6			Adjacent site users - commercial		Unlikely	Medium	Low	Adjacent site users are unlikely to come into contact with site soil following completion of the development. Risks can be managed via good working practices during site construction during periods of dry weather including damping down to avoid airborne dust.
7		Ground gases including carbon dioxide, methane and hydrogen sulphide	Future site users - ground floor commercial (retail), upper floors residential (student accommodation)	Migration and ingress of ground gases into the building, build-up in confined spaces and explosion/ asphyxiation or harm.	Low Likelihood	Severe	Moderate	The BGS map and nearby borehole records indicate much of the site to be covered by made ground which may potentially extend to 11m depth. Biodegradation of any putrescible material would generate hazardous gases including carbon dioxide, methane and hydrogen sulphide which could impact the overlying development.

Risk matrix		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

6.2.2 Potentially Complete Pollutant Linkages

The review of the available information and the production of the initial conceptual model and risk assessment has identified risks associated with potentially complete pollutant linkages that vary from Low to Moderate.

Linkages with risk estimations of moderate or above would typically require further investigation. These linkages include:

- Linkage 7 – ingress of hazardous gases into the building leading to asphyxiation, explosion or chronic damage to health.

The above risk linkage should be further evaluated by undertaking a geoenvironmental site investigation to inform on the validity of the assumptions made in this assessment.

6.2.3 Proposed Site Investigation Scope

The scope of investigation should include:

2 cable percussion boreholes to 15 m depth with gas standpipes installations from 5 m depth to the base of the made ground.

4 window samples holes to 5 m depth or refusal with gas monitoring standpipes in 2 holes with response zones from 0.5 m to 5 m depth.

Monitoring of ground gas concentrations and flow rates on 4 visits at weekly intervals, including at least 1 visit under low and falling pressure if this occurs in the time available for investigation.

This work would also allow general characterisation of the made ground and natural soils for Total Organic Carbon (TOC) of the fine soil fraction as an additional line of evidence in the ground gas risk assessment.

Additionally, this work could provide general characterisation of the made ground on the site to provide information on potential risks to site workers, and potential classification of soils for off-site disposal.

At least 6 soil samples should be analysed for asbestos, arsenic, cadmium, chromium (total), lead, mercury, selenium, copper, nickel, zinc, speciated polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPH banded 1 with ID), soluble organic matter, soluble sulphate and pH.

If groundwater is encountered then samples from the 2 deeper standpipes should be analysed for arsenic, cadmium, chromium (total), lead, mercury, selenium, copper, nickel, zinc, speciated polycyclic aromatic hydrocarbons (PAH), total petroleum hydrocarbons (TPHCWG (speciated)), sulphate, calcium, dissolved organic carbon, hardness and pH.

Any intrusive site investigation works would need to be undertaken following demolition and site clearance, and before construction, so time is likely to be limited.

A plan of the proposed hole locations is shown in Appendix A.

7 SUMMARY

- 7.1** This report was prepared by Structural Soils Ltd (SSL) on the instructions of Shear Design Ltd. (the Engineer) on behalf of Fusion Glasgow Devco Ltd. (the Client) at the site of 172 Sauchiehall Street, in Glasgow. The purpose of the work was to obtain information for the proposed 17 storey student accommodation block with ground-floor retail units.
- 7.2** A Preliminary Risk Assessment that included research into the past uses of the site and the surrounding area and production of a contamination conceptual model identifying potentially complete pollutant linkages was undertaken.
- 7.3** The rectangular site is approximately 65 m by 50 m in size with its long axis orientated northeast to southwest and was previously occupied by a three-storey Marks & Spencer clothing store with a Scottish Power sub-station located in the building near its northeast corner. Positioned in the middle of a terraced block of commercial properties, the site is bounded to the northwest by an Argos store and Boots beauty supply store, to the southeast by an offices and souvenir store, to the northeast by Renfrew Street and to the southwest by pedestrianised Sauchiehall Street.
- 7.4** The earliest maps from 1859-1861 show the site to be located in a mixed residential – commercial area and was occupied by a Timber Yard to the north, probable residential buildings to the south and Wellington Arcade along its eastern margin. The site experienced two major phases of development between the late 1890's and 1930's, which were focused on the timber yard and the probable residential buildings. The final phase of redevelopment occurred in the 1950's when the entire site was cleared and redeveloped taking on its present-day configuration.
- 7.5** BGS Geological maps indicate the northern and central portions of the site to underlain by made ground; whilst glaciomarine sediments and glacial diamicton deposits comprising boulders and gravels in a sandy silty clay matrix outcrop along its southern margin. Nearby BGS borehole records indicate the made ground and superficial deposits in the area to extend to an approximate depth of 11 m. The made ground and superficial deposits are underlain by the Upper Limestone Formation of the Clackmannan Group which comprises cyclic units of sandstone, mudstone, limestone and seatrocks.
- 7.6** Given the anticipated ground conditions it is expected that the proposed building would make use of piled foundations progressed through the made ground and any glaciomarine and glacial diamicton deposits encountered to be founded on the Upper Limestone Formation.
- 7.7** Contamination on this site is likely to relate to the former construction, use and demolition of the commercial premises with a substantial thickness of made ground anticipated based on nearby borehole records. The use of hardstanding across the entire site would prevent direct contact between potential contaminants and end-users however biodegradation of any putrescible material within the made ground would generate hazardous gases including carbon dioxide, methane and hydrogen sulphide which could impact the overlying development.
- 7.8** The review of the available information and the production of the initial conceptual model and risk assessment has identified risks associated with potentially complete pollutant linkages that vary from Low to Moderate. Linkages with risk estimations of moderate or above would typically require further investigation. These linkages include:

- Linkage 7 – ingress of hazardous gases into the building leading to asphyxiation, explosion or chronic damage to health.

7.9 To further investigate this linkage we would recommend an intrusive ground investigation as detailed in 6.2.3, specifically tailored to collect information on this risk following demolition and site clearance.

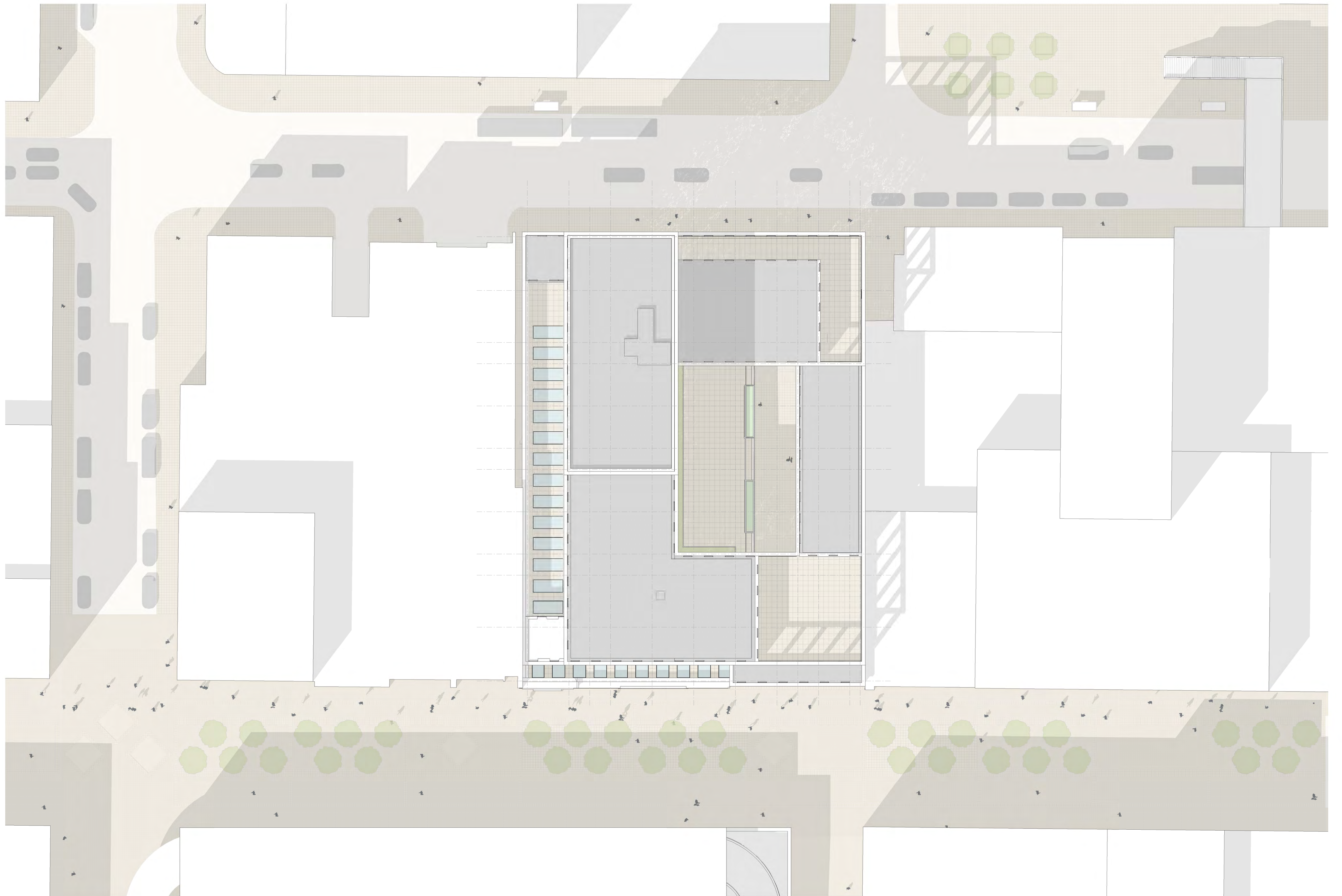
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APPENDIX A - PLANS AND DRAWINGS

- (i) Proposed Development Layout Plans
- (ii) Plan of Potential Contamination Sources
- (iii) Plan of Proposed Exploratory Holes



1 GA Level RF - GA Presentation
1 : 250

0 5.0 10.0 25m

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Rev.	Description	Date	Drawn	Chk.
P03	With Layouts & Notes	20/09/2022	DM	JD
P02	Spot heights added	2022.08.01	DM	JD
P01	First Issue	2022.06.15	DM	JD

Client: Fusion		MattBrookArchitects	
Project: Sauchiehall Street		St George's Gardens 1F Spencers Way Manchester, M15 4UJ 0161 806 1396	
Drawing Title GA Roof Plan		Drawing No. SAU-MBA-B1-RF-DR-A-2019	Revision P03
Drawing Status PLANNING	Drawn DM	Checked JD	Paper Size A1
	Scale 1 : 250	Date 06/14/22	

Sauchiehall Street, Glasgow

General Arrangement Plans

20th April 2023



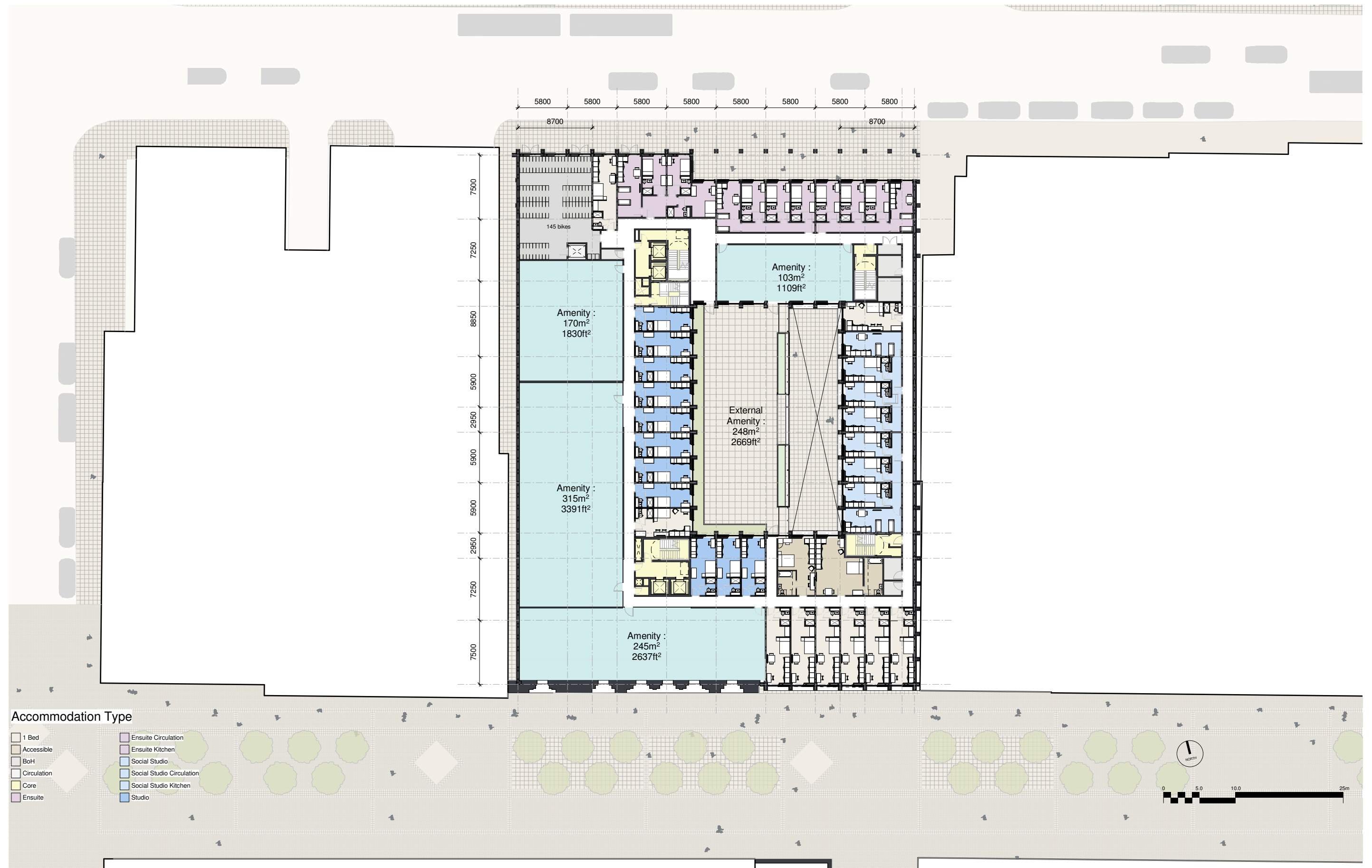
MattBrookArchitects

GA Plans

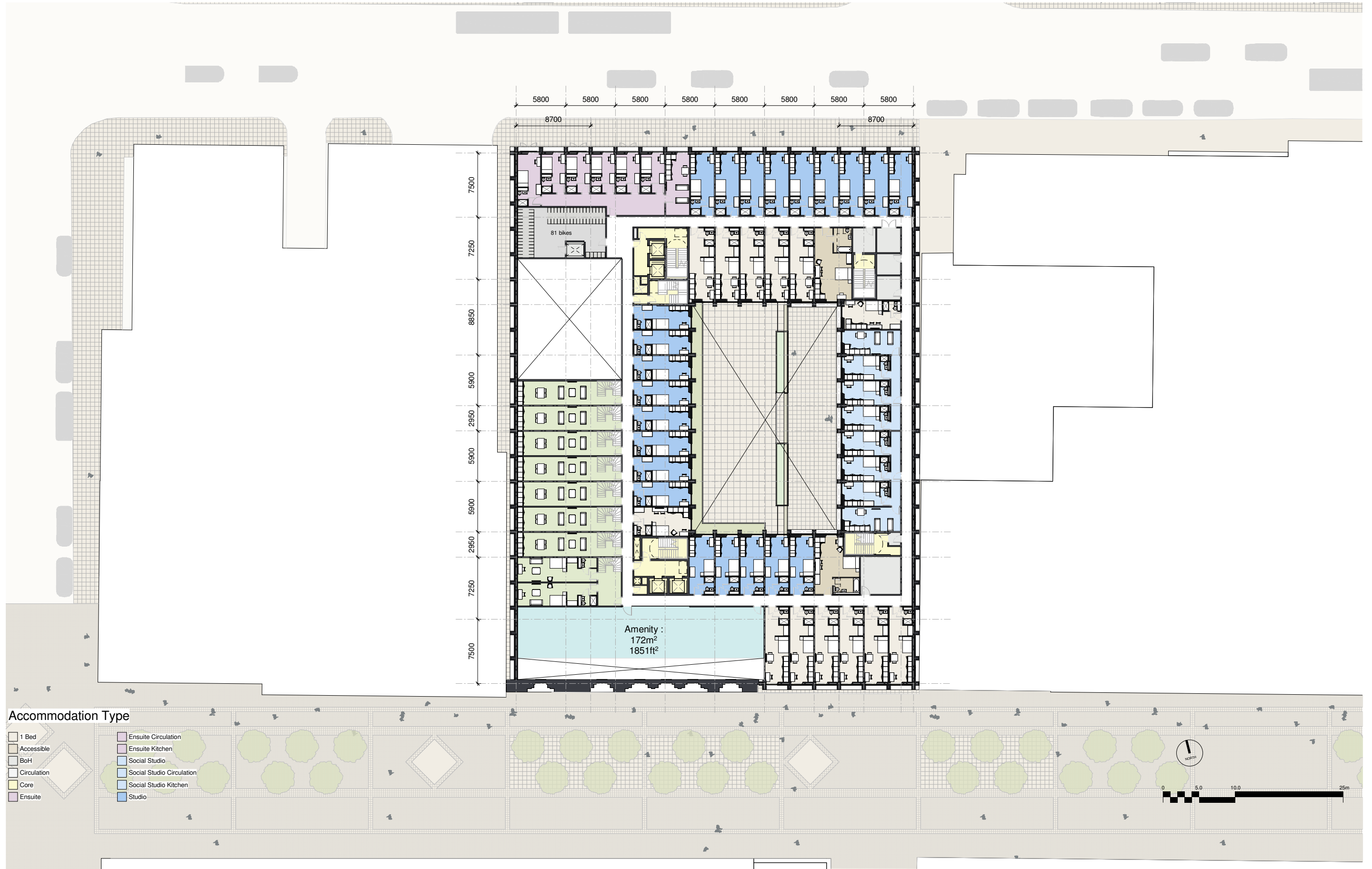
Ground Floor



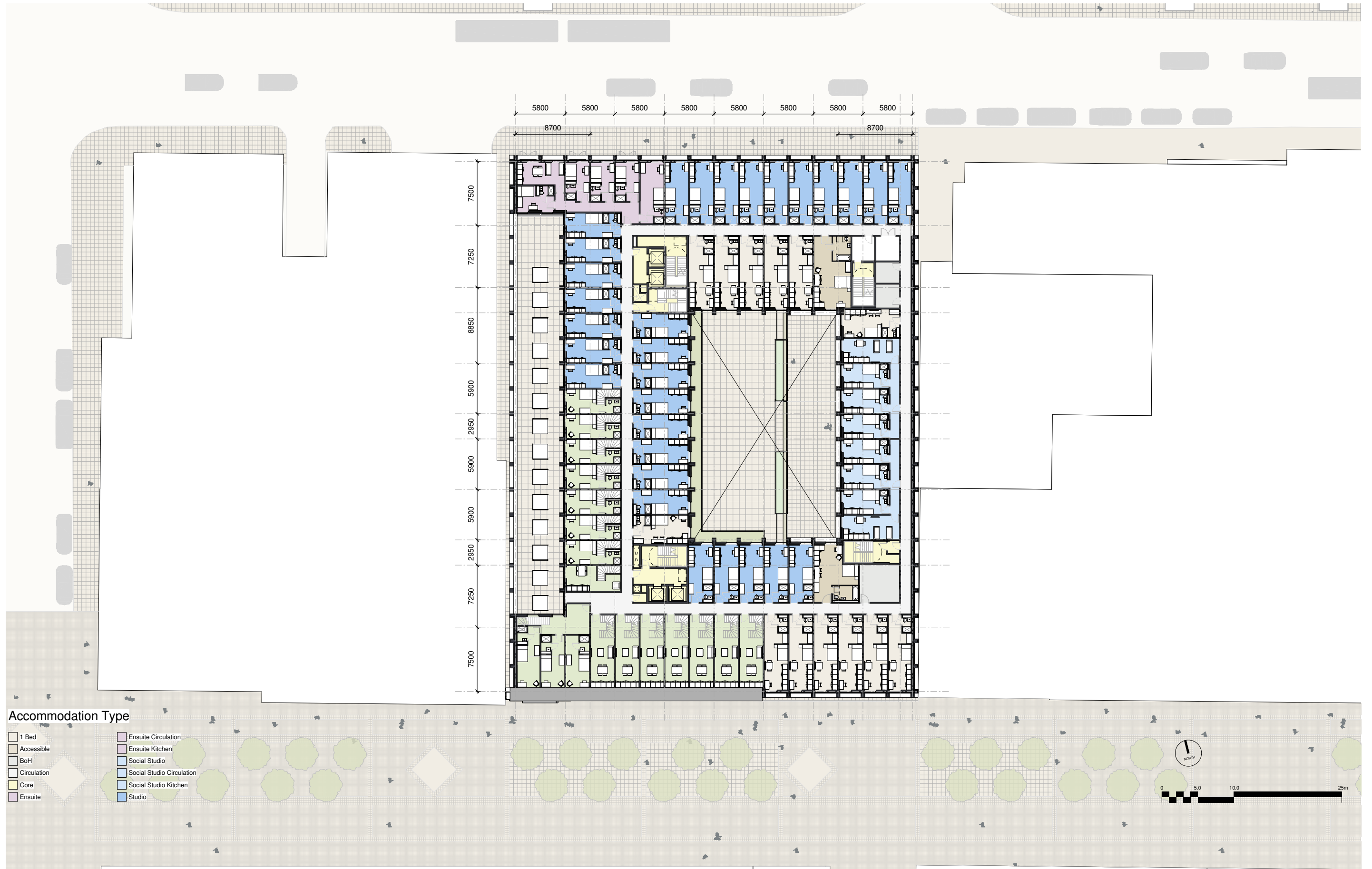
First Floor



Second Floor



Third Floor



Fourth Floor



Fifth Floor



Accommodation Type

- 1 Bed
- Accessible
- BoH
- Circulation
- Core
- Ensuite
- Ensuite Circulation
- Ensuite Kitchen
- Social Studio
- Social Studio Circulation
- Social Studio Kitchen
- Studio

Eighth Floor

