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GEO-ENVIRONMENTAL ENGINEERING EXCELLENCE

ST MICHAELS UK PROPCO 2 LTD / DOMIS CONSTRUCTION LTD

St Michaels, Jacksons Row, Manchester

Piling Risk Assessment

JM/C5128/12015

PROJECT QUALITY CONTROL DATA SHEET

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DRAWINGS

Drawing Number	Rev	Title
S73-000	P03	Proposed Development Layout Plans (Numerous)
C5128/01	-	Site Location Plan

1.0 INTRODUCTION

1.1 Context and Objective

This report describes a Piling Risk Assessment produced by Brownfield Solutions Limited (BSL) for St Michaels UK Propco 2 Ltd / Domis Construction Ltd on a site off Jacksons Row, Manchester, known as St Michaels.

This assessment has been completed in general accordance with the following guidance:

-
- Environment Agency (EA) Document NC/99/73, "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention".
 - Environment Agency (EA) Document, National Groundwater and Contaminated Land Centre, Piling into Contaminated Sites, February 2002.
-

The objective of this assessment is to determine the suitability of continuous flight auger pile foundations for the proposed development.

The proposed piling solution has the potential to create a pathway for contamination to migrate through the made ground and into the natural strata and groundwater. As such, these activities are carried forward only after an assessment of the impact of works in this report have been undertaken.

1.2 Proposed Development

The proposed development is for a 41-storey tower within the centre of the site along with a 7-storey podium across the entire footprint of the site. A full footprint 3-storey deep basement incorporating car parking, cycle store, water tank and storage rooms is also proposed. The frame is to be of reinforced concrete construction with a mix of post tensioned and traditional RC floor slabs. The end use is mixed, with the ground floor being for a retail use, with the remainder of the structure to be utilised as a mixture of offices, a hotel and residential areas. Previous Reports

This risk assessment follows the completion of the following reports, which should be read in conjunction with this assessment:

-
- WSP, Phase 1 Preliminary Geo-Environmental Risk Assessment, reference 70010925/001/10465, dated January 2016.
 - WSP, Preliminary Geotechnical & Environmental Assessment, reference 70010925/002/10482, dated November 2016.
 - WSP, Ground Investigation Report, reference 700028727/20160109, dated February 2017.
 - Ramboll, Ground Contamination Assessment, dated January 2021.
 - Ramboll, Remedial Statement, dated January 2021.
 - BSL Phase II Geo-Environmental Assessment Report, reference CM/C5128/11668 Rev B, dated March 2023.
-

1.3 Limitations

The findings and opinions conveyed via this assessment are based on information obtained from a number of sources as detailed within this report, BSL have assumed this information is correct and reliable. Nevertheless, BSL cannot and does not guarantee the authenticity or reliability of the information it has relied upon.

BSL have used all reasonable care and skill in the production of this report. There may be other conditions prevailing on the site which are outside the scope of work and have not been highlighted by this assessment and therefore have not been taken into account by this report. Responsibility cannot be accepted for such site conditions not revealed by the assessment.

This report has been prepared for the sole use and reliance of the Client, St Michaels UK Propco 2 Ltd / Domis Construction Ltd. No other third parties may rely upon or reproduce the contents of this report without the written permission of Brownfield Solutions Ltd (BSL). If any unauthorised third party comes into possession of this report, they rely on it at their own risk and BSL do not owe them any Duty of Care.

Any recommendations made in this report should be confirmed with the Regulatory Authorities prior to implementation to ensure compliance.

This assessment has been based on the proposed planning layouts provided. Any subsequent change to the planning layout may have an impact on the validity of recommendations made within this report. Furthermore, new information, changed practices or new legislation may necessitate revised interpretation of the report after the date of its submission.

2.0 GROUND MODEL SUMMARY

2.1 Description of Site

The site is located off Jacksons Row, Manchester, M2 5NH. It is situated approximately 200m south-west of Manchester City Centre, centred on National Grid Reference 383645, 398043 as shown on the Site Location Plan, Drawing No. C5128/01.

The main site features and potential issues identified prior to construction commencing at the site are detailed below.

Feature	Description
Site Area	The site covers an area of approximately 0.2 hectares.
Site Access	Access to the site is gained off Jackson Row to the north and Bootle Street to the south of the site.
Current Land Use and Site Features	The site comprises of a hard standing car park accessed from Jacksons Row to the north and Bootle Street to the south. A synagogue is present across the central northern section of the site.
Potential Sources of Gross Contamination	No potential sources of gross contamination have been identified during the site walkover.
Vegetation	Sporadic overgrown minor vegetation is present onsite.
Topography	The site is topographically flat.
Site Boundaries	The site is bounded by Jackson Row to the north, Bootle Street to the south, a public house to the south-east, a construction site to the north-east, and a multi-storey block of residential apartments to the west.
Surrounding Area	The site is set within the centre of Manchester City and is surrounded by residential apartments, office blocks and retail/hospitality units.

2.2 Environmental Setting

History

The earliest maps indicate the site to have had several previous used for both residential and commercial end uses including a public house, police station, car parking and a synagogue.

Geology

Made ground was encountered within all the exploratory holes across the site and was observed from ground level to depths between 1.35m and 2.85m bgl.

Hardstanding surfacing of tarmacadam, concrete, or building footprint was present across the entirety of the site, recorded as being 0.10m thick.

The composition of the made ground beneath the hardstanding was fairly consistent across the site and represented demolition material comprising sandy gravel and gravelly sand. Cobbles of brick ranged from medium to high content.

The natural strata underlying the site was generally a gravelly fine to coarse sand with varying amounts of silt as a minor constituent. This interpreted to represent glacial Till. The gravel was generally subangular to subrounded fine to coarse of sandstone, mudstone and quartz. The superficial strata were encountered to depths of between 4.00m and 4.70m bgl.

Weak becoming moderately strong sandstone bedrock was encountered from depths of between 4.00m and 5.00m bgl, which was proven to a maximum depth of 45.00m bgl across the site and is interpreted to represent the Chester Formation.

Hydrogeology

The superficial deposits (Till and Glaciofluvial Sheet Deposits) in this area are classified by the Environment Agency as a Secondary Undifferentiated Aquifer. The classification is assigned where it is not possible to attribute either category A or B to the aquifer.

The bedrock (Chester Formation) is classified as a Principal Aquifer. These are defined as layers of rock 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.

There are no source protection zones indicated to lie within 500m of the site.

Groundwater was not encountered during the drilling works; due to the water flush method of rock coring, it is likely that the exact location of the water strike was unable to be observed. Post site works monitoring recorded groundwater ranging from 10.75m to 11.60m bgl.

Hydrology

The nearest named watercourse to the site is the Rochdale Canal circa 270m to the south-east of the site.

Information obtained from the Environment Agency indicates that the site lies within a Flood Zone 1.

2.3 Summary of Risk Assessments

The ground investigations have confirmed the following:

-
- Asbestos cement fragments in the central eastern part of the car park in previous WSP investigation.
 - Elevated levels of Lead within the made ground.
-

Human Health Risks

Based on the testing and assessment undertaken it would appear that there is localised contamination within the made ground in the north-western section of the site in the form of elevated levels of lead. This is generally in line with the findings of previous ground investigation on site, whereby lead and arsenic have been identified.

Asbestos fragments were also noted at a single location (D2) within the made ground during a historical investigation beneath the central eastern section of the car park, to east of the synagogue.

The above potentially pose a risk to human health and will require further consideration.

Ground Gas

Based on the gas risk assessment, taking into account the results of the gas monitoring programme, the conditions on site and the proposed construction, the site has been classified as CS1. Therefore, the risk is considered to be low and no mitigation measures will be required.

Risk to Controlled Waters

Groundwater/surface water testing has not been carried out based on the preliminary CSM risk assessment and the site is not considered to pose a significant risk to controlled water for the following reasons:

- No significant gross or mobile contamination has been identified on site in soils based on the results obtained as a potential indicator of groundwater contamination.
- There is no indication under present conditions of significant pollution of controlled waters and conditions following development of the site will not be any worse.
- The nearest watercourse is the River Irwell over 400m away, which provides considerable distance for attenuation and contaminant degradation.
- The site does not lie within 500m of an SPZ.
- There are no groundwater abstractions within 2000m.
- There are no potable (sensitive) water abstractions within 2000m.
- The previous reporting undertaken by Ramboll (2021) highlighted minor concentrations of chromium, however, this is considered to be derived from natural background concentrations in the aquifer and not derived from site, with a low risk assessed. Minor impacts of zinc were also noted, however, this was deemed to also be of low risk, with the actual bioavailable content being unlikely to be above the GAC.

Based on the above, no further action is required, although given a piled foundation solution is to be adopted, which may lead to the creation of new pathways, the Local Authority and EA may condition that a piling risk assessment is carried out to support the assessed low level of risk.

Outcome of Risk Assessments

The made ground onsite will be removed during the construction of the basement, which will remove the source of the identified lead contamination, alongside the previous reported asbestos. This will effectively remediate the site, therefore no specific remedial measures are required for soils in respect to human health for the proposed end use.

Based on the proposed development plans, no soft landscaping is proposed – however should this not be the case, where soft landscaping is present a cover of “clean” subsoil and topsoil should be provided to break the pathway to site end users. This should be 450mm in soft landscaping areas (Public Open Space – POS) in accordance with BRE 465. This will allow plants to be grown and prevent undesirable soils being brought to the surface. The inclusion of a geotextile marker layer at the base or a coarse granular, ‘hard dig’ layer is recommended.

2.4 Summary of Remedial Recommendations

Based on the previous investigations at the site, no specific remedial measures over and above source removal to accommodate the basement are required for soils in respect to human health for the proposed end-use.

2.5 Proposed Works and Foundation Options

Due to the magnitude of the column loads expected to be imposed by the proposed high rise multi-storey structure, from a geotechnical perspective the most suitable foundation solution for the proposed store is considered to be piles. The piled foundations should extend through the made ground and superficial deposits, and be socketed into the sandstone bedrock which was observed from depths between 4.00-4.70m bgl and proven to a maximum depth of 45.00m bgl.

It is understood that a replacement type piled solution will be required, such as continuous flight auger piles. These are considered to be penetrative works for the purpose of this Risk Assessment.

As part of the development, the entirety of the made ground onsite will be removed in order to accommodate the construction of a new basement and the build-up of a working platform for the piling rig. A minimum of 10.00m of material will be removed for the foundation design.

This will in effect remove the source of heavy metal contamination identified from the ground investigation. The entirety of the site will be comprised of building footprint, with a new drainage system installed. This will significantly reduce the amount of infiltration available and the propensity for the generation of contaminated leachate from the site.

3.0 PILING RISK ASSESSMENT

3.1 Introduction

The risks associated with piling and ground improvement works must be considered on a site-specific basis and the potential receptors are defined by the hydrogeological properties of the strata underlying the site, the proximity of other receptors along with the site history, current use and surroundings. The Environment Agency indicate that concerns about water protection are likely to be most severe when:

- Contaminants are present on the site and ground works could allow them to migrate.
- Piling would breach an aquitard or connect two previously discrete aquifers.
- The site overlies a Principal or a Secondary A Aquifer.
- The site is located within a Source Protection Zone (SPZ).
- Groundwater is currently of good quality.
- The water table is shallow or likely to be intersected by piles.
- The geological strata are fractured or fissured.
- Works are close to a surface water body and run-off from arisings could pollute those waters.

This risk assessment takes into consideration the current guidance on Pollution Prevention and the source-pathway-receptor (S-P-R) approach. There are six possible generic pollution linkages considered by the Environment Agency to be created by piling and these are:

1. Creation of permeable pathways through a low permeability layer to allow potential contamination of an underlying aquifer.
2. Creation of preferential pathways, through a low permeability surface layer, to allow upward migration of land gas, soil gas or contaminant vapours to the surface.
3. Direct contact of site workers or others with contaminated soil arisings 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 down of contaminants down into the aquifer during pile driving.
6. Contamination of groundwater, and subsequently surface waters, by concrete, cement paste or grout.

3.2 Sources of Contamination

Elevated heavy metals (lead) has been identified within the made ground across the site. Asbestos was also identified in a previous investigation.

No specific remedial action was recommended for these contaminants based on the rationale summarised in Section 2.3.

3.3 Ground Gas

Based on the ground gas monitoring, the site is classified as CS1 and no mitigation measures are required.

3.4 Pathways

No specific contaminants have been identified to present potential risks to controlled waters on site. However, the potential following pathways exist:

-
- Leaching of mobile contamination into groundwater.
 - Migration of perched groundwater in any permeable soils or along existing or proposed service runs.
 - Saturated zone flow through the made ground underlying the site.
 - The installation of piles resulting in the creation of a preferential pathway.
-

3.5 Receptors

The relevant sensitive receptors include:

-
- Rochdale Canal to the south of the site.
 - Groundwater within the superficial Till and Glacifluvial Sheet Deposits Secondary Undifferentiated Aquifer.
 - Groundwater within the Principal Aquifer of the Chester Formation.
 - Construction workers.
 - Site end-users.
 - The fabric of the piles.
-

3.6 Risk Assessment

Each of the relationships described above are qualitatively assessed with relation to the six specific scenarios detailed in the table overleaf. Any assessed risk that is above moderate/low will possibly require further action.

Pollution Scenario	Activity	Source	Pathway	Receptor	Likelihood	Consequence	Risk	Justification
Scenario 1 Creation of permeable pathways through a low permeability layer to allow potential contamination of an underlying aquifer	Installation of deep foundations (piles)	Heavy metals within made ground	No pathway present as source removed	N/A	N/A	N/A	Negligible	In order to accommodate the proposed foundation design, circa 10m of material will be removed from site. This includes the entirety of the made ground material, and therefore the entirety of the identified sources of contaminants. Furthermore, the location of the piles will be within the footprint of the proposed building, with a large concrete slab which will also benefit from newly installed drainage, drastically reducing the amount of water infiltrating the made ground and reducing the possibility of contaminated water reaching the piles.
Scenario 2 Migration of vapours	CFA piles / bored piles without casing	Ground gas generated from degradable matter within the made ground	No pathway present as no source	N/A	N/A	N/A	Negligible	Based on the ground gas monitoring, the site is classified as CS1 and no mitigation measures are required.
Scenario 3 Contact (dermal contact, dust inhalation, accidental ingestion) between Site Workers and contaminants in pile arisings	CFA piles / bored piles without casing	Heavy metals within made ground	No pathway present as source removed	N/A	N/A	N/A	Negligible	In regard to risks to human health and construction workers, no elevated contaminants will be left onsite. Any residual risks from made ground will be mitigated by standard PPE including gloves. Welfare facilities should be made available to wash before hand to mouth activities. General guidance on these matters is given in the Health and Safety Executive (HSE) document "Protection of Workers and the General Public during the Redevelopment of Contaminated Land".

Pollution Scenario	Activity	Source	Pathway	Receptor	Likelihood	Consequence	Risk	Justification
Scenario 4 Degradation of pile materials via sulphate attack thereby increasing contaminant mobility	Installation of deep foundations (piles)	Sulphates within natural strata	Via zone of degradation next to pile	Groundwater beneath the site / Rochdale Canal (via base flow)	Unlikely	Medium	Low	Degradation of pile materials via sulphate attack would likely increase contaminant mobility, leading to increased contaminant migration. However, the appropriate design concrete class will be adopted in accordance with BRE Special Digest 1 to mitigate against this, minimising the risk of degradation of pile materials. In addition, where steel tubular piles are utilised due to obstructions, the pile fabric is highly unlikely to significantly degrade over the design lifetime of the structure, otherwise this would also pose a geotechnical instability risk.
Scenario 5 Driving down solid Contaminants	CFA piles / bored piles without casing	Heavy metals within made ground	No pathway present as source removed	N/A	N/A	N/A	Negligible	There is no potential for made ground to be entrained down to the deeper strata on site due to the entire removal of the made ground strata in order to accommodate the basement structure, circa 10m bgl.
Scenario 6 Contamination of groundwater by concrete, cement paste or grout	CFA piles / bored piles without casing	Wet Concrete	Contact with groundwater and off-site flow in aquifer	Groundwater beneath the site / Rochdale Canal (via base flow)	Unlikely	Medium	Low	The piling technique employs the use of wet concrete, however this will likely go off within a very short duration of time, thereafter inhibiting groundwater flow. The concrete will be poured either on or within sandstone bedrock and will therefore be confined within the bedrock and will limit migration of any concrete to wider areas of the aquifer. The risk is considered to be low.

4.0 CONCLUSIONS

The proposed piling method at the site is a replacement type piled solution. The risk assessment carried out demonstrates overall risks to the identified receptors associated with the chosen piling methods are considered to be low/moderate to low in accordance with the Environment Agency's Piling Risk Assessment methodology.

Pollution Scenario	Level of Risk
Scenario 1	Negligible
Scenario 2	Negligible
Scenario 3	Negligible
Scenario 4	Low
Scenario 5	Negligible
Scenario 6	Low

Due to the very low risk at the site the use of specific mitigation measures are not considered necessary in respect of controlled waters, site end users and construction workers. The evidence in this assessment should be provided to satisfy the regulatory authorities. Should a change in piling methodology be proposed then this risk assessment would need to be revised accordingly.



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S73 SUBMISSION

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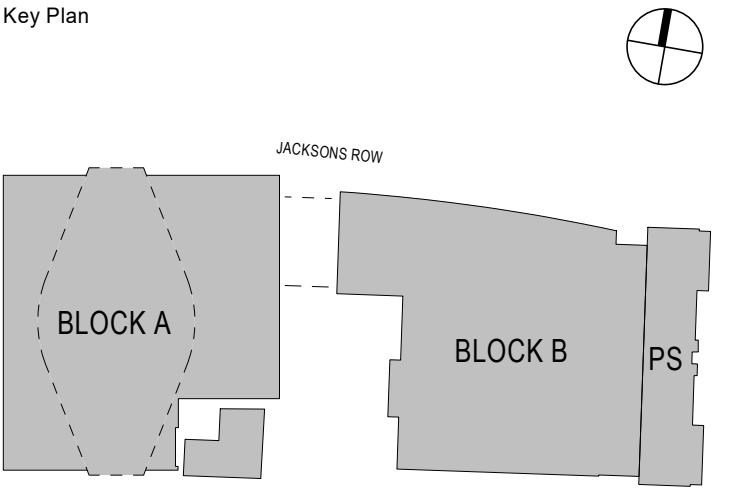
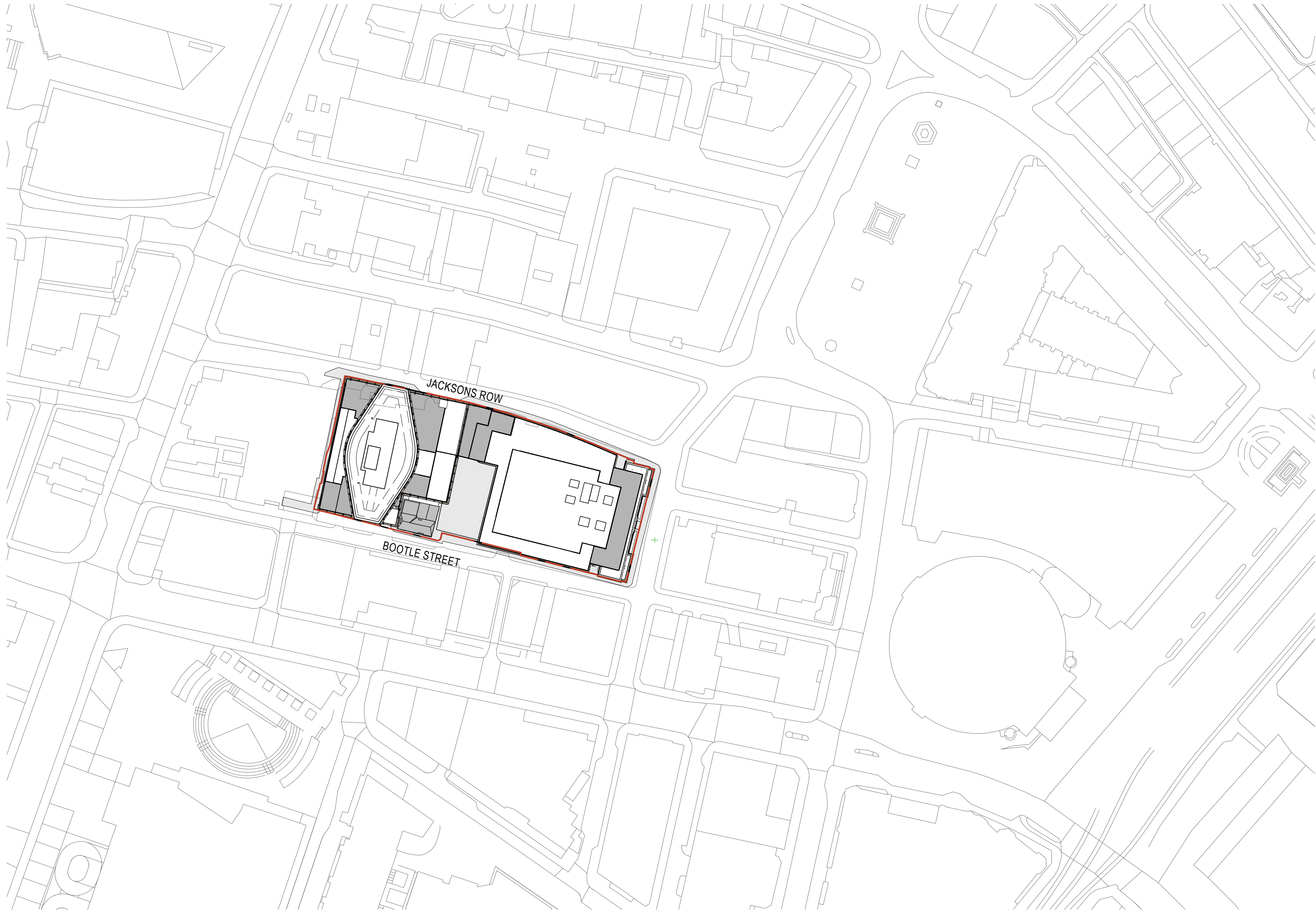
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SITE PLAN

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General Notes

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P02	20/08/21	S73 Submission DRAFT
P01	15/11/19	S73 Submission
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Status

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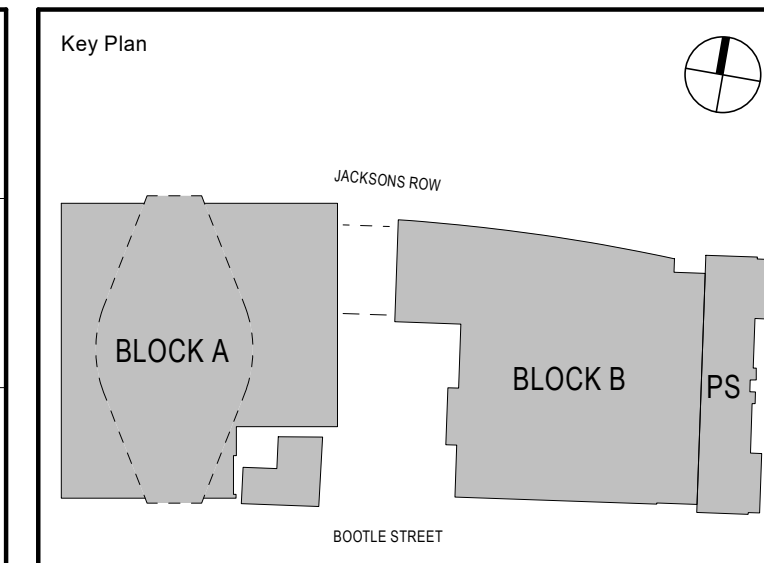
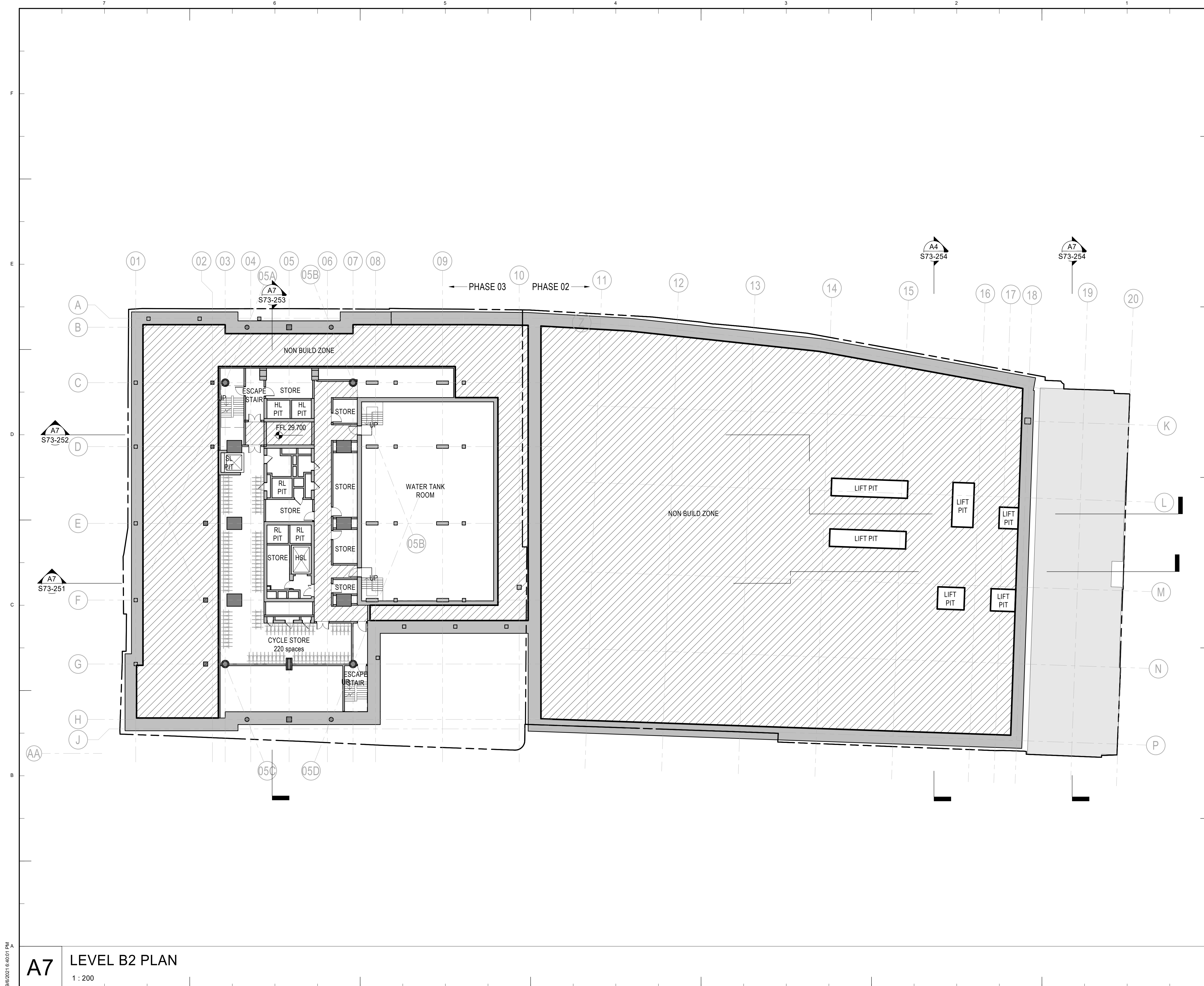
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SITE PLAN

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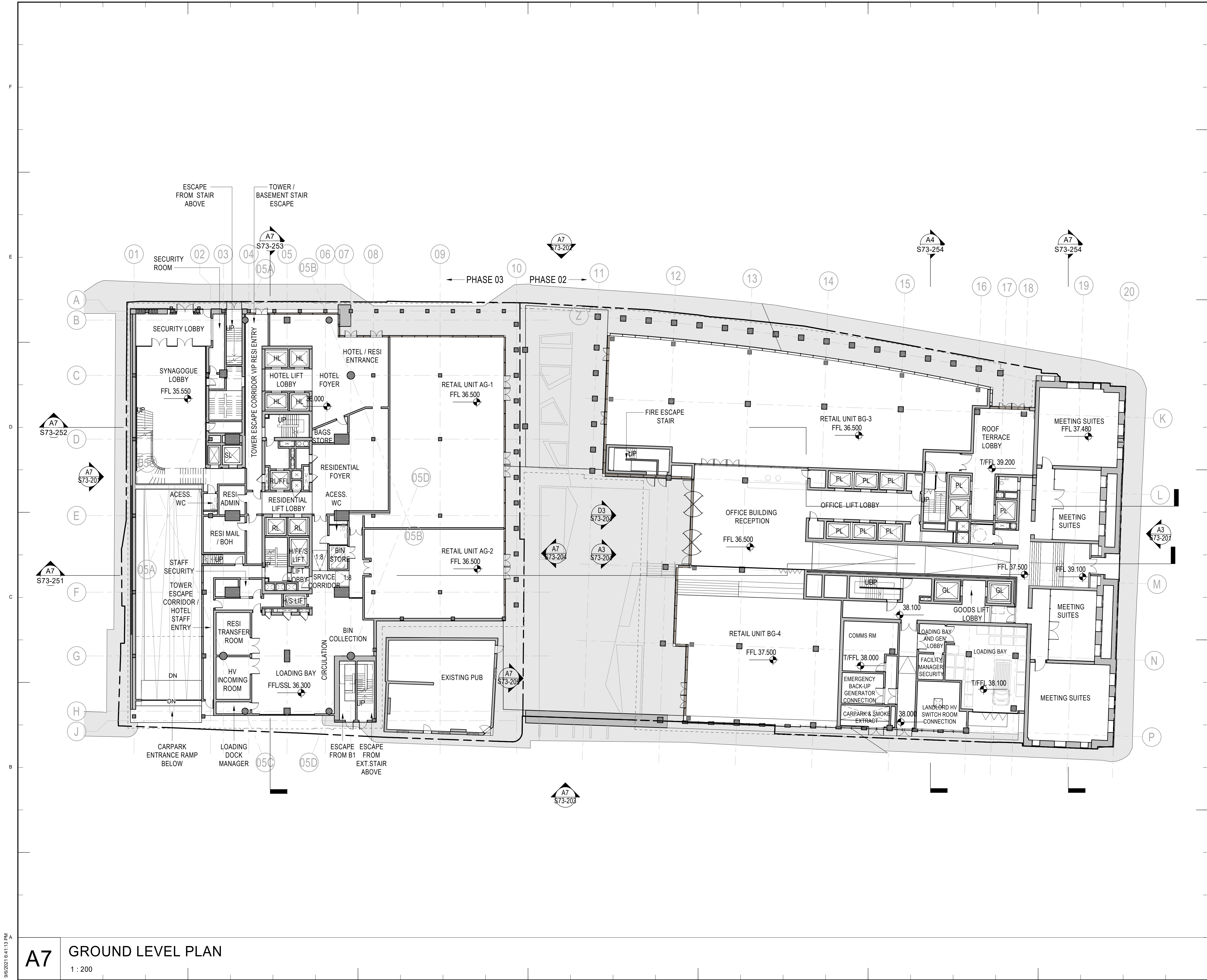
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GROUND LEVEL PLAN

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Key Plan

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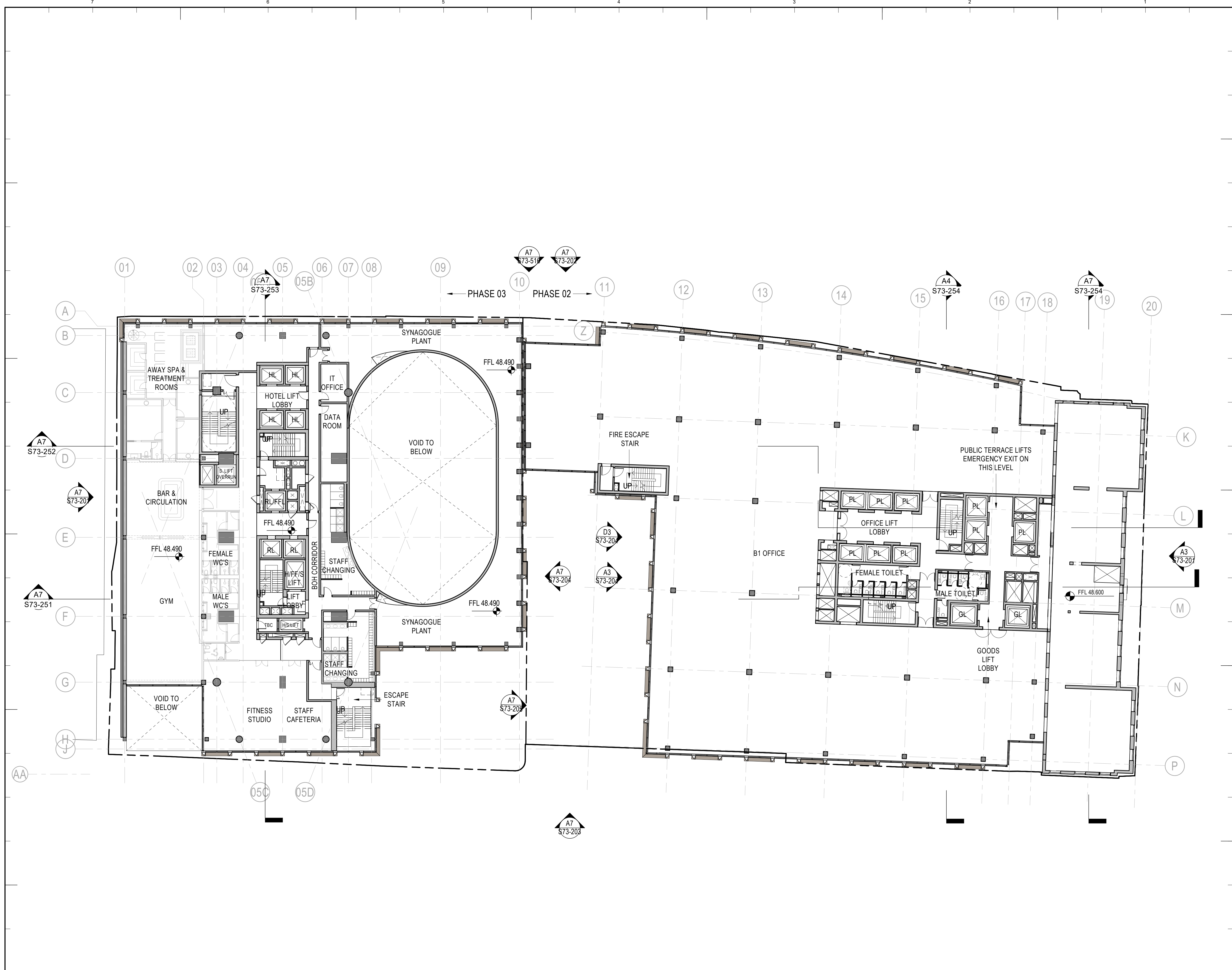
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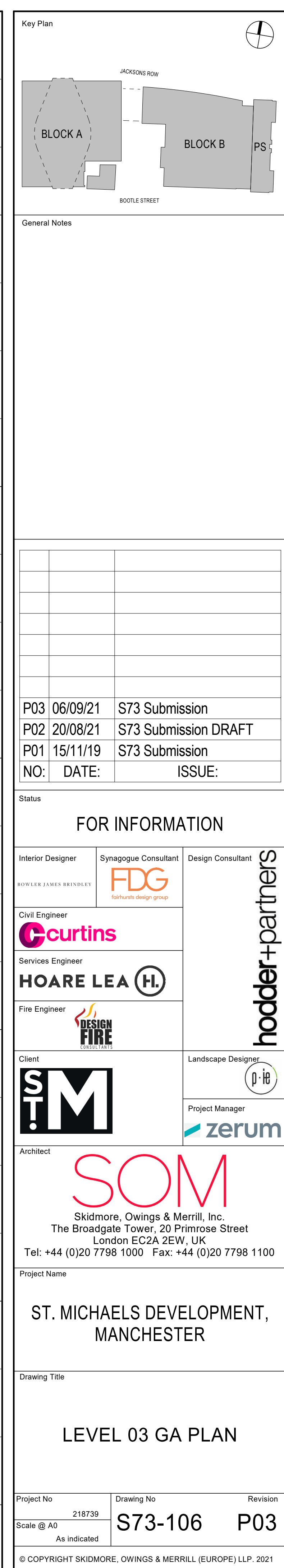
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Services Engineer	HOARE LEA (H)	
Fire Engineer	DESIGN FIRE	
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GROUND LEVEL GA PLAN		
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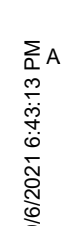




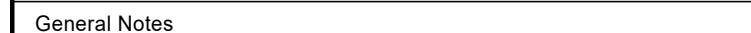
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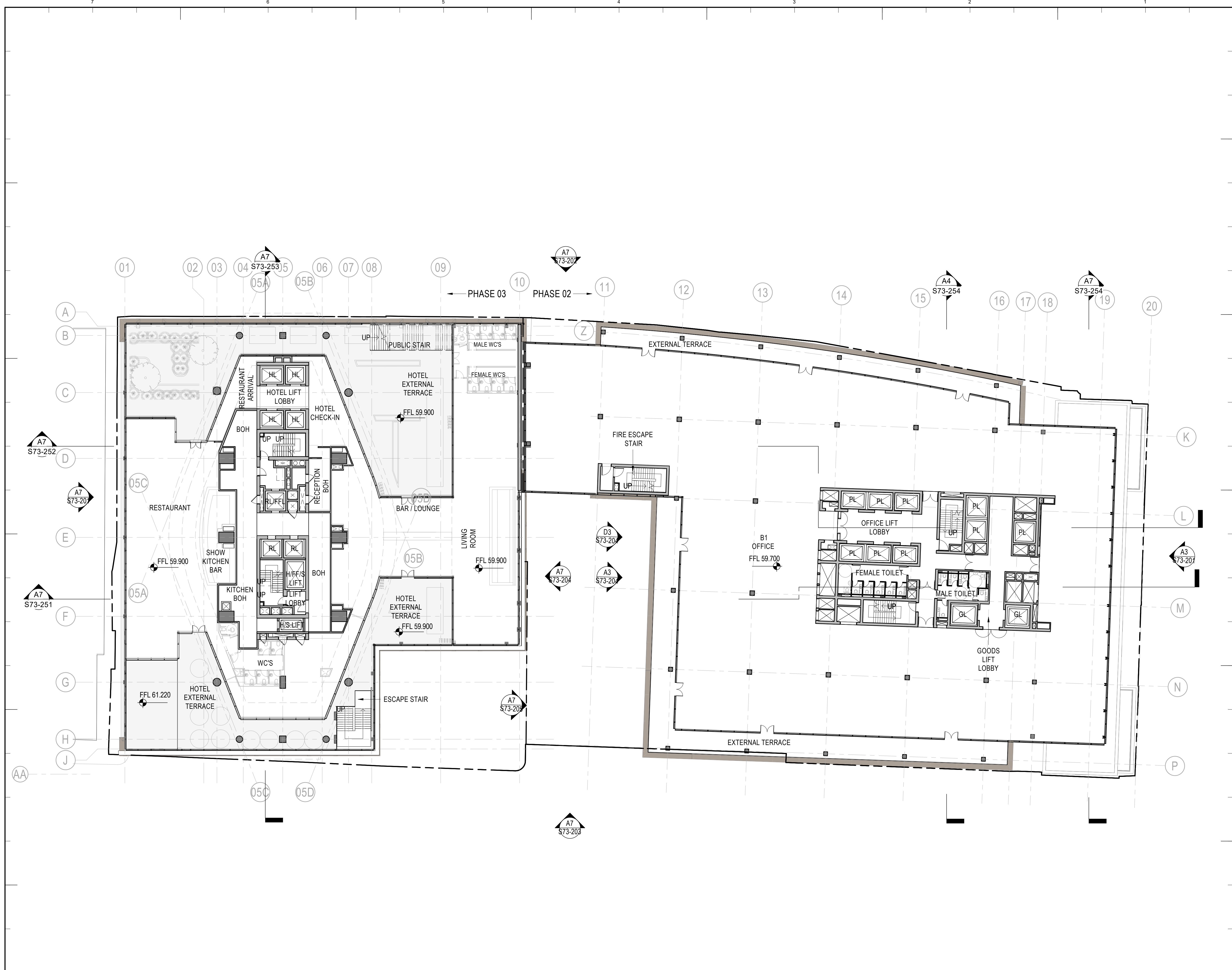
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Architect

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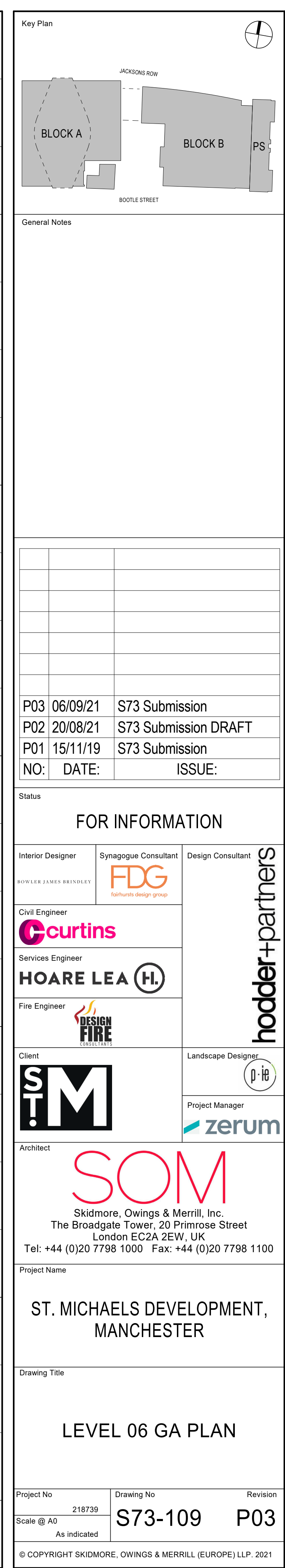
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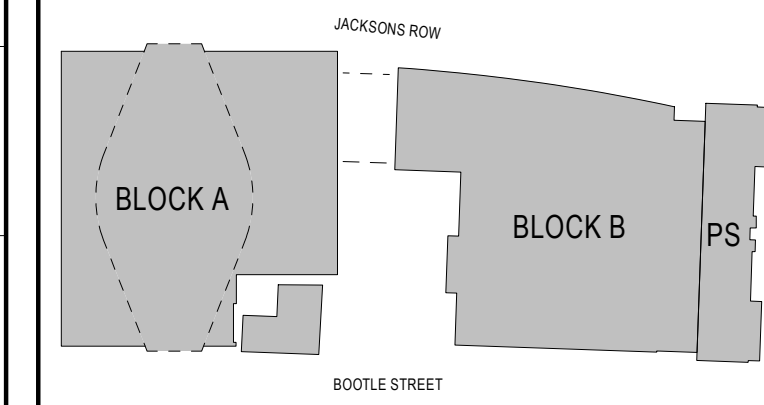


LEVEL 06 PLAN

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Key Plan



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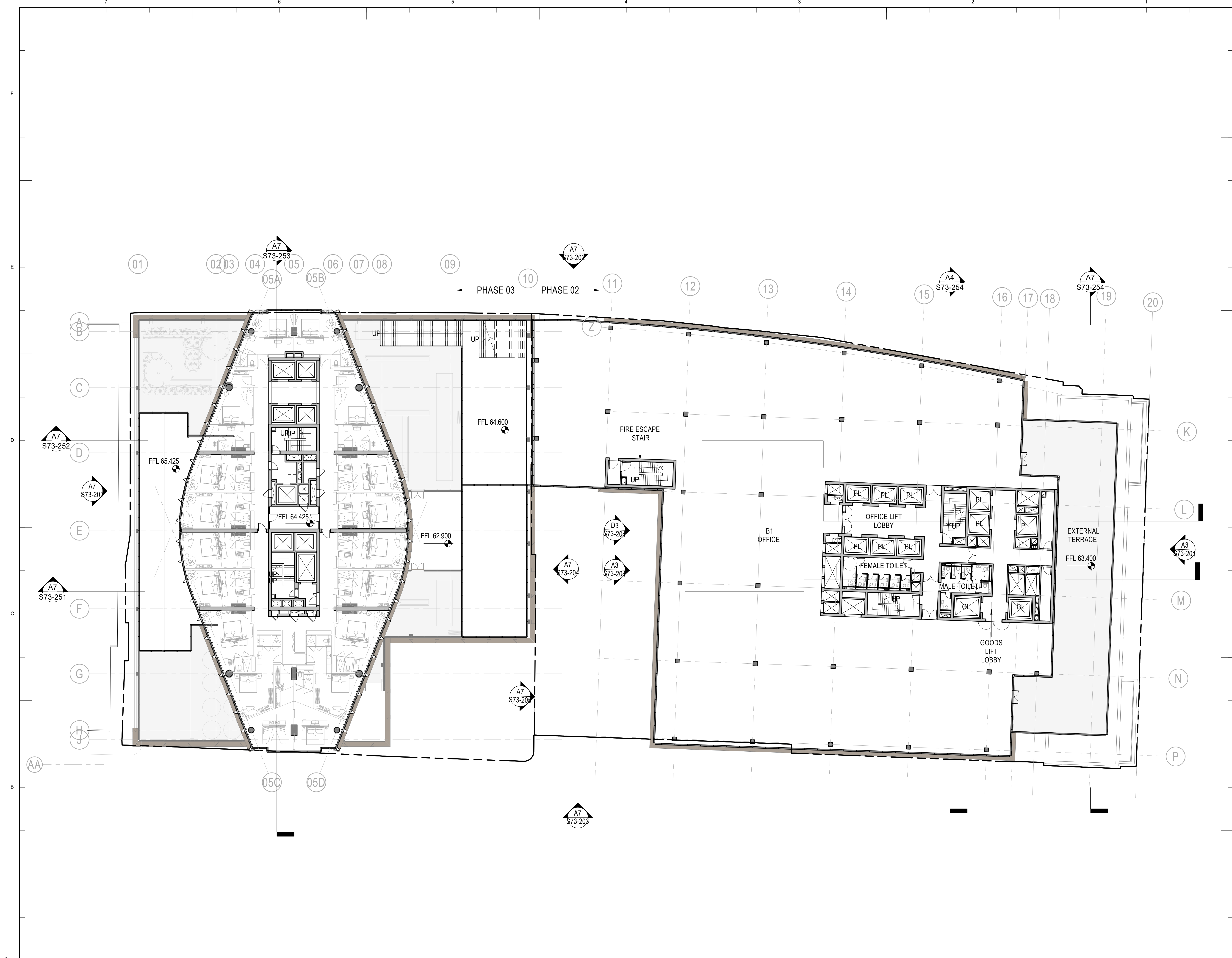
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LEVEL 06 GA PLAN

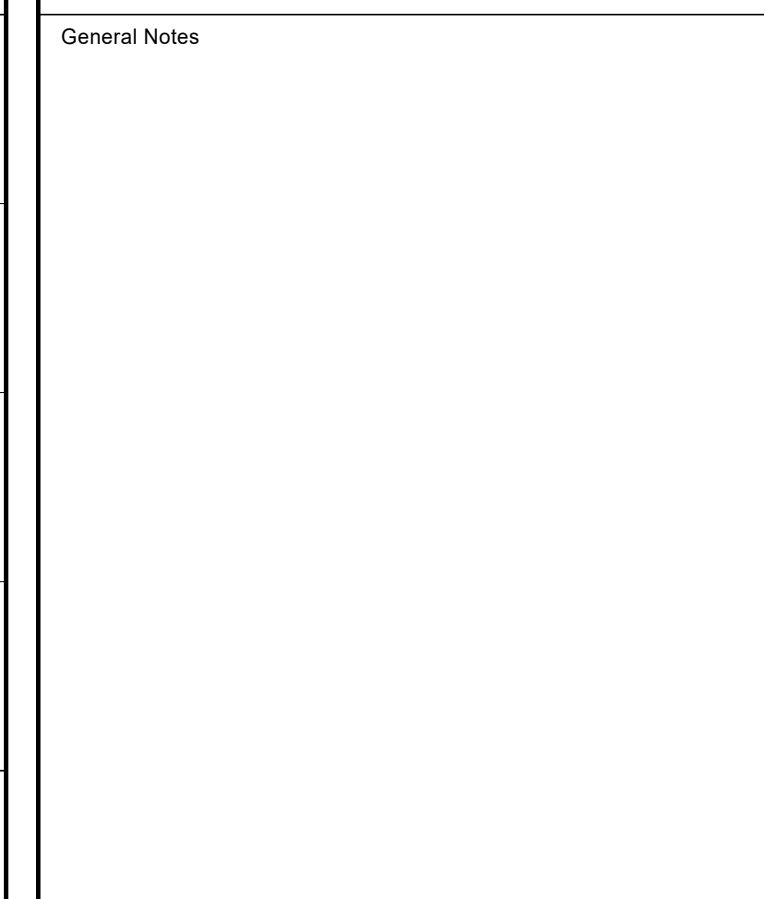
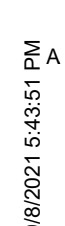
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218739	S73-109	P03
Scale @ A0 As indicated		

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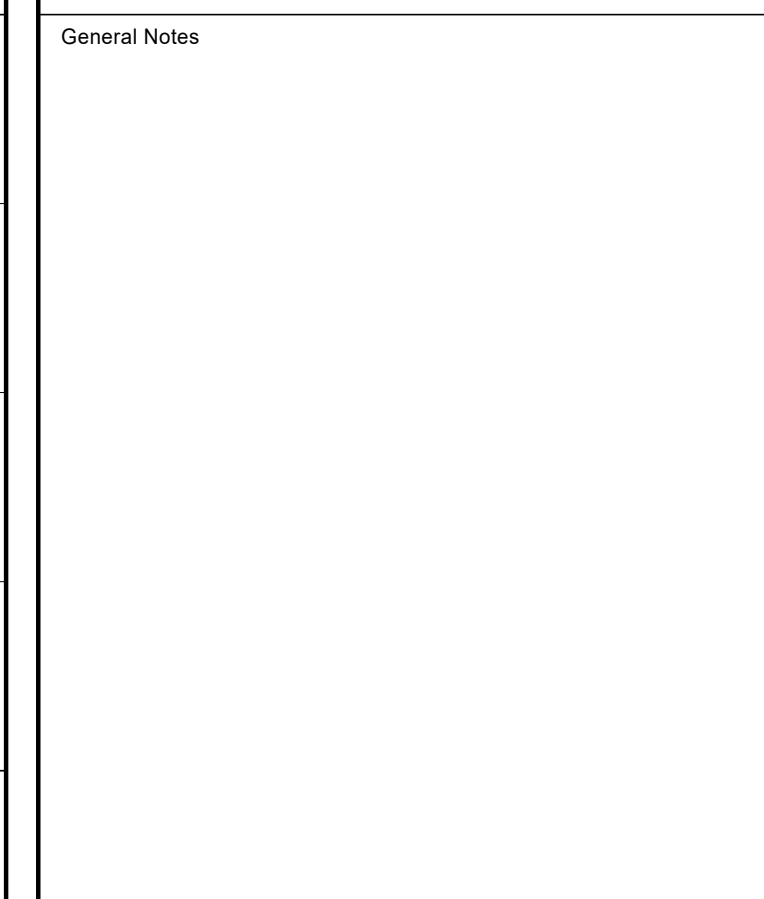


Status FOR INFORMATION		
Interior Designer BOWLER JAMES BRINDLEY	Synagogue Consultant FDG forthwaite design group	Design Consultant hoddler+partners
Civil Engineer Gcurtins		hoddler+partners
Services Engineer HOARE LEA (H.)		
Fire Engineer DESIGN FIRE ENGINEERS		
Client ST!M	Landscape Designer (p-le)	
Project Manager zerum		

Project Name

ST. MICHAELS DEVELOPMENT,
MANCHESTER

Project No	Drawing No	Revision
218739	S73-111	P03
Scale @ A0 As indicated		
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Status FOR INFORMATION		
Interior Designer ROWLER JAMES BRINDLEY	Synagogue Consultant 	Design Consultant 
Civil Engineer 		
Services Engineer HOARE LEA 		
Fire Engineer 		
Client 		Landscape Designer 
		Project Manager 

Project Name

ST. MICHAELS DEVELOPMENT,
MANCHESTER

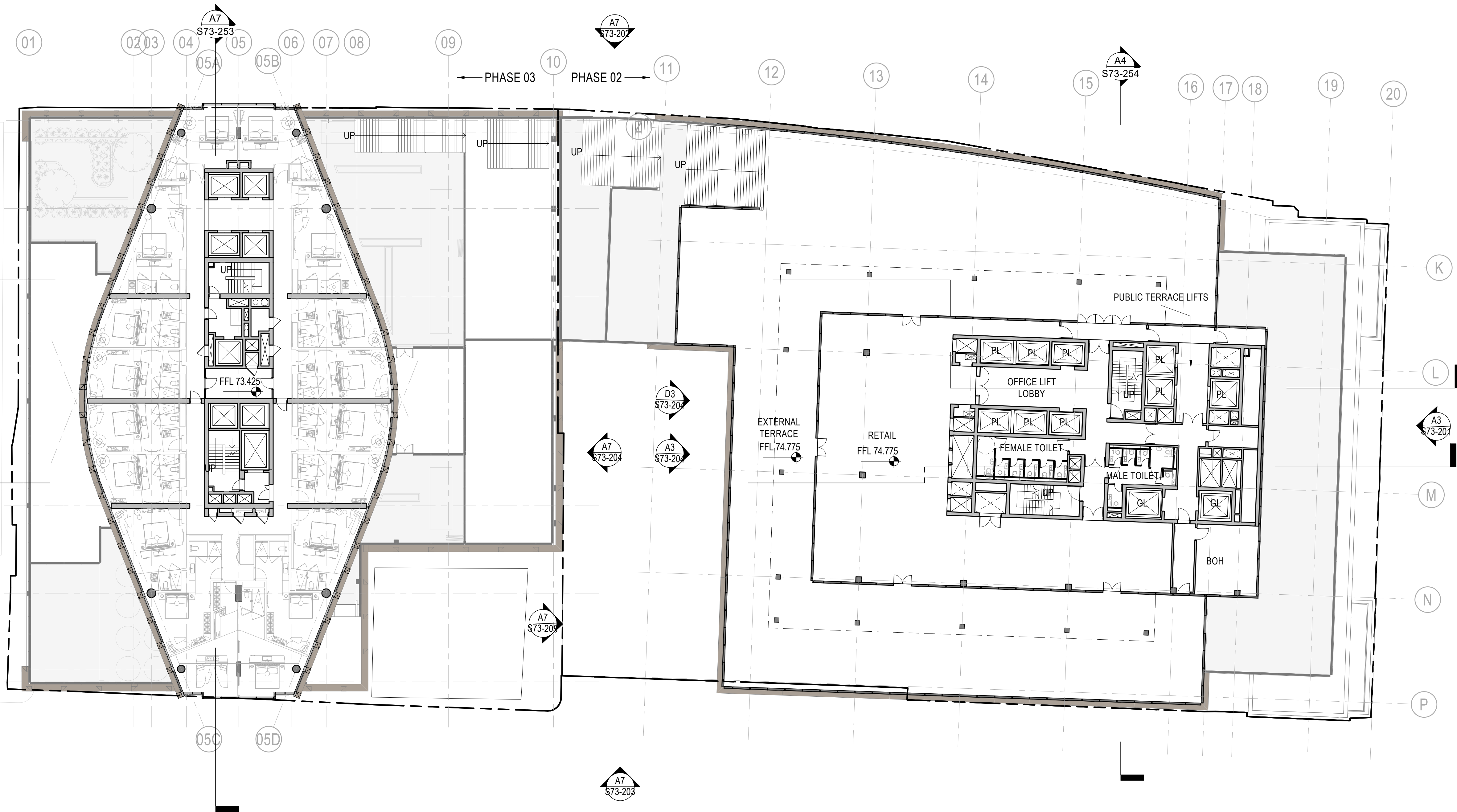
Project No	Drawing No	Revision
218739	S73-112	P03
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LEVEL 10 PLAN

1 : 200



Key Plan

General Notes

P03	06/09/21	S73 Submission
P02	20/08/21	S73 Submission DRAFT
P01	15/11/19	S73 Submission
NO:	DATE:	ISSUE:

Status

FOR INFORMATION

Interior Designer	Synagogue Consultant	Design Consultant
ROWLER JAMES BRINDLEY	FDG	hodder+partners
Civil Engineer	Curtins	
Services Engineer	HOARE LEA (H)	
Fire Engineer	DESIGN FIRE	
Client	S!M	
Architect	SOM	
Skidmore, Owings & Merrill, Inc. The Broadgate Tower, 20 Primrose Street London EC2A 2EW, UK Tel: +44 (0)20 7798 1000 Fax: +44 (0)20 7798 1100		
Project Name	ST. MICHAELS DEVELOPMENT, MANCHESTER	
Drawing Title	LEVEL 10 GA PLAN	
Project No	Drawing No	Revision
218739	S73-113	P03
Scale @ A0	As indicated	
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