PROJECT: 19/21 HIGH HOLBORN, LONDON

CIVIL AND STRUCTURAL PLANNING REPORT

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Revision: B

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1. INTRODUCTION

1.1 Purpose of the Report

This document descries the structural scheme and associated works for the proposed development of the existing building located at 19/21 High Holborn.

The report summarises the design proposals for the civil and structural engineering scheme of the proposed development to RIBA Stage 2, and has been produced in support of the planning application. It draws together information prepared during the design period up to November 2016. The report defines the design criteria for the structure and the standards and methods used to justify the design by calculation.

The aims of the report are as follows:

- To confirm our understanding of the brief and the scope of works
- To give technical support to the architectural scheme
- To highlight principal engineering design issues
- To form the basis of the following design phase
- To enable a preliminary cost plan to be produced
- To identify the key design risks associated with the project which will require attention in the following phases

The scheme has been developed with the design team and therefore this report should be read in conjunction with the design brief, drawings and specifications from all other consultants assigned to the project.

1.2 Scheme Description

19/21 High Holborn is a development for The Honourable Society of Gray's Inn under our appointment to The Honourable Society of Gray's Inn. The Honourable Society of Gray's Inn have appointed the following consultants to form the project design team.

Rick Mather Architects	Architects
Savills	Planning Advisors
Gleeds	Project Manager / Quantity Surveyor / Health and Safety Consultant
AECOM	Structural Engineer / Underground Drainage
Watermans	Services Engineer / Acoustic Consultant / Sustainability Consultant / Fire Consultant*

**Structural fire design of the building is currently based on advice given by Watermans.*

The building as it stands contains two storeys of retail (basement and ground), five storeys of office space (first to fifth) and one storey of residential (sixth).

To the rear of the existing site stands a five storey extension with mezzanine, which the current scheme proposes to demolish along with the existing stair core. In their place it is proposed that a new 5/6 storey lightweight steel frame will be constructed and a new stability core in the place of the existing stair core. Over the footprint of the remaining building the existing roof slab is to be demolished and replaced with a new lightweight steel roof deck to provide greater floor to ceiling heights on the sixth floor.

The proposed building will maintain its retail unit over the ground and basement. The extension to the existing basement will be used primarily as plant space. The six storeys above this will be for office use, combining the new steel frame with the existing RC frame as one structure. All roof space will be used to house plant, along with the base of the lightwell to the East.

1.3 Reliance

This report had been prepared for the use by our Client, The Honourable Society of Gray's Inn, in accordance with the agreement under which our services were performed. No other warrantee, expressed or implied, is made as to the professional advice included in this report or any other services provided by AECOM. This report is confidential and may not be disclosed by the client or relied upon by any other party without prior and express written agreement of AECOM.

1.4 Limitations

This recommendations and conclusions contained within this report are based upon information provided by others and upon the assumption that all relevant information provided by those parties is accurate. Information obtained by AECOM has not been independently refined by AECOM, unless otherwise stated in the report.

The design work described in this report was undertaken between March 2015 and January 2016 and is based on the information available during the said period of time.

2. SITE

2.1 Location

The site is located in the London Borough of Camden, within Gray's Inn, which can be found aside the A40 (High Holborn). The site is located approximately 75m to the West of the entrance to Chancery Lance Underground Station.

Ryman's and the post office currently use the ground floor and basement areas. The upper floors are currently leased to a number of different tenants, who will vacate the premises at various times between November 2015 and the end of 2016.

The site covers approximately 1200 square metres (including the Paddock), and is bounded by the Cittie of York public house to the West, Number 14-18 High Holborn to the East, High Holborn to the South and Gray's Inn to the North.

Along High Holborn in both directions are a number of retail units and office blocks, with Gray's Inn containing office and residential units.

The front elevation of Number 21 High Holborn is located above Chancery Lane's escalator shaft.

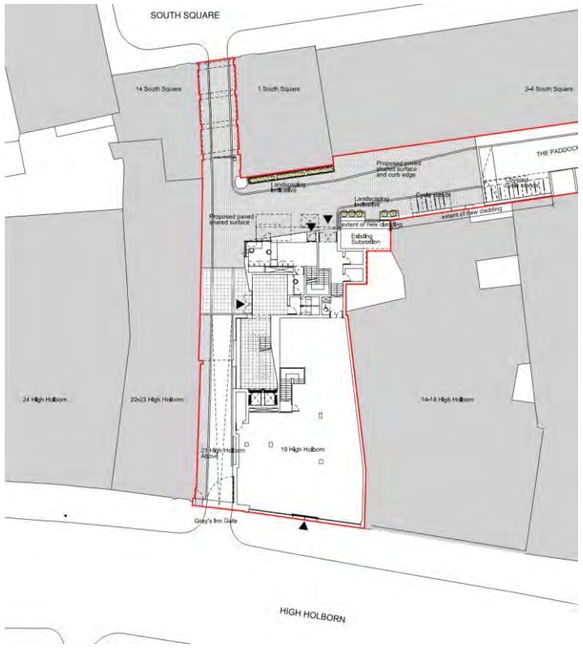


Figure 1.0: Site Plan (Rick Mather Architects)

2.2 History

Maps dated 1746 and 1827 show the site to have been developed with the road "High Holbourn", which was renamed at a later date to "High Holborn". Based on the Charles Booth map, dated 1898, the site was developed with middle-class housing. The next map, dated 1951, shows the site to have been unchanged, while in 1975 the Gray's Inn was annotated at the location of number 19 High Holborn. This change would have been brought about by the construction of the current building at 19/21 High Holborn. Based on record drawings, 19/21 High Holborn was constructed in the 1960s.

Since the construction of the building in question, there has been the introduction of a substation to the rear. The surrounding area of Gray's Inn has remained largely unchanged, other than the post office and public house to the east becoming office space.

2.3 Ground Conditions and Ground Water

A Site Investigation was carried out by Geotechnical & Environmental Associates (GEA) (Report Ref. J15193, September 2015) to: determine ground conditions and existing foundation type and size, provide recommendations in respect of foundation design and other geotechnical and environmental matters for the development at 19/21 High Holborn.

The investigations carried out by GEA have been split into two phases. Phase One includes two boreholes and seven external trial pits and one internal trial pit. Phase Two includes 14 internal trial pits. The investigation works have been split in such a way due to restricted internal access, and therefore this report has been written prior to Phase Two commencing.

Of the two boreholes conducted on site, one was to a depth of 20.0m below ground while the other to 5.0m. It is for this reason the information available for variation in strata below 5.0m is limited. It is proposed that further boreholes are carried out once internal access becomes available.

Along with the information obtained by GEA, public records of the sites geology have been accessed via the online archives contained in British Geological Survey library.

Available and relevant records consist of nearby boreholes, TQ38SW510, TQ38SW513 & TQ38SW514 undertaken throughout the 1890s, and TQ38SW13 in 1952. The depths of the boreholes range from 5.5m to 54.5m.

For the record, the borehole logs obtained from the British Geological survey are attached as an appendix to this Planning Document (Refer to Appendix C).

Figure 2.0: Extract from British Geological Survey Borehole scans map (BGS)

Trial pits were carried out to a range of depths to encounter either the shallow foundations below the rear four storey block (no existing basement), or the deeper strip footing around the perimeter of the existing basement.

Samples were taken from the boreholes and trial pits and subjected to geotechnical laboratory testing.

2.3.1 Geology

The British Geological Survey indicates that the geology near to the site is comprised of a sandy clay overlying a medium dense gravel with a stiff clay formation. This matches the findings of the GEA investigation of: Hackney Gravels overlying a London Clay Formation.

2.3.2 Site Specific Data

The site specific borehole logs are summarised below from GEA Report Ref. J15193:

Borehole 1 (to depth of 20m)

Summary of Geological Section	Depth [mbgl]	(mOD)	Thickness (m)
Made Ground	0.00 to 4.00	+19.85 to +15.85	4.00
Medium dense brown slightly silty SAND and GRAVEL (Hackney Gravel)	4.00 to 6.60	+15.85 to +13.25	2.60
Firm brown CLAY (London Clay)	6.60 to 6.80	+13.25 to +13.05	0.20
Stiff to very stiff silty CLAY (London Clay)	6.80 to depth	+13.05 to -0.15	>13.20

Borehole 2 (to depth of 5.0m)

Summary of Geological Section	Depth [mbgl]	(mOD)	Thickness (m)
Made Ground	0.00 to 3.40	+20.44 to +17.04	3.40
Soft to firm brown silty sandy very gravelly CLAY (Hackney Gravel)	3.40 to 4.60	+17.04 to +15.84	1.20
Very dense pale brown very sandy silty Gravel (Hackney Gravel)	4.60 to depth	+15.84 to +15.44	>0.40

Due to the depth of all the trial pits, only made ground was encountered.

Comparison of the GEA boreholes against the BGS Geological Data shows strong correlation between the two (summarised as follows).

Summary of Geological Section	Depth to U/S of Stratum [mbgl]	Thickness (m)
Made Ground	0.60 to 3.20	0.60 to 3.20
Clay	1.40 to 4.70	0.80 to 1.50
Gravel	4.90 to 9.20	0.20 to 6.20
London Clay	34.10	25.90
Reading Beds	47.40	13.30
Thanet Sand	>54.30	>6.90

2.3.3 Soils

In summary the Ground Strata (idealised) as derived from the raw borehole data and other exploratory site works, is as follows:

Summary of Geological Section	Exploratory Holes Encountered	Depth to Top of Stratum (mbgl)	Thickness [m]
Made Ground	All	GL	3.40 to 4.00
Clay (Hackney Gravel)	BH2	3.40	1.20
Hackney Gravel	BH1 & BH2	4.00 to 4.60	>0.40 to 2.60
London Clay Formation	BH1	6.80	Proven to 20mbgl

Descriptions of the Strata are summarised as follows – taken from the GEA Site Investigation Report Ref. J15193, 2015.

Made Ground

Made ground was encountered at all exploratory holes and to a maximum of 4.0m depth in BH1. Beneath the surface covering of cobbles and concrete it comprised brown gravelly sand and very sandy clayey silt with pockets of yellow-brown and pale grey clay, coal, concrete and crushed brick to a depth of 2.0m, below which, the made ground comprised dark brown silty sandy gravelly clay with frequent crushed brick, concrete, ash, tile, shell fragments and coal.

Hackney Gravel

Along the western elevation the Hackney Gravel initially comprised soft to firm brown silty sandy very gravelly clay with pockets of dark greyish brown clay, fine to coarse subangular gravel and occasional roots which extended to a depth of 4.60m. Below this layer (and directly below the made ground in BH1), the Hackney Gravel comprised medium dense to dense brown and pale brown slightly silty sand and gravel, gravel is fine to coarse subangular to rounded and was encountered to a depth of 6.60m.

No visual or olfactory evidence of contamination was observed within these soils.

London Clay

The London Clay initially comprised an upper weathered horizon of firm brown clay to a depth of 6.80m. Below this, high strength stiff fissured dark brownish grey silty clay with occasional pockets of sand extended to a depth of 15.50m. The London Clay then comprised fissured dark brown very silty clay with occasional fine shell fragments, medium selenite crystals and black carbonaceous material and was encountered to the full depth investigated (20.0m).

Claystones were encountered within this stratum at depths of 14.30m, 15.50m and 18.20m. The results of laboratory testing indicate the clay to be of high volume change potential.

These soils were observed to be free of any evidence of soil contamination.

2.3.4 Deep Foundation Recommendations

Bored piles are preferred to driven piles, based on the ground conditions at the site – See GEA's Geotechnical Report (Ref. J15193) for further recommendations.

Taken from the GEA Geotechnical Report – Design parameters for bored piles (Shaft friction and End bearing capacity respectively)

Stratum	Depth, m	Ultimate Unit Shaft Friction
Basement Excavation	GL to 4.5	Ignore
Hackney Gravel	4.5 to 5.0	34
Hackney Gravel (Saturated)	5.0 to 7.0	38
London Clay	7.0 to 18.0	Increases linearly from 37 to 75 kPa
Ultimate End Bearing		
London Clay	15.0 to 18.0	Increases linearly from 1170 to 1350 kPa

From the data present in the above tables, GEA believe the below table of pile diameters, lengths and capacities are achievable based on an overall factor of safety of 2.5.

		Pile Length (m)			
		10	15	20	25
Pile Diameter (mm)	300	100	210	355	530
	450	170	345	565	830
	600	250	490	790	1160

2.3.5 Contamination

Contaminant testing was undertaken on six samples of made ground. The contamination analyses were carried out at a MCERTS accredited laboratory. The analytical suite for the soil included a range of metals, specification of total petroleum hydrocarbons (TPH), polycyclic aromatic hydrocarbons (PAH), total cyanide and monohydric phenols.

The results of the contamination testing indicated elevated concentrations of lead only.

The pH was only found to be elevated within a sample of made ground from trial pit No 17.

2.3.6 Groundwater

Ground water was encountered as strikes in Borehole 1 at depths of 5.50m and 14.30m below ground. No ground water was encountered in Borehole 2. Standpipes were installed in both borehole locations and were monitored over the following weeks. No water has ever been encountered in Borehole 2, while the water level in Borehole 1 rose to 5.00m below ground on 25/07/15.

The proposed development contains an extension to the existing basement, however based on the recorded ground water levels to date; water is unlikely to be encountered during the excavation or during the permanent state. However it would be prudent to construct the basement slab and retaining walls with a waterproof concrete.

GEA advise using a head of water up to ¾ of the retained height when designing the basement retaining walls.

2.3.7 Shallow Foundation Appraisal

Spread footings have been noted as a viable alternative to bored piles, and provided they bear on the medium dense sands and gravels may be designed to apply a net allowable bearing pressure of 200kN/m^2. New piled foundations are currently proposed for the development, as to reduce the risk of differential settlement between proposed and existing structures.

GEA state that an increase in loading on the existing spread foundations of 10% will not cause any significant increase in settlement. However, it is a LUL requirement that the load on any existing foundation located above their assets must not increase by more than 5%.

2.4 Underground Structures and Obstructions

Due to the history of the site and the proposal of a new basement to a depth of around 5.0m (bgl), the made ground and any obstructions located within this material will be removed during the bulk excavation, so reducing the risk of encountering any obstructions other than the existing spread foundations, which are known and are incorporated or altered in the proposed scheme.

2.4.1 Unexploded Ordinances

1st Line Defence Limited conducted a Detailed Unexploded Ordnance (UXO) Threat Assessment (Report Ref. 2542JF00, July 2015). The report considers the level of risk from unexploded ordnance on the site to be **low**. The site was occupied by undamaged structures throughout WWII, with no obvious signs of ground disturbance.

London bomb census mapping does however show a bomb strike on/close to the site. This is believed to be mis-plotted based on all other evidence available. Refer to the 1st Line Defence Assessment, Ref. 2541JF00, for more detailed information.

2.4.2 Tunnels

The site is located approximately 75m to the West of Chancery Lane Underground Station, with the Circle Line running parallel to High Holborn road. With the close proximity of London Underground's assets it has been important to inform LUL of the development, and maintain their involvement throughout.

LUL provided a number of archive drawings of Chancery Lane station, which can be found in Appendix E. The approximate locations of London Underground's assets were plotted on to the existing basement structural survey plan, through use of the archive drawings.

21 High Holborn sits partially over the half landing of Chancery Lane's escalator tunnel. The tunnel is approximately 12.0m below the existing basement level, with proposed piles positioned 4.0m north of the shaft.

In order to obtain a letter of "No Objection in Principle" from LUL there is a list of criteria which must be adhered to, stated below:

- Restricting differential deflections across the escalator shaft to 2.0mm to ensure escalator mechanics are not affected,
- Increased net loading on existing building's foundations above LUL assets is no greater than 5%, and
- A statement of Risk Management for installation of piled foundations in the vicinity of LUL assets prior to commencement of works on site.

To meet the above criteria AECOM have provided LUL with a Ground Movement Assessment (including subsequent statement to justify the reduction in foundation loading), produced by GEA (Report Ref. J15193A, January 2016), a basement plan with the percentage change in loading on existing columns in the proposed state (Appendix E), and an Escalator Movement Report (including subsequent statement to justify the reduction in foundation loading). The statement of Risk Management will be provided at a later date once a contractor has been appointed.

While investigating the position of London Underground's assets it was discovered that a deep-level air-raid shelter, in the form of two tunnels running parallel to Chancery Lane's platforms (Appendix E), are located below the station. After WWII these tunnels were turned into the Kingsway telephone exchange. The telephone exchange is located further from the development, and is therefore less of a concern than the station itself.

2.4.3 Underground Services

An existing underground drainage and services survey produced by Subsight Surveys Limited can be found in Appendix F. The proposed development requires the existing Mercury telephone line to be repositioned to the north, out of the proposed basement footprint, while UKPN's shallow LV cable which currently runs down the private road under number 19 and heads east to the rear of the structure will need to be diverted around the perimeter of the proposed basement.

2.5 Ground Movement Assessment

GEA were instructed by THSGI to carry out a ground movement assessment for the proposed development at 19/21 High Holborn. Report Ref. J15193A includes:

- Ground Movements
  - Surrounding the basement, and
  - Movement within the basement (heave).
- Damage Assessment
  - Damage to neighbouring structures, and
  - Monitoring of ground movements.
- Tunnel Movements.

2.5.1 Ground Movements

The predicted movements within the report are based on the worst case of individually analysed segments of “hogging” and “sagging”, in reality these movements will work against one another to reduce the actual levels of movement. The movements surrounding the basement are summarised below:

Surrounding Structure	Max. Vertical Movement (mm)	Max. Horizontal Movement (mm)
Nos 14 to 18 High Holborn	7	<1
Nos 4 to 13 High Holborn	<1	<1
Nos 2 to 4 South Square	4	2
No 1 South Square	11	5
No 14 South Square	4	2
Cittie of Yorke Public House	10	5
No 24 High Holborn	4	2

Maximum surrounding movements are likely to occur once the piled wall has been installed and the proposed basement is excavated.

It is expected that the proposed excavation will result in a net unloading of 90kN/m^2. The analysis predicts that by the time the basement construction is complete and the pile group loading has occurred, around 10mm to 15mm of heave is likely to have occurred in the centre of the proposed basement. This will reduce to 5mm to 10mm at the perimeter of the new basement.

There is likely to be an additional 15mm to 20mm of long term heave in the centre of the proposed basement. Therefore it is recommended that either a void is left below the basement slab or a compressible material is introduced. The compressible material will need to resist the potential uplift forces of 30kN/m^2.

The effect of heave on LUL’s assets is covered in section 2.5.3.

2.5.2 Damage Assessment

The neighbouring buildings are considered to be sensitive structures, requiring Building Damage Assessments, on the basis of the classification given in Table 2.5 of CIRIA Report C580.

The likely damages, summarised in the table below, are based on the combined retaining wall installation and basement excavation phases.

Surrounding Structure	Worst Case Category of Damage
Nos 19/21 High Holborn	Category 2 -Slight
Nos 14 to 18 High Holborn	Category 0 – Negligible
Nos 4 to 13 High Holborn	Category 0 – Negligible
Nos 2 to 4 South Square	Category 0 – Negligible
No 1 South Square	Category 0 – Negligible
No 14 South Square	Category 0 – Negligible
Cittie of Yorke Public House	Category 0 – Negligible
No 24 High Holborn	Category 0 – Negligible

All structures which fall into Category 0 are deemed to be within acceptable limits according to the Camden Planning Guidance. The two existing retaining walls which abut the proposed new basement were the only areas of structure which fall into Category 2. The existing wall to the east of the proposed basement is to be demolished, while the wall to the south is to be supported off of new structure and largely reconstructed, minimising the risk associated with damage.

Prior to construction, it is recommended that condition surveys are carried out on the structures listed above, along with the monitoring of any movements throughout all phases of construction. Contingency measures and trigger levels will need to be developed as the design develops.

2.5.3 Tunnel Movements

To assess tunnel movements a separate report has been produced by AECOM (“Escalator Movement Report”). The Ground Movement Assessment carried out and explained within the report has considered all stages of the construction period. The effect of the unloading of the ground to the rear to form the basement, the load transferred through the new pile group below the new stability core and the change in pressure below the existing shallow foundations have all been assessed.

Sleeved CFA piles have been used close to the tunnel so that no load is transferred via shaft friction to the sensitive structure.

The movement across the tunnel has been assessed at eight reference points, the crown, invert, north wall, south wall and the four quadrant positions between these. These points are modelled as straight lines at 1.0m intervals along the length of the tunnel, following the slope of the lower section of the escalator barrel. Please see the table below for maximum movements and stresses at the four reference points.

The worst case movements are present following the conclusion of the basement extension, with a maximum differential movement across the tunnel of less than **1mm**. The maximum overall movement of the tunnel is expected to be **1.3mm** and this will at the base of the escalator shaft.

The GMA and Escalator Movement Report should be repeated once the design has been developed further and foundation sizes and loads are finalised.

(Note: Since the production of the two movement assessment reports the decision has been made to omit the additional seventh floor, therefore two statements have been produced to accompany the two reports detailing how the reduction in load will not have an adverse effect of the tunnel movements.)

3. GENERAL ENGINEERING REQUIREMENTS

The design has been approached in a manner so as to meet all relevant standards for safety, durability, fire resistance and serviceability.

3.1 Design Life

The structure has been designed and specified to meet a minimum 50 year design life.

3.2 Lateral Movement

The lateral movement of the structure is to be controlled in order to:

- Maintain the strength and stability requirements of the structure,
- Avoid fatigue in structural members and connections caused by fluctuations in lateral loads,
- Avoid degrees of lateral deflection that may cause cracking of internal partitions, finishes and external cladding in serviceability conditions,
- Avoid sway that would otherwise cause discomfort to occupants.
- Avoid differential movement between the new and existing elements.

The lateral movement requirements apply for both Wind and Equivalent Horizontal Load effects.

3.3 Differential Movement

The effect of differential movement between the existing structure and proposed structure must be controlled through the careful selection of foundation system, and the connection between the existing and proposed structures.

The new and existing structures must be tied laterally in a temporary state to allow the new stability core to resist the lateral forces applied to the new steel frame. Once the permanent loads are realised, prior to any quasi-permanent loads being applied, the two structures can be tied vertically as well.

3.4 Thermal Effects

The seasonal temperature change that will be used in the detailed calculation of stresses and strains acting upon the structure will be taken as no less than 35°C. A significant change in the ambient temperature of materials elements to expand and contract.

3.5 Tolerances and Buildability

The use of either a mobile or tower crane will be required, the decision as to which will be based upon the contractor's preference. A tower crane can be positioned within the new basement and steel frame to the rear, whereas a mobile crane would be stationed on the private road to the rear of the proposed basement.

Deliveries and access to the site will come off of A5200 (Gray's Inn Road), and West along the Private road to the rear of 19/21 High Holborn. Smaller vehicles will then be able to leave via Gray's Inn Square, however larger vehicles will be required to exit via the private road along which they arrived due to the restricted height access to Gray's Inn Square. Deliveries will therefore require a well thought out delivery and access plan as not to obstruct the entrance and exit to site.

3.6 Fire Requirements and Durability

The structural form and the materials specified must afford sufficient protection against corrosion and resistance to fire.

Watermans have advised the fire protection ratings that will be required. The structural elements (slabs, beams, columns and walls) have been designed to satisfy the following requirements:

Structural Element Location	Fire Resistance [Minutes]
Basement Plant/ Retail Unit	90
Ground Floor Retail Unit	90
Office Space	90

The measures taken will depend upon the specified structural material. Concrete will be designed and specified with suitable cover to the reinforcement and steelwork will be specified with the appropriate protective coating of intumescent paint.

3.3 Future Flexibility

As each floor plate is to be leased to one tenant, the design must allow for flexibility and rearrangement. This has been achieved by limiting the number of internal columns to a minimum, and therefore allow for greater flexibility and future change across the floor plate.

3.8 Project Delivery

3.8.1 Analysis and Design Packages

- Autodesk ROBOT Structural Analysis Professional 2014 - Version 27.0.5.4679
- TEDDS
- Approved Concrete Centre Spreadsheets

3.8.2 CAD Packages

- Autodesk REVIT 2015 – Structures Suite

3.8.3 Document Management Systems and Quality Assurance

AECOM maintains a quality assurance system which has been assessed and approved by Lloyds Register Quality Assurance to BS EN 1509001:2000.

The approved quality management systems apply to works undertaken in all our divisions. Our quality assurance manuals are available for inspection, together with our relevant management procedures.

4. DESIGN CRITERIA AND STANDARDS

4.1 General

The design has been approached in a manner so as to meet all relevant standards for safety, durability, fire resistance and serviceability.

All designs shall comply with British Standard and Eurocode regulations and requirements.

4.2 Design Codes and Guides

The following are the principal 'Design Codes of Practice' which are expected to be used in the design of the structure:-

4.2.1 Loadings

BS EN 1991-1-1:2005 – Eurocode 1: Densities, Self-weight and Imposed Loads

BS EN 1991-1-2:2005 – Eurocode 1: Actions on Structures Exposed to Fire

BS EN 1991-1-3:2005 – Eurocode 1: Actions on Structures – Snow Loads

BS EN 1991-1-4:2005 – Eurocode 1: Actions on Structures – Wind Actions

BS EN 1991-1-5:2005 – Eurocode 1: Actions on Structures – Thermal Actions

BS EN 1991-1-6:2005 – Eurocode 1: Actions on Structures – Actions During Execution

BS EN 1991-1-7:2005 – Eurocode 1: Actions on Structures – Accidental Actions

4.2.2 Concrete

BS EN 1992-1-1:2004 – Eurocode 2: Design of Concrete Structures: Common rules for building and civil engineering structures

BS EN 1992-1-2:2004 – Eurocode 2: Design of Concrete Structures: General Structural Fire Design

4.2.3 Steel

BS EN 1993-1-1:2005 – Eurocode 3: Design of Steel Structures: Design of steel building and civil engineering structures

4.2.4 Composite

BS EN 1994-1-1:2004 – Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings

4.2.5 Substructure

BS EN-1992 3 – Eurocode 2: Liquid Retaining and Containment Structures

BS EN 1997-1 – Eurocode 7: Geotechnical: General Rules

CIRIA Report C580- Embedded Retaining Walls – Guidance for Economic Design

4.3 Serviceability Limits

Serviceability limits will be met with respect to the design codes of practice applicable for the construction material(s) employed.

Prior to tender, AECOM will prepare a Movement and Tolerances Specification in order to consolidate the serviceability and design tolerance demands of the building as a whole (from a Structural perspective).

In summary, no horizontal elements will deflect greater than Span /360 under live load conditions, or Span/250 under combined dead and live load conditions. No vertical components, be them individual or the building elevation as a whole, will deflect laterally greater than height/300.

In instances these limitations may be significantly bettered.

4.4 Wind Effects Criteria

Basic wind speed (V_b): 22m/s.

4.5 Earth and Hydrostatic Pressure Effects

The proposed earth retaining structures will be designed to resist the earth pressure. Also, as the water table varies across the site, they will be designed to resist the horizontal water pressure resulting from the design water table for ¾of the retained height.

The basement floor slab and any necessary piled foundations will be designed to resist heave and the vertical water pressure arising from the design water table at 1.0m below existing ground level.

5. MATERIALS

Materials have been selected and specified with a view to suitability and provision of an economic design. Sourcing of these specified materials will be dependent upon the Main Contractor and therefore early input should be sought to ensure adequate, timely and economic availability and supply.

Typically the Structural Specifications that will be prepared will include:

- Demolition Specification
- Groundwork's Specification (excavation and filling)
- Piling Performance Specification
- Concrete Specification
- Steelwork Specification
- Building Movement and Tolerance Specification
- Design Philosophy Document
- Movement Monitoring Specification.

5.1 Strength and Specification of Concrete

The design of all in-situ concrete elements has been based on the following concrete grades and reinforcement specifications:

Location	Grade	Special Requirements
Foundations *)	C35/45	Sulphate Class DS-2
Slabs in contact with the ground *)	C35/45	Sulphate Class DS-2
Slabs generally	C35/45	None
Concrete stairs (where applicable)	C35/45	None
Concrete walls	C35/45	None
Concrete retaining walls	C35/45	Sulphate Class DS-2

**) – Concrete grade (and cover) for these elements may require upgrading dependent on exposure condition (element location within building)*

Where conventional reinforcement used in the concrete it must have a yield strength500N/mm² for high yield tensile reinforcement.

Additives may be specified in certain instances to assist with the placement process and assist with the performance. Concrete shall need to be tested in accordance with requirements of the codes listed in section 4.2. All testing will need to be carried out by an approved independent testing laboratory.

5.1.1 Concrete Cover to Reinforcement

Cover to reinforcement will be shown on the reinforcement drawings as required to achieve the appropriate fire rating listed in section 3.5. The cover listed below is the minimum required to satisfy durability and fire requirements, this may increase for bond conditions.

Element	Concrete Cover
Piles	50mm
Ground Floor Slab (External Face)	50mm
Ground Floor Slab (Internal Face)	25mm
Retaining Walls (External Face)	50mm
Retaining Walls (Internal Face)	25mm
Shear Walls	25mm
Slabs/beams	25mm
Upstands	25mm
Internal Exposed Structure	30mm
External Exposed Structure	50mm

5.1.2 Properties of Concrete (to BS EN 1992-1-1:2004)

Normal weight:	25kN/m3
Poisson's ratio:	0.2 – for uncracked concrete
	0 – for cracked concrete
Young's Modulus:	(short term) 28kN/mm²
	(long term) 14kN/mm²
Co-efficient of linear expansion:	$12x10^{-6}$ per ^{o}C

5.2 Strength and Specification of Steelwork

The grade of steel used is to meet the requirements of BS-EN-10025. Strength classes S275 and S355 for hot rolled sections, hollow sections, bars and plates will be specified.

5.3 Durability and Fire

In order to ensure protection of structural elements against corrosion and fire, cover over the reinforcement of concrete elements will be specified to ensure an adequate fire rating (see section 3.5). Structural Steelwork will require an appropriate protection system; this will partly depend on architectural requirements, exposure classification and codes of practice. Suitable methods that may be used are:

- Painting the steel with Intumescent Paint [default standard protection method to be specified]
- Boxing in with fire resistant boarding [to be detailed by, and at the direction of the architect]

5.4 Piled Foundations

5.4.1 General

All piling shall be in accordance with the Institution of Civil Engineer Specification for Piling and Embedded Retaining Walls.

5.4.2 Factor of Safety

The following minimum factors for safety will be used by the contractor when designing the piles, subject to the approval of the local Building Control Department.

FOS = 3.5 Limited site investigation carried out

FOS = 3.0 Detail site investigation carried out

FOS = 2.5 Detail site investigation carried out and one working load test carried out per 100 piles installed.

5.4.3 Settlements

The following settlement limits shall be used by the contractor when designing the piles:-

- Maximum pile settlement: 6mm
- Differential settlement between two adjacent piles: 1 in 500 (vertical and horizontal)
- The effects of group action of piles should also be taken into account so that the whole group has a settlement of: <6mm
- The induced settlement of any adjoining building is:<15mm

5.4.4 Concrete for In Situ Piles

It is envisaged that this will be a minimum Class DS2 – AC2 (Refer to table in Section 5.1). Further details will be given at the time of preparing the relevant specifications.

5.4.5 Integrity Testing

All cast in situ load-bearing piles are to be integrity tested by an independent NAMAS testing firm.

5.4.6 Working Load Test for Load Bearing Piles

Working piles should be loaded to 150% of their working loads. The total recorded settlement of a pile shall not exceed 15mm at 1.5 x working load. In addition the settlement at 1.25 x working load shall not exceed the maximum allowed settlement at working load by no more than 50%.

5.4.7 Tolerances

The following construction tolerances have been used when designing the pile.

On plan tolerances: +/-25mm

Vertical tolerances: 1 in 75

The induced movement on any adjoining building should not exceed a classification of ‘negligible’ or category ‘0’ on the BRE Category of damage classification.

6. BUILDING DESIGN LOADING AND LOAD COMBINATIONS

All loadings have been calculated in accordance with the Codes of Practice and Criteria listed in Section 4 of this report. Dead loads have been calculated under the guidance of the architect to meet the client's brief. Loadings that act on the building are summarised as follows:

6.1 Vertical Loads

- Permanent Actions (Structural self-weight)
- Quasi-Permanent Actions (Finishes / Ceilings / Services / Non-Structural Blockwork Walls / Building Envelope / Attenuated Water)
- Variable Actions (Occupancy Loads)

6.2 Horizontal Loads

- Wind Loading

6.3 Equivalent Horizontal Load

This will be calculated in accordance with BS EN 1992-1-1:2004 - Eurocode 2 (Clause 5.2). This clause directs that geometric imperfections should be considered. This is determined as a percentage of the characteristic dead load accumulated from above and is applied as a horizontal load on that relevant structural element.

6.4 Loading Combinations

Appropriate Load combinations, as specified in BS EN 1990:2002, will be used in the design of the structure. The most onerous combination is taken as the critical condition.

6.5 Load Schedule

The table adjacent details the estimated loading schedule for all the vertical loading listed in section 6.1.

Floor Loading Allowances in kN/m^2 at SLS (unfactored)			
Location (Area usage)	Permanent & Quasi-Permanent Actions		Variable Action (kN/m^2)
	Structure, Finishes[1] & Services[3]		Use (Ref.)[4] (kN/m^2)
	Description	Area load (kN/m^2)	
Roof (without Plant)	140mm ComFlor 60 concrete ribbed deck	**5.00**	**0.60** (H)
Roof (with Plant)	140mm ComFlor 60 concrete ribbed deck	**5.00**	**5.00**[3]
Office Space	140mm ComFlor 60 concrete ribbed deck	**5.00**	**2.50** (B1)
Retail Unit	140mm ComFlor 60 concrete ribbed deck	**5.00**	**4.00** (D1)
Basement Plant	140mm ComFlor 60 concrete ribbed deck with no services	**4.75**	**5.00**[3]
Basement Storage	140mm ComFlor 60 concrete ribbed deck with no services	**4.75**	**4.00** (E13)

Façade/Partition Loading kN/m^2 at SLS (unfactored)			
Facade	Lightweight modular façade (Front)	**1.00**	N/A
Facade	Traditional construction (Rear)	**4.00**	N/A

(1 – At this stage the build-up of finishes has been assumed. This will be confirmed by the architect during the next stage
(2 – An allowance of 0.25kN/m^2 has been applied for services throughout the structure.
(3 – At this time no information has been received from the MEP Engineer with regards to the weight of plant equipment, so a load of 5.00kN/m has been assumed.

7. STRUCTURAL PROPOSALS

The structural proposals have been developed to suit the primary usage of the development being office space. The proposal consists of the demolition of the rear four storey extension and existing stair core. Based on construction speed, the self-weight of the structure, structural floor plate depth and acoustic properties, the new extension will be constructed from a steel frame supporting a lightweight concrete ribbed deck, with a reinforced concrete basement box to the rear of the development.

The frame will consist of universal column section beams supporting a ribbed deck within the depth of the beams in order to keep the structural slab depth to a minimum, while avoiding the need to plan and coordinate service routes through the steelwork at this early stage.

As the profile of the building steps at both the front and rear of the structure, the inclusion of transfer structure has been unavoidable.

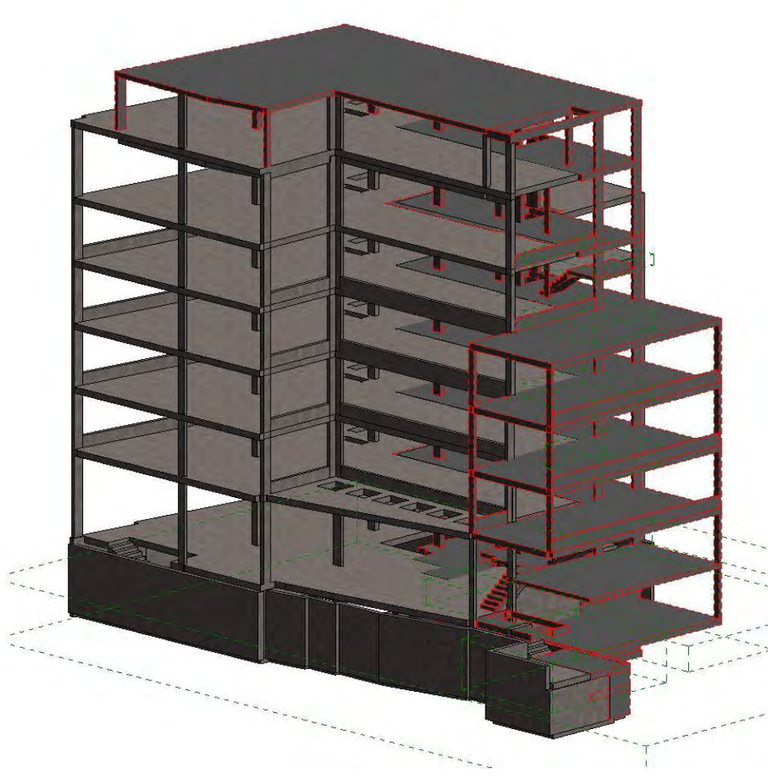


Figure 3.0: As existing structure – elements to be demolished shown with red outline

7.1 Substructure

The walls and basement slab of the proposed basement box to the rear of the development are to be constructed from RC35/45 waterproof concrete. As mentioned in Section 2.3.6 the water table is located at around 5.0m below ground level, although this is below the proposed level of new basement, it is important to protect the new basement from water ingress which may occur during wet seasons and periods of heavy rainfall.

It is proposed that a 450mm dia. contiguous piled wall will be installed around the perimeter of the proposed basement to retain the surrounding earth during the temporary state to allow the proposed basement to be excavated. A contiguous wall was selected over a secant wall based on cost and the low level of the water table not requiring a sealed perimeter to the excavation.

The possibility of providing shallow foundations, in either the form of pad footings below columns and walls or a raft over the footprint of the building was considered. However as the existing structure is founded on shallow pads and strip footings, which will have incurred the majority of their settlement prior to the development, piled foundations have been proposed based on the smaller levels of settlement likely to be realised compared to shallow foundations. This will limit differential settlement between the proposed and existing structures.

The basement box will be hung from a reinforced concrete capping beam spanning across the contiguous piled wall. In the permanent state the concrete basement box will retain the earth laterally, while the piled wall will be required to resist vertical loads.

Piles will also be installed below the new stability core and along the boundary between proposed and existing. As the proposed basement slab level is 1.69m below the existing, the new basement is intended to support the perimeter of the existing slab.

The existing structure is supported on shallow foundations in the form of pads below the internal columns and strip footings below the perimeter retaining walls. The exact size of the existing foundations is currently unknown. However, based on the bearing capacity stated in the Geotechnical report and in Section 2.3.7 of 200kN/m^2 it is assumed that pads have a bearing area of approximately 9.0m^2.

Based on the tabled info in section 2.3.4 and the Ground Movement Assessment (Ref. J15193A), it is currently proposed that approximately 8m long sleeved CFA and cast in-situ concrete piles, of 450mm diameter, are provided and will penetrate the London Clay at close to 7.0m. This will yield an estimated working capacity of 565kN, following guidance form the GEA's Geotechnical Report. This is to be independently verified and design responsibility assumed by the Main Contractor/Subcontractor as part of their Contractor Design Packages.

The close proximity between proposed pile locations and existing structure has dictated the foundation type to be used. A sleeved CFA system is required to limit the level of disturbance to the existing structure and Chancery Lane escalator tunnel.

Piles will need to be designed to resist reverse vertical pressures arising from raised water table and soil heave effects.

Reinforced concrete Pile Caps will be supported onto the installed piles. The caps will be restrained by the new basement slab within the new basement.

7.2 Superstructure

7.2.1 Refurbishment of Existing Superstructure – Ground to Level 6

Within the retained existing building, a new RC stability core is to be constructed in place of the existing stair core. The existing slab surrounding this new core is to be replaced with a new 300mm thick RC slab to allow for the introduction of new service penetrations and to provide a new prepared surface to fix the existing slabs back to, as shown on the structural drawings in Appendix B.

As mentioned in Section 3.3, the vertical connection between new and existing must be made once the majority of the vertical loads have been realised in the core and any initial settlement has already occurred.

Along with demolition of the existing stair core, it is also proposed that the existing roof and plant room is removed in its entirety, and columns broken down to the sixth floor slab level, ready to accommodate the new steel frame proposed in its place. The load of the demolished slab has been offset against the new steel frame in order to restrict the increase in pressure below the existing foundations to within 5%, so as to justify their re-use and to gain acceptance from LUL.

The existing structure consists of concrete hollow pot floor slabs spanning between solid concrete beam strips, which in turn span between concrete columns, as shown on the existing structural survey drawings in Appendix A.

There are a number of upstand beams around the perimeter of the floor plates to accommodate the large spans and support the façade in these locations.

There are currently two transfer beams found at the front of fifth floor level where the profile of the building steps back. These are to be utilised in the new scheme to support the new steel frame above.

The current scheme proposes to house condenser units on the existing roof of number 19. At this time the structural capacity of the existing roof slab is unknown, therefore a grillage of steel beams are currently proposed to sit on this existing slab and spread the additional load from the plant back to the stiffer solid strips of slab and columns. If following intrusive investigation works, the existing slab has sufficient capacity to support the new plant, the proposed steel grillage can be omitted.

7.2.2 New Steel Frame

The ground floor slab will be a typical RC slab spanning between RC walls in the basement. The slab thickness is 300mm throughout, constructed from RC35/45 and has been designed to support HA vehicle loading found in the DMRB where the basement extends under the private road to the rear.

As previously stated, the steel frame contains various levels of transfer structure to suit the profile of the proposed building. The structural slab depth must be kept to a minimum due to the low slab to slab heights in the existing building. To achieve the slimmest structural zone where the building cantilevers out to the rear at first floor, doubled-up UC sections have been proposed.

The ribbed deck system selected is a 140mm thick comflor 60 system, utilising lightweight concrete in order to keep the self-weight of the structure to a minimum. The 140mm thick comflor 60 system accommodates the 90 minute fire rating, the acoustic consultant should confirm that this arrangement is able to provide sufficient separation.

8. STABILITY

8.1 Stability Systems

With no structural record drawings available, all information on the structure of the existing building comes from limited site investigations. During the investigations no concrete shear walls were encountered. Due to the apparent absence of any shear walls or a stability core, it is assumed that the existing frame utilises the columns and beam strips within the slab to form a sway frame.

To eliminate the need to justify the reuse of the sway frame following the removal of a number of columns within the vicinity of the new core, the new RC core is to provide stability to both the new and existing structures.

The new stability core contains 6 shear walls, ranging in thickness from 180mm to 300mm. These are located around the new stair and lifts. These walls have been taken down to new piled foundations where possible, with one wall being required to transfer the lateral loads down through a thickened column at ground and basement level to accommodate a large opening in this wall.

The cores will be designed as vertical cantilevers acting from their foundation at the top of Pile Cap level.

It has been envisaged that the new concrete core, located within the existing structures footprint, will provide stability to the new and existing frames in both the temporary and permanent states. In order to achieve this, the new stability core should be constructed prior to erection of the steel frame. As mentioned in Section 3.3, the proposed frame is to be tied to the existing laterally during construction, transferring no vertical forces. Once the permanent loads have been realised, the two frames can then be tied vertically as well.

If a reduction in programme is required, the introduction of temporary cross bracing may be considered to allow the steel frame to be erected in tandem with the works to the existing RC frame.

8.2 Disproportionate Collapse

In the UK, design against disproportionate collapse is provided by ensuring the load bearing structural elements are tied both vertically and horizontally sufficiently to meet the criteria outlined in Part A of the UK Building Regulations 2014. This ensures that in the event of an accident the building will not suffer damage or collapse disproportionate to the cause.

The proposed building will be defined as a Class 2B building. This requires that the structural frame is effectively tied horizontally with either vertical ties or allowance made for the notional removal of support. These ties will be provided by ensuring there is sufficient continuous reinforcement between slabs and walls to resist loads from the assumed accidental loading or by ensuring connections between steel members are designed to resist this loading. The ties will be designed according to BS EN 1991-1-7 clause A.5.1 and BS EN 1992-1-1 clause 9.10.

The connection between new and existing will be provided in the form of dowelled bars resin fixed to the existing beam strips, and sufficiently anchored into the new concrete.

Where required, ‘Key Elements’, as defined in part A3 of the Building Regulations, will be identified and designed for accidental loading.

9. CONSTRUCTION SEQUENCE

The following section describes our assumed sequence and our structural proposals are subject to this sequence being adhered to. Construction methodology is a matter that is best addressed and formulated at an early stage, whilst it cannot be ignored that the Main Contractor and the chosen Sub-Contractors will offer a great deal of expertise on the most effective and efficient way to execute the Structural Proposals.

It should be noted that the design and specification of temporary works is outside AECOM's scope and will be the responsibility of the main contractor.

- Site is secured by way of erecting an appropriate perimeter hoarding prior to demolition.
- Services are disconnected in the manner as outlined in the M&E Consultants documentation. Underground drainage connections are capped off to preserve the connections to the main off site sewer infrastructure.
- Temporary props are installed to allow for the demolition of the rear four storey block and existing stair core. Props must be founded off of a secure and stable platform in the basement. Temporary footings may be required.
- The rear four storey block and stair core is demolished, and any existing ground/basement level slabs are broken up and significant obstructions in the near surface ground are removed (existing foundations for instance).
- Following removal of all major obstructions, and breaking up of the existing lowest level of slab, the ground level is prepared for trafficking by excavating to a consistent level across the site, and providing a level piling platform to support the plant and equipment.
- The contiguous piled wall is installed.
- A route down to basement level for the piling rig is formed by excavation and sloping of existing material on site.
- Propping to the piled wall is installed if required before the remaining areas of the basement are excavated down to formation level.
- Internal piles are installed from basement formation level.
- Pile heads are broken down to proposed levels and pile caps and basement floor slab cast.
- Tower crane is erected at a defined location by Contractor to achieve the lifting requirements and jib lengths, and avoiding obstructions to the permanent works constructions.
- On conclusion of the Basement floor slab, and following adequate curing time. The new stability core, surrounding new 300mm thick RC slab and concrete basement box are constructed in tandem. It is essential that the stability core is fully constructed and tied to the existing building prior to erection of the steel frame. If it is believed that construction of the stability core can commence at an earlier date, this would be preferable.
- If stair flights have not been constructed in-situ with the cores as they have been raised, these will need to be constructed as the superstructure floor plates follow. It is important that the cores are either constructed hand in hand with the in-situ landings as the core progresses, or an onerous temporary load case is accounted for (possibly in conjunction with some temporary horizontal bracing) to ensure they are stable in the temporary condition. Without internal slabs, the cores are vulnerable as a collection of vertically unrestrained walls, having no cellular inter-relationship. This characteristic must be noted.
- The steel frame can be lifted into place and erected a floor at a time, with the ribbed metal deck being installed and concrete poured as the floor is complete to provide a diaphragm transfer all lateral loads back to the new stability core.
- Finally, and once the concrete slabs have cured, any temporary propping to the underside of the metal deck can be removed. The new steel frame can also be tied to the existing concrete frame following the introduction of the permanent loads (excluding quasi-permanent loads).

10. DRAINAGE PLANNING POLICY

10.1 Existing Drainage

There are Thames Water sewers in the following locations shown in Appendix C;

- 1372 x 914mm combined sewer running west to east in High Holborn, which appears to be around 6m deep (this is based on an invert level of 15.36m and cover level of 21.20m).
- 229mm sewer running west to east within the private road north of the site before outfalling to the sewer within Gray's Inn Road. This sewer is around 3m deep (MH0602)

Within Appendix C, there are the historic records for the drainage at basement level. This drawing shows the following;

- Drainage for both surface water and foul water is collected at basement level – this is shown by stacks penetrating through the basement slab.
- There are a series of internal manholes, which collect these stacks prior to discharging to a final manhole, located along the southern elevation of the basement
- An interceptor is provided at the final manhole prior to connection out to the Thames Water sewer.

The historic drawing does not show any levels for the manholes and this will need to be verified by lifting the covers and ascertaining the depths of the sewers. Further investigation should be carried out to ascertain the condition of the sewers via a CCTV survey.

10.2 Proposed Drainage Strategy

It is expected that the building will drain in the same way that it currently does, especially with regard to surface water. Based on the existing drainage system, there appears to be no attenuation provided on-site and it is expected that the flows are unrestricted.

It is proposed that the surface water will be unrestricted to the combined sewer and both Thames Water and the Local Planning Authority will need to agree with this strategy. Thames water may impose a restricted discharge rate which will require onsite attenuation and will likely be located within the basement. This will need to be discussed with Thames Water.

Currently the building has the following configuration;

- 7 storey building with;
    - Residential on top floor;
    - Ground floor retail and;
    - Rest of the building is office space

It is understood that, as part of the works, the top floor will be turned into office space, with the rest of the floors remaining as per the current use.

Foul water flows will increase slightly due to the increase in additional floor space and the decrease of the residential flows. There will be a requirement to liaise with Thames Water to agree these flows.

There may be a requirement to pick up new stacks in the basement as part of the refurbishment works. Where possible, the intent would be to reuse the existing drainage points. However, there may be the following issues;

- If there are additional appliances being provided, there is a possibility that the existing system may not be able to cope with it.
- There may not be enough fall to connect to the basement system depending where the proposed stacks will be.
- Condition of the existing drainage/connections may be poor or blocked.
- Proposed gullies for the plant rooms may be at a risk or surcharge as there is limited protection. As such, it would be advisable to provide a sump pump to protect these areas by separating it from the gravity system.

At the time of writing this report, we have no knowledge of any issues that occur in the basement with regard to flooding. Should there be an issue, a separate design solution may need to be investigated further.

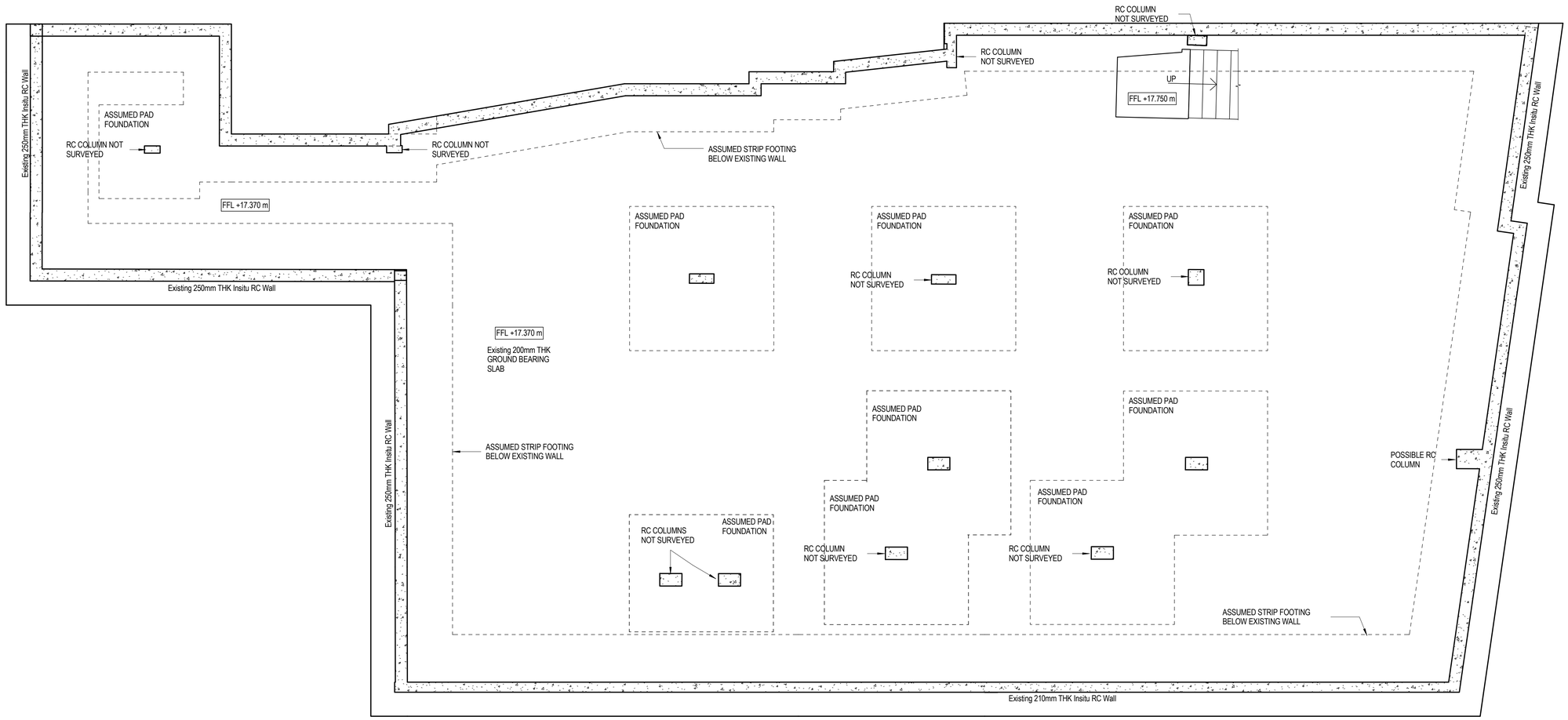
10.3 Key Risks with reusing existing drainage

The main risk that is expected in reusing the existing basement system, should drainage pass through the basement slab, is that potential surcharge of the Thames Water sewer could cause the basement to flood.

This could be solved by separating the basement system from the rest of the building, and providing pumps. However, this may be difficult to implement given the limited space in the basement.

The footprint of the building is reasonably small and it appears that the majority of the below slab drainage is 100mm diameter with only the penultimate connection onwards slightly larger (150mm). Further investigation is required to ascertain whether there is a risk of flooding, given that the modern day design standards are more onerous.

APPENDIX A – EXISTING STRUCTURAL SURVEY DRAWINGS



1 -01 Basement Existing

1 : 50

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19 - 21 HIGH HOLBORN

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A	03.12.15	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

EXISTING BASEMENT PLAN

SHEET NUMBER **REV**

HH-ACM-EX-B1-DR-SE-0001 A

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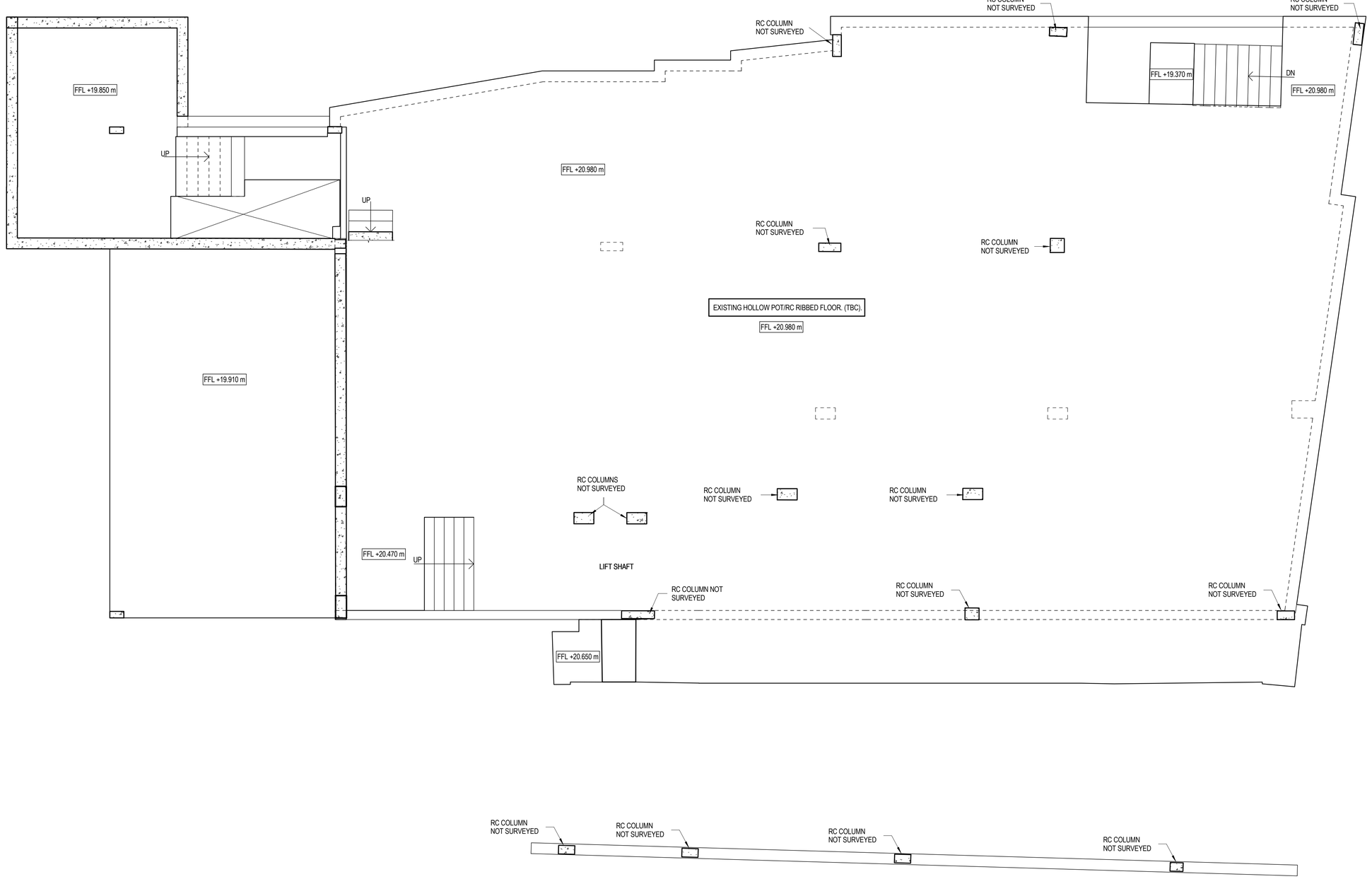

1 00 Ground Floor Existing

1 : 50

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SHEET TITLE

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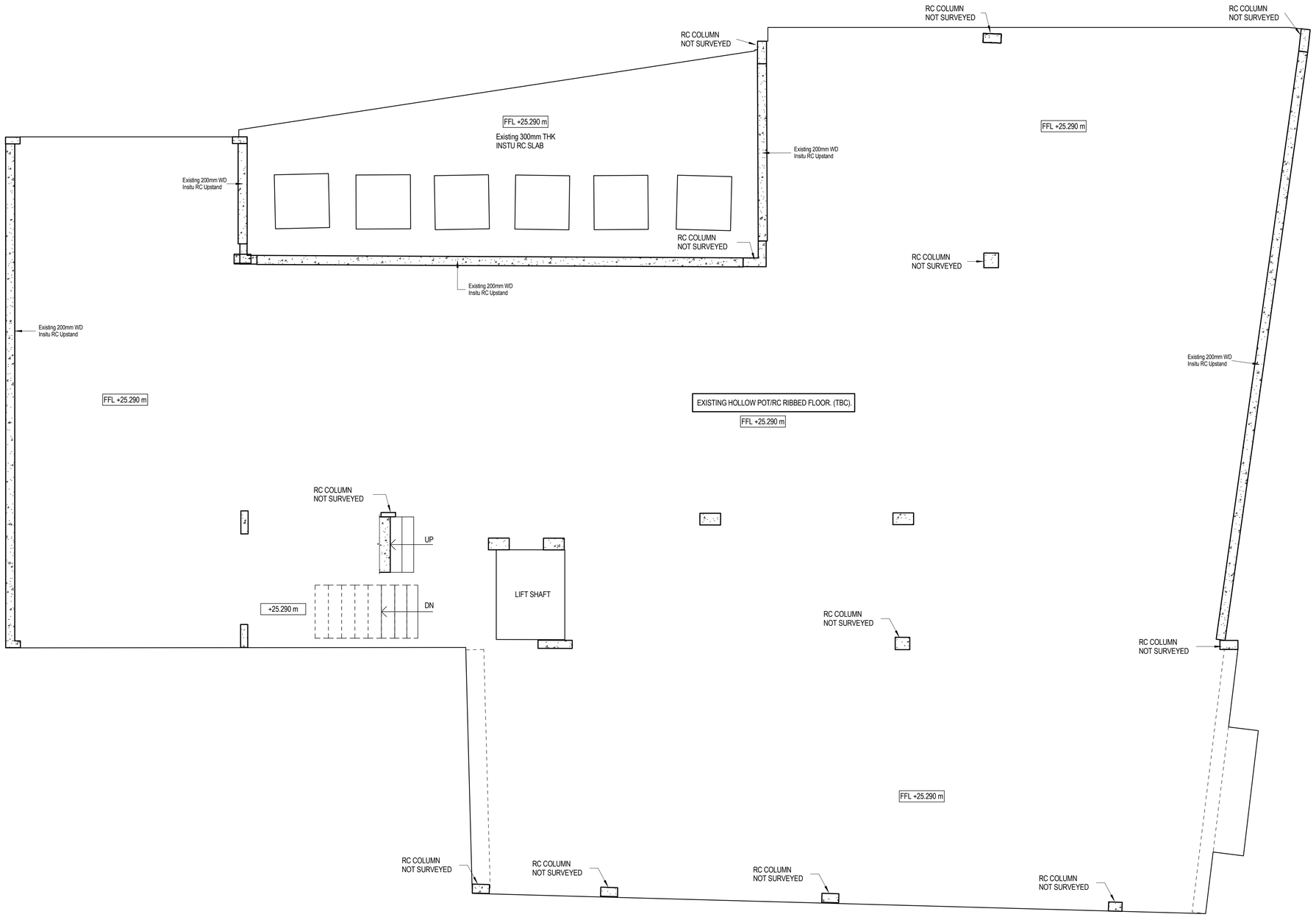

1 01 First Floor Existing

1 : 50

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SHEET TITLE

EXISTING FIRST FLOOR PLAN

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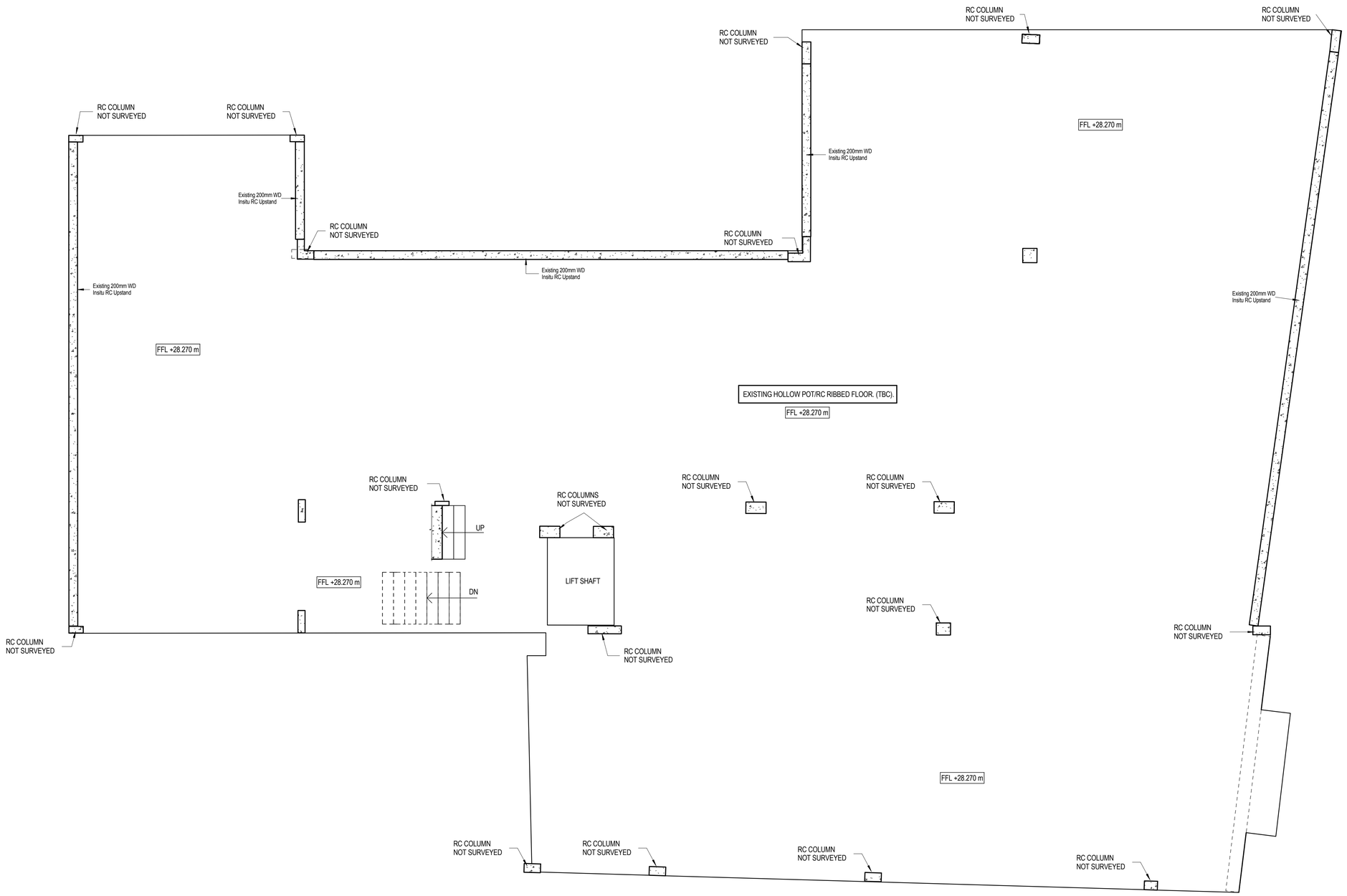

1 02 Second floor Existing

1 : 50

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SHEET TITLE

EXISTING SECOND FLOOR PLAN

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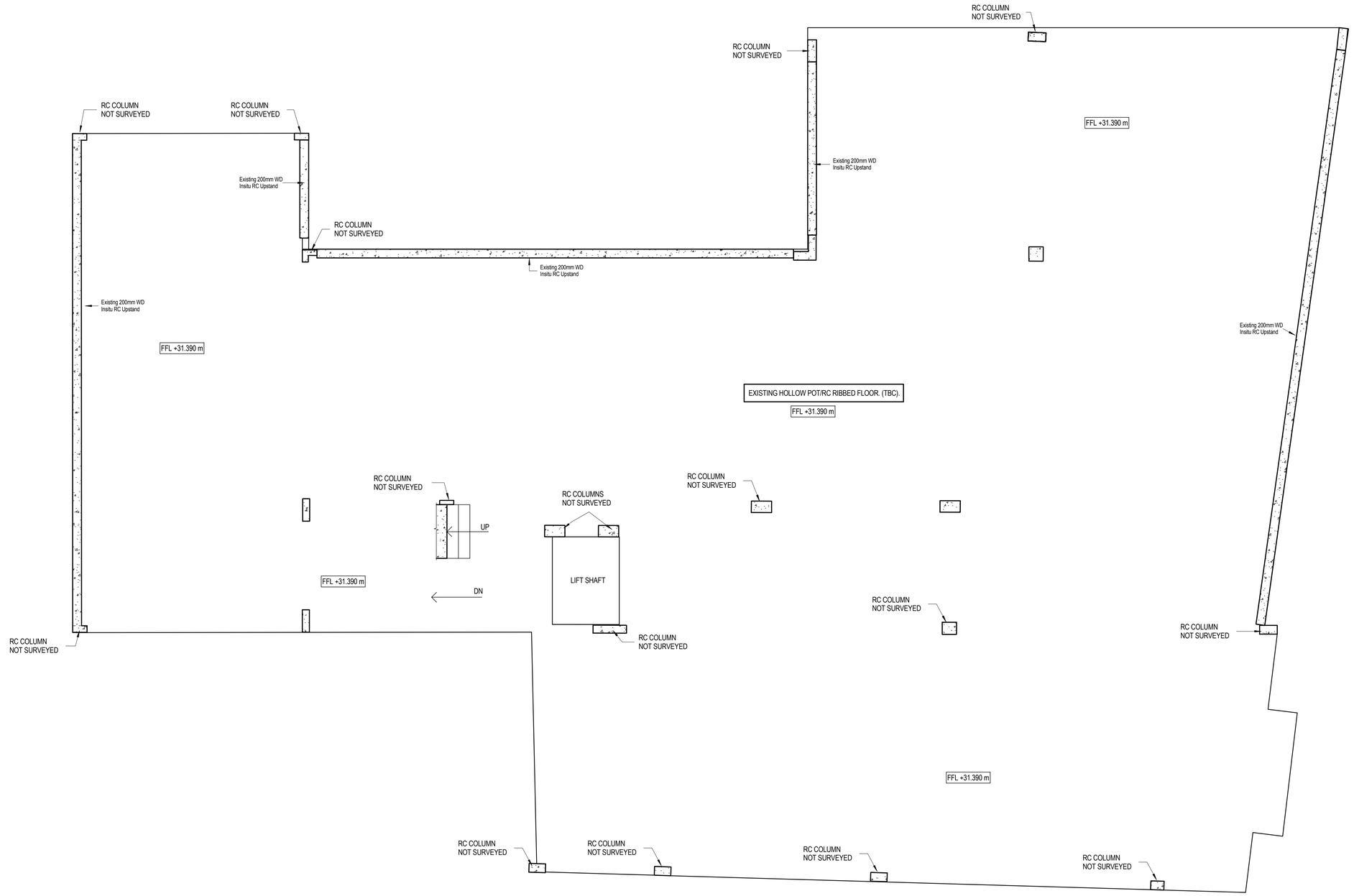

1 03 Third Floor Existing

1 : 50

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SHEET TITLE

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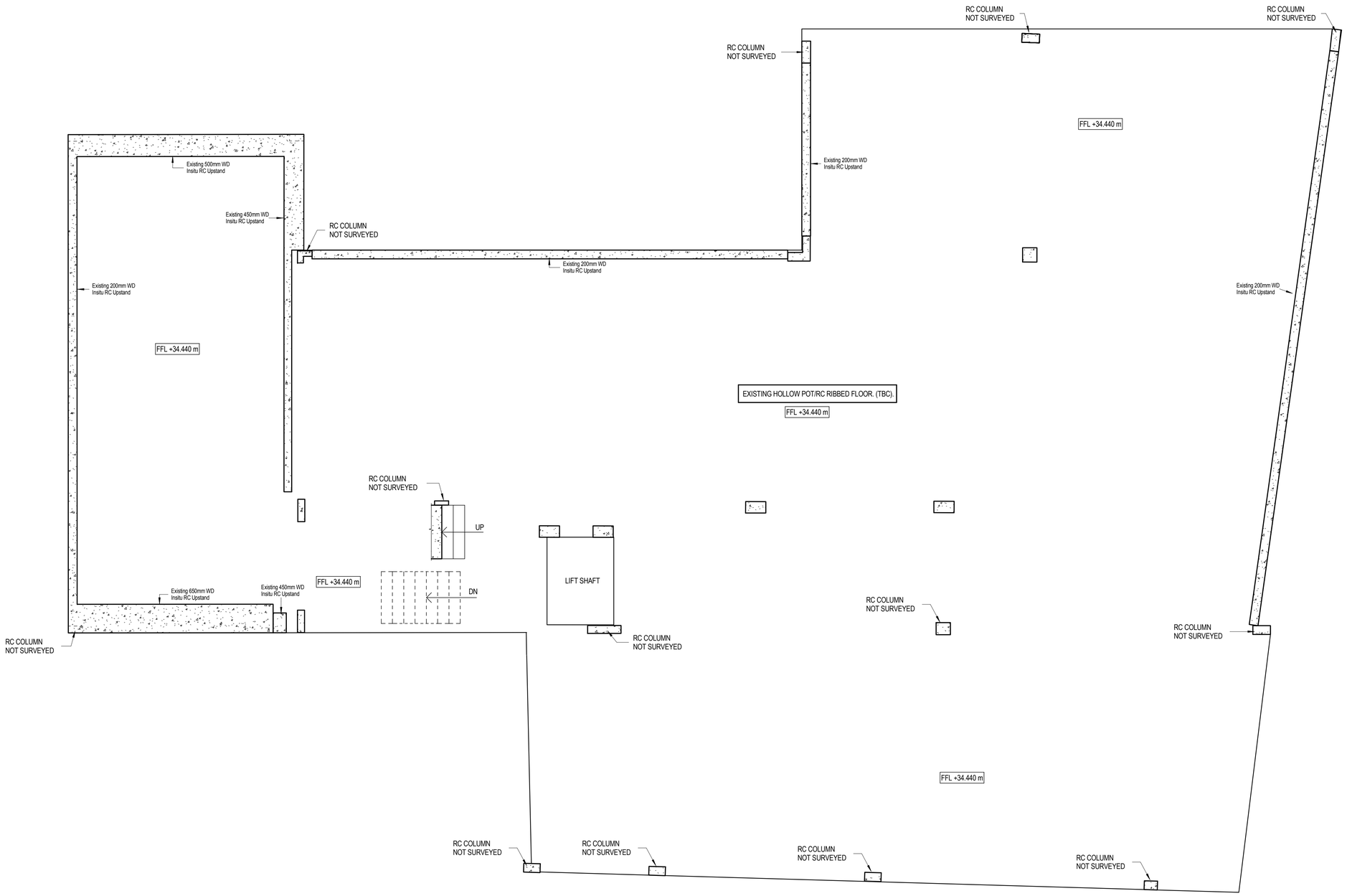

1 04 Fourth Floor Existing

1 : 50

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PROJECT NUMBER

47074716

SHEET TITLE

EXISTING FOURTH FLOOR PLAN

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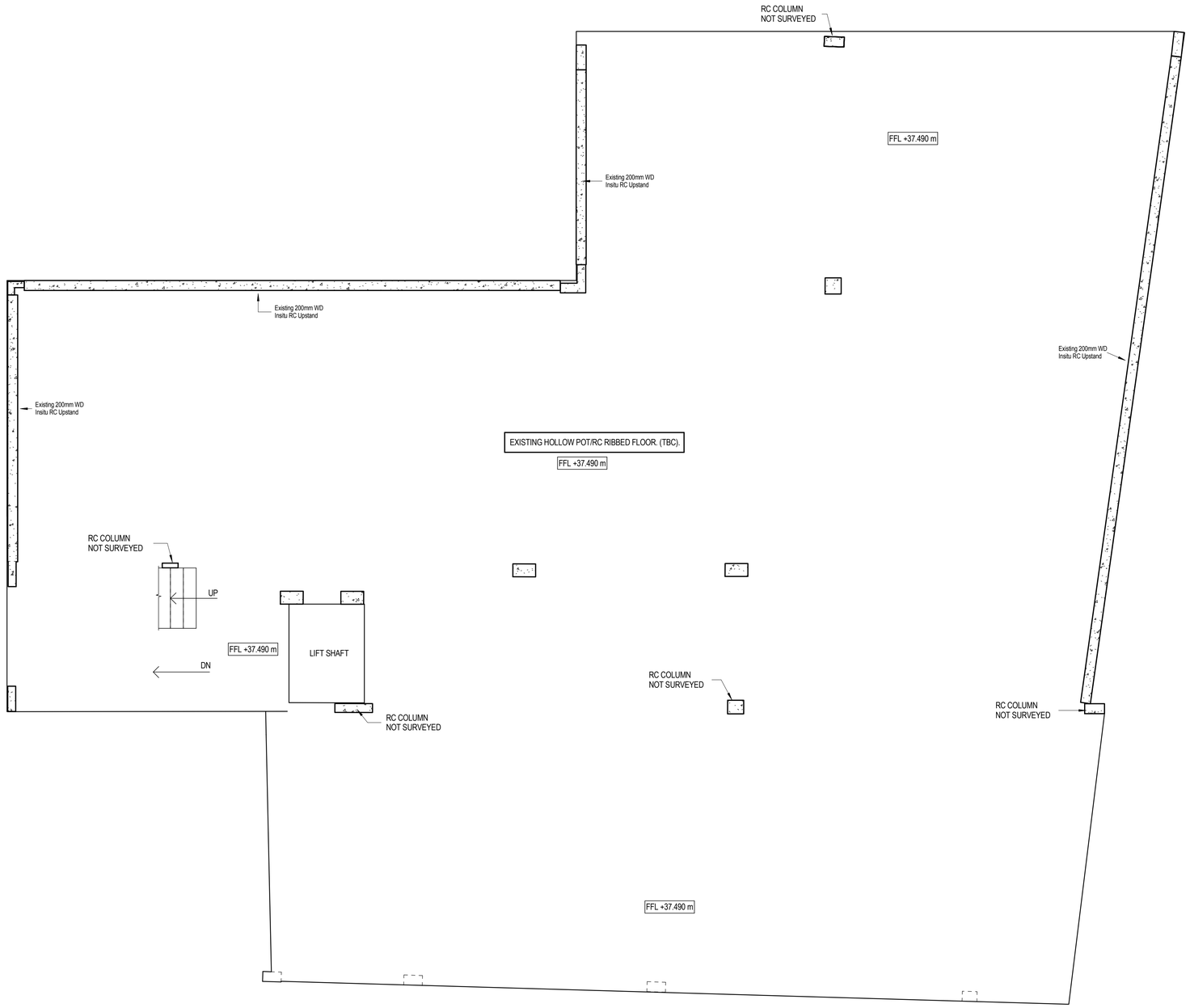

1 05 Fifth Floor Existing

1 : 50

AECOM

PROJECT

19 - 21 HIGH HOLBORN

CLIENT

THE HONOURABLE SOCIETY OF GRAY'S INN

CONSULTANT

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Tel +44 (0)207 798 5000
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NOTES

ISSUE/REVISION

I/R	DATE	DESCRIPTION
A	03.12.15	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

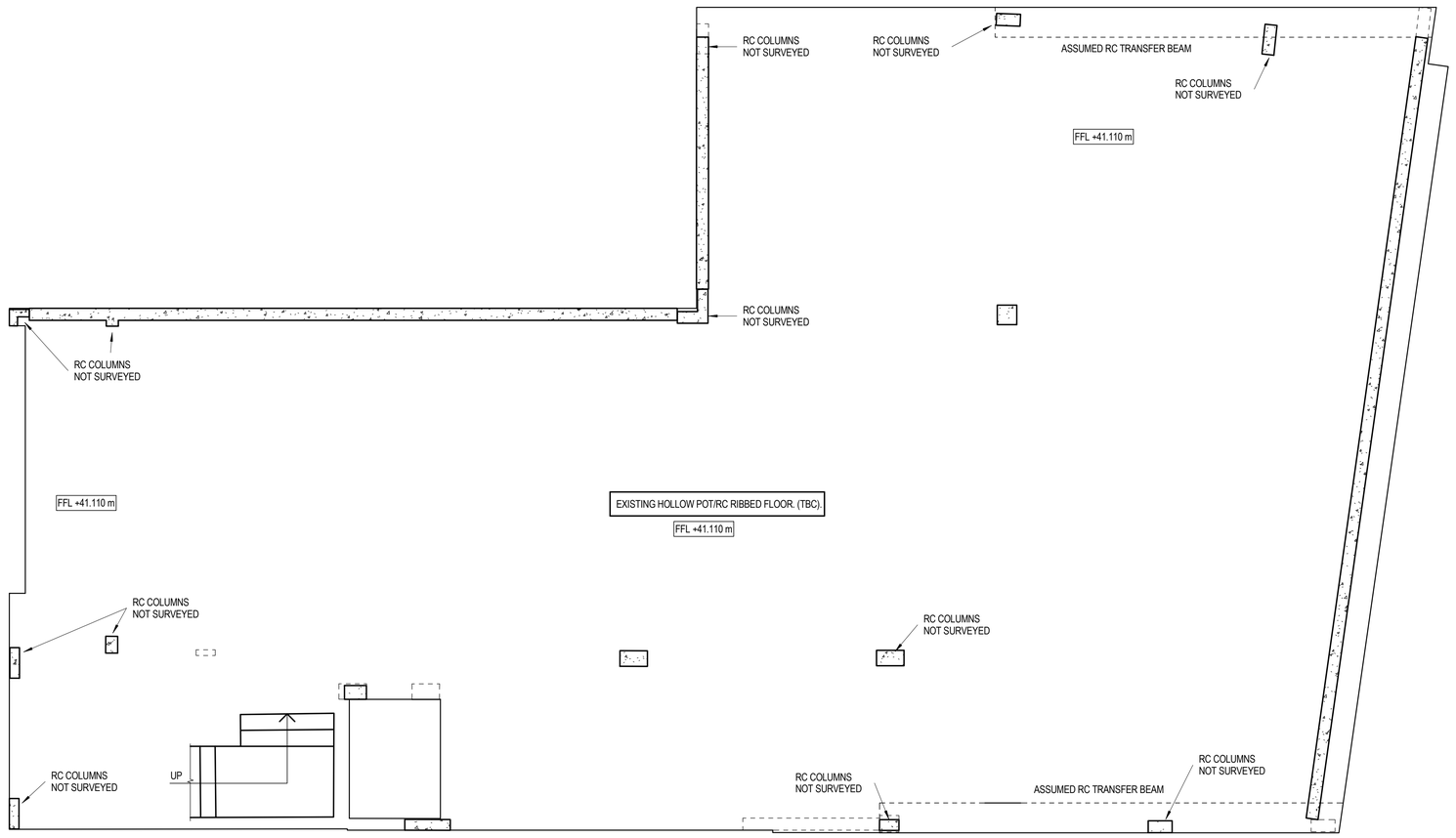
47074716

SHEET TITLE

EXISTING FIFTH FLOOR PLAN

SHEET NUMBER HH-ACM-EX-05-DR-SE-0007 **REV** A

SCALE @A1: 1 : 50



1 06 Sixth Floor Existing

1 : 50

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KEY PLAN

PROJECT NUMBER

47074716

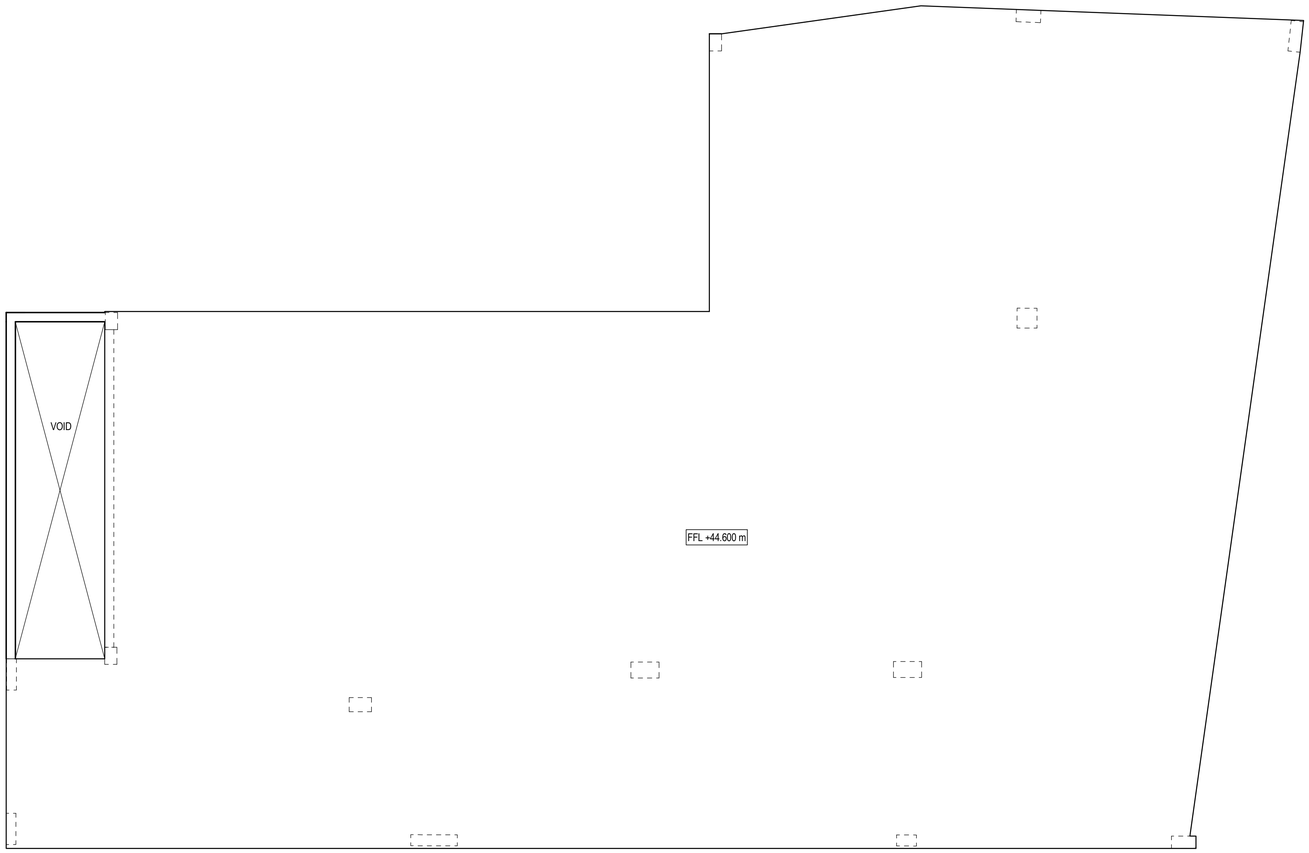
SHEET TITLE

EXISTING SIXTH FLOOR PLAN

SHEET NUMBER HH-ACM-EX-06-DR-SE-0008

REV A

SCALE @A1: 1 : 50



1 07 Seventh Floor Existing
1 : 50

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KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

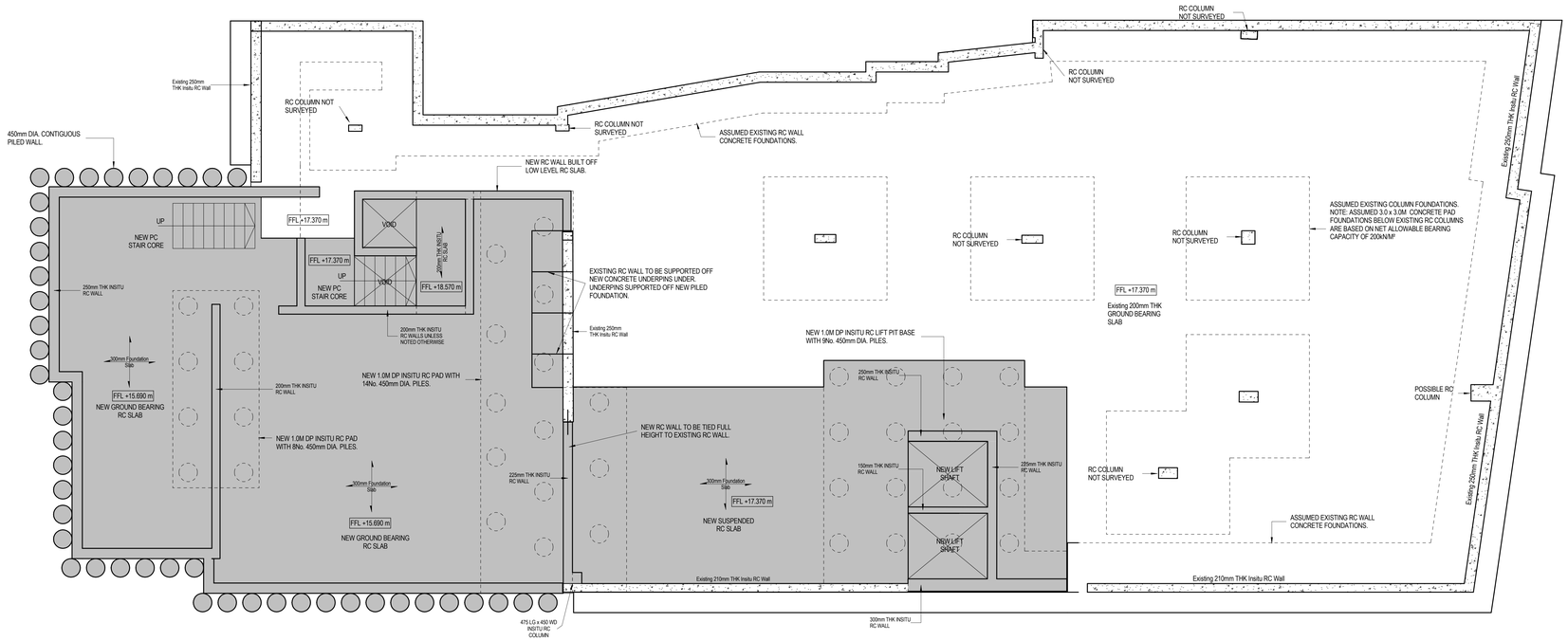
EXISTING ROOF PLAN

SHEET NUMBER HH-ACM-EX-RF-DR-SE-0009 **REV** A

SCALE @A1: 1 : 50

Last Plotted: 03/12/2015 12:41:57
Filename: C:\CHRIS\Revit\19 - 21 High Holburn\47072654-19 - 21 HIGH HOLBURN_chrisp.rvt

APPENDIX B – PROPOSED STRUCTURAL DRAWINGS



1 -01 Basement Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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NOTES

LEGEND

- DENOTES NEW INSITU RC SLAB/WALL. (THICKNESS NOTED).
- DENOTES NEW 140mm THK COMFLOOR 60 METAL DECKING.
- DENOTES EXISTING STUCTURE.

ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

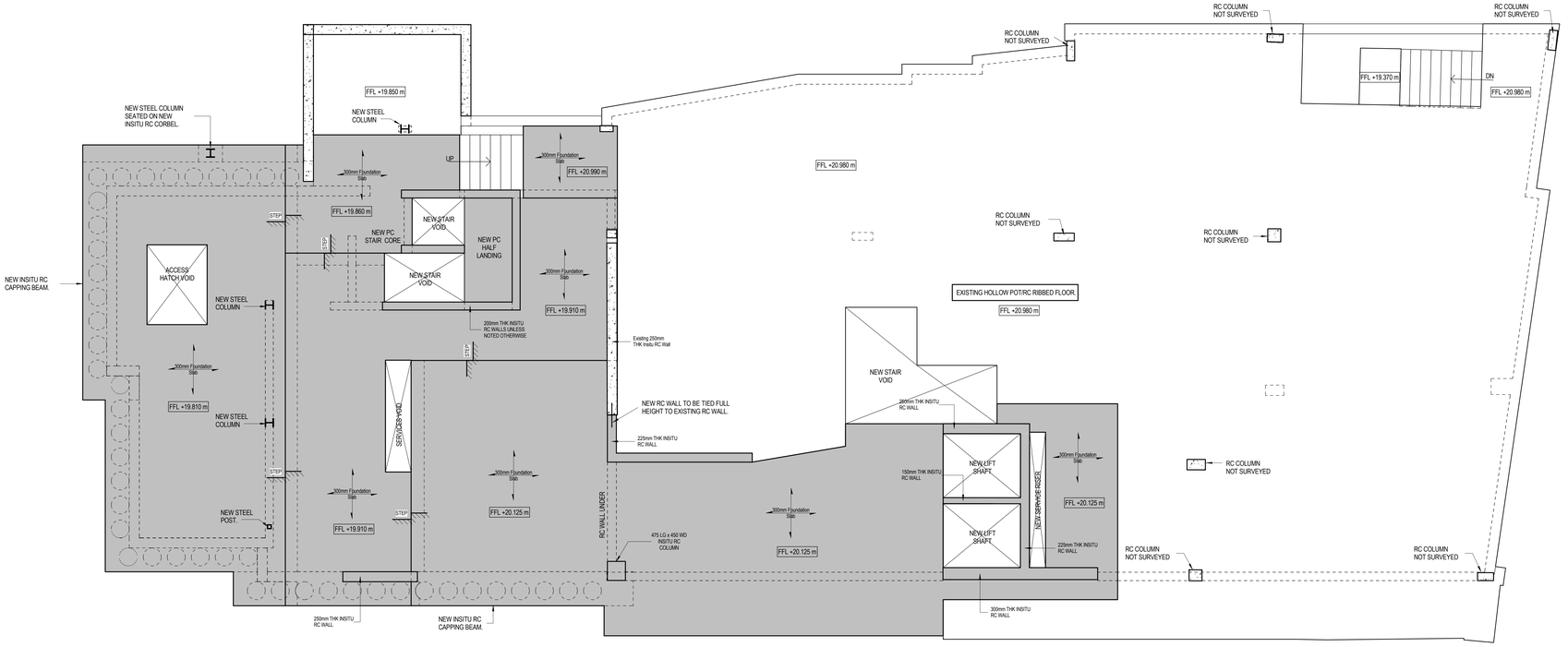
BASEMENT GENERAL ARRANGEMENT

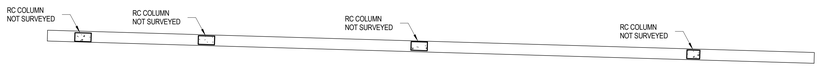
SHEET NUMBER HH-ACM-XX-B1-DR-SE-0040

REV B

SCALE @ A0: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37





NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 00 Ground Floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

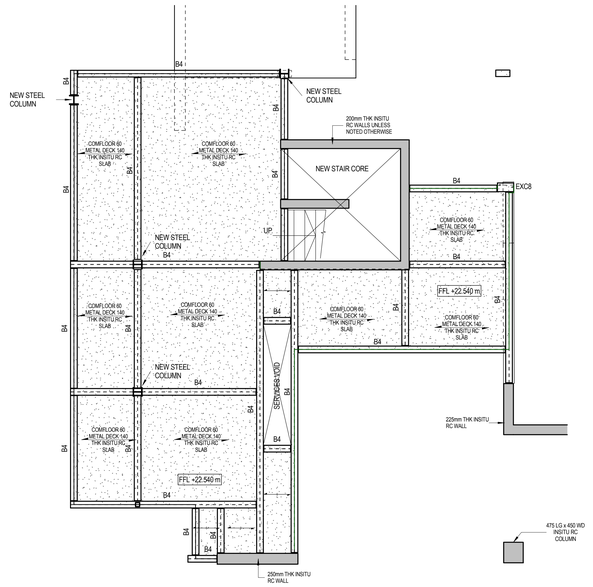
SHEET TITLE

GROUND FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-00-DR-SE-0041

REV B

SCALE @ A0: 1 : 50



1 001 Mezz Proposed
1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37

NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

0 1 2 3 4 5m
SCALE 1:50

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

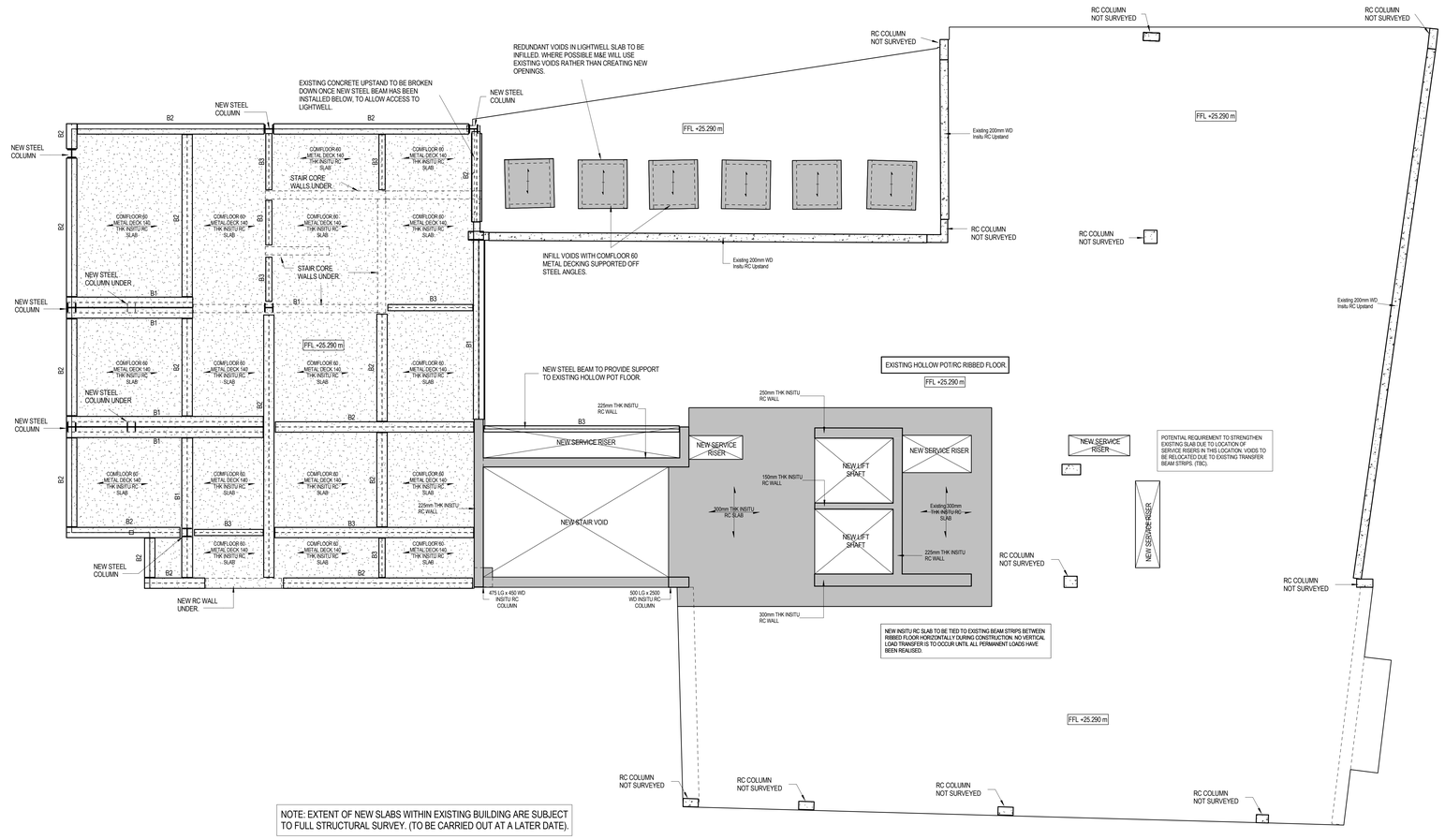
SHEET TITLE

MEZZANINE GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-MZ-DR-SE-0042 **REV** B

SCALE @A1: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 01 First Floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

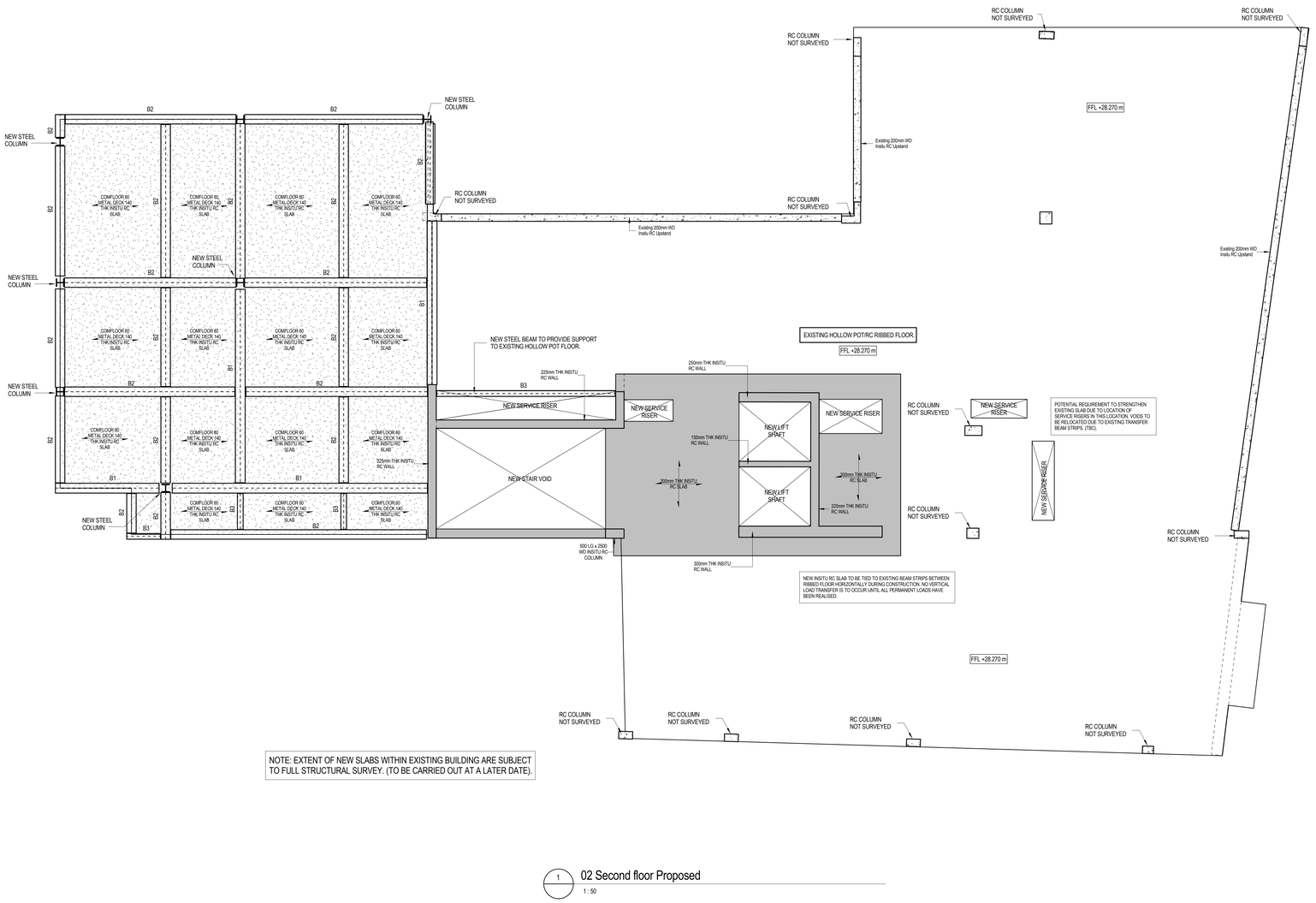
PROJECT NUMBER
47074716

SHEET TITLE
FIRST FLOOR GENERAL ARRANGEMENT

SHEET NUMBER **REV**
HH-ACM-XX-01-DR-SE-0043 B

SCALE @ A0: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 02 Second floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

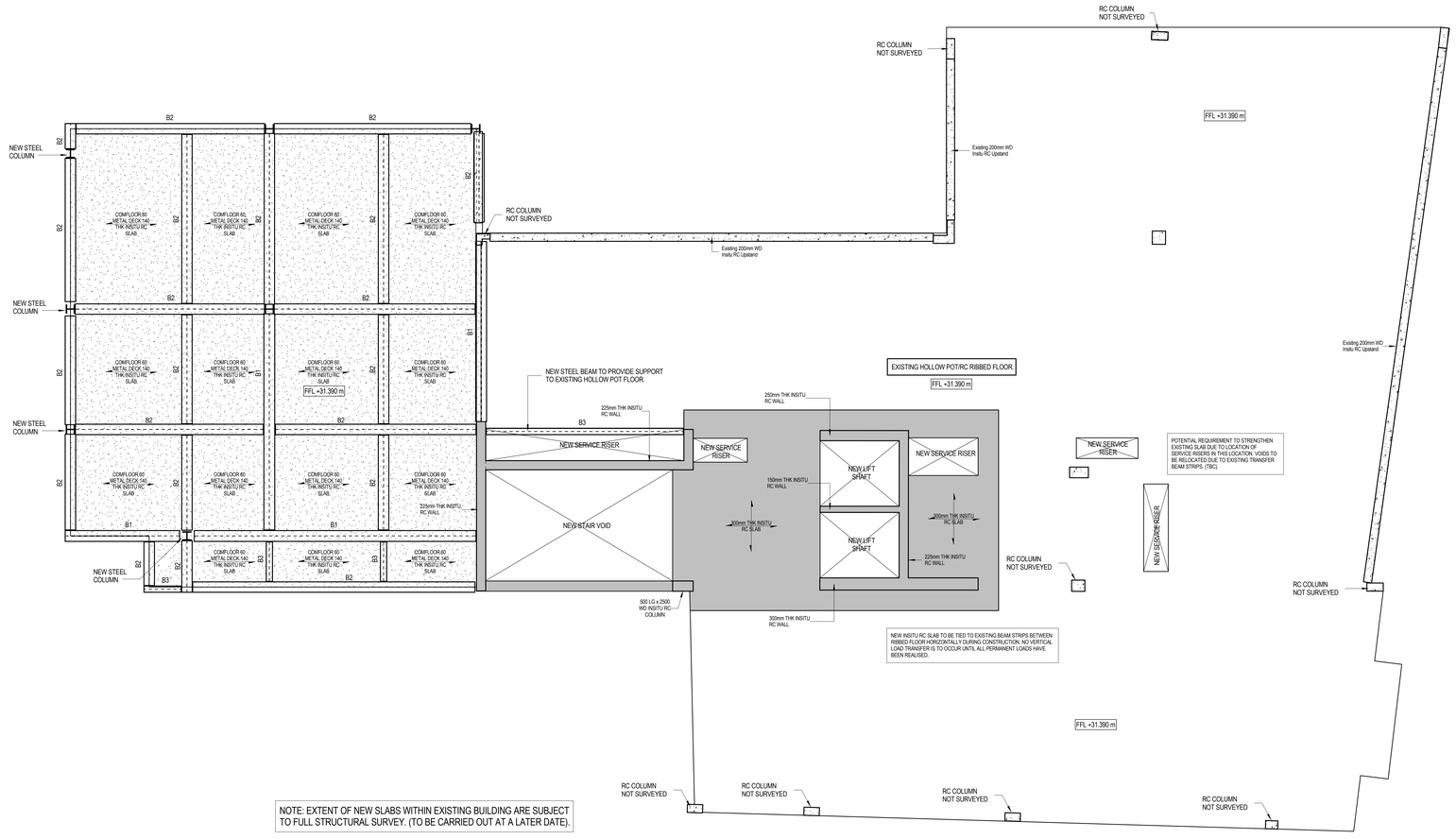
PROJECT NUMBER
47074716

SHEET TITLE
SECOND FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-02-DR-SE-0044 **REV** B

SCALE @ A0: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 03 Third Floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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PROJECT

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- DENOTES EXISTING STUCTURE.

ISSUE/REVISION

IR	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

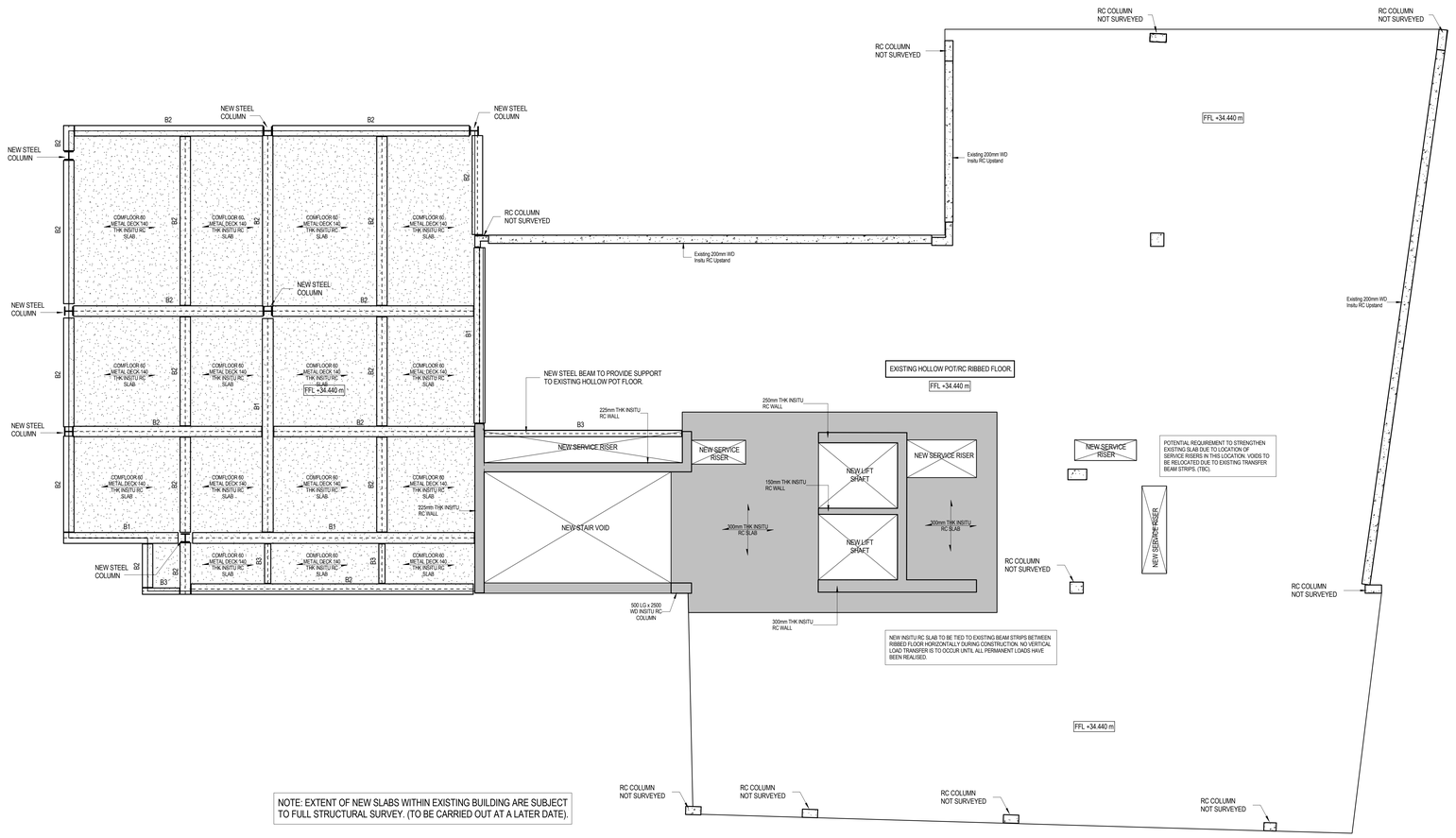
SHEET TITLE

THIRD FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-03-DR-SE-0045 **REV** B

SCALE @ A0: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



1 04 Fourth Floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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PROJECT

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ISSUE/REVISION

I/R	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

FOURTH FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-04-DR-SE-0046

REV B

SCALE @ A0: 1 : 50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
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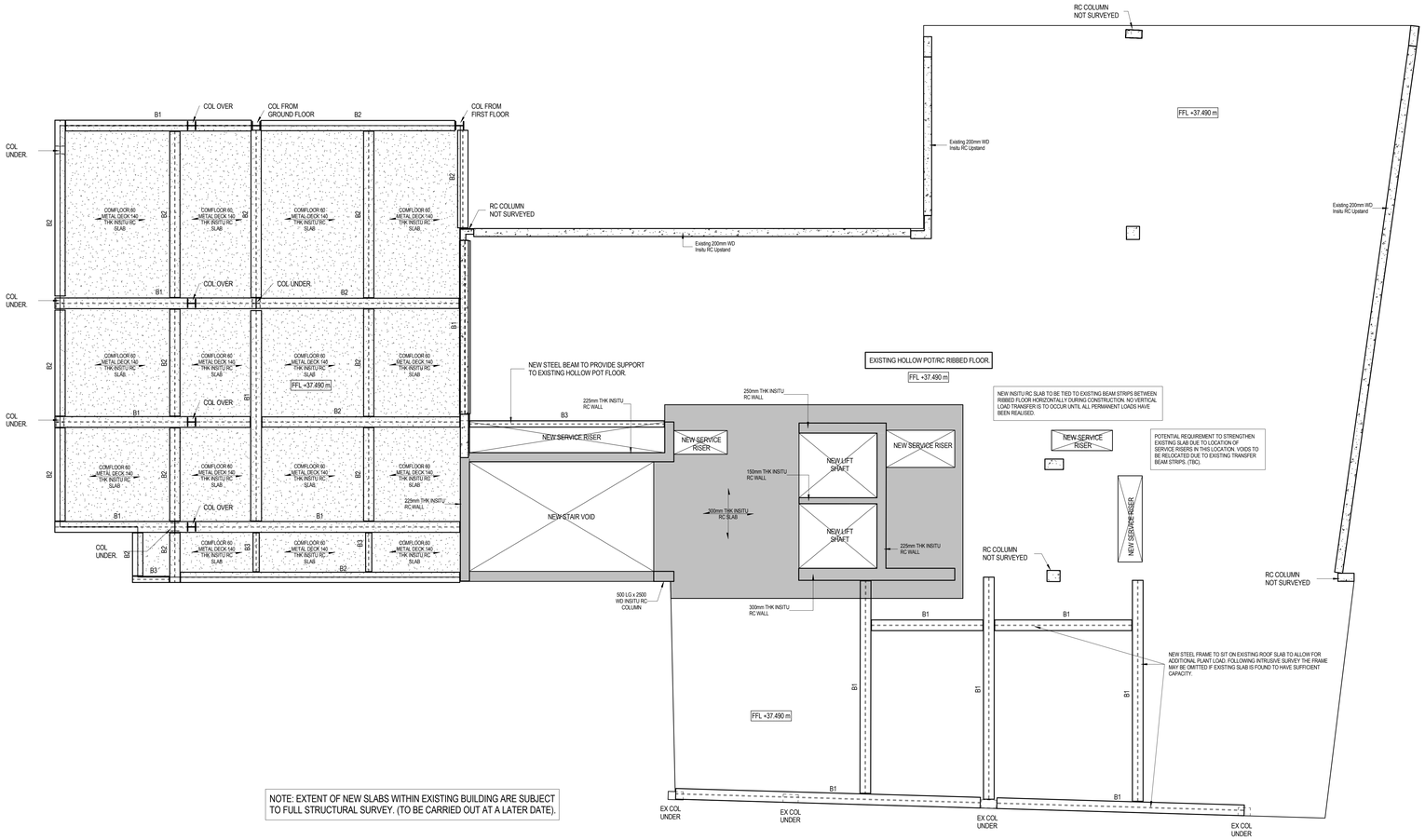
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 05 Fifth Floor Proposed
1 : 50

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ISSUE/REVISION

IR	DATE	DESCRIPTION
B	15.11.16	PLANNING RESUBMISSION
A	29.01.16	PLANNING REPORT ISSUE

KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

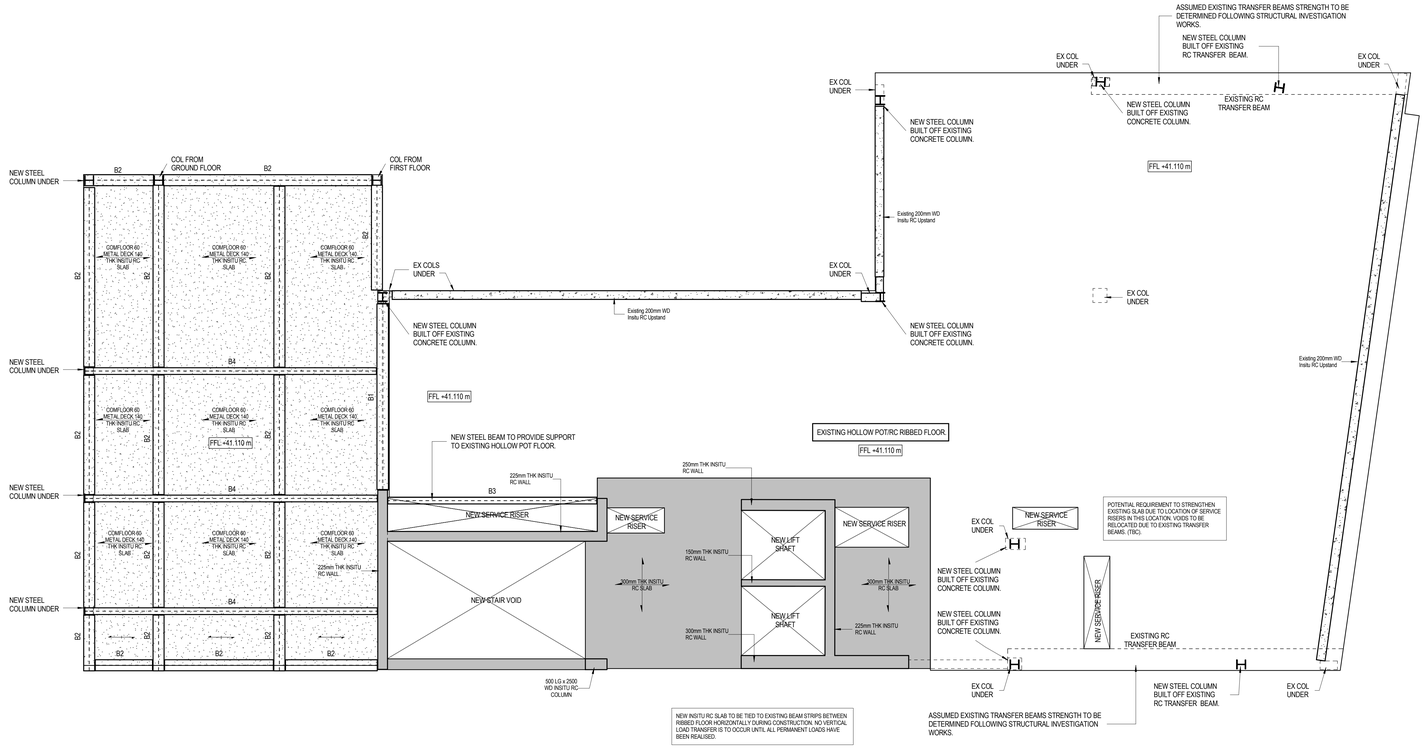
FIFTH FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-05-DR-SE-0047 **REV** B

SCALE @ A0: 1 : 50

0 1 2 3 4 5m
SCALE 1:50

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 06 Sixth Floor Proposed
1 : 50

0 1 2 3 4 5m
SCALE 1:50

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I/R	DATE	DESCRIPTION
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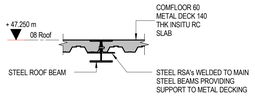
KEY PLAN

PROJECT NUMBER
47074716

SHEET TITLE
SIXTH FLOOR GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-06-DR-SE-0048 **REV** B

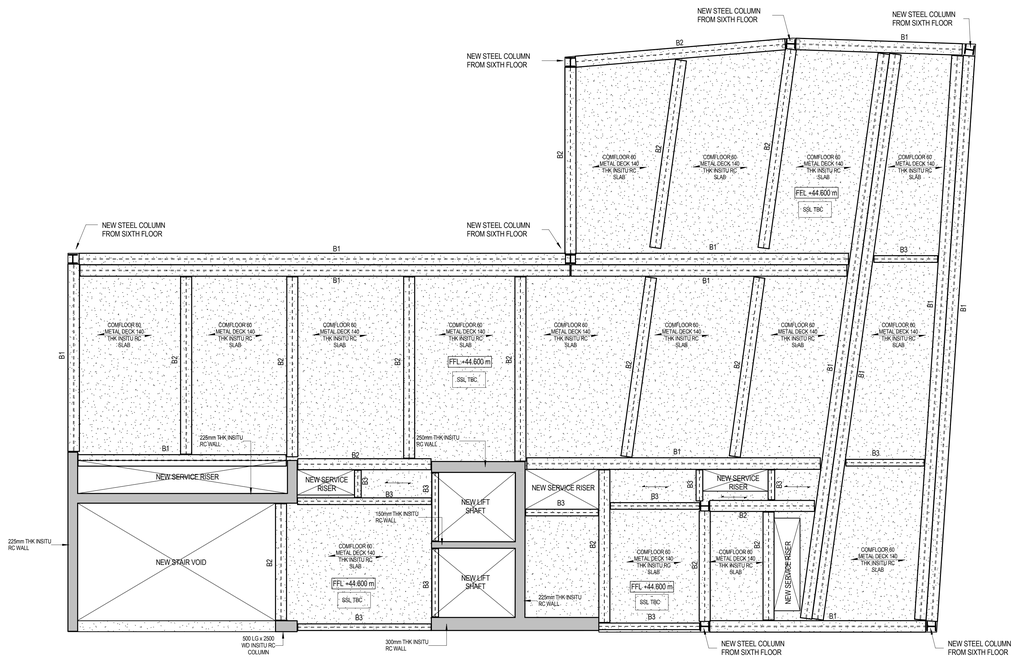
SCALE @ A0: 1 : 50



2 SECTION THRU ROOF

HH-ACM-XX-RF-DR-SE-00505

BEAM SCHEDULE	
BEAM REFERENCE	BEAM SIZE
B1	UC254x254x167
B2	UC254x254x73
B3	UC152x152x30
B4	UC152x152x37



NOTE: EXTENT OF NEW SLABS WITHIN EXISTING BUILDING ARE SUBJECT TO FULL STRUCTURAL SURVEY. (TO BE CARRIED OUT AT A LATER DATE).

1 07 Roof Plan Proposed

1 : 50

0 1 2 3 4 5m

SCALE 1:50

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KEY PLAN

PROJECT NUMBER

47074716

SHEET TITLE

ROOF GENERAL ARRANGEMENT

SHEET NUMBER HH-ACM-XX-07-DR-SE-0049

REV B

SCALE @ A0: As indicated

Last Plotted: 09/11/2016 15:10:00
Filename: C:\CHRIS\Revit\19 - 21 High Holburn\47072654-19 - 21 HIGH HOLBURN_cnris.pryor_091116.rvt

APPENDIX C – BRITISH GEOLOGICAL SURVEY BOREHOLE LOGS

TQ 38 SW 13
3102 8163

BOREHOLE LOG

LON N 5 SW/E

LOCATION No 1187 SCHEME 2147 - SITE 4.

CARRIED OUT FOR MINISTRY OF WORKS.

BOREHOLE No 1 DIAMETER: 6 in.

GROUND LEVEL: 16'.7 TUNNEL DATUM (N.B. +1.0) DATE: 3rd March 1952 - 4th [illegible]

Description	O.S.D.	Legend	Sample	Depth	Thickness	Water Level
	160.7			0'0"		
Concrete slab.					2'0"	
	158.7		1	2'0"		
Soft brown sandy silty CLAY with fine medium coarse gravel.					2'6"	
	156.2		2	4'6"		
			3			
Light brown fine medium coarse sand and fine, medium, coarse GRAVEL.			4		11'6"	
			5			
			6			▼ G.W.L. 14'0" BELOW SURFACE OF CONCRETE
			7	16'0"		
Stiff brown silty CLAY	144.7		8		1'0"	
	143.7		9	17'0"		Bar + Drift at +144.7'-0
			10			
Stiff blue grey fissured silty CLAY. Colour changes gradually from blue-grey to grey between 20'0" and 30'0".			11			
			12			
			13			
			14			
			15		23'0" penetrated.	
			16			
			17			
			18			
			19			
			20			
Claystone boulder at 37'0"			21			
	120.7		22	40'0"		
END OF BORING						

4-OCT 1952

FIG.2

SCALE: 1cm = 2'6" ● DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE

256/599
TQ 38/250

256/599

CHANCERY LANE. Southampton Buildings. Birkbeck Bank. Lond. 7 SW (b. 7).
Ref. P.G.S. p. 165. Well O.D. 68. Depth 178. Chalk—110. Water—86. Shaft to Chalk. Yield 3,000. Tilley. 1899.

Southampton Buildings. BIRKBECK BANK, 1899.

London Map 7 S.W. Street level 68 feet above Ordnance Datum.
Made and communicated by Messrs. TILLEY.
Shaft to the Chalk.
Water-level 154½ feet down. Yield about 50 gallons a minute.

		Thickness.	Depth.
		Ft.	Ft.
To basement, below road-level		—	12
[River Gravel] Ballast		15	27
London Clay		85	112
[Reading Beds, 43½ feet]	Coloured [mottled] clay	15	127
	Sand and water	7	134
	Coloured [mottled] sandy clay and pebbles	15	149
	Pebbles, sand and oyster-shells ...	2	151½
	Sand and small pebbles	4	155½
Fine [Thanet] sand and water		22½	178

	ft.	in.
Drift + basement	27	0
London Clay	85	0
Woolwich + Reading Beds (= Reading Type)	43	6
Thanet Sand	22	6

Swaffield 1976

Corner of Chancery Lane

J10.

WELL BORING at High Holborn WC. County

Geol. map 1 in. map New Series 256 6 in. map 7 S.W.

Made by TQ 38 SW 153 Date 1894

Sunk feet. Bored feet.

Communicated by L C C.

Height above Ordnance Datum 71' 21 6V Rest level of water

Yield

Quality (with copy of analysis on separate sheet) 3097 8161

GEOLOGICAL FORMATION	NATURE OF STRATA	THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches	
	Made ground.	10	6			3.40
	Clay & sand.	5	–	15	6	4.92
	Ballast. 6 455		6	16	–	4.88
	Yellow clay.	2	–	18	–	5.49
	Blue clay.	into				

71
15

5' 4/c
[illegible]
Le

J.11.

WELL BORING at Corner of Grays Inn Rd. & High Holborn.

Geol. map — 1 in. map New Series 256 — County — 6 in. map 7 S.W.

Made by TQ 38 SW 154 — Date 1897

Sunk feet. — Bored feet.

Communicated by L.C.C.

Height above Ordnance Datum 68' — Rest level of water 27' from surface.

Yield

Quality (with copy of analysis on separate sheet) 3114 8162

GEOLOGICAL FORMATION	NATURE OF STRATA	THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches	
	Hard core.	2	-			0.61
	Made ground.	8	-	10	-	3.05
	Ballast	20	6	30	6	1.21
	Blue Clay.	into				

Base of Drift at + 37.5 OD

(50478X) Wt. W39733/0131 2,500 4/31 H. J. R. & L., Ltd. Gp. 616

APPENDIX D – DRAINAGE

Asset Location Search

Subsight Surveys Ltd
Subsight House,2 Braunston,

DAVENTRY
NN11 7HH

Search address supplied 19
High Holborn
London
WC1V 6NP

Your reference 47834

Our reference ALS/ALS Standard/2014_2931206

Search date 9 December 2014

You are now able to order your Asset Location Search requests online by visiting
www.thameswater-propertysearches.co.uk

Asset Location Search

Search address supplied: 19, High Holborn, London, WC1V 6NP

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0845 070 9148, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset Location Search

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an ‘as constructed’ record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and

pressure test to be carried out for a fee.

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset Location Search

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0845 850 2777
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2014_2931206

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 531045,181646

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
2505	n/a	n/a
2602	19.55	13.85
2409	18.62	13.54
2508	18.04	12.63
2804	n/a	n/a
2707	19.56	14.15
2805	18.77	14.82
2705	19.92	15.28
1706	20.28	15.43
2706	n/a	n/a
1707	20.23	16.82
0706	n/a	n/a
1708	19.67	14.62
1801	n/a	n/a
0801	21.15	17.54
0805	n/a	n/a
2802	19.93	15.97
1803	n/a	n/a
7801	24.75	19.32
8804	23.5	20.09
8803	23.51	19.76
8802	23.59	18.77
8711	n/a	n/a
8712	n/a	n/a
9704	23.25	18.84
9803	n/a	n/a
9802	21.17	17.49
9801	21.06	17.43
0704	20.9	17.3
0408	19.94	14.95
1501	19.59	18.43
2502	19.38	n/a
9501	21.13	16.15
2501	18.84	14.08
0502	21.17	16.36
1502	19.52	18.15
2504	19.35	14.04
1503	20.2	15.27
1504	19.98	15.06
9633	22.14	n/a
1601	20.4	n/a
1604	n/a	n/a
0602	19.33	16.19
0603	19.37	15.68
1606	19.81	15.13
1605	19.58	15.52
0604	19.43	18.07
0701	19.48	16.56
9702	n/a	n/a
9703	21.03	17.5
0702	19.59	16.39
1701	20.05	15.4
1703	19.96	15.65
1704	20.03	15.08
0703	20.79	17.08
1705	20.14	15.29
8709	n/a	n/a
8603	24.68	21.15
8710	n/a	n/a
8504	23.49	20.05
8403	22.63	18.28
87BG	n/a	n/a
8502	23.39	n/a
8606	24.6	20.63
8512	n/a	n/a
8601	23.79	19.34
87BF	n/a	n/a
8513	23.03	9.26
87BE	n/a	n/a
8402	22.14	19.95
8401	22.02	20.89
8605	23.87	19.98
8602	23.09	19.08
8702	23.78	20.87
9710	n/a	n/a
9711	n/a	n/a
9712	n/a	n/a
9701	22.47	18.41
9605	n/a	n/a
9604	22.76	18.8
9603	22.96	18.33
0401	19.25	18.11
9401	19.79	19.03
0402	19.29	18.2
2403	18.81	14.87
2402	18.39	14.48
9402	20.33	16.61
0403	19.42	18.43
9403	20.23	19.44
2404	19.8	15.58
9404	19.97	19.26

Manhole Reference	Manhole Cover Level	Manhole Invert Level
0404	19.41	14.46
9405	20.16	16.2
2408	19.06	14.18
9406	20.08	15.58
9407	20.27	15.42
1403	20.16	15.35
1401	19.98	n/a
0406	20.13	15.16
0407	19.96	14.98

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

Trunk Surface Water

Trunk Foul

Storm Relief

Trunk Combined

Vent Pipe

Bio-solids (Sludge)

Proposed Thames Surface Water Sewer

Proposed Thames Water Foul Sewer

Gallery

Foul Rising Main

Surface Water Rising Main

Combined Rising Main

Sludge Rising Main

Proposed Thames Water Rising Main

Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

Air Valve

Dam Chase

Fitting

Meter

Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

Control Valve

Drop Pipe

Ancillary

Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

Outfall

Undefined End

Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

Public/Private Pumping Station

Change of characteristic indicator (C.O.C.I.)

Invert Level

Summit

Areas

Lines denoting areas of underground surveys, etc.

Agreement

Operational Site

Chamber

Tunnel

Conduit Bridge

Other Sewer Types (Not Operated or Maintained by Thames Water)

Foul Sewer

Surface Water Sewer

Combined Sewer

Gulley

Culverted Watercourse

Proposed

Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.

2) All measurements on the plans are metric.

3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.

4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.

5) 'na' or '0' on a manhole level indicates that data is unavailable.

6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in milimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Insight on 0845 070 9148.

Asset Location Search Water Map - ALS/ALS Standard/2014_2931206

The width of the displayed area is 500 m and the centre of the map is located at OS coordinates 531045, 181646.

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to him at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0845 070 9148** quoting your invoice number starting CBA or ADS.	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Thames Water Utilities Ltd Registered in England & Wales No. 2366661 Registered Office Clearwater Court, Vastern Rd, Reading, Berks, RG1 8DB.

Search Code

IMPORTANT CONSUMER PROTECTION INFORMATION

This search has been produced by Thames Water Property Searches, Clearwater Court, Vastern Road, Reading RG1 8DB, which is registered with the Property Codes Compliance Board (PCCB) as a subscriber to the Search Code. The PCCB independently monitors how registered search firms maintain compliance with the Code.

The Search Code:

- provides protection for homebuyers, sellers, estate agents, conveyancers and mortgage lenders who rely on the information included in property search reports undertaken by subscribers on residential and commercial property within the United Kingdom
- sets out minimum standards which firms compiling and selling search reports have to meet
- promotes the best practise and quality standards within the industry for the benefit of consumers and property professionals
- enables consumers and property professionals to have confidence in firms which subscribe to the code, their products and services.

By giving you this information, the search firm is confirming that they keep to the principles of the Code. This provides important protection for you.

The Code's core principles

Firms which subscribe to the Search Code will:

- display the Search Code logo prominently on their search reports
- act with integrity and carry out work with due skill, care and diligence
- at all times maintain adequate and appropriate insurance to protect consumers
- conduct business in an honest, fair and professional manner
- handle complaints speedily and fairly
- ensure that products and services comply with industry registration rules and standards and relevant laws
- monitor their compliance with the Code

Complaints

If you have a query or complaint about your search, you should raise it directly with the search firm, and if appropriate ask for any complaint to be considered under their formal internal complaints procedure. If you remain dissatisfied with the firm's final response, after your complaint has been formally considered, or if the firm has exceeded the response timescales, you may refer your complaint for consideration under The Property Ombudsman scheme (TPOs). The Ombudsman can award compensation of up to £5,000 to you if he finds that you have suffered actual loss as a result of your search provider failing to keep to the Code.

Please note that all queries or complaints regarding your search should be directed to your search provider in the first instance, not to TPOs or to the PCCB.

TPOs Contact Details

The Property Ombudsman scheme
Milford House
43-55 Milford Street
Salisbury
Wiltshire SP1 2BP
Tel: 01722 333306
Fax: 01722 332296
Email: admin@tpos.co.uk

You can get more information about the PCCB from www.propertycodes.org.uk

PLEASE ASK YOUR SEARCH PROVIDER IF YOU WOULD LIKE A COPY OF THE SEARCH CODE