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Geotechnical Engineering and Environmental Services across the UK.



# REMEDIAL STRATEGY AND VERIFICATION PLAN

**FOR** 

PROPOSED DEVELOPMENT AT 56D – 58A VICARAGE ROAD WATFORD



Report Title: Remedial Strategy & Verification Plan for 56D – 58A Vicarage Road, Watford

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#### 1 INTRODUCTION

#### 1.1 Terms of Reference

1.1.1 Henry Construction Projects Ltd ("The Client"), has commissioned Jomas Associates Ltd ('Jomas') to produce a remedial strategy prior to the development of 56D – 58A Vicarage Road, Watford.

#### 1.2 Previous Reports

- 1.2.1 The previous reports that have been utilised by Jomas for the purposes of this document comprise:
  - Geotechnical and Geo-Environmental Interpretive Report for 56D 58A Vicarage Road, Watford, Card Geotechnics Ltd, CG/28566A, July 2018.
- 1.2.2 This document should be read in conjunction with the above report.

#### 1.3 Site Information

- 1.3.1 Jomas has not attended the site, but has been provided with a report produced by others (referenced in Section 1.2).
- As reported by others, at the time of the ground investigation the centre of site was occupied by a number of empty commercial and light industrial buildings, a storage building was reported in the south-west of site, a yard area in the south west and a garden in the northeast. Various previous site uses were reported including a picture framer, print works and bridal wear shop.
- 1.3.3 A site location plan is provided as Figure 1.

#### 1.4 Proposed Development

- 1.4.1 The proposed development is to comprise the demolition of the existing structures and the construction of residential units with private gardens.
- 1.4.2 Proposed development plans are provided as Figure 2.

# 1.5 Background

- 1.5.1 Development permission is being granted by Watford Borough Council with a number of conditions relating to various requirements.
- 1.5.2 Planning Conditions 5 and 6 of application ref 20/00553/VARM, relate to land contamination matters, as reproduced below:

## Condition 5

No demolition of the existing buildings or construction of the development shall commence until a detailed scheme to deal with the risks associated with the potential contamination of the site has been submitted to and approved in writing by the Local Planning Authority. The scheme shall include:

i) a preliminary risk assessment which has identified: all previous uses; potential contaminants associated with those uses; a conceptual model of the site indicating



sources, pathways and receptors; and potentially unacceptable risks arising from contamination at the site:

ii) a site investigation scheme, based on (i) to provide information for a detailed assessment of the risk to all receptors that may be affected, including those off site;

iii) the results of the site investigation and risk assessment referred to in (ii) above and, based on these, an options appraisal and remediation strategy giving full details of the remediation measures required and how they are to be undertaken;

iv) a verification plan providing details of the data that will be collected in order to demonstrate that the works set out in the remediation strategy in (iii) are complete and identifying any requirements for longer-term monitoring of pollutant linkages, maintenance and arrangements for contingency action.

#### Condition 6

No construction works shall commence until a verification report demonstrating completion of the works set out in the approved remediation strategy (see Condition 4 above) and the effectiveness of the remediation has been submitted to and approved, in writing, by the Local Planning Authority. The report shall include results of sampling and monitoring carried out in accordance with the approved verification plan to demonstrate that the site remediation criteria have been met.

- 1.5.3 Condition 5 parts i and ii are understood to have been address by the CGL Desk Study report reference CG/28566, April 2018 (not provided to Jomas) and the CGL Geotechnical and Geoenvironmental Interpretive Report provided to Jomas and referenced in Section 1.2
- 1.5.4 This report seeks to address Condition 5 parts iii and iv, by detailing potential remedial options and outlining the required remedial strategy and verification plan.

#### 1.6 Objectives

- 1.6.1 The primary objectives of this document are as follows:
  - To provide information on the site setting; identify ground conditions and potential environmental risks associated with the development.
  - To provide an assessment of various options for remediation.
  - To set out the remediation strategy that will provide a site that is suitable for the intended use and addresses any identified unacceptable risks.
  - To provide relevant information to address anticipated planning conditions relating to contaminated land. A separate verification report will be required following the implementation of the remediation strategy.
- 1.6.2 The primary remediation objective is the mitigation of the risks associated with lead, and asbestos impacted soils.
- 1.6.3 This document provides an assessment of potential remedial strategies and describes the methodology for the proposed remedial action.
- 1.6.4 The remediation strategy and associated remediation criteria have been developed with reference to previous works carried out at the site. The remediation criteria used to develop the proposed remediation strategy will be used for the proposed verification works.

# SECTION 1 INTRODUCTION



- 1.6.5 The Principal Contractor will be responsible for implementing the appropriate methodology and site management procedures to achieve the required outcome and comply with these principles.
- 1.6.6 The works will be undertaken by experienced personnel and will be managed in accordance with the Contractor's Construction Environmental Management Plan. Detailed construction method statements will be prepared for the impacted soil removal works. An Environmental Specialist will supervise the works and undertake soil sampling and analysis as part of the validation process.

#### 1.7 Limitations

- 1.7.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Henry Construction Projects Ltd, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.
- 1.7.2 This report provides an overview of conclusions drawn from previous investigations, some of which has been conducted by others. Third party information used is assumed to be correct, and Jomas has not validated any of the data provided. Jomas is unable to guarantee the accuracy of the information provided by others.



#### 2 LAND CONTAMINATION OVERVIEW

# 2.1 Desk Study Findings

- 2.1.1 A desk study was produced for the site (CGL, April 2018), and issued separately. This report has not been provided to Jomas, but the provided ground investigation report contains a summary of the desk study findings, reproduced below:
  - Earliest available historic maps (1871) indicate three unidentified buildings in the south west of the site with the north east apparently undeveloped. By 1898 a public school is shown in the south-west, with the current site layout first indicated on the 1938 map edition comprising unidentified buildings in the south-west, a large warehouse style building and three smaller buildings in the north-east.
  - The site is reported to be underlain by superfical deposits of the Winter Hill Gravel overlying solid deposits of undifferentiated Seaford Chalk and Newhaven Chalk.
  - The superfical deposits underlyign the site are reported to be a Secondary A Aquifer, overlying the Principal Aquifer of the solid chalk deposits.
  - The site is reported to lie with a Source Protection Zone 3, with the nearest potable abstraction reported 700m east of site.

## 2.2 Intrusive Investigation

- 2.2.1 The ground investigation was undertaken between 11<sup>th</sup> 31<sup>st</sup> May 2018, and consisted of the following:
  - 2No cable percussion boreholes (BH1-BH2) to a maximum depth of 20mbgl with associated in situ testing and sampling.
  - 4No window sampling boreholes (WS1-WS4), drilled up to 2.3m below ground level (bgl), with associated in situ testing and sampling;
  - ) 6No gas and groundwater monitoring standpipes, extending up to a maximum depth of 20mbgl;
  - Laboratory analysis for chemical and geotechnical purposes.
- 2.2.2 The results of the ground investigation revealed a ground profile comprising a variable thickness of Made Ground (up to 1.05m depth), overlying silty gravelly sand to silty sandy gravel to a maximum depth of 10.50mbgl, overlying chalk recovered as gravelly silt to the base of the deepest boreholes at 20.0mbgl.
- 2.2.3 Groundwater was not reported during the drilling process, although it was noted that the drilling of BH1 and BH2 involved the introduction of water to aid drilling which may have obscured a strike.

# 2.3 Soil Gas Risk Assessment

2.3.1 Following 3No return monitoring visits, the site was classified as Characteristic Situation 1, meaning no formal gas protection measures are considered necessary.

# 2.4 Controlled Waters Risk Assessment

2.4.1 Although several contaminants were found to exceed Environmental Quality Standards and Drinking Water Standards based on leachate testing, it was concluded that overall the potential



for contamination in the Made Ground to migrate to the Principal Aquifer and the nearest potable abstraction is low, and the potential for contaminants to migrate to the nearest surface water feature is low to negligible.

#### 2.5 **Human Health Risk Assessment**

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2.5.1	Following a review of the Site Investigation reports, the following factors are noted:

- Following generic risk assessments an elevated concentration of lead was reported (720mg/kg against a threshold of 200mg/kg). Asbestos was also detected in a single sample in the form of loose fibrous chrysotile in bitumen.
- Concentrations of copper and zinc within the Made Ground may be detrimental to plant growth.
- Health and Safety measures will be required for the protection of construction workers.

#### 2.6 **Impact to Neighbouring Properties and Buried Services**

- 2.6.1 The risk to buried services is considered to be "medium" and standard polyethylene (PE) pipework were not considered to be suitable to use with drinking water supply due to elevated hydrocarbon concentrations in the soil.
- 2.6.2 Upgraded pipework is likely to be required and requirements should be confirmed with the relevant utility supplier at an early stage.

#### 2.7 Conceptual Site Model (CSM)

- 2.7.1 A review of potential sources Identified During Desk Study is presented below, with an updated CSM thereafter
  - Explosive/ asphyxiating gases from underlying soils and vapours from Made Ground onsite and historical onsite works - Site considered Characteristic Situation 1 based on three return ground gas monitoring visits. No evidence of a source of hydrocarbon vapours reported.
  - o Organic/inorganic contaminants such as lead and asbestos, within underlying Made Ground (from on-site and off-site sources) – Elevated lead reported in soils, as well as asbestos and concentrations of metals above phytotoxic thresholds.
  - o Organic/inorganic contaminants within shallow groundwater (from on-site and off-site sources) - risks to controlled waters concluded to be low
- 2.7.2 A revised conceptual site model, updated following the ground investigation is reproduced overleaf from that provided in the CGL ground investigation report.



**Table 2.1: Updated Conceptual Site Model** 

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
Explosive/ asphyxiating gasesfrom underlying soils and vapours from Made Ground onsite and historical onsite works	On-site future internal building spaces & future residents	Migration of gases through the surface via permeable soils (Winter Hill Gravel Member and potential granular Made Ground)	Low
Organic/ inorganic contaminants such as leadand asbestos, within	Construction workers	Direct/ indirect ingestion of soil and dust, inhalation of particles and	Medium
underlying Made Ground (from on-	Future site users	vapours, and dermal contact	Medium
site and off-site sources)	Off-site receptors	Direct/indirect ingestion of soil and dust, inhalation of particles and vapours, and dermal contact	Low to Medium
	Buildings and structures	Direct contact with underground structures and services	Low to Medium
	Plants and vegetation	Root uptake	Low to Medium
	Superficial Deposits (Secondary A Aquifer – superficial deposits)	Lateral and vertical migration of contaminants	Low
	Principal Aquifer (Chalk)	Lateral and vertical migration of contaminants	Low
	Local surface water bodies	Lateral migration of contaminants	Low to negligible
Organic/inorganic contaminants within	Construction workers	Direct contact and ingestion of	Low
shallowgroundwater (from on-site and off-site sources)	Future site users	contaminated groundwater	Low
	Off-site receptors		Low
	Buildings and structures	Direct contact with underground structures and services	Low
	Principal Aquifer	Vertical migration	Low
	Local surface water bodies	Lateral migration	Low to negligible



#### 3 REMEDIAL OPTIONS APPRAISAL

#### 3.1.1 Soil Screening

- A possible remedial option would be to undertake soil screening, comprising excavation of impacted soils, screening within the site to remove likely contaminative materials, and re-deposition of materials on site. Such an operation may include a variety of screening methodologies, including soil washing etc.
- Such an operation may be successful at removing materials responsible for elevated concentrations of polyaromatic hydrocarbons. Any visual asbestos materials may be removed by hand, with extensive dust control measures required during the soil screening operations for the protection of site workers and nearby residents. Asbestos fibres in soil will however, not be visible for removal.

## 3.1.2 Excavation and disposal

- Made Ground displaying elevated concentrations of contaminants may be excavated for disposal off site. From a review of chemical testing data, excavations to a depth of the order of 1.0mbgl minimum would be required, with the importation of a respective thickness of certified clean material to restore site level.
- The costs and vehicle movements required for such an operation may render the costs associated with this method prohibitive.

#### 3.1.3 Encapsulation

- In order to sever the identified pathways to the most sensitive receptors (human health), encapsulation of impacted materials below building footprints or areas of hard surfacing may be undertaken. This would have the effect of removing the potential pathways of direct contact and inhalation.
- In areas of soft landscaping, the impacted soils will be encapsulated by the use of a capping layer. This should comprise a minimum 600mm thickness of clean cover layer, laid over a geotextile membrane.
- 3.1.4 Dust control measures will be required during the undertaking of all the remedial options identified above for the protection of site workers.
- 3.1.5 When issues of cost effectiveness, requirements for vehicle movements etc. are taken into account, it is recommended that encapsulation of impacted soils is adopted as the preferred remedial methodology.
- 3.1.6 The requirements for the remedial methodology are presented within Section 5 of this report.



#### 4 PROPOSED REMEDIATION STRATEGY

#### 4.1 Introduction

- 4.1.1 The proposed remediation scheme serves to address the potential unacceptable risks identified in the context of the proposed redevelopment of the site.
- 4.1.2 The remedial measures comprise;
  - Decommissioning of existing gas and groundwater monitoring wells
  - The encapsulation of impacted soils below areas of building footprint or hardstanding,
  - A watching brief following demolition and during enabling works,
  - Within areas of private soft landscaping, a cover layer comprising a minimum 600mm thickness of clean subsoil/topsoil over a geotextile membrane/marker layer will be utilised. In areas of public or communal soft landscaping, the clean subsoil/topsoil cover layer may be reduced to 450mm.
  - Where Made Ground is removed and the base of the Made Ground is encountered at shallower depth than the depth of the proposed clean cover, the depth of clean cover can be limited to the thickness of made ground removed, or thickness required for finished levels.
  - Validation testing will be undertaken upon soils imported to site to confirm their suitability for use as a clean capping layer.

#### 4.2 Remediation Strategy

# **Decommissioning of Existing Monitoring Wells**

- 4.2.1 In order to avoid the creation of preferential pathways for contamination migration into the underlying aquifer units, the existing monitoring wells on site will be decommissioned prior to commencement of demolition works.
- 4.2.2 Monitoring wells will be decommissioned by grouting from base to surface using a grout and tremmie pipe, which is inserted to the base and retrieved as the grout is pumped, to avoid bridging across the well. The grout will comprise a bentonite/cement mixture.

#### **Backfill of Existing Basement**

- 4.2.3 Although not required as a formal remedial measure, it is understood that the existing basement level on site will be backfilled to restore site level as part of the proposed development.
- 4.2.4 It is understood that the client intends to use site-won crushed hard core to backfill the basement, obtained from the demolition of the existing structures.

#### **Impacted Soils Encapsulation**



- 4.2.5 Where buildings or hardstanding are proposed, no formal remedial works are considered necessary, beyond the hand picking discussed above, and the construction of the building/hardstanding, as this should provide an appropriate barrier to impacted soils. External hardstanding within private areas should be of a construction that discourages possible removal by future occupiers.
- 4.2.6 Within areas of soft landscaping, soils will be encapsulated below a cover layer of imported clean subsoil/topsoil. This should comprise a minimum 600mm thickness of soil within private landscaping area and a minimum of 450mm of soil within communal soft landscaping areas, laid over a geotextile membrane/marker layer.
- 4.2.7 Where topsoil and sub-soil is imported to the site, the soil should be chemically suitable for use. All imported soil should conform to the following chemical specification:

**Table 4.1: Topsoil Requirements** 

Determinand	Unit	Screening Criteria			
Arsenic	mg/kg	S4UL	37		
Boron	mg/kg	S4UL	290		
Cadmium	mg/kg	S4UL	11		
Chromium	mg/kg	S4UL	910		
Lead	mg/kg	C4SL	200		
Mercury	mg/kg	S4UL	40		
Nickel	mg/kg	BS3882	110		
Selenium	mg/kg	S4UL	250		
Copper	mg/kg	BS3882	200		
Zinc	mg/kg	BS3882	300		
Asbestos	%	S4UL	None Detected		
рН	-	S4UL	5-9		
Naphthalene	mg/kg	S4UL	2.3		
Acenaphthylene	mg/kg	S4UL	170		
Acenaphthene	mg/kg	S4UL	210		
Fluorene	mg/kg	S4UL	170		
Phenanthrene	mg/kg	S4UL	95		
Anthracene	mg/kg	S4UL	2400		
Fluoranthene	mg/kg	S4UL	280		
Pyrene	mg/kg	S4UL	620		
Benzo(a)anthracene	mg/kg	S4UL	7.2		
Chrysene	mg/kg	S4UL	15		
Benzo(b)fluoranthene	mg/kg	S4UL	2.6		
Benzo(k)fluoranthene	mg/kg	S4UL	77		
Benzo(a)pyrene	mg/kg	S4UL	2.2		
Indeno(123-cd)pyrene	mg/kg	S4UL	27		
Dibenzo(ah)anthracene	mg/kg	S4UL	0.24		
Benzo(ghi)perylene	mg/kg	S4UL	320		
TPH C <sub>5</sub> -C <sub>6</sub>	mg/kg	S4UL	42		



Determinand	Unit	Screening	Criteria
TPH C <sub>6</sub> -C <sub>8</sub>	mg/kg	S4UL	100
TPH C <sub>8</sub> -C <sub>10</sub>	mg/kg	S4UL	27
TPH C <sub>10</sub> -C <sub>12</sub>	mg/kg	S4UL	74
TPH C <sub>12</sub> -C <sub>16</sub>	mg/kg	S4UL	140
TPH C <sub>16</sub> -C <sub>21</sub>	mg/kg	S4UL	260
TPH C <sub>21</sub> -C <sub>35</sub>	mg/kg	S4UL	1100

4.2.8 The imported sub/topsoil should be a specific soil product meeting the requirements of BS3882.

#### 4.3 Foundation Works Risk Assessment

- 4.3.1 Shallow foundations are proposed to support the development, comprising a 400mm thick ground-bearing raft foundation formed at 1.0mbgl to provide an allowable bearing capacity of 300kN/m². No piled foundations are proposed.
- 4.3.2 The shallow foundations will be formed within the shallow deposits and therefore will not create a preferential pathway for the migration of contaminants to the principal aquifer within the chalk.

# 4.4 Health and Safety / PPE

- 4.4.1 Excavations will have suitable barriers and access points, with pedestrian routes clearly marked. Appropriate safety signage and instructions will be clearly visible, with accesses to be kept clear of debris, materials and cables.
- 4.4.2 Operatives will be briefed on sharps protection in order to ensure safety. Clean/dirty rooms will be provided for operatives working within contaminated areas
- 4.4.3 Standard PPE will be required at all times, namely:

J	Hard hat
J	Safety spectacles
J	Hi-viz waistcoat or jacket
J	Gloves
J	Boots or shoes with steel toe and midsole protection

4.4.4 Other items may be required as per detailed in the specific method statement;

J	Harness
J	Dust protection
J	Ear protection
J	Other specialist equipment

4.4.5 A method statement will be produced by the chosen contractor.

#### 4.5 Unexpected Contamination



- 4.5.1 To accord with best practice if, during the construction of the development, contamination and/or materials not previously identified are found to be present at the site, then no further development (unless otherwise agreed in writing with the Local Planning Authority) shall be carried out until Jomas' (or qualified environmental engineer) has been informed, and a suitable strategy implemented to the approval of the engineer and/or the Local Planning Authority.
- 4.5.2 Examples of such materials include:

J	Buried drums, tanks, pipework or containers
Ĵ	Soil or water with colour or odour
J	Non-natural materials and wastes
J	Other evidence of contamination, for example iridescent sheens (like oil or diesel) or
	soil or water.

4.6.1



# 4.6 Operational Standards – Summary

re	ediation site works;
	All materials subject to excavation and disposal must be tracked throughout and evidence generated to provide an auditable trail.
	Any excavated soils will be stockpiled/stored in a designated area on site, with plastic sheeting placed at ground surface to prevent cross-contamination. The contractor shall be responsible for the removal of spoil from the site.
	Personal protective equipment shall be employed by all site remediation and ground worker personnel in accordance with site specific risk assessments. These are to be completed by all contractors following consideration of the potentially hazardous properties of contaminants within the site.
	A copy of this remediation statement together with all previous geo-environmental assessment reports shall be retained on site for reference during the full course of remediation activities.

As a minimum, the following standards shall be employed during the full course of this



#### 5 VERIFICATION PLAN

#### 5.1 Proposals for Validation & Verification

5.1.1	Α	qualified	environmental	engineer	shall	undertake	the	following	tasks	to	monitor	the
	re	medial act	tivities described	d in this st	ateme	nt.						

Following importation of subsoil/topsoil to site, representative samples will be
obtained prior to laying of the material. It is anticipated that 1No sample will be taken
per 50m <sup>3</sup> of soil imported or a minimum of 3No samples tested (whichever greater)

- The thickness of the clean cover layer and the presence of a geotextile/marker layer will be verified by a series of hand dug pits in areas of soft landscaping, with accompanying photographs.
- These samples shall be sent directly to an MCERTS and UKAS accredited laboratory for testing.
- The results will be screened against the criteria given previously within Table 4.1, which comprise current published Environment Agency residential end-use soil guideline values (SGVs) or where unavailable, LQM or S4UL generic assessment criteria safe for use levels for human health risk assessment. If these values become out of date, reference shall be made to industry approved superseded values.

## 5.2 Remediation Verification/Completion Report

5.2.1 The Remediation Completion Report shall include the following information:

J	Summary of all works undertaken
J	Photographic log of the works.
J	A full chemical soil analysis results schedule.
J	Full details of any further contamination reported during construction works
J	Disposal documentation for any spoil or asbestos materials spoil.

# 5.3 Reporting

5.3.1 All activities will be documented (including photographs) to show compliance with the Remediation Strategy. This documentation will be kept on site at all times during the works and updated daily as part of a field record as the works progress, which would be available for regulatory inspection at any time. All documentation would be included in a final verification report to be presented to the Local Authority.



#### 6 REFERENCES

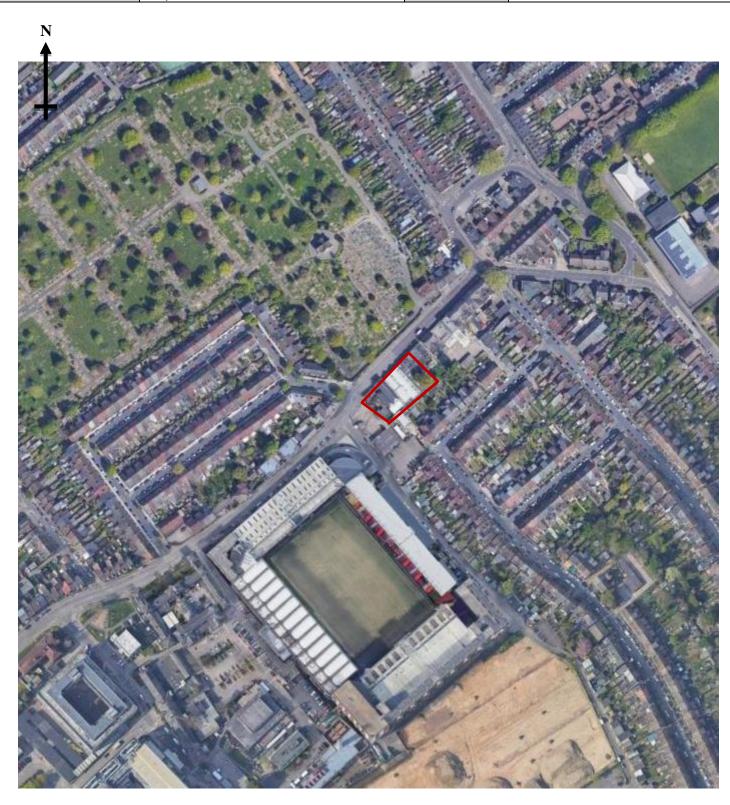
- A possible approach for generating site specific assessment criteria for polycyclic aromatic hydrocarbons (draft internal HPA briefing note)
- CIEH & CL:AIRE (2008) Guidance on comparing soil contamination data with a critical concentration. London: Chartered Institute of Environmental Health (CIEH) and CL:AIRE
- Environment Agency (2004) *Model procedures for the management of land contamination*. CLR11. Bristol: Environment Agency
- Environment Agency, NHBC & CIEH (2008) Guidance for the safe development of housing on land affected by contamination. R & D Publication 66. London: Environment Agency
- Environment Agency Technical Report P45 "Polycyclic Aromatic Hydrocarbons (PAH): Priorities for Environment Quality Standard Development
- Geotechnical and Geo-Environmental Interpretive Report for 56D 58A Vicarage Road, Watford, Card Geotechnics Ltd, CG/28566A, July 2018.
- LQM/CIEH S4ULs. LQM, 2014
- National Planning Policy Framework. Department for Communities and Local Government, March 2012



**APPENDIX 1: FIGURES** 

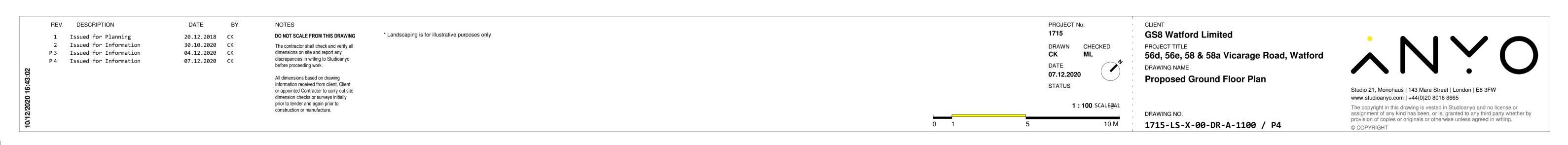


PROJECT NAME:	Vicarage Road	CLIENT:	Henry Construction Projects Ltd
TITLE:	Site Location Plan	PROJECT NO.	P3704J2325
DATE:	July 2021	FIGURE:	1

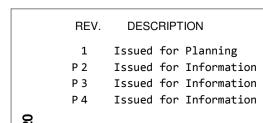


# VICARAGE ROAD











DATE BY 20.12.2018 CK 30.10.2020 CK 04.12.2020 CK

07.12.2020 CK

NOTES

DO NOT SCALE FROM THIS DRAWING The contractor shall check and verify all dimensions on site and report any discrepancies in writing to Studioanyo

before proceeding work. All dimensions based on drawing information received from client, Client or appointed Contractor to carry out site dimension checks or surveys initially prior to tender and again prior to

construction or manufacture.

\* Landscaping is for illustrative purposes only

1715 DRAWN CHECKED ML

CK DATE 07.12.2020 STATUS

PROJECT No:

PROJECT TITLE

**GS8 Watford Limited** 

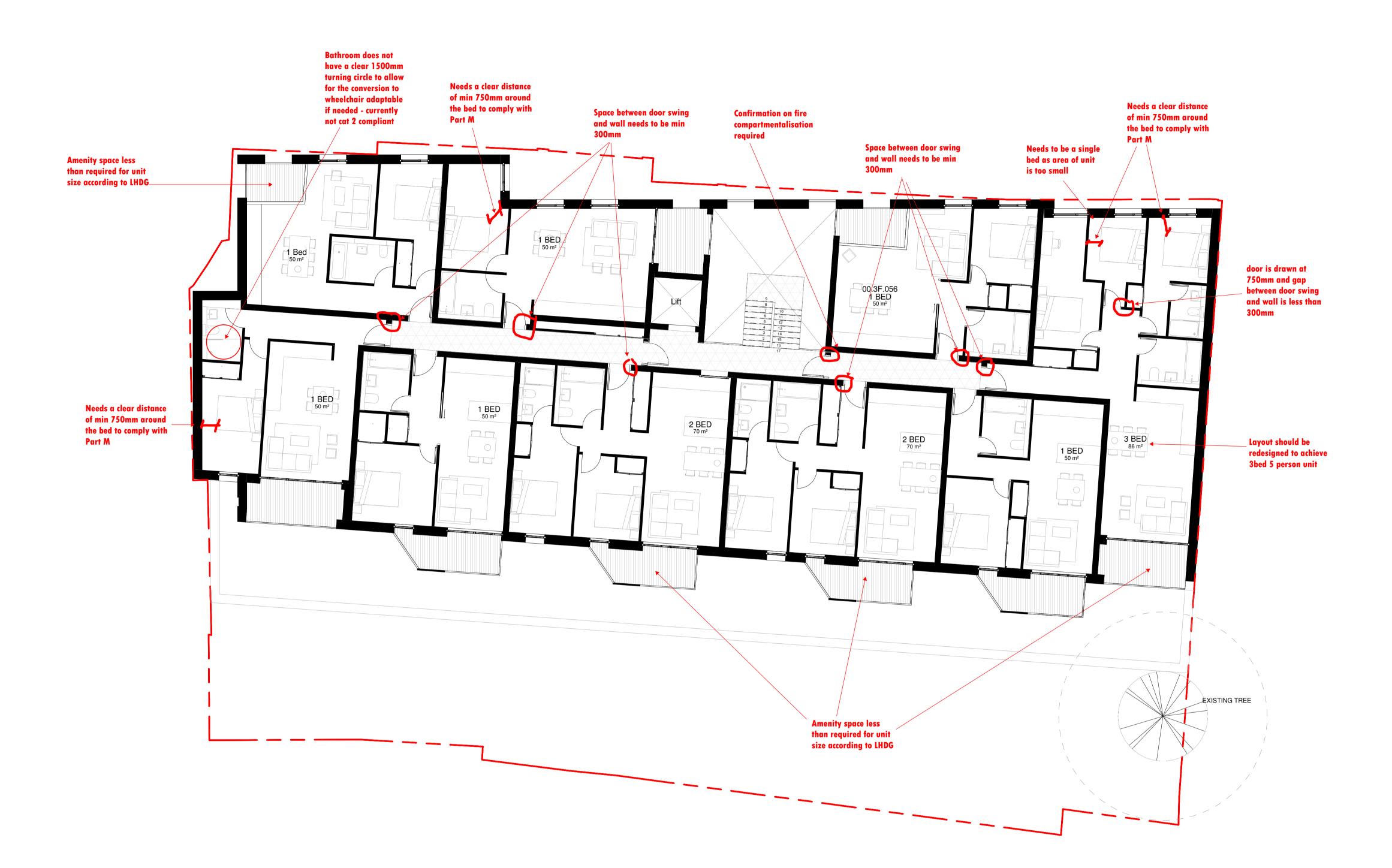
DRAWING NAME Proposed Upper Ground Floor Plan

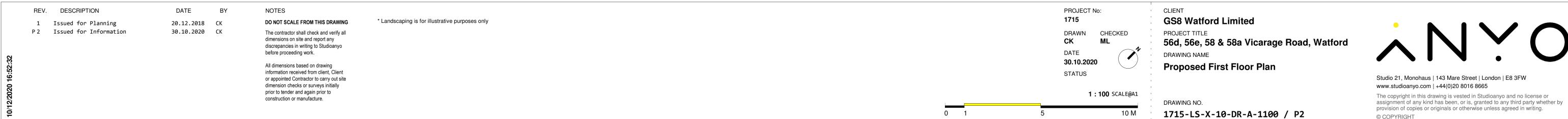


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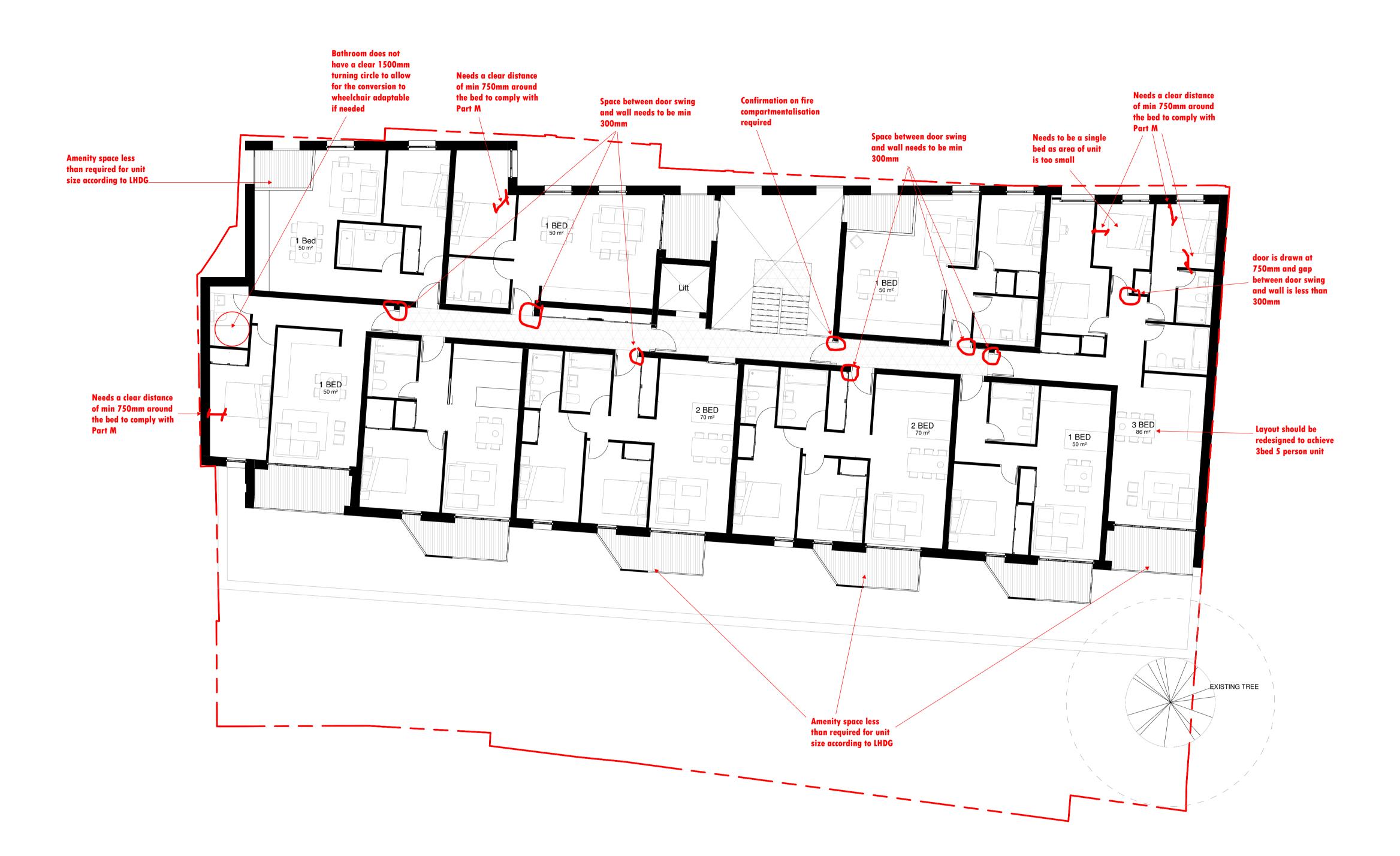
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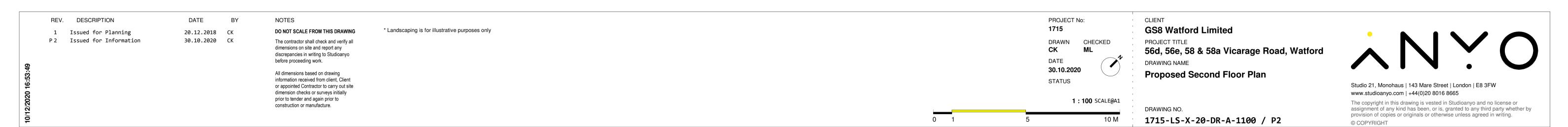
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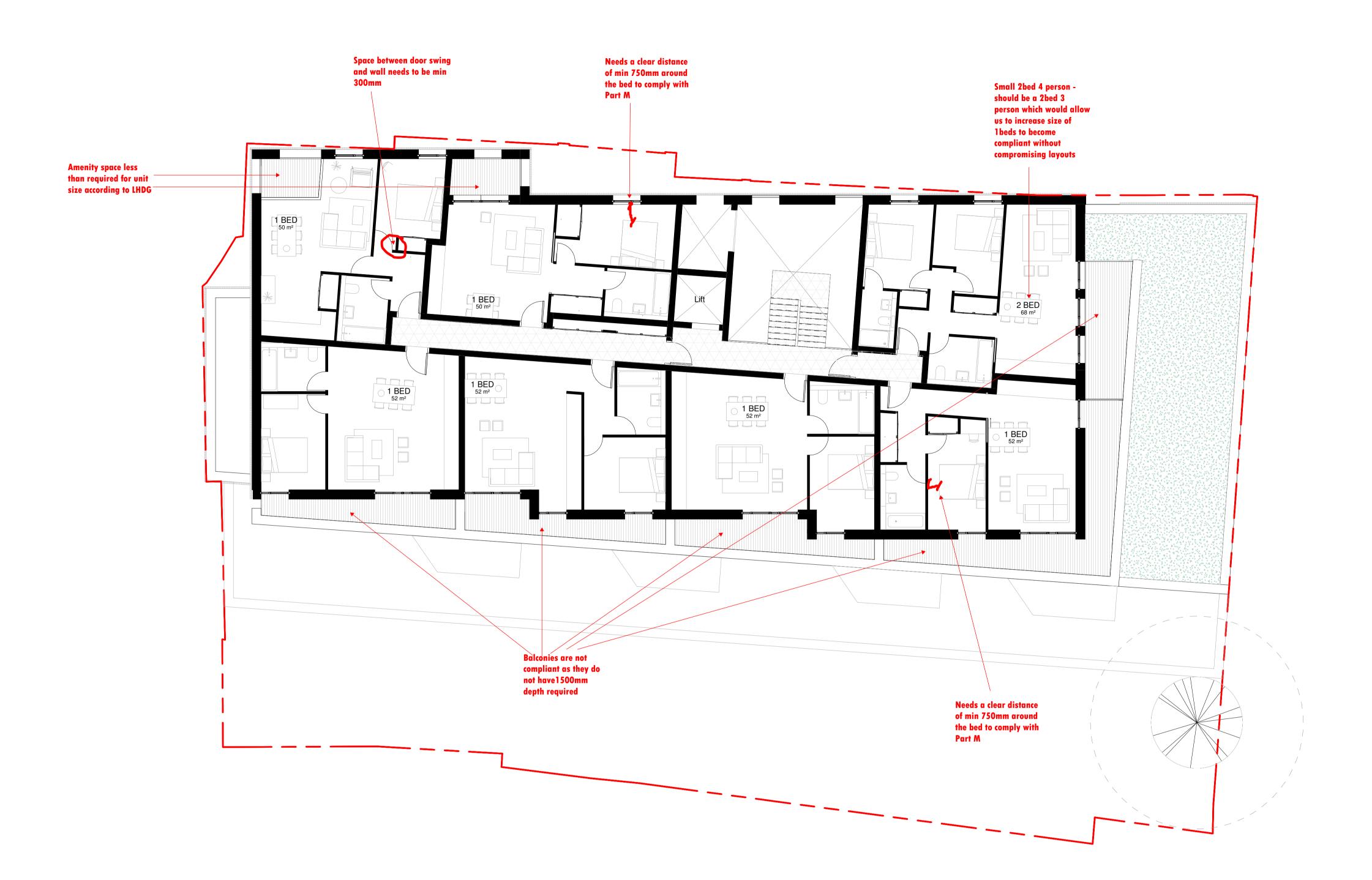


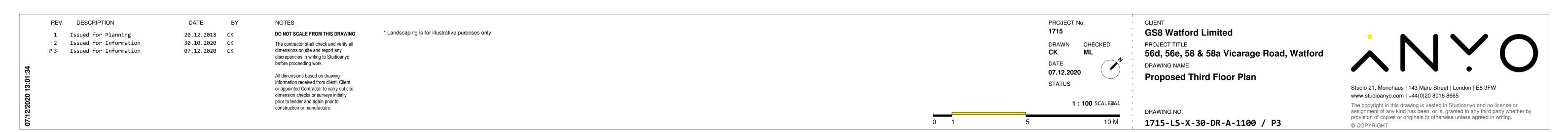


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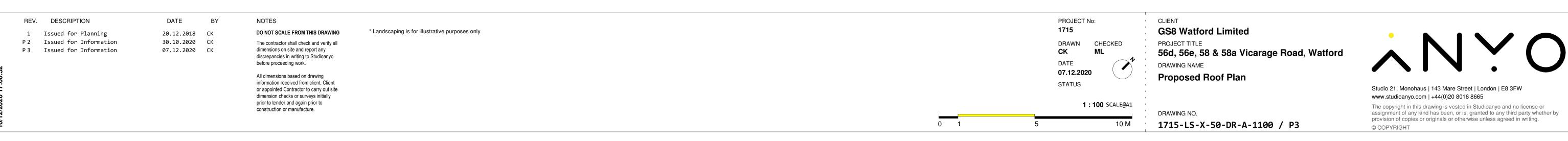






# VICARAGE ROAD







# WE LISTEN, WE PLAN, WE DELIVER

Geotechnical Engineering and Environmental Services across the UK.

























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