



## Remedial Strategy & Implementation Plan

### Forge Works

120 Heronsgate Road  
Chorleywood  
Hertfordshire  
WD3 5BB

### Prepared for:

Mr John Henderson



EPS Reference Number: UK23.6704b

Date Issued: 14<sup>th</sup> February 2024

Report Status: Issue 1



## FORGE WORKS, HERONSGATE ROAD

### NON-TECHNICAL CLIENT SUMMARY

This report provides a review of the current condition of the above referenced site, based on the findings of a previous investigation, as well as a summary of what actions are needed to reduce potential risks to future site users during forthcoming redevelopment. Pertinent findings and details are presented as follows:

- The site is located to the southwest of Heronsgate Road in Chorleywood, Hertfordshire. It currently comprises a single-storey office building at the centre with garden areas to the south, although historically the site was used as a smithy from the early 1900s until the 1970s. The proposed development includes the conversion of the existing office building into a residential dwelling. This document presents the site context, a summary of potential remedial options, an outline of the relevant regulatory requirements and then a process for the implementation of the remedial works.
- Previous intrusive investigations at the site identified a limited thickness of made ground within the garden areas, and laboratory testing identified plausible risks to future residents due to levels of lead, copper and asbestos within the shallow soils, likely associated with the historical usage. As such, the soils were deemed unsuitable for use within the residential land use setting.
- Due to the identified presence of these contaminants, a remedial control measure comprising the removal of the made ground down to **600mm** or natural soils in all proposed areas of garden/soft landscaping was recommended. The removed materials should then be replaced by certified clean imported soils. A checklist has been provided to outline the quality requirements of the soil.
- Upon completion of the source removal works, EPS, or a suitably qualified environmental consultant, will need to revisit the site to confirm the required thickness of made ground has been removed down to the natural soils and subsequently to check appropriate material has been installed, compile the necessary records and issue a Verification Report. Good practise health and safety measures to ensure ground workers are protected are also recommended.
- This report is intended to satisfy the remaining pre-commencement requirements relating to contaminated land for the planning application and should be submitted to Three Rivers District Council.

By their very nature, the above bullet points represent a simplified summary of our work and should not be relied upon to form the basis for key decisions. A full picture is provided in the following report, or alternatively give us a call and we'll talk you through it.



<b>Project Reference:</b>	UK23.6704b	
<b>Title:</b>	Remedial Strategy & Implementation Plan – Forge Works, Heronsgate Road	
<b>Client:</b>	Mr John Henderson	
<b>Date:</b>	14 <sup>th</sup> February 2024	
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<b>Status:</b>	Issue 1	

<b>Author:</b>	<b>Reviewed:</b>	<b>Authorised:</b>
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Consultant	Senior Consultant	Director

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If third parties have been contracted / consulted during compilation of this report, the validity of any data they may have supplied, and which are included in the report, have been assessed as far as possible by EPS however, EPS cannot guarantee the validity of these data. Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation.

No part of this report, or references to it, may be included in published documents of any kind without approval from EPS.

This report and its contents, together with any supporting correspondence or other documentation, remain the property of Environmental Protection Strategies Ltd until paid for in full.

The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' in house quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.



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## 1 INTRODUCTION

In January 2024, Environmental Protection Strategies Ltd (EPS) was commissioned by Wide Sky Architects, on behalf of Mr John Henderson to complete a Remedial Strategy & Implementation Plan for Forge Works, 120 Heronsgate Road, Chorleywood, WD3 5BB ('the site'). A plan showing the site location is provided as Figure 1.

The work was commissioned to support a planning application for the conversion of the existing office building (Use Class E) into a residential dwelling (Use Class C3) with associated alterations to fenestration, under a Class MA Prior Approval (Three Rivers District Council Planning Reference: 23/1073/PDM). A proposed development plan is included as Appendix A.

This report aims to appraise the current site conditions, specifically the environmental risks (expressed here as 'plausible contaminant linkages') then outline a form of remediation appropriate to mitigate the risks and ensure safe redevelopment.

### 1.1 Objective

The objective of this Remedial Strategy (and Implementation Plan) are as follows:

- a) To outline the appropriate form(s) of remediation necessary to remove unacceptable risks to end users to ensure safe development.

### 1.2 Scope of Work

To perform a limited Options Appraisal and Remedial Strategy with Implementation Plan (Remedial Method Statement) in accordance with the principles and requirements of the Environment Agency's *Land Contamination: Risk Management* (2023), the National Planning Policy Framework, DEFRA's 'Contaminated Land Statutory Guidance' and the NHBC's Standards and Technical Requirements, the following tasks were undertaken:

#### Remedial Options Appraisal:

- Review of remedial objectives
- Appraisal of available remedial methods
- Development of a Remedial Strategy

#### Implementation of the Remedial Strategy (Inc. Implementation Plan):

- Define the process of remediation
- Allocate responsibilities for remediation, including reporting arrangements
- Identify whether permits/licenses are required
- Outline forecasted timescales
- Present a Verification Plan to determine how remediation has performed in relation to strategy.

### 1.3 Limitations and Constraints

The purpose of this report is to present the Remedial Strategy & Implementation Plan for the site in terms of risks from contaminated land. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:



A Remedial Strategy has been presented based on the findings of an investigation carried out by third parties, the validity of any data others may have supplied, and which are included in the report, have been assessed as far as possible by EPS, however, EPS cannot guarantee the validity of these data. No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site.

This report does not include specific survey for the presence of either Potential Asbestos Containing Material or Japanese Knotweed at the subject site.

## 2 BACKGROUND & PREVIOUS REPORTS

The site has been subject to a previous Phase I & II Geo-Environmental Assessment by EPS in November 2023. For background and reference, it is recommended the reader review the following report which is briefly summarised below:

- EPS, 2023. *Phase I & II Geo-Environmental Assessment – Forge Works, Heronsgate Road*, EPS Ref: UK23.6704, dated 17<sup>th</sup> November 2023 –Issue 1

The results of the Phase I Desk Study stage identified a limited number of plausible contaminant linkages that have the potential to become active at the site during redevelopment works, mainly relating to the historical usage of the site as a smithy/forge where contaminated shallow soils are likely to be present. These contaminant linkages primarily comprised potential risks to future site users and construction workers by handling or ingesting contaminated made ground soils within the areas of private gardens and soft landscaping.

On this basis, intrusive investigations were conducted by EPS and comprised the formation of four hand auger boreholes to a maximum depth of 1.2m to investigate the shallow soil quality, particularly targeting areas of private gardens. Ground conditions were generally found to comprise a limited thickness of made ground described as a dark brown, clayey sand with common brick and concrete fragments, extending to 0.35m and 0.40m beneath the surface. Underlying this were materials recovered as a light brown, sandy gravelly clay, followed by a layer of orangey-brown slightly clayey gravelly sand to beyond the maximum borehole depth; both of which were interpreted as being representative of the underlying Lambeth Group bedrock. Groundwater was not encountered during the investigation.

Laboratory analysis of shallow soils sampled from across the site has identified contamination in the form of lead and copper. Four samples returned lead above the residential screening criteria with a maximum concentration of 966mg/kg identified at HA01 (0.1-0.4m) with one exceedance of copper (10,190mg/kg) also reported at HA01 (0.1-0.4m), which is unusually high as copper rarely drives a human health risk assessment. Additionally, whilst visible asbestos fragments weren't identified, detectable concentrations of asbestos (Chrysotile Fibre Bundles and Debris) were identified in one shallow soil sample (HA01 0.1m to 0.4m) and quantified at a concentration of 0.02% mass. The soils therefore fail the necessary standards for planning and are not suitable for use within the proposed residential setting and could present an unacceptable risk to future site users as well as ground workers. As such, a remedial control measure comprising the removal of made ground materials was recommended for all areas of proposed domestic gardens and soft landscaping, down to a maximum depth of 600mm, or until the natural soils are reached, followed by its replacement with clean, certified imported soils.

Risks to underlying groundwater were not identified.

### 2.1 Regulatory Context

Following the Client's submission of the Phase I & II Geo-Environmental Assessment report, comments were received from the Council's Environmental Protection Officer Mr. Ben Firmin on behalf of Watford Environmental Health Team, dated 20<sup>th</sup> December 2023, indicating that a remediation scheme and verification plan report would be required to fulfil parts iii) and iv) of Condition 1 of the Planning Application. The remedial measures presented in this strategy should

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satisfy the comments from Mr. Firmin. If any feedback is received following submission of this document, EPS will review the comments and respond/revise the strategy accordingly.

## 2.2 Sustainable Principles

Wherever a requirement for remediation is identified, the sustainability of employing any specific technology must be considered and this is included within the Options Appraisal presented in Section 4.

In the case of soil-based cover systems, often there is a tendency to opt for the benchmark 'double-dig' depth of 600mm. However, all stakeholders need to be aware of what the implications of that are, as in most cases it will also result in condemning 600mm of site-derived materials to landfill which may not be necessary. Hence in this strategy, once the made ground materials are removed, there is no need to continue excavating clean natural soils.

Provided unacceptable risks to people and the environment are avoided, all stakeholders should encourage the minimisation of landfilling soils. It is a highly unsustainable practise, taking into account space available in engineered landfill cells, inherent risks to life and emissions associated with road haulage and, particularly with topsoil, the loss of a valuable resource which performs a key role in the environment and natural cycles.



### 3 CONCEPTUAL SITE MODEL

Based on the information presented in the previous EPS report following the Preliminary Risk Assessment and the subsequent Generic Quantitative Risk Assessment, the plausible contaminant linkages which have the potential to be active or become active as a result of the proposed re-development of the site are shown below.

These linkages are associated with elevated levels of contaminants identified within the shallow made ground soils which, following a process of generic screening, suggest they are not suitable for use within modern garden areas. This end use primarily relates to residential (with homegrown produce).

Plausible risks to controlled waters were assessed and not deemed an unacceptable risk based on the results of the previous investigation.

On this basis, the contaminant linkages which require further action or control measures to ensure they do not become active as a result of the proposed development are shown below:

Source	Pathway	Receptor
Contaminated soils (Made Ground/Residual Contamination from Smithy)	Direct contact and inadvertent ingestion by eating or smoking with dirty hands.	Construction workers during redevelopment & site users
	Inhalation of fugitive dusts.	Site users
	Direct uptake and/or adherence of contaminated soil to vegetation and subsequent ingestion.	
	Direct uptake via root systems.	Plants

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which warrant mitigation to ensure unacceptable risks are not posed to receptors.

### Forge Works, Chorleywood – Illustrative Conceptual Site Model



Potential Pathways:

1. Direct contact with/ingestion of soil
2. Inadvertent contact with/inhalation of fugitive dusts
3. Plant uptake and possible ingestion

## 4 REMEDIAL OPTIONS APPRAISAL

It has been established that the risks associated with this site are driven by the quality of the shallow made ground soils, including any residual contamination from the previous land uses, and the potential for this material to pose risks to human health.

The presence of lead, copper and asbestos within the soils and its subsequent remediation is appraised in the following section. Given the modest, small-scale nature of the site and likely extent of contamination, this options appraisal has been limited to a qualitative review of the most commonly-applied solutions.

### 4.1 Shallow Made Ground Contamination

The Environment Agency's Options Appraisal Matrix (2019) highlights several possible remedial options to consider. For the presence of this type of contamination in shallow soils on a site of this scale, industry recognised approaches in this situation largely fall into two categories;

- Removal of the source of contamination, either through physical off-site removal or through reduction of contamination within the soil to safe levels through remedial action / treatment, or
- The physical separation of the material from future site users, (referred to as 'breaking the pathway') through the use of a capping strategy.

Other methods of potential treatment or stabilisation are commonly less favourable in terms of efficacy and timescale.

In this situation, considering the nature of the lead, copper and asbestos contamination found at the site, a full source removal of made ground materials in areas of soft landscaping is recommended. Clean imported soils will then be required to replace the removed made ground materials.

As such technically the clean soil layer proposed at this site will not be a 'cover system' following guidance from the BRE (2004), as there would be no residual contamination underneath. Rather it would be a source removal exercise, but the imported soils will still need to be verified to ensure they are suitable as they will be present within a sensitive garden area.

Any permanent hardstanding introduced at the site through the proposed development will break the pathways in the identified plausible contaminant linkages (associated with physical interaction with the shallow soils).

## 5 REMEDIAL STRATEGY

The Environment Agency's Land Contamination: Risk Management (2023) states a Remedial Strategy must include a clear set of remediation activities, how they will be implemented and verified.

On this basis, the contaminant linkages identified above associated with lead, copper and asbestos contamination can be broken through incorporation of the following proposed mitigation measures which represents the Remedial Strategy:

Pathway	Mitigation Measures
Soil / dust ingestion & inhalation (construction workers)	<p>Construction workers operating at the site should be advised of the potential for contact with contaminated soils within the subsurface. Appropriate health and safety precautions should also be adopted during any excavation works to avoid exposure to soils. Reference should be made to relevant health and safety guidance including the following CIRIA document: <i>R132 Guide for Safe Working on Contaminated Sites</i>.</p> <p>Care should be taken during any earthworks with appropriate health and safety measures employed to minimise any exposure to asbestos fibres during the redevelopment works. If any evidence of visually identifiable asbestos (ACM) is suspected and found to be widespread during the site development, it is recommended that all works are postponed until suitable assessment and control measures (including a Working Method Statement (WMS)) are created.</p> <p>The WMS will supplement the ground worker's risk assessment method statements with regards to handling soils containing asbestos. This would be based on guidance from CIRIA as well as the CL:AIRE /Joint Industry Working Group industry guidance on <i>Interpretation for Managing and Working with Asbestos in Soil and Construction and Demolition Materials</i>(2016).</p>
Exposure of future site users to Contaminated Shallow Soils –Soft Landscaping & Direct Uptake via Root Systems (plants)	<p>Removal of all made ground materials within all areas of proposed gardens and soft landscaping down to a maximum depth of <b>600mm</b> , or until the natural soils are reached. The previous investigation suggests made ground to extend to 400mm and therefore it is likely all of the made ground soils will be removed from the garden areas.</p> <p>There is no requirement for source removal under any buildings or areas of permanent hardstanding. All soil arisings must be disposed of under the appropriate duty of care at a suitably permitted facility, and the waste transfer documented retained by the site owner/ developer.</p> <p>All imported topsoil to replace the removed made ground should be of a good quality and suitable for use within a residential setting both in terms of chemical and physical characteristics. The quality that the cover soils must achieve align with the residential screening criteria included as Appendix B. Specific requirements of the clean topsoil are</p>



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Pathway	Mitigation Measures
Exposure of future site users to Contaminated Shallow Soils –Soft Landscaping & Direct Uptake via Root Systems (plants) Cont.	outlined within the cover soils checklist included as Appendix C. Upon completion of the source removal and installation of imported topsoil material (which typically ‘book ends’ a redevelopment of this nature), the source removal should be verified and the findings reported to Three Rivers District Council for approval.

## 6 IMPLEMENTATION OF REMEDIAL STRATEGY

The following section of this report provides a detailed scope of work for the deployment of recommended remedial measures outlined in previous chapters, with specifications of any materials required and details of any verification work needed to satisfy relevant planning conditions. This section represents the Implementation Plan for Forge Works, Heronsgate Road.

### 6.1 Source (Made Ground) Removal

It is recommended that the made ground is removed down to **600mm** or the natural soils (likely to be encountered from 400mm) and certified clean cover material is installed across the proposed gardens areas/soft landscaping to bring the soft landscaped areas up to the required level. No form of cover would be required below any future permanent hardstanding. The area requiring remediation is outlined in Figure 2.

#### 6.1.1 Source Removal Verification

Prior to the installation of the imported topsoil an EPS engineer/suitably qualified environmental consultant will visit the site to confirm by visual/physical inspection whether the made ground materials have been properly removed down to 600mm. It is acknowledged that given how tight the space available on the site is, there will be limitations to the excavations around boundaries, structures and trees whereby damage will need to be avoided.

#### 6.1.2 Imported Materials

All imported topsoil / subsoil for use within the cover soils should be accompanied by appropriate laboratory analysis to demonstrate its chemical and physical suitability for use, with the relevant screening criteria included in Appendix B. The analysis should include Total Petroleum Hydrocarbons, Asbestos, Speciated Poly-cyclic Aromatic Hydrocarbons and Metals and should also comply with the relevant physical parameters outlined within the British Standard BS 3882:2007 '*Specification for topsoil and requirements for use*'.

A checklist outlining the relevant soil requirements is outlined within the Cover Soils Checklist included in Appendix C.

#### 6.1.3 Waste Transfer Documentation

All details of any additional imported soils and exported waste soils will need to be compiled and presented and these will be documented within the Verification Report.

#### 6.1.4 Responsibilities for Remediation and Reporting

The client will appoint a groundworks contractor to undertake the excavation of contaminated soils and importation of clean soils.

EPS or a suitably qualified consultant will prepare the associated Verification Report.

#### 6.1.5 Identify whether permits/licenses are required

As no 'treatment' of soils or potential wastes is being undertaken and the material to be brought onto site will be clean, high quality, non-waste topsoil from a supplier such as British Sugar, there should be no requirement to deploy a mobile treatment permit or prepare a framework for establishing material for re-use, such as a Materials Management Plan under the CL:AIRE Code of Practise.

#### 6.1.6 *Outline Timescales*

The remediation will likely 'book-end' the redevelopment phases, with the initial excavations undertaken at the point of commencement and the instatement of clean cover soils shortly prior to completion.

### 6.2 Contingency

There is limited potential for variables to be encountered which may require a revised remedial strategy or making the current strategy unachievable. One possible scenario would be the encountering of unforeseen contamination. Such an eventuality is covered by the planning process and a method statement outlining the process, whereby EPS and the Local Authority should be notified is included as Appendix D.

### 6.3 Verification Reporting

In reference to the mitigation measures outlined above, following implementation, a Verification Report must be prepared for submission to the Council on completion.

Specifically, the final document must contain the following details:

- Description of the project
- Waste transfer documentation, including the disposal of any Asbestos Containing Material in accordance with the Control of Asbestos Regulations 2012.
- Imported soil delivery notes and analytical quality data.
- Photographic records of the made ground removal before imported soils are installed.
- Records of any contingency or deviations from original strategy.
- Records of quantities of materials imported and disposed of.

### 6.4 Land Reclamation Relief (Tax)

It is likely the Client (and landowner) would be eligible for land reclamation relief on all activities associated with the remediation of the site at the rate of x1.5 the original expenditure. Areas where this relief could be applied would include but not necessarily be limited to the following, although a detailed review of the issue should be undertaken by a suitably qualified accountant.

Relief is likely to apply to:

- EPS' fees in developing the remedial strategy and the verification works.
- The appointed contractor's fees for undertaking the muckaway.
- The disposal costs of waste soils.
- The costs of importing any clean soils.



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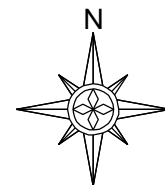
A copy of this report should be provided to the Environmental Health Department of Three Rivers District Council so that the information may be used to support planning proposals for the site.





# FIGURES





**Notes:**

1. Base map reproduced under Crown Copyright Licence Number: 100054115

Rev	Date	Drawn	Description	Ch/Kit



The Geotechnical and Environmental Engineers  
www.epstrategies.co.uk

Site  
Forge Works, 120 Heronsgate Road  
Chorleywood, WD3 5BB

Client  
Mr John Henderson

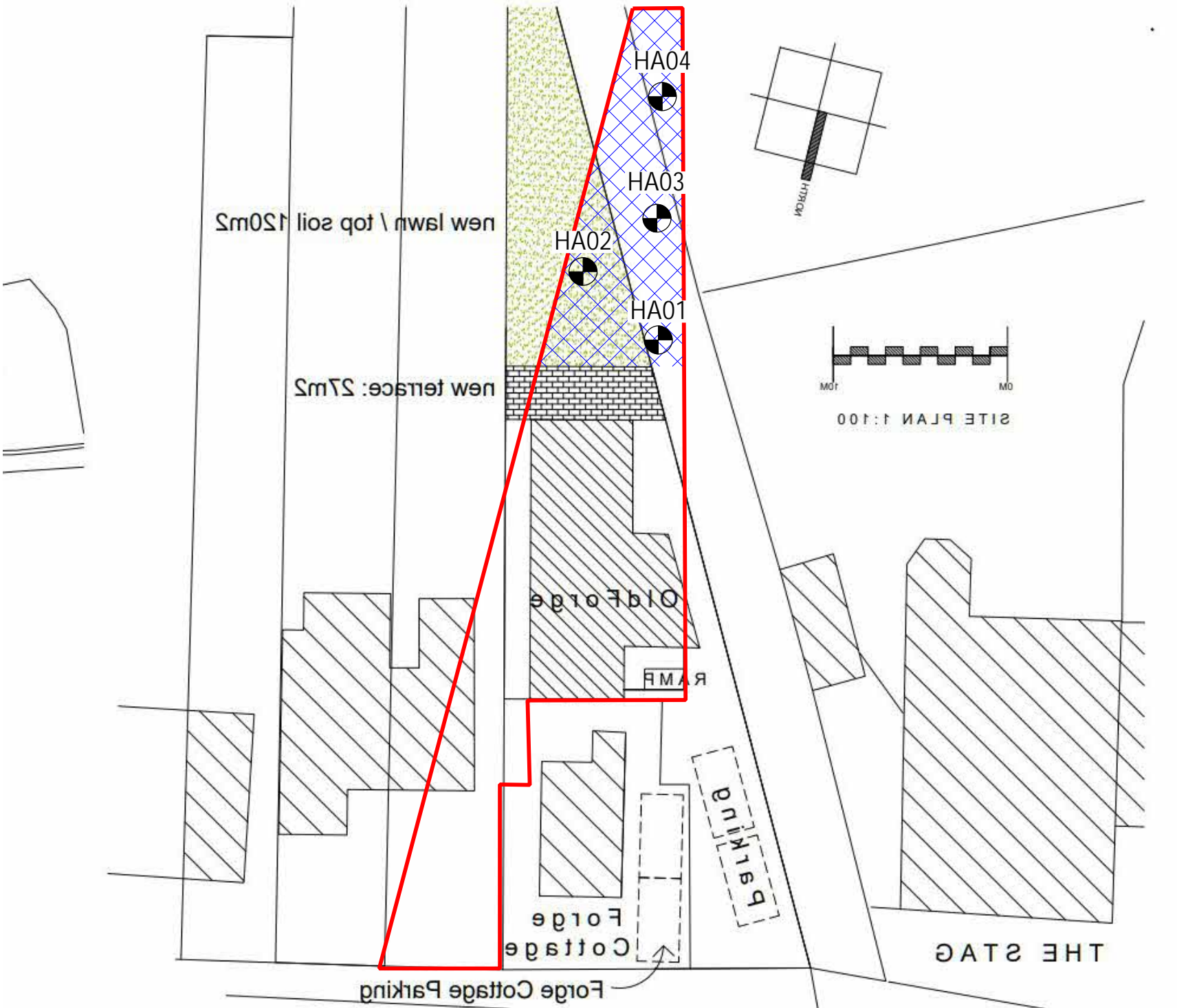
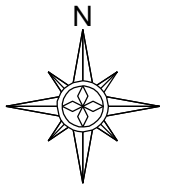
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Figure 01 - Site Location Plan

Surveyed:	-	Drawn by:	BN
Checked by:	JB	Date:	30/01/2024

Scale:	(As Shown)	Drawing Reference:	Fig_01_UK23.6704b
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**KEY:**

- SITE BOUNDARY
- AREAS OF MADE GROUND TO BE REMOVED AND REPLACED WITH CLEAN IMPORTED TOPSOILS
- BOREHOLE LOCATIONS

**Notes:**

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Rev	Date	Drawn	Description	CHK'd



The Geotechnical and Environmental Engineers  
www.epstrategies.co.uk

Site  
Forge Works, 120 Heronsgate Road  
Chorleywood, WD3 5BB

Client  
Mr John Henderson

Title  
Figure 02 - Areas Requiring Remediation

Surveyed:	-	Drawn by:	BN
Checked by:	JB	Date:	30/01/2024

Scale	(A4 Sheet)	Drawing Reference
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# APPENDICES

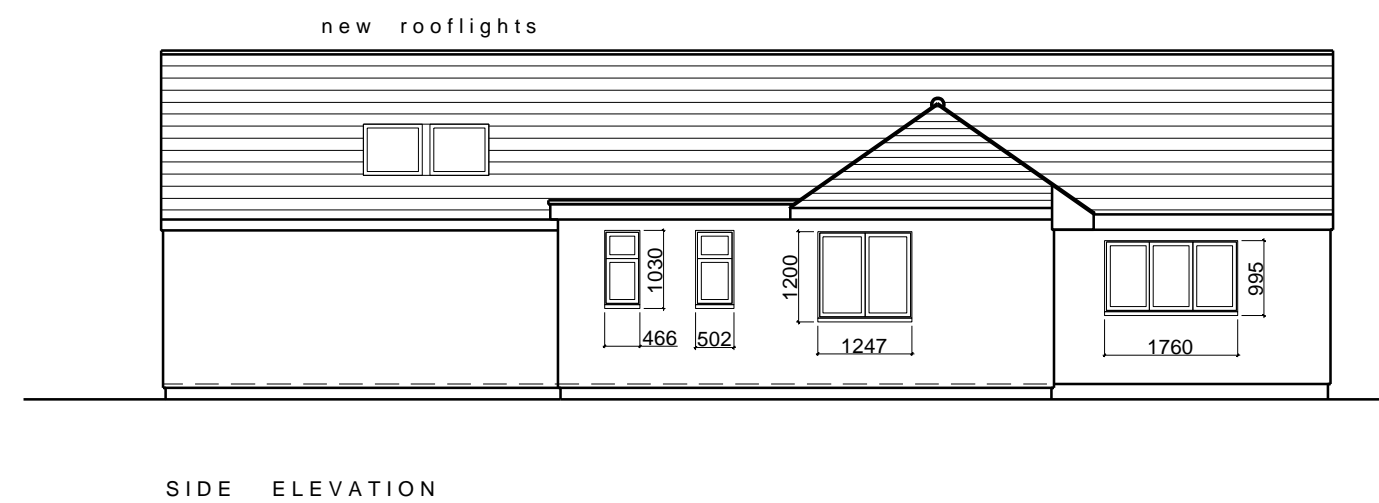
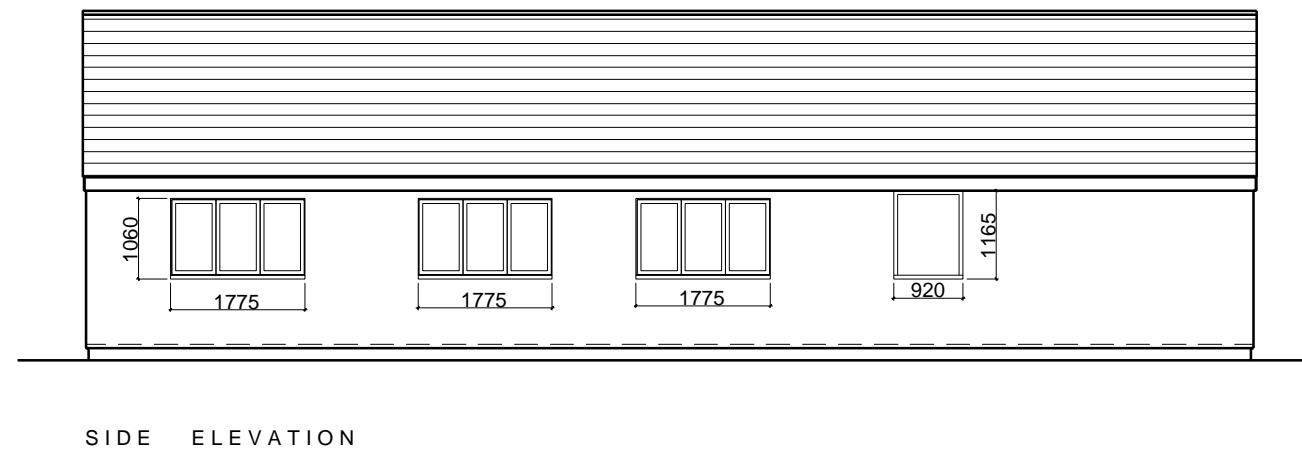
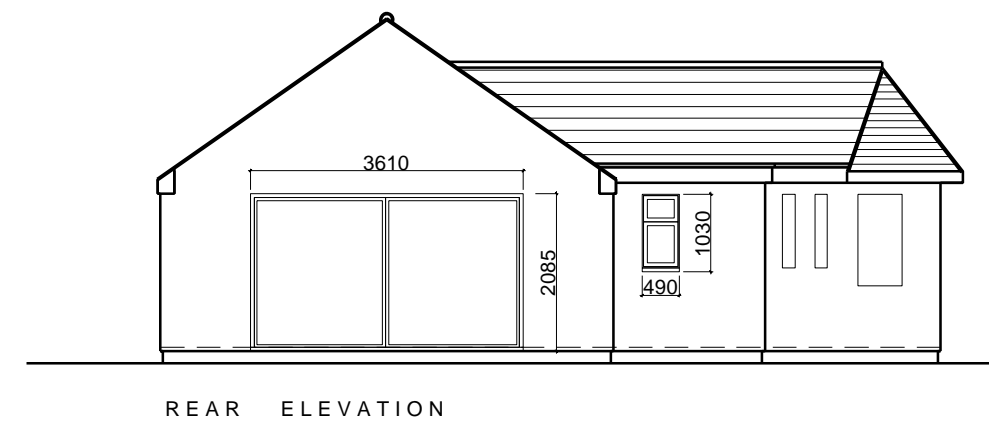
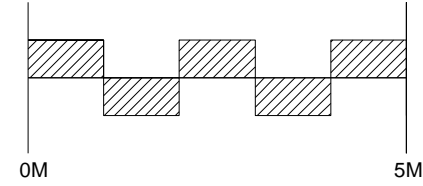
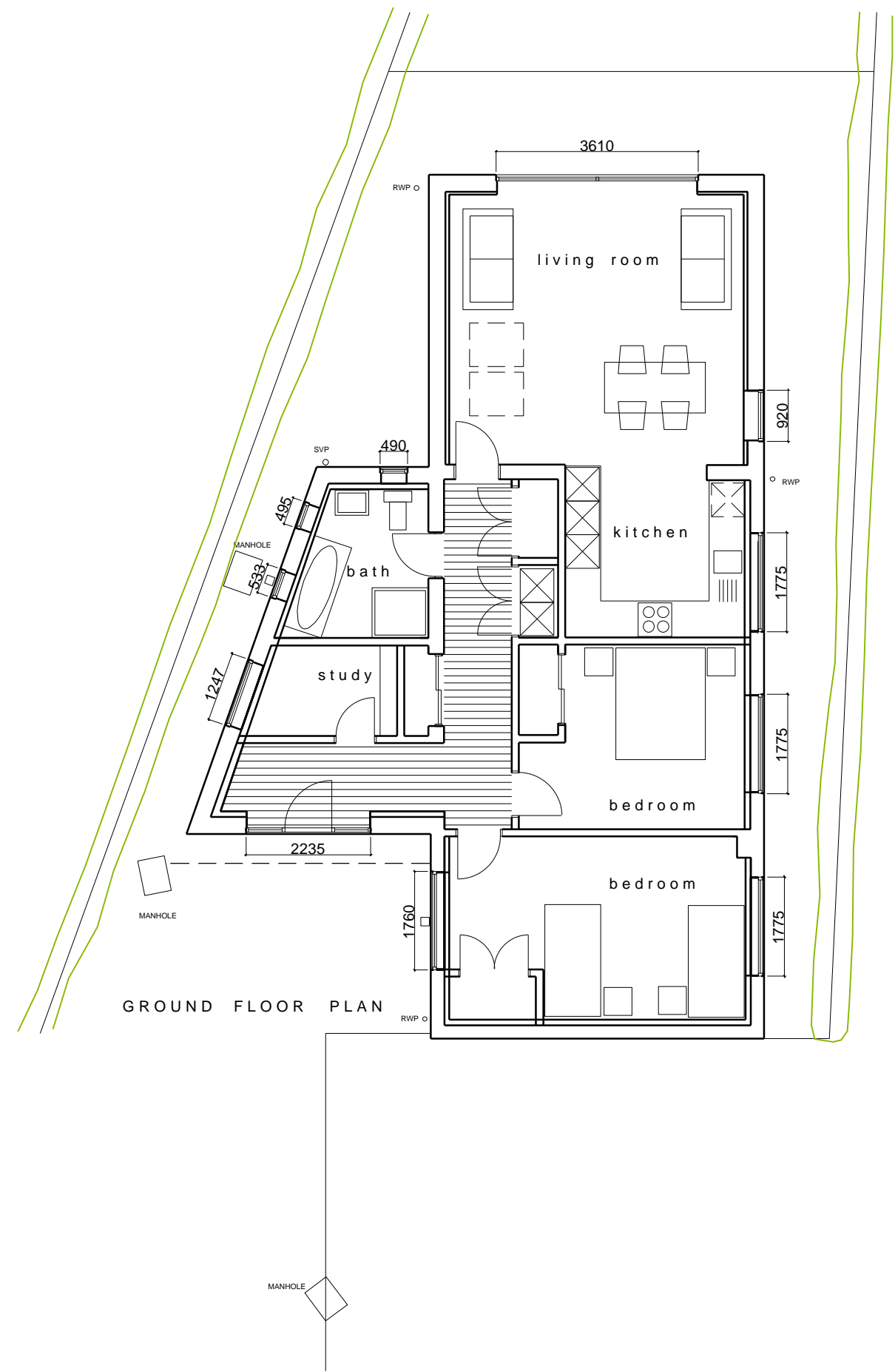


## APPENDIX A

### Proposed Development Plan

All dimensions and levels to be checked on site and any discrepancies to be reported to the architect before construction.

Written dimensions to be taken in preference to scaled dimensions.



REV	DATE	AMENI

CLIENT  
John Henderson

PROJECT  
Forge Works  
120 Heronsgate Road  
Chorleywood  
Herts

DRAWING  
CONVERSION OF OFFICE TO DWELLING  
Proposed Plans and Elevations

DATE  
JULY 2023  
DRAWN  
AW  
DATE  
1:100 @ A2  
D'  
JOHN HENDERSON DESIGN

DRAWING NO.  
0404.06

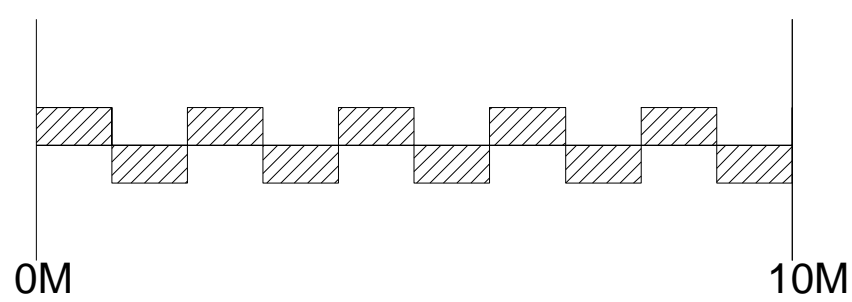
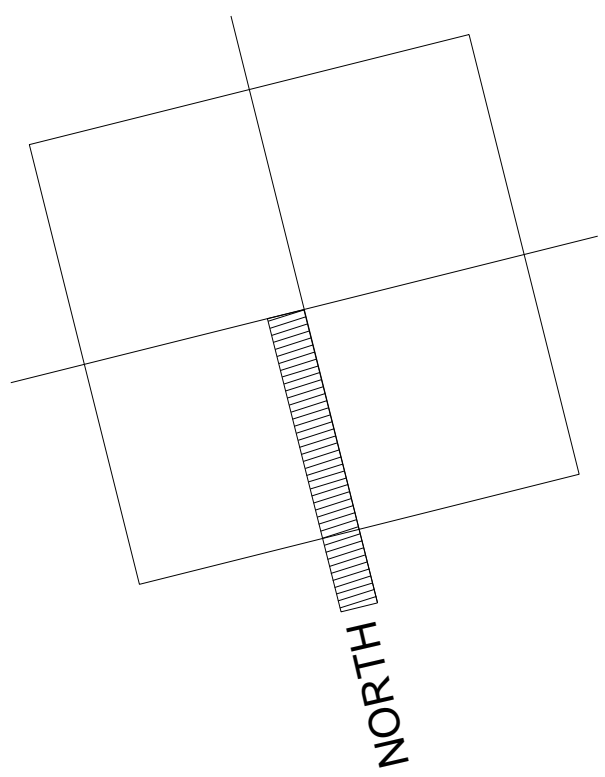
WIDE SKY ARCHITECT

4 WINDMILL WOOD, AMERSHAM, BUCKS. HP6 5QY

T/F: 01494 725567

All dimensions and levels to be checked on site and any discrepancies to be reported to the architect before construction.

Written dimensions to be taken in preference to scaled dimensions.



SITE PLAN 1:100

new lawn / top soil 120m<sup>2</sup>

new terrace: 27m<sup>2</sup>

Old Forge

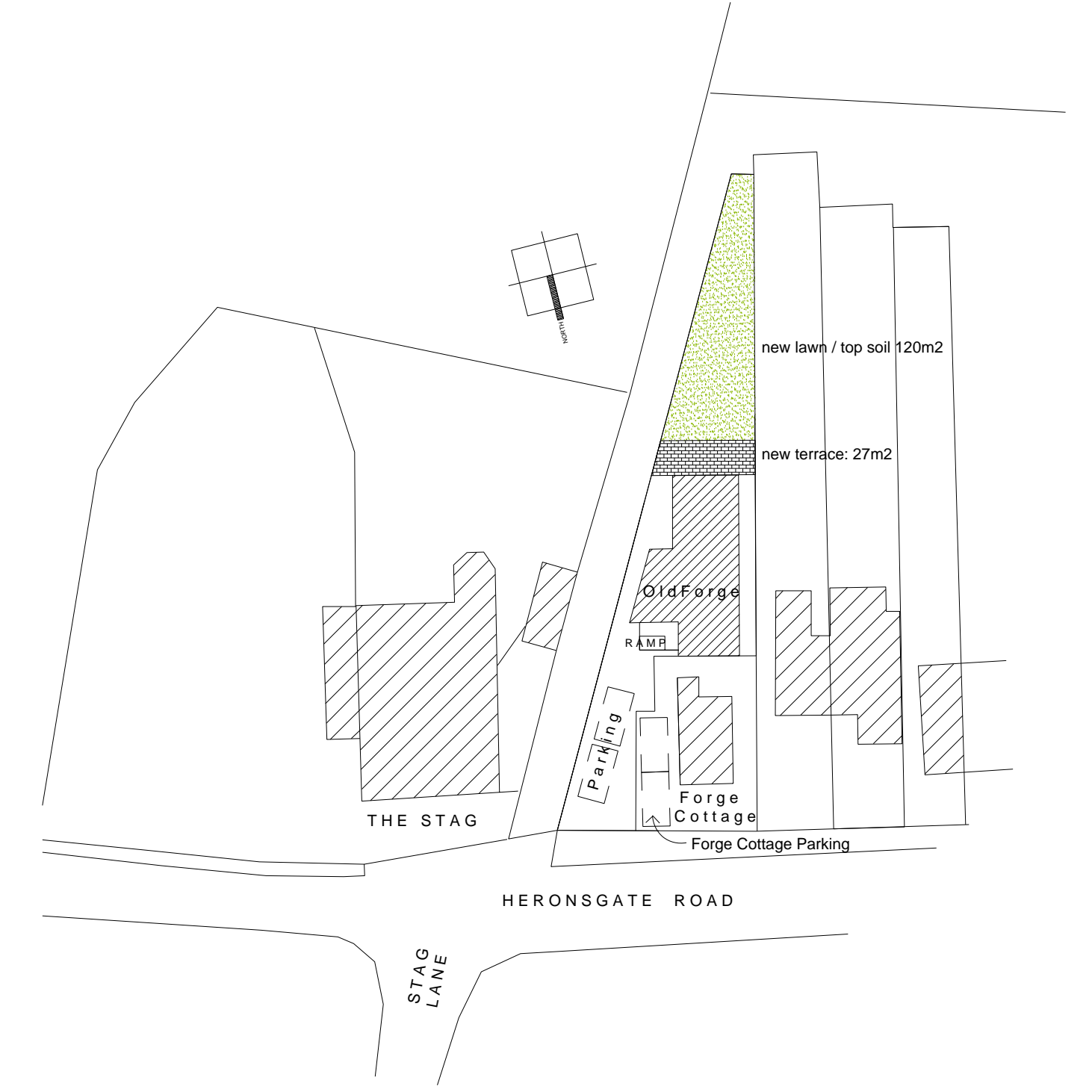
RAMP

Parking

Forge Cottage

Forge Cottage Parking

THE STAG



A 15 JANUARY 2024 2 CAR PARKING SPACES ADDED TO FORGE COTTAGE

REV	DATE	AI

CLIENT  
John Henderson

PROJECT  
Forge works  
120 Heronsgate  
Chorleywood  
Herts

DRAWING  
CONVERSION OF OFFICE TO DWELLING  
Site Plan

DATE  
NOVEMBER 2023 1:500 and 1:100

DRAWN  
AW HENDERSON B REGS

DRAWING NO. 0404.38A

WIDE SKY ARCHITECTS

4 WINDMILL WOOD, AMERSHAM, BUCKS. HP8 5DY  
T/F: 01494 725567



## APPENDIX B

### Residential Screening Criteria





## EPS Generic Quantitative Risk Assessment

### Generic Screening Criteria (C4SLs) - All Land Uses

Contaminant	Soil Targets					
	Residential		Allotments	Commercial	Public Open Spaces	
	With Home Grown Produce	Without Home Grown Produce			Residential	Parks
Unit	mg/kg					
Arsenic	37	40	49	640	79	168
Benzene	0.87	3.3	0.18	98	140	230
Benzo(a)pyrene	5	5.3	5.7	76	10	21
Cadmium	26	149	4.9	410	220	880
Chromium (VI)	21	21	170	49	23	250
Lead	200	310	80	2330	630	1300
Chloroethene (Vinyl Chloride)	0.017	0.029	0.0058	2.2	7.8	19
Trichloroethene (TCE)	0.043	0.045	0.16	3.4	79	69
Tetrachloroethene (PCE)	1.6	1.6	11	130	3400	2500

#### Notes:

Targets for Human Health have been taken from the publicly available Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination issued by DEFRA/CL:AIRE in December 2013 and May 2021.

Within the modelling for C4SLs, a Soil Organic Matter content of 6% has been used. Reference to site-specific data should be made where possible.

The C4SLs for the contaminant benzene along with the three chlorinated solvents are the most susceptible to changes in SOM.

May-23

## EPS Generic Quantitative Risk Assessment - Residential Land Use

Contaminant	Soil Targets		
	Human Health	Controlled Waters	
		Surface Water	Groundwater
Unit	mg/kg		
Arsenic	See C4SL	n/c	n/c
Cadmium	See C4SL	n/c	n/c
Chromium III	910	n/c	n/c
Chromium VI	See C4SL	n/c	n/c
Copper	2400	n/c	n/c
Mercury (elemental)	1.2	0.085	1.22
Nickel	180	n/c	n/c
Lead	See C4SL	n/c	n/c
Selenium	250	n/c	n/c
Zinc	3700	n/c	n/c
Benzene	See C4SL	0.064	0.0064
Toluene	130	1.33	12.6
Ethylbenzene	47	0.77	11.5
Xylene (para)	56	1.18	19.6
MTBE#	49	4.41	0.026
Benzo(a)Pyrene	See C4SL	n/c	n/c
Naphthalene	2.3	0.11	0.11
Aliphatic C5-C6	42	4.06	0.81
Aliphatic C6-C8	100	17.8	3.57
Aliphatic C8-C10	27	n/c	n/c
Aliphatic C10-C12	130(48)*	n/c	n/c
Aliphatic C12-C16	1100(8.48)**	n/c	n/c
Aliphatic C16-C35	65000 (8.48)**	n/c	n/c
Aromatic C8-C10	34	6.71	1.34
Aromatic C10-C12	74	10.6	2.13
Aromatic C12-C16	140	21.2	4.23
Aromatic C16-C21	260	n/c	n/c
Aromatic C21-C35	1100	n/c	n/c
Tetrachloroethene	See C4SL	0.24	0.24
Trichloroethene	See C4SL	0.13	0.13
cis-1,2 Dichloroethene		0.21	0.21
Vinyl Chloride	See C4SL	0.0012	0.0012

Contaminant	Groundwater Targets		
	Human Health	Controlled Waters	
		Surface Water	Groundwater
Unit	µg/l		
Arsenic	n/c	50	10
Cadmium	n/c	2.5#	5
Chromium III	n/c	4.7	50
Chromium VI	n/c	3.4	
Copper	n/c	93.1#	2000
Mercury (elemental)	1.1	1	1
Nickel	n/c	14.8#	20
Lead	n/c	27.7#	10
Selenium	n/c	10	10
Zinc	n/c	373#	3000
Benzene	210	10	1
Toluene	230,000	74	700
Ethylbenzene	10,000	20	300
Xylene (para)	9,900	30	500
MTBE#	83,000	2600	15
Benzo(a)Pyrene	n/c	0.005 (0.00017)	0.01
Naphthalene	220	2	2
Aliphatic C5-C6	1,900	50	10
Aliphatic C6-C8	1,500	50	10
Aliphatic C8-C10	57	50	10
Aliphatic C10-C12	37	50	10
Aliphatic C12-C16	n/c	50	10
Aliphatic C16-C35	n/c	50	10
Aromatic C8-C10	1,900	50	10
Aromatic C10-C12	6,800	50	10
Aromatic C12-C16	39,000	50	10
Aromatic C16-C21	n/c	50	10
Aromatic C21-C35	n/c	50	10
Tetrachloroethene	34	10	10
Trichloroethene	5.7	10	10
cis-1,2 Dichloroethene	130	50	50
Vinyl Chloride	0.62	0.5	0.5

### Notes:

f = Oral, dermal and inhalation exposure compared with oral HCV N/C = Not Calculated

\* = S4UL exceeds vapour saturation limit (in brackets)

\*\* = S4UL exceeds solubility saturation limit (in brackets)

n/c = not calculated. Under normal conditions contaminant exhibits low solubility /volatility, therefore risks from leaching and or vapour pathways are considered low.

# To establish suitable compliance criteria for Surface Water review of baseline groundwater quality in England and Wales was completed following research reported in Shand, P, Edmunds, W M, Lawrence, A R, Smedley, P L, and Burke, S, 2007. The natural (baseline) quality of groundwater in England and Wales. British Geological Survey Research Report No. RR/07/06. Where compliance criteria was found below the 97.7 percentile of baseline value, the latter was adopted as GAC.

### Soil Targets

Targets for Human Health have been taken from S4ULs 'Suitable For Use Levels for Human Health Risk Assessment' – LQM and CIEH (2014) derived using standard sandy loam soil with 1% SOM, except (#) = EIC/AGS/CL/AIRE GAC 'Soil Generic Assessment Criteria' (2010). For sites where ground conditions differ significantly from sandy loam or site-specific SOM and pH are available, the generic human health targets may be revised.

Targets for Controlled waters have been derived using EA Remedial Targets Worksheet (v3.1) - using standard Sandy Loam ground conditions as described in Science Report SC050021/SR3, assuming no degradation for a 10m compliance distance with criteria of EQS or UKDWS for Surface Water and Groundwater respectively (see notes for GW targets).

### Groundwater Targets

For Surface Water, targets have been taken as Freshwater EQS where available. For MTBE Predicted No Effect Concentration (European Risk Assessment Report, 2002) was used. For individual TPH fractions, in absence of UK EQS, a 5 times multiplier of UKDWS has been taken.

For Groundwater, targets have been taken as UKDWS where available. In the absence of UK targets internationally recognised criteria were adopted. For MTBE, WHO taste threshold has been adopted.

Targets for Human Health have been taken from Society of Brownfield Risk Assessment (SoBRA) 'Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater' - Version 1.0, February 2017, derived using sandy soil and 1%SOM. GAC were set up assuming source at 50cm below typical ground bearing slab of 15cm thickness. GAC were derived for vapour pathways only. For sites where ground conditions, or differ significantly from described above, the generic human health targets may be revised.



## APPENDIX C

### Cover Soils Checklist



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## ADVISORY NOTE

### SOILS FOR USE IN COVER SYSTEMS

This note applies where there is a need for a control measure in the form of a defined thickness of clean soil to be used in gardens and soft landscaped areas in order to reduce risks from underlying contamination (a 'cover system'). Where a specific thickness has been presented, it is what EPS consider sufficient provided the soil forming the cover system is good quality, as it is assumed that over time this soil will become intermixed with the underlying soils and therefore needs to have the necessary 'dilution' effect. The aim being that an acceptable reduction in exposure to contamination is achieved, rather than absolute prevention.

These simple cover systems are designed in general accordance with the BRE 2004 guidance '*Cover Systems for Land Regeneration, Thickness of Cover Systems for Contaminated Land*'. In many cases guidance from a Local Planning Authority or NHBC/Approved Inspector may also apply and need to be taken into account. In most cases, to design the cover system EPS have to assume a certain quality of cover soils in advance. In these circumstances, we utilise what we consider to represent 'good quality soil' in that the soil could never be considered 'contaminated' but is also pragmatic and does not represent an unrealistic or unsustainable objective for much of the soils in the UK. In numerical terms, this standard typically equates to soil containing contaminants at around 25% of their adopted screening values in the risk assessment.

For the cover system itself, EPS would usually carry out a verification process of your site to demonstrate the control measure has been implemented as intended to satisfy all interested parties such as planning authorities, the NHBC and the future property owner. To document this process, EPS will prepare a Verification Report. If you wish for EPS to do this, we will need the following points confirmed relating to the soils preferably before they are installed in gardens.

If there are any queries, please contact EPS before purchasing any soil.

#### EPS Contact Details:

Tel: 01954 710666

Email: [info@epstrategies.co.uk](mailto:info@epstrategies.co.uk)



Pre-Verification Cover System Checklist		Yes?
Soil Source	The soil must not be a waste. Has it been confirmed that the soil is not a waste and has never been deemed as such in the past?	
	Has the source of the soil been provided?	
	Have all the delivery notes confirming the source, volume and type been provided for all that is to be used? Where suppliers such as British Sugar are used, the soils should be delivered direct to site (not via an intermediary depot).	
Soil Quality	The soils are free of invasive plant species such as Japanese Knotweed and have not been sourced from an affected area?	
	Do the soils look clean and of a high quality? I.e. the soil must not have an odour or contain any visual evidence of contamination, including oils, asbestos, glass, plastic, rubble, metal, ash, sharp objects or tarmac/ bitumen?	
	Testing to 'BS 3882:2015 <i>Specification for topsoil and requirements for use</i> ' is preferable but generally not essential for public health regulation, provided you can confirm the soils comply with the above points, are suitable for their intended purpose and will provide an adequate growing medium?	
	Has the soil been chemically tested prior to it arriving at site?  Any soil test results presented to EPS by a third party must be current and clearly relate to the soil used, i.e. the testing must generally be dated within 6 weeks of delivery. The quantity of testing will be dependent on how much confidence is generated in the quality of the material, as well as any specific local regulatory requirements. If the soil is clean soil from an established source such as British Sugar, the testing they provide at source may be sufficient alone without further testing (by EPS).  For other soils, EPS can advise on the likely testing frequencies but as a rule of thumb, anticipate at least one sample per average-sized plot. The testing would usually comprise the following: Heavy Metals, Poly Aromatic Hydrocarbons, Asbestos and Total Petroleum Hydrocarbons at an accredited lab. If adequate testing has not been completed, then EPS will need to test it from stockpiles prior to installation. Installing the soils into gardens without any testing data is not advised, as it may need to all be removed later.	
Cover Thickness	Are all excavations ready which will allow the necessary thickness of soils to be installed?	
	If yes, can you provide waste transfer documentation for any excavated soils?	



## APPENDIX D

### Method Statement for Unexpected Contamination



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## METHOD STATEMENT

### ACTIONS TO BE TAKEN IN THE EVENT OF DISCOVERING UNEXPECTED CONTAMINATION DURING INTRUSIVE GROUNDWORKS

If at any point during intrusive groundworks at a site, evidence of unforeseen contamination is encountered in the form of significant noxious odours, discolouration, or instability within soils or sheen/ discolouration in groundwater, the following actions will be taken:

Intrusive works in the immediate area of the impacted ground will be suspended and the continuation of work in other areas of the site will be considered within the context of the site specific health & safety plan.

Environmental Protection Strategies Ltd (EPS) will be contacted and appraised of the situation so that arrangements can be made to characterise the impact and determine what action may be necessary in addition to the scheduled site works. Where possible / health & safety plan permits, digital photographs of the impacted ground will be taken and emailed to EPS at the address below to assist in the initial assessment


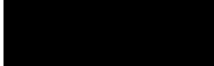
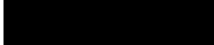
It may well be necessary for EPS to attend site to undertake visual inspection and obtain samples for field and/or laboratory analysis, although the actions taken will be dependent on the nature of what is encountered

In cases where EPS consider the unforeseen contamination likely to pose a significant risk of significant harm to adjacent site users or local environmental receptors, the local authority and the Environment Agency will be informed of the situation and the actions being taken

Once appropriate action has been agreed and undertaken, a written summary will be produced by EPS for submission to the Local Authority, (and where relevant, the Environment Agency) in accordance with planning requirements. The submission will include details of work undertaken, analytical results of investigative and validation samples obtained and conclusions and recommendations for any further actions considered necessary

Where regulatory bodies have been involved, site works should only recommence following their agreement and in all cases should only recommence when the site manager considers it safe to do so within the context of the site specific health & safety plan.

#### EPS Contact Details:

Marcus Bell	Associate Director	Tel:	
Will Evans	Director	Tel:	
Steve Bullock	Director	Tel:	

Email: [info@epstrategies.co.uk](mailto:info@epstrategies.co.uk) (Automatically forwarded to the above and office-based personnel)



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