

REMEDIATION STRATEGY

JACQUES WAY, WREXHAM

REC REFERENCE: 108157P3R1

REPORT PREPARED FOR: CASTLEMEAD GROUP LIMITED

DECEMBER 2019



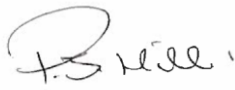
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QUALITY ASSURANCE

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TABLE OF CONTENTS

1.0	INTRODUCTION	1
1.1	Background	1
1.2	Objective and Scope of Works	1
1.3	Previous Reports	1
1.4	Stakeholders	2
1.5	Limitations and Confidentiality	2
2.0	SITE SETTING	3
2.1	Site Location and Description	3
2.2	Ground Conditions	3
2.3	Hydrogeology and Hydrology	3
2.4	Human Health Risk Assessment - Soils	4
2.5	Ground Gas	4
2.6	Revised Conceptual Site Model	5
3.0	REMEDIAL STRATEGY	6
3.1	Remedial Options	6
3.1.1	Clean Cover System	6
3.1.2	Removal of Made Ground materials	6
3.2	Validation Site Won and/or Imported Materials	7
3.2	Waste Sampling and Frequency	7
3.3	Previously Unidentified Contamination	8
3.4	Validation and Record Keeping	9
APPENDICES		
Appendix I	Limitations	
Appendix II	Glossary	
Appendix III	Drawings	
	Drawing No 108157 – Site Location Plan	
	HDS Architectural Services – Site Plan as Proposed – JWA/PD/00 revision I	
	Drawing No 108157-003 Exploratory Hole Location Plan (trial pitting)	
Appendix IV	REC remediation / validation criteria	



1.0 INTRODUCTION

1.1 Background

Resource and Environmental Consultants Ltd (REC) was commissioned by Castlemead Group Limited ("the Client") to prepare a Remediation Strategy for Jacques Way, Wrexham (hereinafter referred to as the 'site').

The proposed development at the site comprises the construction of residential dwellings. A proposed development plan (HDS Architectural Services – Site Plan as Proposed – JWA/PD/00 revision I) is shown in Appendix III.

1.2 Objective and Scope of Works

The site is subject to the conditions as defined in Wrexham County Borough Council Planning Application, Code Number WRO P/2018/0898, dated 07/06/2019. The following conditions relate to site investigations and remediation:

9) *No development shall take place until a phased site investigation of the nature and extent of contamination has been carried out and submitted to and approved in writing by the Local Planning Authority. If any contamination is found during the site investigation, no part of the development shall commence until a scheme specifying the measures that will be taken to remediate the site to render it suitable for the development hereby permitted has been submitted to and approved in writing by the Local Planning Authority. The site shall thereafter be remediated in accordance with the approved scheme. If during the course of development any contamination is found that has not been identified in the site investigation, no further development shall take place on those parts of the site where that contamination has been found until an additional scheme of remediation has been submitted to and approved in writing by the Local Planning Authority for those parts of the site. The relevant parts of the site shall thereafter be remediated in accordance with the additional scheme of remediation.*

10) *Each part of the site subject to the remediation under the scheme(s) approved as part of condition 09 shall not be occupied / used until a Validation Report has been completed in respect of that part of the site and submitted to and approved in writing by the Local Planning Authority.*

The objective of this document is to identify feasible remedial techniques and the process for validation of the implemented scheme, in accordance with the requirements of conditions 9 and 10.

1.3 Previous Reports

REC has previously produced the following reports for the site:

- ▶ Geo-Environmental Assessment, REC Reference: 102904p1r1, dated October 2018; and
- ▶ Phase II Geo-Environmental & Geotechnical Site Investigation, REC 108157p2r0, dated November 2019.



1.4 Stakeholders

Table 1.1 summarises the key companies and agencies involved in the development:

Table 1.1 Stakeholders

Function / Interest	Stakeholder
Land Owner / Developer	Wales & West Housing Association
Geo-Environmental Consultant	REC Ltd
Principal Contractor	Castlemead Group Limited
Local Planning Authority	Wrexham County Borough Council

1.5 Limitations and Confidentiality

The full limitations of this report are presented in Appendix I. REC has prepared this report solely for the use of the Client and those parties with whom a warranty agreement has been executed, or with whom an assignment has been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from REC.



2.0 SITE SETTING

2.1 Site Location and Description

Table 2.1 Site Location Details

Site Address	Land off Jacques Way, Wrexham, LL11 2BY
National Grid Reference	332859, 350642
Site Area	0.51 hectares

The site is located to the south of Jacques Way in Wrexham, and is currently an area of unused land with a known historic use as a scrapyard. Active railway tracks are to the east, west and south of the site, and a Premier Inn is directly to the north. There are occasional areas of dense vegetation containing Japanese Knotweed, particularly towards the western and southern site boundaries. Two spoil heaps were identified in the north west area of the site, in front of an entrance to site. Slight changes in elevation can be seen in the western and southern areas where the site slopes slightly towards the railway track.

2.2 Ground Conditions

Ground investigation undertaken by REC generally confirm the published geology and a summary of previous findings is provided below.

Made Ground

Made ground was encountered at every location and found to be relatively homogeneous across the site, varying from very gravelly sand to slightly clayey gravelly sand, with varying degrees of cobble content. Gravel consisted of angular to sub rounded fine to coarse brick and concrete. Cobbles of brick, concrete and mudstone are present. The Made Ground was also found to contain slate, plastic, glass and metal.

The thickness of Made Ground where proved was typically between 5.00m bgl (CP102) and 5.80m bgl (CP103). Shallow Made ground was identified in TP105 to a maximum depth of 2.80mbgl.

Glaciofluvial Deposits

Glaciofluvial deposits were encountered under the Made ground in all. These were encountered to a maximum depth explored depth of 19.95m bgl (CP103) and typically consisted of gravelly silty clays, dense sand and gravels and clayey gravelly sands.

Eturia Formation

Bedrock was not encountered at any location.

2.3 Hydrogeology and Hydrology

Table 2.2 below identifies the hydrogeological setting for the site:



Table 2.2 Summary of Geological and Hydrogeological Data

Geological Unit	Classification	Aquifer Classification	Permeability	Sensitivity
Superficial	Glaciofluvial Sand and Gravel and Alluvium	Secondary A	Moderate	Moderate
Bedrock	Etruria Formation	Secondary A	Moderate	Moderate

The River Gwenfro exits from a culverted section approximately 10m from the south western boundary of the site, flowing towards the west.

2.4 Human Health Risk Assessment - Soils

Within the REC Phase II Geo-Environmental Assessment (Report No LA108157p2r0) long term (chronic) risk to human health was assessed by utilising appropriate and conservative generic assessment criteria (GAC) to determine whether potentially unacceptable risks were present.

The results of this direct comparison indicated that the screening values have been exceeded for lead in six samples and PAHs in five samples, and asbestos in WS102, WS103, WS104 and TP105. All samples were retrieved from shallow Made Ground. Results are indicative of potential widespread contamination.

All five samples of asbestos were submitted for quantification with all results reported as <0.001 % (the limit of detection) chrysotile fibres. However, dealing with these materials should fall under the Control of Asbestos Regulations 2012.

Lead concentrations ranged from 280 – 650 mg/kg and are therefore notably elevated above the screening value of 200 mg/kg.

Benzo(b)fluoranthene concentrations ranged from 3.3 to 4.9 mg/kg and are therefore consistent across the site and exceed the screening value of 3.3 mg/kg.

2.5 Ground Gas

The potential impact on the development from ground gases has been assessed with reference to standards and guidelines published within BS 8485:2015+A1:2019. Made Ground was generally granular with inclusions of brick, slate and tile and very little ashy material and therefore is unlikely to generate hazardous ground gases.

Four monitoring visits were undertaken at periods of both rising and falling pressure. Based on the results obtained, the site is characterised as Characteristic Situation 1 (CS1) in accordance with BS8485:2015. As such, no gas protection measures are considered necessary.



2.6 Revised Conceptual Site Model

The results of the Phase II ground investigation and laboratory analyses identified an outstanding potential risk from PAHs, lead and detection of asbestos fibres within the Made ground with respect to future residential receptors.

Based on ground gas monitoring, no risk from ground gases was identified onsite. As such, no further measures are deemed necessary.

No visual or olfactory evidence of contamination was noted that is likely to impact groundwaters and no ongoing source of contamination was recorded that could leach contaminants to groundwater.



3.0 REMEDIATION STRATEGY

The remediation strategy is based on the redevelopment of the site for a residential development with private gardens. The key points are:

- ▶ A potential risk exists from PAHs, lead and detection of asbestos fibres within the Made ground; and,
- ▶ Material that is to be disposed off site should be classified as hazardous/non-hazardous to comply with waste regulations; and

3.1 Remedial Options

3.1.1 Clean Cover System

It should be noted that asbestos fibres have been identified in the majority of samples, albeit at concentrations less than the limit of detection. However, as the presence of fibres is widespread, due consideration should be given to the earthworks elements of the development being undertaken under the Control of Asbestos Regulations 2012.

Where the creation of formation level does not remove impacted soils, additional sampling and analysis will be required to determine the residual risk.

Areas beneath the footprint of the proposed buildings or access roads will break the exposure pathway for contaminants. However, the location and concentration of residual contamination will need to be recorded.

In areas of soft standing / residential gardens, a cover system could be utilised to ensure adequate thickness of a suitable growing medium is present.

Due to the presence of asbestos fibres, it is advised that these materials are not incorporated into soft standing / garden areas and that they are removed from site.

It is recommended that the following depths of materials are incorporated into the garden areas above a permeable barrier:

- ▶ 450mm clean imported sub-soil, free of deleterious materials; and,
- ▶ 150mm clean imported topsoil, free of deleterious materials

Depths of installed materials should be validated and chemical validation should be in-line with the frequency requirements and chemical parameters as set out in Section 3.2 below

Where site won soils are to be reused, this should be completed using the benefit of a materials management plan or applicable waste exemption.

3.1.2 Removal of Made Ground materials

An alternative to the incorporation of a clean cover system is the removal of Made Ground materials from beneath all garden areas, and building up of garden areas to the required formation level.



Should this be the preferred remedial option the garden areas should be excavated to the required depth, and then the exposed surface should be both visually examined and subsequently sampled

A suitable thickness of growing medium should be incorporated into each garden area. Any imported subsoil and topsoil should be tested for the contaminants and frequency as indicated in section 3.2 below prior to being brought to site.

3.2 Validation Site Won and/or Imported Materials

Validation samples are required from all materials that are to be imported to site where there is the potential for contaminants to be present. The sampling frequency for testing of materials is presented within Table 3.1 below.

Table 3.1 – Specification of Materials Validation Laboratory Analysis

Material Use	Testing Frequency	Suite of Analysis
Imported Topsoil	1 sample per 50m ³ (minimum 3 samples per source)	Speciated PAHs, banded TPH CWG, asbestos (ID), CLEA inorganic suite
Imported Sub-Soil	1 Sample Per 250m ³ (minimum 3 samples per source)	
Imported Fill Material	1 Sample Per 1000m ³ (minimum 3 samples per source)	

Test results should be compared against screening criteria provided in Appendix IV. Where materials are found to contain concentrations of contaminants in excess of the screening criteria further assessment will be required to ensure their suitability for use.

3.2 Waste Sampling and Frequency

Should materials require removal from site, the Environment Agency document 'Waste Sampling and Testing for Disposal to Landfill' provides suitable sampling frequencies based upon whether the material is homogenous or heterogenous and the volume of material to be tested. An excerpt from the document is provided below:

	Population (tonnes)	Homogeneous (number of samples)	Heterogeneous and new wastes (number of samples)
Level 1 Characterisation for Descriptive, Total Concentration & Leaching Tests	<100 t	2	5
	< 500 t	3	8
	<1000 t	5	14
	10,000 t	11	22
	plus per additional 10,000 t	+5 (pro rata)	+10 (pro rata)



Sampling density will be reviewed during the work and if material is homogenous sampling number reduced. Significant variances in material encountered or more material is present than first estimated would increase the sampling density. Any increased sampling will be agreed in advance.

REC will address the findings and assist in classifying the material as hazardous or non-hazardous using Hazwaste Online.

In addition, Waste Acceptance Criteria (WAC) testing will be required where soils are to be removed from site and disposed of at a suitably licensed landfill.

Dependant on ground condition encountered, samples will be scheduled for:

- ▶ Metal suite comprising of arsenic (As), barium (Ba), beryllium (Be), water soluble boron (B), cadmium (Cd), chromium total & hexavalent (Cr & CrVI), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni), selenium (Se), vanadium (V) & zinc (Zn);
- ▶ Cyanide (total);
- ▶ Asbestos screen;
- ▶ Total Organic Carbon & Soil Organic Matter;
- ▶ Speciated Polycyclic Aromatic Hydrocarbons (PAH);
- ▶ Total Petroleum Hydrocarbons (TPHCWG); and
- ▶ Phenols (total).

Analysis will be undertaken on samples as seen appropriate. Asbestos quantification may be required where asbestos is identified.

3.3 Previously Unidentified Contamination

In accordance with the pre-commencement planning conditions should any significantly impacted material be encountered during the development, then the following procedure should be followed:

- ▶ The contractor shall contact a suitably qualified Environmental Consultant and describe the findings;
- ▶ The area will be made inaccessible and signed as containing potentially contaminated materials or alternatively stockpiled on an impermeable surface to allow development on site to continue;
- ▶ A suitably qualified Environmental Consultant will attend site to assess and characterise the contamination, including obtaining samples where required;
- ▶ Results will be screened against relevant screening criteria depending on the proposed use; and
- ▶ The local planning authority (LPA) / environmental health officer (EHO) shall be made aware of the findings.

Recommendations for any further action if required shall be agreed with the LPA/EHO which may include revision of this remediation strategy.



3.4 Validation and Record Keeping

In accordance with pre-commencement planning condition 10, any works undertaken in-line with this remediation strategy requires verification and submission of a verification report to confirm the findings and to the satisfaction of the Local Planning Authority (LPA). The verification report shall include as a minimum:

- ▶ Summary of pre-development conditions;
- ▶ Summary of land regrading / raising and details of any unexpected contamination;
- ▶ Description of any remedial measures including excavation volumes, obstructions, soils placement and laboratory analysis;
- ▶ Confirmation of existence of demarcation membranes in garden areas;
- ▶ Confirmation of depths of topsoil and subsoil in private garden or areas of soft standing;
- ▶ Information on waste disposal including waste carriers, receiving sites and volumes of materials moved; and
- ▶ Details of the source and volumes of imported materials clearly referencing the origin of the materials used and testing carried out to confirm its suitability for use via comparison to the criteria in Appendix IV, where required.



Remediation Strategy
Jacques Way
Castlemead Group Limited
108157p3r1
December 2019

APPENDIX I

LIMITATIONS



1. This report and its findings should be considered in relation to the terms of reference and objectives agreed between REC Ltd and the Client.
2. For the work, reliance has been placed on publicly available data obtained from the sources identified. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. When using the information it has been assumed it is correct. No attempt has been made to verify the information.
3. This report has been produced in accordance with current UK policy and legislative requirements for land and groundwater contamination which are enforced by the local authority and the Environment Agency. Liabilities associated with land contamination are complex and requires advice from legal professionals.
4. During the site walkover reasonable effort has been made to obtain an overview of the site conditions. However, during the site walkover no attempt has been made to enter areas of the site that are unsafe or present a risk to health and safety, are locked, barricaded, overgrown, or the location of the area has not been made known or accessible.
5. The executive summary, conclusions and recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon without considering the context of the report in full.
6. REC cannot be held responsible for any use of the report or its contents for any purpose other than that for which it was prepared. The copyright in this report and other plans and documents prepared by REC is owned by them and no such plans or documents may be reproduced, published or adapted without written consent. Complete copies of this may, however, be made and distributed by the client as is expected in dealing with matters related to its commission. Should the client pass copies of the report to other parties for information, the whole report should be copied, but no professional liability or warranties shall be extended to other parties by REC in this connection without their explicit written agreement there to by REC.
7. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.



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APPENDIX II

GLOSSARY



AST	Above Ground Storage Tank
BGS	British Geological Survey
BSI	British Standards Institute
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CIEH	Chartered Institute of Environmental Health
CIRIA	Construction Industry Research Association
CLEA	Contaminated Land Exposure Assessment
CSM	Conceptual Site Model
DNAPL	Dense Non-Aqueous Phase Liquid (chlorinated solvents, PCB)
DWS	Drinking Water Standard
EA	Environment Agency
EQS	Environmental Quality Standard
GAC	General Assessment Criteria
GL	Ground Level
GSV	Gas Screening Value
HCV	Health Criteria Value
ICSM	Initial Conceptual Site Model
LNAPL	Light Non-Aqueous Phase Liquid (petrol, diesel, kerosene)
ND	Not Detected
LMRL	Lower Method Reporting Limit
NR	Not Recorded
PAH	Poly Aromatic Hydrocarbon
PCB	Poly-Chlorinated Biphenyl
PID	Photo Ionisation Detector
QA	Quality Assurance
SGV	Soil Guideline Value
SPH	Separate Phase Hydrocarbon
TPH (CWG)	Total Petroleum Hydrocarbon (Criteria Working Group)
SPT	Standard Penetration Test
SVOC	Semi Volatile Organic Compound
UST	Underground Storage Tank
VCCs	Vibro Concrete Columns
VOC	Volatile Organic Compound
WTE	Water Table Elevation



Remediation Strategy
Jacques Way
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APPENDIX III

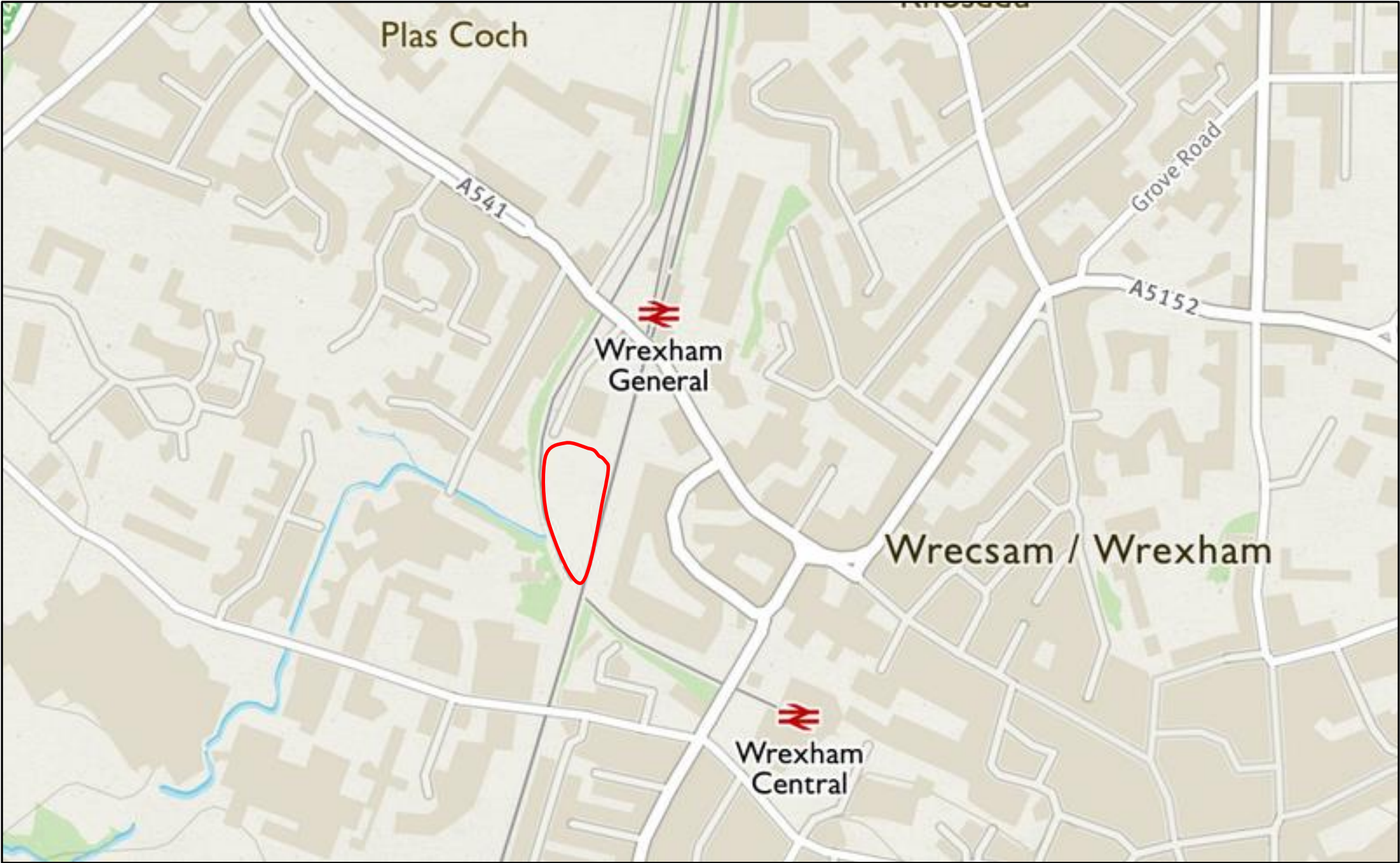
DRAWINGS

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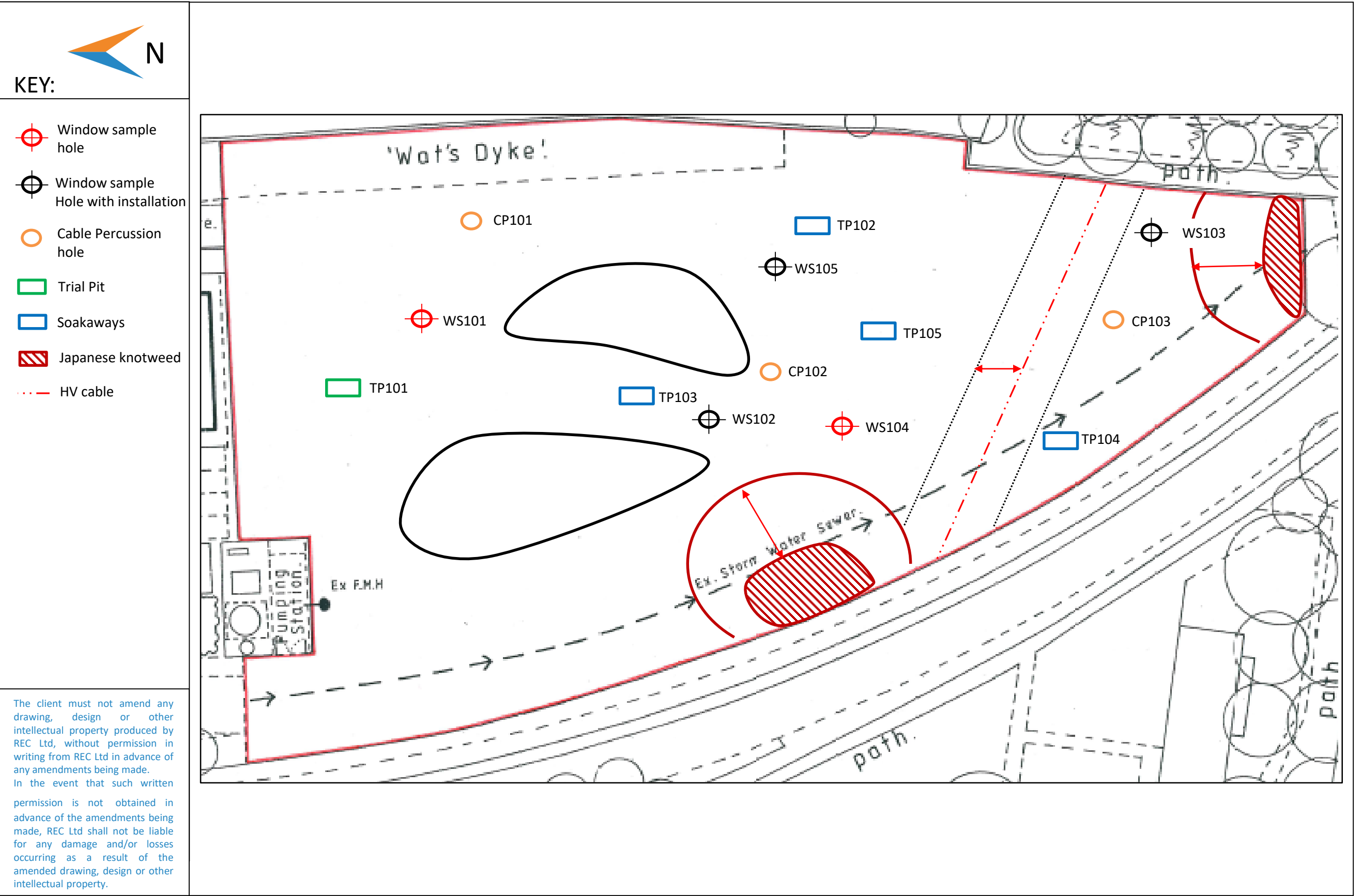


 Site Boundary

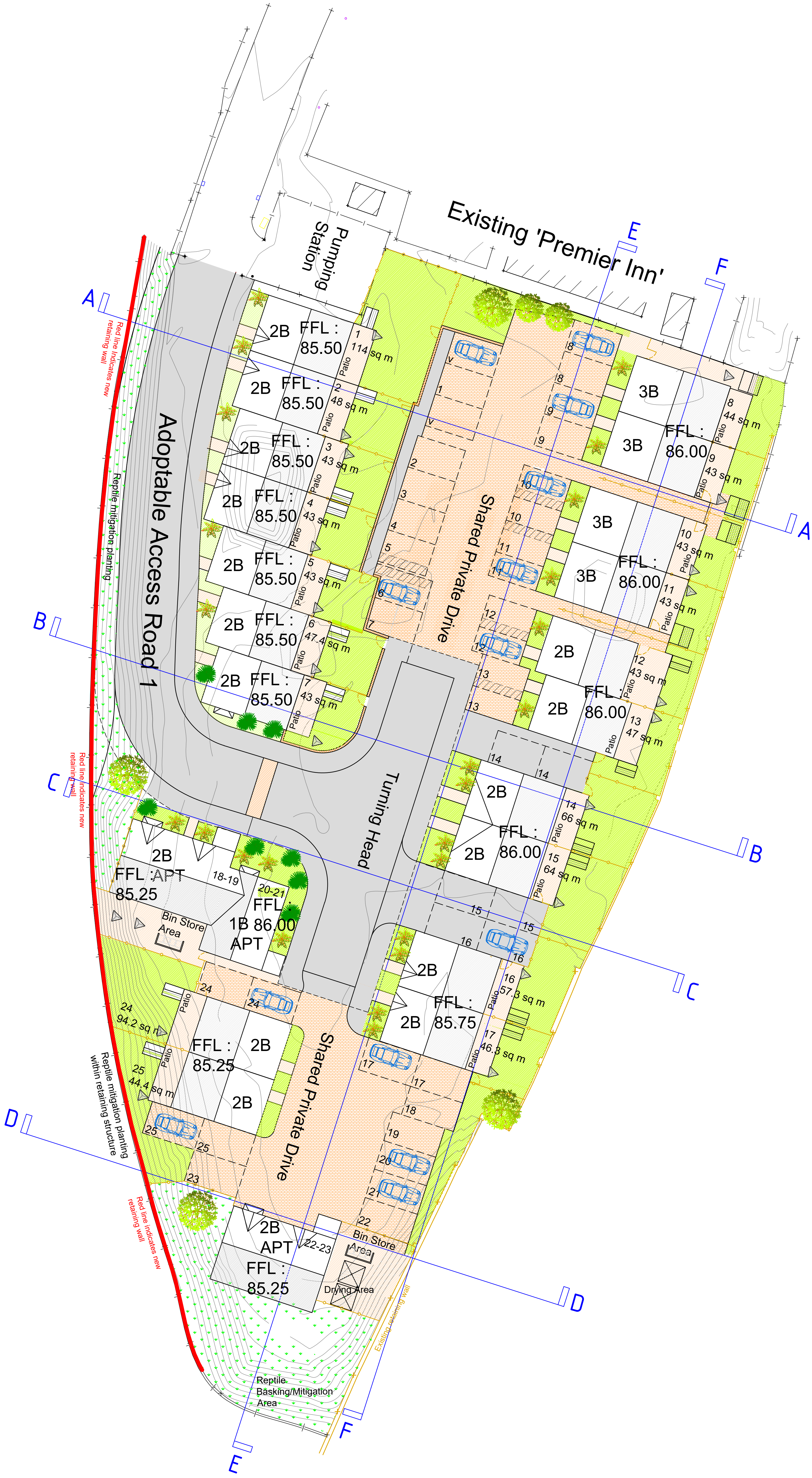
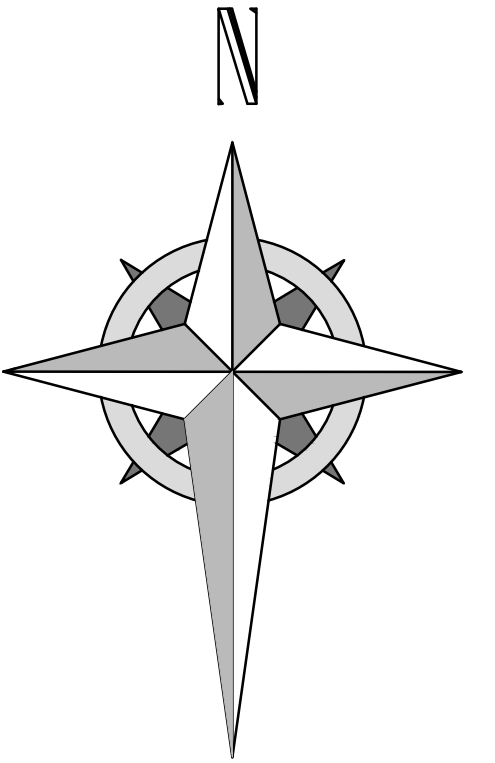
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			Drawn By: CL		
			Approved by: ML		



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				Drawn By: CL		
				Approved by: ML		



BLOCK PLAN
SCALE - 1:200



Ferndale Villa, 25 Manley Road,
Wrexham, LL13 8HD
Tel: (01978) 353445
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Project; Residential Development to Land adjoining 'Premier Inn', Jacques Way, Wrexham.	
Title; Site Plan As Proposed	Scale (A1); 1:200
Dwg No; JWA/PD/00	Date; February 2018
Revision; Rev A: Amend risk as requested by client - 28-03-17 Rev B: Add collocation/maintenance area - 04-04-18 Rev C: Amend layout to apartments - 01-10-18 Rev D: Amend layout to apartments - 05-10-18 Rev E: Add bin store and drying area - 06-10-18 Rev F: Remove security fence - 18-10-18 Rev G: Amend layout to suit latest scheme - 09-02-19 Rev H: Add further info as requested by Wrexham - 13-02-19 Rev I: Amend layout to suit latest scheme - 09-04-19	



Remediation Strategy
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APPENDIX IV

REC REMEDIATION / VALIDATION CRITERIA



SUITABILITY TARGETS FOR IMPORTED MATERIALS

Determinand	Units	Screening Value for Use Of imported materials			Screening Value Source
Inorganics					
Arsenic	mg/kg	37			(i)
Cadmium	mg/kg	11			(i)
Chromium (VI)	mg/kg	6.0			(i)
Lead	mg/kg	200			(ii)
Inorganic Mercury	mg/kg	40			(i)
Nickel	mg/kg	180			(i)
Selenium	mg/kg	250			(i)
Copper	mg/kg	2400			(i)
Zinc	mg/kg	3700			(i)
Cyanide	mg/kg	97			(iv)
Asbestos	%	Non Detected			N/A
Organics – PAHs and Phenol					
		1% SOM	2.5% SOM	6% SOM	
Phenol	mg/kg	280	550	1100	(iii)
Naphthalene	mg/kg	2.3	5.6	13	(iii)
Acenaphthylene	mg/kg	170	420	920	(iii)
Acenaphthene	mg/kg	210	510	1100	(iii)
Fluorene	mg/kg	170	400	860	(iii)
Phenanthrene	mg/kg	95	220	440	(iii)
Anthracene	mg/kg	2400	5400	11000	(iii)
Fluoranthene	mg/kg	280	560	890	(iii)
Pyrene	mg/kg	620	1200	2000	(iii)
Benzo(a)Anthracene	mg/kg	7.2	11	13	(iii)
Chrysene	mg/kg	15	22	27	(iii)
Benzo(b)Fluoranthene	mg/kg	2.6	3.3	3.7	(iii)
Benzo(k)Fluoranthene	mg/kg	77	93	100	(iii)
Benzo(a)Pyrene	mg/kg	2.2	2.7	3.0	(iii)
Indeno(123-cd)Pyrene	mg/kg	27	36	41	(iii)
Dibenzo(a,h)Anthracene	mg/kg	0.24	0.28	0.30	(iii)
Benzo(ghi)Perylene	mg/kg	320	340	350	(iii)
Organics – TPHs					
TPH C ₅ -C ₆	mg/kg	42	78	160	(iii)
TPH C ₆ -C ₈	mg/kg	100	230	530	(iii)
TPH C ₈ -C ₁₀	mg/kg	27	65	150	(iii)
TPH C ₁₀ -C ₁₂	mg/kg	74	180	380	(iii)
TPH C ₁₂ -C ₁₆	mg/kg	140	330	660	(iii)
TPH C ₁₆ -C ₂₁	mg/kg	260	540	930	(iii)
TPH C ₂₁ -C ₃₅	mg/kg	1100	1500	1700	(iii)
TPH C ₃₅ -C ₄₀	mg/kg	1100	1500	1700	(iii)
Screening Value Source					
(i)	LQM/CIEH Suitable For Use Level (S4UL) (2015)				
(ii)	Defra Category 4 Screening Level (2014)				
(iii)	S4UL –1%, 2.5% and 6% SOM				
(iv)	CLEA v1.06 Derived Value				