



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

TE1704-TE-00-XX-RP-GE-003-V01

28 AUGUST 2026

Final

Prepared for:

EEIP Arundel Propco 2 Holdings Ltd

Prepared by: Micaela Martins

Tier Environmental Ltd

Chester	London	Manchester	Bromsgrove	Bristol	Sheffield
HQ Telephone 01244 684900			Telephone 01925 818388		
Website: www.tieruk.com			Email: environmental@tieruk.com		
Tier Environmental is a trading name of Tier Environmental Ltd. Registered in England and Wales no 05441804					

DOCUMENT CONTROL

Report No. :	TE1704-TE-00-XX-RP-GE-003-V01
Report Status:	Final
Project Engineer:	Micaela Martins
Date of Issue:	28/08/2026

This report has been prepared by Tier with all reasonable skill, care and diligence, within the best practice and guidance current at the time of issue within the scope of works which have been agreed with the client. This report is confidential to the client and Tier accepts no responsibility whatsoever to third parties to whom this report, or any part thereof is made presented, unless this is formally agreed in writing by a Director of Tier Environmental Ltd before any reliance is made. Any such party relies upon the report at their own risk. Tier disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

Version No.	Description of Issue / Revision	Date of Issue	Author	Reviewed By	Approved By
1	FINAL	28/08/2026	Micaela Martins	Adrian Read	Adrian Read



**REMEDIAL STRATEGY AND VERIFICATION
PLAN FOR DEACON BUSINESS PARK, KNOWSLEY**

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : i of iii

Engineer: Micaela Martins

Date: 28/08/2026

CONTENTS

1.	INTRODUCTION.....	1
1.1.	Proposed Development	1
1.2.	Previous Reports	1
1.3.	Background and Previous Works Summary	1
1.4.	Anticipated Outline Remedial Works.....	3
1.5.	Objectives	3
1.6.	Assumptions.....	4
2.	SITE DETAILS AND DESCRIPTION	5
3.	REVISED CONCEPTUAL MODEL.....	6
4.	REMEDIAL OPTIONS APPRAISAL.....	8
4.1.	Ground Gas Risk Considerations	8
4.2.	Remedial Options Appraisal.....	8
4.3.	Remedial Options Appraisal.....	9
5.	REMEDIAL STRATEGY	10
5.1.	Introduction	10
5.2.	Anticipated Remedial Works	10
5.3.	Site Obstructions.....	10
5.4.	Contingency for any Unknowns or Previously Unidentified Localised Contamination ..	11
5.5.	Environmental Monitoring and Mitigation	11
6.	VERIFICATION TESTING AND PLAN	13
6.1.	Verification Testing and Plan	13
6.2.	Waste Soils – Basic Characterisation and WAC.....	14
6.3.	Verification Report.....	15
7.	REGULATORY APPROVALS	16
8.	REFERENCES	17
9.	GLOSSARY OF TERMS	20

TABLES

Table 1.1 Summary of Asbestos Delineation	2
Table 2.1 Current Site Overview.	5
Table 3.1 Revised Assessment of Potential Pollutant Linkages.	7



**REMEDIATION STRATEGY AND VERIFICATION
PLAN FOR DEACON BUSINESS PARK, KNOWSLEY**

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : ii of iii
Engineer: Micaela Martins
Date: 28/08/2026

Table 4.1 Remedial Options Appraisal – Localised Asbestos	9
Table 5.1 Obstructions and Underground Services Summary Table.....	10
Table 6.1 Imported Materials Verification Requirements	13

APPENDICES

Appendix A - Drawings

Appendix B - Previous Site Investigation Report (Available as a Separate Document)

Appendix C - Definitions of Terms Used in Qualitative and Quantitative Risk Assessments

Appendix D - Human Health Assessment Criteria

Appendix E - Controlled Waters Risk Assessment

Appendix F - Chemical Test Sampling

Appendix G - Complying With Control of Asbestos Regulations 2012



**REMEDIATION STRATEGY AND VERIFICATION
PLAN FOR DEACON BUSINESS PARK, KNOWSLEY**

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : iii of iii

Engineer: Micaela Martins

Date: 28/08/2026

EXECUTIVE SUMMARY

Introduction	Tier Environmental was commissioned by EEIP Arundel Propco 2 Holdings Ltd to undertake a Remedial Options Appraisal, Remediation Strategy and Verification Plan of Deacon Park based on the results of previous Geoenvironmental risk assessments.
Proposed land use	It is proposed that the site will be developed with a large commercial unit in the centre of the site, with a HGV yard and parking along the east of the site and car parking to the west. The existing entry road to the north will be amended for two-way traffic, whilst the access road in the south will be retained as a fire access track/access to the offsite carpark to the southeast. An attenuation pond will be constructed to the south of this, with soft landscaped areas shown along the northern, western and southern peripheries of the site.
Remediation strategy	The asbestos impacted materials within the vicinity of WS103 have been reported at 0.35m bgl. It is therefore considered that a combination of viable techniques above could be implemented to effectively break the pathways: a) a watching brief and hand picking of any visible ACMs in the vicinity of WS103 by a suitably qualified geoenvironmental engineer or asbestos specialist if the materials are being excavated; b) off-site disposal under the Duty of Care of any suspected hand-picked ACMs (if encountered) subject to confirmatory testing (as required); c) residual low-level asbestos impacted soils re-use in areas requiring general fill in a controlled manner in accordance with an MMP; d) Capping of the layer via proposed hardstanding or building Alternatively, if no excavation is required in the vicinity of WS103, the materials may remain in situ beneath proposed hardstanding / building. Implementation of this combined approach provides confidence that the pollutant linkage will be adequately broken. Materials imported to site shall be tested at the frequencies and for the suites of testing presented within this report to confirm suitability for use.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 1 of 21
Engineer: Micaela Martins
Date: 28/08/2026

1. INTRODUCTION

Tier Environmental was commissioned by EEIP Arundel Propco 2 Holdings Ltd to undertake a Land Contamination Risk Management (LCRM) Remedial Options Appraisal, Remediation Strategy and Verification Plan for an area of land referred to as Deacon Park, located at Deacon Business Park, Moorgate Road North, Knowsley, Liverpool L33 7RX (the "site").

The title of this report is in accordance with that described in the Land Contamination Risk Management guidance (available at <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm>) which has superseded CLR 11:

- Stage 2 - LCRM Options Appraisal Report
- Stage 3 - LCRM Remediation Strategy

1.1. Proposed Development

Under current proposals the development will comprise a large commercial unit in the centre of the site, with a HGV yard and parking along the east of the site and car parking to the west. The existing entry road to the north will be amended for two-way traffic, whilst the access road in the south will be retained as a fire access track/access to the offsite carpark to the southeast. An attenuation pond will be constructed to the south of this, with soft landscaped areas shown along the northern, western and southern peripheries of the site. The proposed layout drawing is presented in Appendix A.

As such, in accordance with the '*Updated technical background to the CLEA model*' (Environment Agency, 2009) and '*Suitable 4 Use Levels*' (LQM / CIEH 2015) the proposed generic land use for this development is commercial/industrial).

1.2. Previous Reports

Tier Environmental have previously completed the following reports:

- A Preliminary Risk Assessment Report (Ref: TE1704-TE-00-XX-GE-RP-001-V01, dated 21st November 2022)
- A Preliminary Ground Investigation Report (Ref: TE1704-TE-00-XX-GE-RP-002-V01, dated 3rd January 2023)
- A Preliminary Risk Assessment Report (Ref: TE1704-TE-00-XX-RP-GE-001-V02, dated 21st August 2026)
- A Ground Investigation Report (Ref: TE1704-TE-00-XX-RP-GE-002-V02, dated 21st August 2026)

1.3. Background and Previous Works Summary

The above reports were reviewed, and pertinent data incorporated alongside supplementary investigation data obtained by Tier Environmental Ground Investigation Report (reference: TE1704-TE-00-XX-RP-GE-002-V02, dated 21st August 2026), hereafter referred to as the 'GIR' report. The GIR report included a generic quantitative risk assessment of laboratory chemical analysis data obtained from soil and groundwater to determine potential risks to human health for the proposed land use and the controlled waters environment.

Contamination – Human Health

During the 2026 Ground Investigation by Tier Environmental, Made Ground was encountered to varying depths across the site, generally of limited thickness within the north (0.20m to 0.60m), deepening towards the centre (0.60m to 0.75m), further deepening towards the south (up to 4.65m



REMEDIAL STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 2 of 21

Engineer: Micaela Martins

Date: 28/08/2026

bgl), potentially associated with infilling of a former watercourse in this area of the site. Made Ground generally comprised granular deposits in the north, and granular and cohesive deposits in the south. The Made Ground is underlain by the Chester Sandstone Formation, which is weathered in the upper horizons, with solid bedrock encountered within the majority of the exploratory holes that achieved refusal from depths of between 0.30m at WS101 in the northwest and 5.15m bgl in WS106A in the south.

During the previous 2022 Preliminary Ground Investigation by Tier Environmental asbestos was recorded within WS103 in the northeast of the site, recorded to be present as fibre bundles and bitumen products at a concentration of 0.006% w/w. Hand dug pits were undertaken to delineate the extent of the asbestos surrounding WS103 as detailed below.

Table 1.1 Summary of Asbestos Delineation

Exploratory Hole Location	Depth (m bgl)	Location on Site	Soil Population	Asbestos Type	Quantification (% w/w)
Asbestos in Soil Samples Recorded During Tier Environmental 2022 Ground Investigation					
WS103	0.35	Northeast	MG2	Amosite and chrysotile	Fibre bundles and bitumen products 0.006% w/w
Delineation Undertaken During 2026 Supplementary Ground Investigation					
HDP201	0.37 to 0.45	1m north of WS103	MG2	None recorded	
HDP202	0.34 to 0.42	5m north of WS103	MG2	None recorded	
HDP203	-	1m of west WS103	Not undertaken due to proximity of services		
HDP204	-	5m of west WS103	Not undertaken due to proximity of services/building		
HDP205	0.36 to 0.47	1m south of WS103	MG2	None recorded	
HDP206	0.48 to 0.50	5m south of WS103	MG2	None recorded	
HDP207	0.40	1m east of WS103	MG2	None recorded	
HDP208	0.30 to 0.50	5m east of WS103	MG2	None recorded	

Of the 17 No. of Made Ground samples submitted for asbestos screening during the more recent phase of investigative works, none were reported to contain asbestos. Additionally, asbestos was not recorded within the hand dug pits undertaken 1.00m and 5.00m north, east and south of this location, suggesting the concentrations are localised to WS103 only. All future works in this area, locally, will need to be undertaken in accordance with CAR:2012 regulations.

Other than the localised presence of asbestos, no measured soil concentrations of potential contaminants of concern have been reported in excess of Generic Assessment Criteria (GACs) protective of human health appropriate to the proposed land use. Neither of the samples of asphalt tested recorded the presence of coal tar, and PCBs were not recorded above the laboratory detection limits in samples taken from the vicinity of the electric substation.

Contamination – Controlled Waters

The majority of the Site (with the exception of the far western boundary) is shown to be underlain by an artificial deposit of Made Ground. The majority of the Site is shown to be underlain by superficial deposits of the Shirdley Hill Sand Formation (Secondary A Aquifer) and the far southern extent of the Site is shown to be underlain by Diamicton Devensian Till (Secondary Unproductive Aquifer). The bedrock beneath the Site and surrounding area is the Chester Sandstone Formation (Principal Aquifer). The Site is situated within a Source Protection Zone; Type 3 – Total Catchment. There are no recorded potable or non-potable abstractions within 250m of the Site. The nearest surfaced water feature is an unnamed



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 3 of 21
Engineer: Micaela Martins
Date: 28/08/2026

inland river not influenced by normal tidal action located 247m south of Site. Groundwater flow is assumed to be in a south / south-westerly direction based upon the topography of the Site. On this basis the controlled waters sensitivity is regarded as being moderate.

The previous Tier 2023 investigation recorded measured groundwater concentrations of arsenic, copper, nickel, zinc, fluoranthene, benzo(a)pyrene, sum PAHs and ammonia in excess of the WQS protective of the controlled waters environment by either the same order of magnitude or one order of magnitude. Given the marginal nature of these exceedances, the potential for significant dilution between the Site and the nearest surface water receptor (an unnamed pond located 115m southeast) or the nearest running water feature (an unnamed inland river located 247m south), the absence of a continuous groundwater body beneath the site, the fact that the Site will incorporate buildings / hardstanding and a dedicated drainage system that shall reduce infiltration rates through the soils, the historical commercial/industrial heritage of the site, and the moderate sensitivity of the controlled waters environment, and that the distance to the nearest active groundwater abstraction point is 845m north and none within 1km hydraulically downgradient, these exceedances are not expected to have pose a significant risk to controlled waters beneath the site; however, it was recommended that this conclusion is reviewed and pre-agreed with the Contaminated Land Officer at the Local Authority / Environment Agency otherwise further investigation and risk assessment may be necessary.

Gas Protection

Gas Screening Value of 0.1118 l/hr has been calculated for the site, based on a maximum carbon dioxide concentration of 7.7% v/v, a maximum methane concentration of 8.6% v/v and a maximum representative flow rate of 1.3 l/hr. Whilst this places the site within Characteristic Situation 2 – low risk, further consideration has been undertaken to demonstrate that when taking into account the wider ground gas regime, the effect of groundwater pumping, and the conceptual site model, it is not considered necessary to increase the Characteristic Situation beyond that of a CS1- Very Low Risk scenario as has been determined via the borehole hazardous gas flow rates. Therefore, no gas protection measures were considered to be required for the proposed building

1.4. Anticipated Outline Remedial Works

The GIR report included the following outline remediation requirements on the basis of the risk assessment conclusions summarised above. In essence, the outline remedial strategy is:

- The asbestos containing Made Ground within 1.00m vicinity of WS103 (Chrysotile and amosite fibre bundles and bitumen products asbestos at 0.006%w/w) may be excavated and re-used beneath areas of hardstanding / building. Alternatively, if no excavation is to occur within this area, it could remain in situ if the area is to be covered by hardstanding (subject to approval from the contaminated land officer). All works in this area will need to be undertaken in accordance with CAR:2012 regulations and a watching brief be carried to observe the presence or absence of any visible ACMs in the vicinity of WS103.

1.5. Objectives

On the basis of the above, the objectives of this report are to:

- To reproduce the Refined Conceptual Site Model derived within the previous Tier Environmental GIR Report;
- Undertake a Remediation Options Appraisal to address reported:
 - Asbestos reported in soils at the site within the Made Ground within 1.00m vicinity of WS103 (chrysotile and amosite fibre bundles and bitumen products asbestos at 0.006%w/w).
- Produce a Remediation Strategy and Verification Plan on the basis of the selected viable approaches determined during the Remedial Options Appraisal.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 4 of 21
Engineer: Micaela Martins
Date: 28/08/2026

This report, which was designed to meet the requirements of all relevant current guidance including 'Land contamination: risk management' (LC:RM) (which supersedes CLR11) presents the factual information available during this appraisal, interpretation of the data obtained and recommendations relevant to the defined objectives.

1.6. Assumptions

The following assumptions are made in this report:

- It is assumed that ground levels will not change significantly from those described in this report or as shown on proposed development drawings. If this is not the case, then amendments to the recommendations made in this report may be required.
- The ground investigations that have informed this remediation strategy were designed with due consideration of known or suspected constraints (including underground services and access constraints).
- Any references to observations of suspected asbestos-containing materials are for information only and should be verified by a suitably qualified asbestos specialist and/or confirmed by laboratory analysis.
- The use of the term 'Topsoil' within this report is based on a visual identification only and that these materials have not been classified in accordance with BS3882:2015.
- The use of the terms 'shallow' and 'deep' within this report (from a geotechnical perspective) assume *typically* between ground level to circa 3.00m below ground level (bgl) for 'shallow' and greater than 3.00m bgl regarded as 'deep';
- The comments and opinions presented in this report are based on the findings of the desk study and ground conditions encountered during intrusive investigation works performed by Tier Environmental and the results of tests carried out within one or more laboratories. There may be other conditions prevailing on the site which have not been revealed by these previous investigations and which have not been taken into account by this report.
- Responsibility cannot be accepted for any conditions not revealed by the previous investigations. Any diagram or opinion on the possible configuration of the findings is conjectural and given for guidance only. Confirmation of intermediate ground conditions should be undertaken if deemed necessary.

This report has been prepared for the sole use of EEIP Arundel Propco 2 Holdings Ltd. No other third party may rely upon or reproduce the contents of this report without the written approval of Tier Environmental. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 5 of 21

Engineer: Micaela Martins

Date: 28/08/2026

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Current Site Overview.

Site name	Deacon Business Park, Knowsley.
Site address	Deacon Business Park, Moorgate Road, Southdene, Kirkby, Knowsley, L33 7RX. A site location plan is included as Drawing No. TE1704-TE-00-XX-DR-GE-001-V01 within Appendix A.
National Grid Reference (NGR)	342534 397564.
Approximate Site area	9.38 ha.
Site shape	The Site is broadly rectangular in shape.
Current land use on the Site	The Site is currently occupied by a commercial warehouse development, with associated offices, ancillary buildings and roadways/parking. Tier Environmental conducted a Site walkover on 9th November 2022 and highlighted the following: • 3 No diesel tanks in the southwest of Site to supply site buildings including a lab, cardboard manufacturer, call centre and offices. • LPG tank in northwest corner used for forklifts for B&M. • Hydraulically operated weighbridges at northwest site entrance. • Grease interceptor in the canteen of B&M which drains into foul sewer. • Water tank in north of the Site used to supply on site sprinklers. • Electrical substation along northern Site boundary, with additional ones inside main factory building. • On site waste storage area (rubbish and recycling). • Asbestos roofs on warehouse, with likely more unrecorded asbestos around Site. No obvious contamination was noted during the site walkover.
Surrounding land uses	The surrounding Site uses comprise of commercial/industrial developments to the north, east and south with residential developments to the west.
General topography and ground levels	OS Mapping shows the northeast corner of the site situated approx. 35m AOD, sloping away to 30m AOD in the southwest corner. The surrounding area's topography also follows this pattern and generally slopes off towards the south / southwest.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 6 of 21

Engineer: Micaela Martins

Date: 28/08/2026

3. REVISED CONCEPTUAL MODEL

The revised combined conceptual site model and conceptual exposure model, developed for the proposed future land use from the desk study information and subsequent ground investigation and the chemical analysis results presented in the GIR report has been reproduced below.

The potential pollutant linkages identified and a generic quantitative risk assessment are presented in Table 3.1. The terms used in the generic quantitative risk assessment are defined in Appendix C.



REMEDIATION STRATEGY AND VERIFICATION
PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 7 of 21
Engineer: Micaela Martins
Date: 28/08/2026

Table 3.1 Revised Assessment of Potential Pollutant Linkages.

Source	Potential Contaminants of Concern	Pathway	Receptor	Consequence	Probability	Qualitative Risk Assessment
Localised asbestos recorded at WS103 at 0.35m bgl within the previous Tier Environmental ground investigation (2022) as fibre bundles and bitumen products at a concentration of 0.006% w/w.	Asbestos	(Dust migration and) dust inhalation	Future site users (commercial)	Severe	Likely	High Risk
			Adjacent site users (commercial)	Severe	Low Likelihood	Moderate / Low Risk
			Adjacent site users (residential)	Severe	Low Likelihood	Moderate / Low Risk
			Construction, site investigation, demolition and future maintenance workers	Severe	Likely	High Risk

For definition of the terms used in the qualitative risk assessment, please see Appendix C.



REMEDIAL STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 8 of 21
Engineer: Micaela Martins
Date: 28/08/2026

4. REMEDIAL OPTIONS APPRAISAL

The information presented in the previous GIR report summarises the physical conditions of the site, the nature of the soils / materials, the contamination status of the Made Ground soils and presents an overview of the controlled waters regime. For completeness, however, it would be prudent to refer to the previous ground investigation reports, should additional information be required. The following section identifies the remediation strategy that could be utilised to effectively manage/mitigate the identified pollutant linkages associated with the soils at the site. In determining the most effective remediation option(s) for the site, consideration needs to be given to a number of techniques, stating (where appropriate) the suitability and limitations of each chosen method.

4.1. Ground Gas Risk Considerations

The conclusions of the previously conducted ground gas risk assessment have demonstrated that no ground gas protection measures are required. As such, ground gas mitigation has therefore not been considered further within the remediation options appraisal.

"A Gas Screening Value of 0.1118 l/hr has been calculated for the site, based on a maximum carbon dioxide concentration of 7.7% v/v, a maximum methane concentration of 8.6% v/v and a maximum representative flow rate of 1.3 l/hr. Whilst this places the site within Characteristic Situation 2 – low risk, further consideration has been undertaken to demonstrate that when taking into account the wider ground gas regime, the effect of groundwater pumping, and the conceptual site model, it is not considered necessary to increase the Characteristic Situation beyond that of a CS1-Very Low Risk scenario as has been determined via the borehole hazardous gas flow rates. Therefore, no gas protection measures are required."

4.2. Remedial Options Appraisal

The following elements have been considered for the site with respect to remedial options, where necessary/appropriate, during the feasibility and options appraisal stage:

- degree to which risks need to be reduced or controlled;
- time within which the remediation strategy is required to take effect;
- practicability of implementing and, where appropriate, maintaining the strategy;
- technical effectiveness of the strategy in reducing or controlling risks;
- longevity of the strategy - i.e. the potential for the proposed remediation technologies to mitigate against contaminant rebound;
- sustainability of the strategy (i.e., how well it meets other environmental objectives, for example on the use of energy and other material resources, and avoids or minimises adverse environmental impacts in off-site locations, e.g. neighbouring residents, or on other environmental compartments, such as air and water);
- cost of the strategy; benefits of the strategy – all remediation strategies should deliver direct benefits (the reduction or control of unacceptable risks) – but many have merits that extend well beyond the boundaries of the site; and
- legal, financial and commercial context within which the site is being handled including the specific legal requirements that remediation has to comply with, and the views of stakeholders on how unacceptable risks should be managed.

Due consideration has been given for possible feasible options, as presented in the tables below to effectively evaluate the practicality, effectiveness, durability and sustainability of potential remedial solutions.

It is also considered that all risks to construction/maintenance workers will be effectively managed via the measures detailed in Section 9.5 of the Tier Environmental GIR Report. As such, risks to construction/maintenance workers fall outside the remit of this Remedial Options Appraisal.



REMEDIAL STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 9 of 21
Engineer: Micaela Martins
Date: 28/08/2026

4.3. Remedial Options Appraisal

Table 4.1 Remedial Options Appraisal – Localised Asbestos

Contaminant Source	Chrysotile and amosite fibre bundles and bitumen products asbestos at 0.006%w/w within the Made Ground within the 1.00m vicinity of WS103.
Pollutant Linkage	Inhalation of dust by end users/ and site operatives.
Excavation with Disposal	Wholesale removal of impacted Made Ground soils. Pollutant linkage is broken, and site works can commence quickly. Given the localised nature this may be commercially viable but not as sustainable as some other options as impacted materials would need to be landfilled.
Hand picking of ACM fragments	Would be effective option to remove the 'grossly' asbestos impacted materials and dispose off-site in a controlled manner. Would facilitate residual low-level asbestos impacted soils for suitability for re-use. As such, this is viable but would need to be carried out in conjunction with other techniques.
Capping including Membrane / Break layer	Earthworks would be required to bring the site to proposed levels; leaving the Made Ground in situ and capping off would be a viable alternative. Capping the entire site would be extremely unsustainable and not cost effective given the localised nature of the impacts; however, targeted re-use of the localised asbestos impacted materials via an MMP and controlled in such a manner that the materials are placed in fill areas which will ultimately be capped by a building or hardstanding is viable and could be verified. Placement beneath soft landscaping areas is not preferable as this would trigger the requirement for a 600mm clean cover system.
On site re-use	As above. Excavation and on-site retention of impacted soils as geotechnical materials for any proposed areas of fill under a Materials Management Plan. Impacted materials remain on site which is a sustainable solution but would have to be used in conjunction with other techniques. Re-use and associated double handling would need to be safely managed in accordance with Control of Asbestos Regulations 2012.
Stabilisation / solidification	This is unlikely to be commercially or practicably viable when compared to other viable techniques. May create geotechnical 'hardspot' given localised nature of the impacts. Stabilisation and solidification process may promote temporary fibre release as the materials are being treated.
Justification	The asbestos impacted materials within the vicinity of WS103 have been reported at 0.35m bgl. It is therefore considered that a combination of viable techniques above could be implemented to effectively break the pathways: a) a watching brief and hand picking of any visible ACMs by a suitably qualified geoenvironmental engineer or asbestos specialist as the materials are being excavated in the vicinity of WS103, specifically; b) off-site disposal under the Duty of Care of any suspected hand-picked ACMs (if encountered) subject to confirmatory testing (as required); c) residual low-level asbestos impacted soils re-use in areas requiring general fill in a controlled manner in accordance with an MMP. d) Capping of the layer via proposed hardstanding or building Alternatively, if no excavation is required in the vicinity of WS103, the materials may remain in situ beneath proposed hardstanding / building. Implementation of this combined approach provides confidence that the pollutant linkage will be adequately broken. Potential for impacted materials to be re-used under an MMP so long as the works are verified in accordance with this remediation strategy.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 10 of 21
Engineer: Micaela Martins
Date: 28/08/2026

5. REMEDIATION STRATEGY

5.1. Introduction

Tier Environmental considers that a combined remedial approach will be required to address the following potential contaminants of concern:

- asbestos reported in soils at the site within the Made Ground within 1.00m vicinity of WS103 (chrysotile and amosite fibre bundles and bitumen products asbestos at 0.006%w/w).

In addition, due consideration has been made within this remediation strategy for previously unidentified and localised visual / olfactory evidence of gross contamination.

5.2. Anticipated Remedial Works

Based upon the findings of the Ground Investigation and the above Remedial Options Appraisal the following remediation strategy has been devised in order to make the site safe and suitable for redevelopment, as proposed:

- a watching brief during and hand picking of any visible ACMs by a suitably qualified geoenvironmental engineer or asbestos specialist as the materials are being excavated in the vicinity of WS103, specifically;
- off-site disposal under the Duty of Care of any suspected hand-picked ACMs (if encountered) subject to confirmatory testing (as required);
- residual low-level asbestos impacted soils re-use in areas requiring general fill in a controlled manner in accordance with an MMP.
- capping of the layer via proposed hardstanding or building

Alternatively, if no excavation is required in the vicinity of WS103, the materials may remain in situ beneath proposed hardstanding / building.

The above integrated strategy is designed to:

- Mitigate risks to human health via direct contact and dust inhalation pathways.

5.3. Site Obstructions

The following potential obstructions/ underground services were encountered during the ground investigation works.

Table 5.1 Obstructions and Underground Services Summary Table

Exploratory Hole Location	Location on Site	Depths recorded from (m bgl)	Depth of Base of Feature (m bgl)	General description and comments
WS206	Centre (within building)	2.00	>2.11	Concrete. SPT was able to penetrate 0.11m suggesting weak/weathered concrete at surface of obstruction.
WS207	Southeast	0.40	0.55	Clay pipe within concrete floor slab.
TP02	Northwest (adjacent to WS109 – see below)	0.25	0.30	Concrete slab with occasional rebar approx. diameter of 5mm, within eastern end of pit only. Assumed to be associated with nearby bike/din shelter footings.



REMEDIAL STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 11 of 21

Engineer: Micaela Martins

Date: 28/08/2026

Exploratory Hole Location	Location on Site	Depths recorded from (m bgl)	Depth of Base of Feature (m bgl)	General description and comments
TP08	South	0.90	>1.00	Plastic pipe approx. diameter of 100mm at 0.90m bgl. Concrete obstruction with rebar approx. diameter of 15mm in the northern half of the pit
WS109 (2022)	Northwest	0.20	0.30	Concrete slab

Any materials (soils and concrete / brick etc) to be re-used on site should be done so under an appropriate end-of-waste protocol such as a U1 Exemption / Wrap Protocol or Materials Management Plan in accordance with the CL:AIRE Definition of Waste Code of Practice.

5.4. Contingency for any Unknowns or Previously Unidentified Localised Contamination

Whilst the ground investigation works conducted to date are regarded as comprehensive, Tier Environmental wishes to demonstrate that due consideration has been given at an early stage on possible remedial solutions in the event that local grossly impacted soils or groundwater are identified on site.

Should any suspicious material be encountered during the redevelopment works, works shall be ceased within this part of the site and the area should then be investigated further by a suitably qualified geo-environmental engineer and sampled as necessary. The Contaminated Land Officer (or equivalent) at the Local Authority should also be notified immediately. Samples (if deemed necessary) will be forwarded to a UKAS/MCERTS accredited laboratory for a suite of analytical testing deemed appropriate based upon an appraisal of the material identified.

Once the results of the analysis are known and have been interpreted, the final required remedial action (if any) and remedial targets (as appropriate) will be determined and approved with the relevant regulatory authorities.

5.5. Environmental Monitoring and Mitigation

Introduction

In order to mitigate the environmental impacts of the works on nearby surrounding land users, a programme of measures will be implemented during the remediation works.

Dust Mitigation

Appropriate measures shall be implemented at all times during the remediation works, to minimise dust emissions. Soils will be dampened down, as necessary, and activity will be minimised in extremely windy conditions to prevent dust nuisance. An adequate supply of water shall be maintained on site at all times to allow for dust suppression activities to be carried out at short notice.

When dusty material is being loaded onto trucks, extra care will be taken to ensure that the drop height is minimised. Trucks will be suitably covered when leaving the site with contaminated material to prevent dust migration.

The amount of disturbed surfaces left exposed for significant time periods will be minimised. Stockpiles of fine or loose materials should be tamped down or covered, if necessary, to reduce the production of dust. Traffic both entering and working on the site shall obey a maximum speed limit of 10 mph.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 12 of 21

Engineer: Micaela Martins

Date: 28/08/2026

Noise

The requirements of BS 5228:1997 "Noise and Vibration Control on Construction Sites" shall be adhered to at all times. All machinery shall be fitted with effective silencers and shall be serviced at regular intervals. No plant shall be operated with engine covers raised.

Run-off into Drains

All potential drainage on site and any discharge points will be identified, including land drains, foul sewers, surface water drains and any combined drains. These will be marked, as appropriate, for easy identification.

Works will be minimised during periods of heavy rainfall to reduce the likelihood of contaminated run-off. Temporary containment and cover measures or tamping down of stockpiles to reduce run-off shall be used where necessary.



REMEDIAL STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 13 of 21

Engineer: Micaela Martins

Date: 28/08/2026

6. VERIFICATION TESTING AND PLAN

6.1. Verification Testing and Plan

Tier Environmental has undertaken a search for the Knowsley Council's website in order to determine whether they have any council-specific imported material testing requirements. In the absence of any Council-specific requirements identified during this search, Tier Environmental has referred to the widely adopted and accepted YALPAG (Yorkshire and Lincolnshire Pollution Advisory Group) for guidance to inform the following requirements:

Table 6.1 Imported Materials Verification Requirements

Objective	It will be necessary to ensure that the development of the site does not cause an increased risk to receptors. All imported materials imported to the site will be tested to determine its suitability for use on the site.
Testing frequency	Imported materials will need to be tested before they are imported to site at a rate of: For materials from a proven greenfield source: - Between 1 sample per 50m³ and 1 sample per 250m³ with a minimum of 3 samples. For materials from a brownfield, manufactured or site-won source - Between 1 sample per 50m³ and 1 sample per 100m³ with a minimum of 6 samples. Hardcore/crush (e.g. 6F2 / 6F5) from Recycled Aggregate - A minimum of 1 sample per 500m³. Quarried materials - A minimum of 1 or 2 samples depending on the type of stone used (to confirm the inert nature of the material).
Testing Suite	For materials from a proven greenfield source: - Metals - Speciated PAH - pH - Asbestos - Soil Organic Matter For materials from a brownfield, manufactured or site-won source - Metals - Speciated PAH - pH - Asbestos - Soil Organic Matter - Additional analysis may be undertaken depending on the history of the donor site: - Total phenol - Total Cyanide - BTEX - MTBE Hardcore/crush (e.g. 6F2 / 6F5) from Recycled Aggregate - Metals - Speciated PAH - Asbestos - Total TPH - Additional analysis may be undertaken depending on the history of the donor site: - Total phenol - Total Cyanide - BTEX



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 14 of 21

Engineer: Micaela Martins

Date: 28/08/2026

	○ MTBE Quarried materials • Metals
Additional Information	Soil descriptions to BS 5930:2015+A1:2020. Photographic records of the materials to be obtained.
Screening Criteria	The purpose of the testing is to verify the quality of any materials imported to the site and to determine the contaminant concentrations of materials. The samples will be compared with appropriate LQM / CIEH 2015 S4UL values protective of a commercial/industrial land use to confirm suitability for re-use. Unsuitable material should not be used.

6.2. Waste Soils – Basic Characterisation and WAC

Any materials that require removal from the site will be exported from the site to the appropriate landfill and shall be hauled by a registered waste carrier in accordance with Duty of Care Regulations, 1991 and the Hazardous Waste Regulations, 2005.

With respect to asbestos, If the waste contains fibres that are free and dispersed then the waste will be hazardous if the waste as a whole contains 0.1% w/w or more asbestos in accordance with WM3. If the waste contains any identifiable pieces of suspected asbestos containing material (i.e. any particle of a size that can be identified as potentially being asbestos by a competent person if examined by the naked eye), then these pieces must be assessed separately. The waste is hazardous if the concentration of asbestos in the piece of asbestos containing material is 0.1% w/w or more. The waste shall then be regarded as a mixed waste and classified accordingly.

The following codes will then be assigned to the asbestos waste as appropriate:

- 17 06 05* Construction material containing asbestos.
- 17 06 01* Insulation material containing asbestos.

17 06 05* would normally be used in preference to 17 06 01* for the asbestos in asbestos contaminated soil and stones in accordance with WM3.

Tier Environmental Geoenvironmental engineers hold up to date UKATA Asbestos Awareness training certificates in order to demonstrate 'competence' that is required as described in WM3.

Basic waste characterisation has determined that Made Ground soils are non-hazardous requiring disposal to a non-hazardous landfill with the following exceptions:

- The Made Ground at WS108 at 0.90m bgl is classed as hazardous due to an elevated TPH concentration.
- The Made Ground at WS107 at 3.60m bgl, WS109 at 0.40m bgl and WS205 at 0.25m bgl is classed as suitable for disposal at an inert waste landfill

It should be noted that the natural sandstone within WS105 at 4.00m bgl is classed as hazardous waste due to an elevated TPH concentration. A hydrocarbon odour was recorded for this material at this depth, which was not encountered within this material elsewhere across the site, and is therefore considered to be limited to this location only. The remainder of natural deposits and bedrock materials are expected to be suitable for disposal as inert waste

There will be requirement for the waste producer to provide appropriate Waste Acceptance Criteria (WAC) testing of the soils for disposal to ensure that the soils are appropriately classified and that the landfill is licensed to receive such soils.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 15 of 21

Engineer: Micaela Martins

Date: 28/08/2026

6.3. Verification Report

The SE should ensure that the requirements of the strategy are complied with. On satisfactory completion of all remedial works, a verification report should be produced. This report will comprise all relevant site records and act as certification that the remedial preparation works have been carried out in accordance with this remediation strategy.

The Verification Report shall include the following:

- A description of the works undertaken in accordance with the Remediation Strategy described above;
- Records of the works;
- Progress photographs;
- Waste Transfer Notes;
- Chemical verification test results.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 16 of 21

Engineer: Micaela Martins

Date: 28/08/2026

7. REGULATORY APPROVALS

The conclusions and recommendations presented above are considered reasonable based on the findings of the site investigations. However, these cannot be guaranteed to gain regulatory approval and, therefore, the report should be passed to the appropriate regulatory authorities and/or other organisations for their comment and approval.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 17 of 21
Engineer: Micaela Martins
Date: 28/08/2026

8. REFERENCES

- BRE BR211 (2015). Radon: Guidance on Protective Measures for New Dwellings. IHS BRE Press, Bracknell.
- BRE SD1 (2005). Concrete in Aggressive Ground. Special Digest 1 (revised edition). IHS BRE Press, Bracknell.
- BRE 414 (2001) Protective measures for housing on gas-contaminated land. BRE.
- BS 10175:2026 Investigation of Potentially Contaminated Sites - Code of Practice. British Standards Institution, London.
- BS EN 1997-1:2004 Eurocode 7. Geotechnical Design. General Rules. British Standards Institution, London.
- BS EN 1997-2:2007 Eurocode 7. Geotechnical Design. Ground Investigation and Testing. British Standards Institution, London.
- BS5930:2015+A12020 Code of practice for ground investigations BSI
- BS EN ISO 17892-1-12:2018 Geotechnical investigation and testing BSI
- BS EN ISO 14688-1:2018 Geotechnical Investigation and Testing. Identification and Classification of Soil. Identification and Description. British Standards Institution, London.
- BS EN ISO 14688-2:2018 Geotechnical Investigation and Testing. Identification and Classification of Soil. Principles for a Classification. British Standards Institution, London.
- BS EN ISO 14689-1:2018 Geotechnical Investigation and Testing. Identification and Classification of Rock. Identification and Description. British Standards Institution, London.
- BS8485 2015 Code of Practice for the design of protective measures for methane and carbon dioxide ground gases in new buildings. British Standards
- BS85762013 Guidance on investigations for ground gas – permanent gases and volatile organic compounds (VOCs). BSI,
- CIRIA Rep R 97 (2001) Trenching Practice. Report 097, 2nd edition, CIRIA, London.
- CIRIA Rep R 149 (1995a) Protecting Development from Methane. Report 149, CIRIA, London.
- CIRIA Rep R 150 (1995b) Methane Investigation Strategies. Report 150, CIRIA, London.
- CIRIA Rep R 151 (1995c) Interpreting Measurement of Gas in the Ground Report 151, CIRIA, London.
- CIRIA Rep R 152 (1995d) Risk Assessment for Methane and Other Gases from the Ground. Report 152, CIRIA, London.
- CIRIA Rep R 132 (1996) A Guide for Safe Working on Contaminated Sites. Report 132, CIRIA, London.
- CIRIA C552 (2001) Contaminated land risk assessment. A guide to good practice (report no. C552).
- CIRIA C665 (2007) Assessing the risks posed by hazardous gases to buildings CIRIA, London



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 18 of 21
Engineer: Micaela Martins
Date: 28/08/2026

CIRIA C748 (2014) Guidance on the use of plastic membranes as VOC barriers, CIRIA, London

CIRIA C735 (2014) Good practice on the testing and verification of protection systems for buildings against hazardous ground gases. CIRIA.

CIRIA C681 (2009) Unexploded ordnance (UXO) A guide for the construction industry (C681)

CIRIA C785 (2019) Unexploded ordnance (UXO) risk management guide for land-based projects (C785)

CIRIA C758D (2019) Abandoned mine workings manual (C758D)

Contaminated Land: Applications in Real Environments (CL:AIRE) (2011) Definition of Waste Code of Practice (version 2).

Department of Environment Food and Rural Affairs (DEFRA) (2012) Environmental Protection Act 1990: Part 2A Contaminated Land Statutory Guidance (report no. PB13735).

Environment Agency (2000) Technical Aspects of Site Investigation. Report P5-065/TR, Environment Agency, Bristol.

Environment Agency (2002) Guidance on Monitoring Landfill Leachate, Groundwater and Surface Water. Report LFTGN02, Environment Agency, Bristol.

Environment Agency (2007) Evaluation of Models for Predicting Plant Uptake of Chemicals from Soil. Report SC050021/SR, Environment Agency, Bristol.

Environment Agency (2006) Remedial Targets Methodology - Hydrogeological Risk Assessment for Land Contamination (report no. ea/br/e/std/vr10thanni).

Environment Agency (2008) Science Report SC050021/SR7 Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values.

Environment agency, 2007. Inter-laboratory comparison of in vitro bioaccessibility measurements for arsenic lead and nickel in soil, Science Report SC040060/SR2.

Environment Agency, 2009 Human health toxicological assessment of contaminants in soil (Science Report Final SC050021/SR2)

Environment Agency (2015) Guidance on the Classification and Assessment of Waste Technical Guidance WM3 (1st edition). European Union (1998) Drinking Water Directive (Council Directive 98/83/EC).

Gibbons, R. (1994) Statistical Methods for Groundwater Monitoring. Wiley, New York.

Groundsure Report 2021 GSIP-2021-10752-4061

Highways Agency (2006) Design of Pavement Foundations. Document HD 25/IAN 73/06.

HSE (1991) Protection of Workers and the General Public During the Development of Contaminated Land. HMSO, London.

HSE (2005) Occupational Exposure Limits. HSE report EH40/2005, HMSO, London.



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01
Page No : 19 of 21
Engineer: Micaela Martins
Date: 28/08/2026

ICRCL (1986) Notes on the Fire Hazards of Contaminated Land. Guidance Note 61/84, 2nd Edition, Interdepartmental Committee on the Redevelopment of Contaminated Land, London.

Jeffries, J.(2009). A review of body weight and height data used within the Contaminated Land Exposure Assessment model (CLEA). Project SC050021/ Technical Review 1. Bristol: Environment Agency

Land Contamination Risk Management (LCRM) Environment Agency October 2020 <https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm> .

LQM/CIEH Ltd (2015) S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham.

NRA (1994) Protocol for a Leaching Test to Assess the Leaching Potential for Soils from Contaminated Sites. R&D Note 181.

SoBRA (2017) Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater – Version 1.0.

The Water Framework Directive, (Standards and Classification) Directions (England and Wales).

UK Water Industry Research (2010) Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites (report no. 10/WM/03/21)

WHO (2000) Air Quality Guidelines for Europe. 2nd edition, WHO Regional Office for Europe, Copenhagen.

World Health Organisation (2017) Guidelines for Drinking Water Quality (4th edition).

Britain From Above - <https://britainfromabove.org.uk/en/image/WPW060399>

<http://www.warstateandsociety.com/Bombing-Britain>

<https://www.epa.gov/pfas/basic-information-pfas>

UK Maps of Radon, <http://www.ukradon.org/information/ukmaps>

Health and Safety Executive (2015) Construction (Design and Management) Regulations.

Coal Authority Interactive Map Viewer, <http://mapapps2.bgs.ac.uk/coalauthority/home.html>

BGS Geology of Britain Viewer <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 20 of 21

Engineer: Micaela Martins

Date: 28/08/2026

9. GLOSSARY OF TERMS

ACEC	Aggressive Chemical Environment for Concrete (classification)
aOD	Above Ordnance Datum
bgl	Below ground level
BGS	British Geological Survey
BRE	Building Research Establishment
CBR	California Bearing Ratio (test)
COMAH	Control of Major Accident Hazards (regulations)
Designated location	Site (and the ecosystem on that site) protected under national or international legislation. A potential ecological receptor to be considered as part of the assessment of land contamination. Example designated locations include SSSIs (q.v.), SACs (q.v.), national nature reserves, Ramsar sites and bird special protection areas.
DQA	Data Quality Assessment
DQO	Data Quality Objective
DQRA	Detailed Quantitative Risk Assessment
DWS	Drinking Water Standard
EQS	Environmental Quality Standard
GAC	Generic Assessment Criterion
GQA	General Quality Assessment (Environment Agency)
GSV	Gas Screening Value
HCV	Health Criteria Value
IPPC	Integrated Pollution Prevention and Control (regulations)
K _{ow}	Octanol-water partition coefficient
LEL	Lower Explosive Limit
LL	Liquid Limit
LoD	Limit of Detection (analytical)
LoQ	Limit of Quantification (analytical)
Mean Value Test	Statistical test (described in the CIEH Guidance) to estimate the mean value of a normally distributed population of data at a given level of confidence. Normally for contaminated land assessment, the 95th percentile (referred to as the 95%UCL or US95) is applied as a reasonable but conservative estimate of the mean concentration for comparison with the relevant assessment criteria.
Maximum Value Test	Statistical test (described in the CIEH Guidance) to identify whether an elevated concentration within a normally distributed data set forms part of the underlying population from which it has been sampled or whether it is an outlier (such as a localised area of contamination) that merits further consideration.
MC	Moisture Content
NGR	National Grid Reference
NIHHS	Notification of Installations Handling Hazardous Substances (regulations)
OS	Ordnance Survey
PI	Plasticity Index
PID	Photoionisation Detector
PL	Plastic Limit
ppm	Parts per million
ppmv	Parts per million by volume
QA	Quality Assurance
QC	Quality Control
SAC	Special Area of Conservation
SOM	Soil Organic Matter



REMEDIATION STRATEGY AND VERIFICATION PLAN FOR DEACON BUSINESS PARK, KNOWSLEY

Report No : TE1704-TE-00-XX-RP-GE-003-V01

Page No : 21 of 21

Engineer: Micaela Martins

Date: 28/08/2026

SPT	Standard Penetration Test
SPZ	Source Protection Zone (see Appendix E)
SSAC	Site-Specific Assessment Criterion
SSSI	Site of Special Scientific Interest
SVOC	Semi-Volatile Organic Compound
TEF	Toxicity Equivalent Factor
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
US95	95 th percentile estimate of the true mean value of a data population (also known as 95%UCL).
VOC	Volatile Organic Compound

APPENDIX A - DRAWINGS



Deacon Business Park Site Location Plan



The Site

Job Number: TE1704

Job Name: Deacon Business Park

Client: EEIP Arundel Propco 2 Holdings Ltd

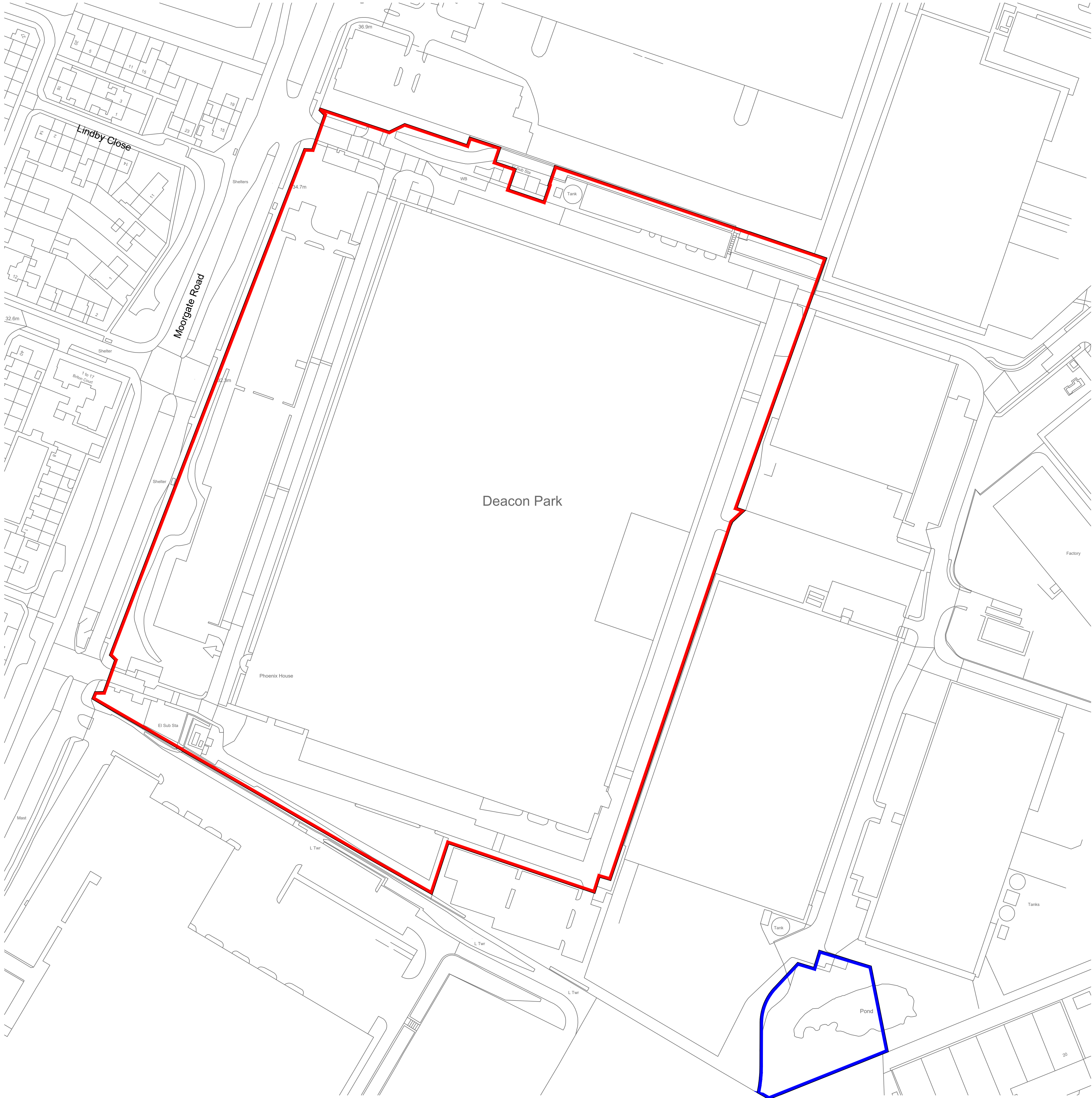
Drawing Name: Site Location Plan

Drawing Number: TE1704-TE-00-XX-DR-GE-001-V02

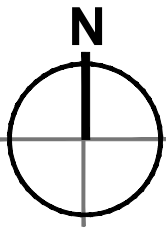
Drawn By: ER

Checked By: AR

Scale: NTS



- Dimensions are in millimeters, unless stated otherwise.
- It is the recipient's responsibility to print this document to the correct scale.
- All relevant drawings and specifications should be read in conjunction with this drawing.



Planning Application Boundary
21.89 Acres / 8.86 Ha

Ownership Boundary

Ordnance Survey, (c) Crown Copyright 2022. All rights reserved. Licence number 100022432

Existing Site Plan
Scale 1:1000



PLANNING

THIS DRAWING IS TO BE USED FOR THE STATED PURPOSE ONLY AND SHOULD NOT BE USED FOR ANY OTHER

P1	Issued For Planning	MS	AD	15.12.22
rev	amendments	by	ckd	date

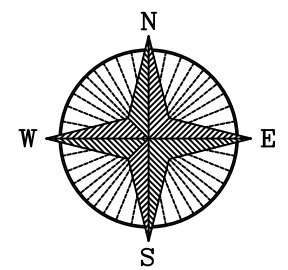
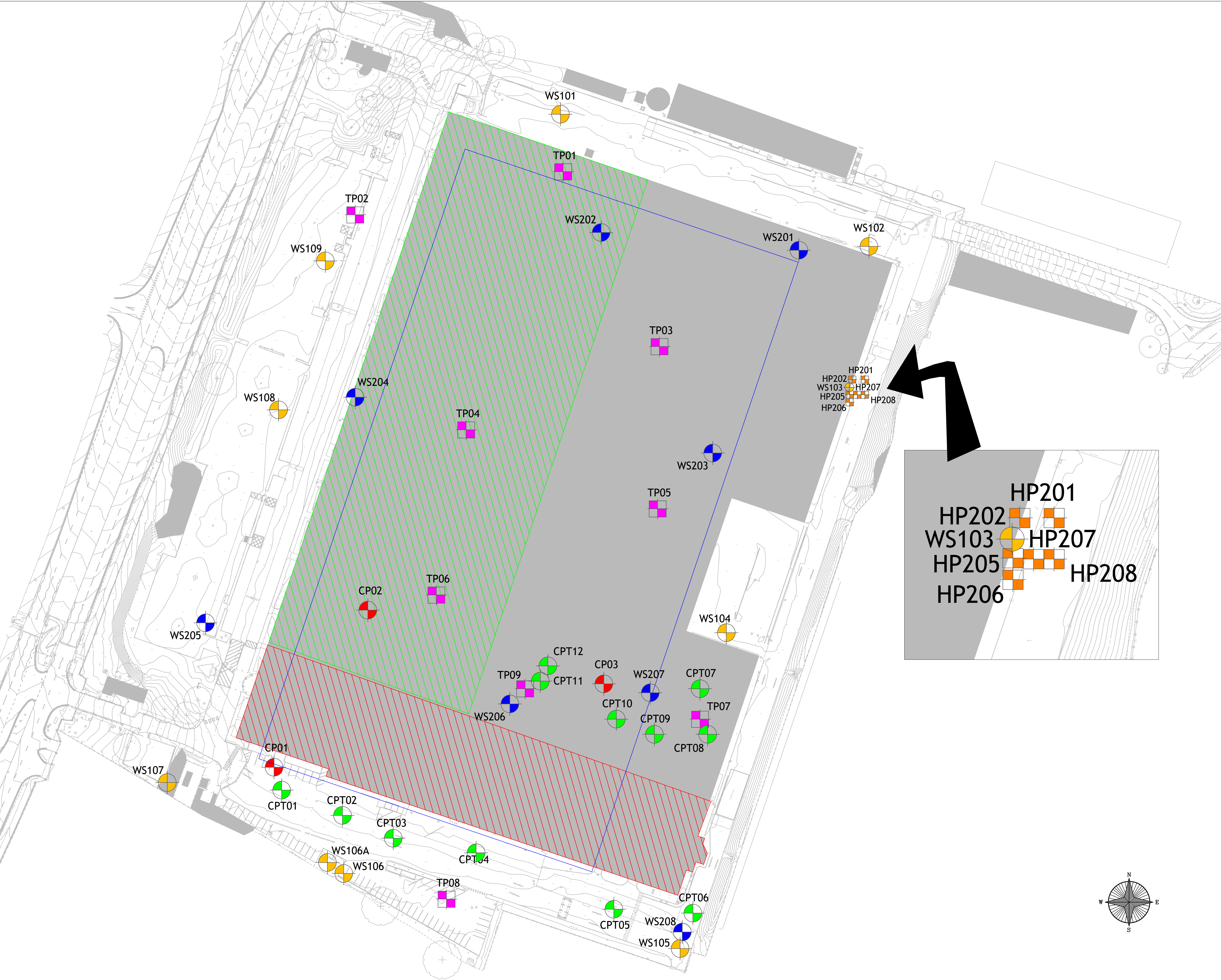
Deacon Business Park, Knowsley

Existing Site Plan

Information Container LOD:	LOD 200
----------------------------	---------



RIBA PoW Stage:	3 - Spatial Coordination
Document Suitability:	S3
Drawn / Checked:	MS / AD
Date:	01/12/2022
Scale:	1:1000 @ A1
UMC Project Number:	21241
Document Reference:	Drawing no: Revision:
21241 - UMC - 0001 - SI - DR - A	0501 P1



DO NOT SCALE

NOTES

2026 CABLE PERCUSSIVE LOCATION

2026 CPT LOCATIONS

2026 WINDOW SAMPLE LOCATION

2026 HAND DUG PIT LOCATIONS

2026 TRIAL PIT LOCATIONS

2022 WINDOW SAMPLE LOCATION

NOT ACCESSIBLE DUE TO LOW HEADROOM

NOT ACCESSIBLE FOR CPT RIG DUE TO DOORWAY WIDTH FOR CLEARANCE

APPROXIMATE EXTENT OF PROPOSED BUILDING LAYOUT

P5	21.08.2026	CS	ISSUED FOR INFORMATION	SE	SE
P4	01.04.2026	CS	ISSUED FOR INFORMATION	SE	SE
P3	30.03.2026	CS	ISSUED FOR INFORMATION	SE	SE
P2	11.03.2026	CS	ISSUED FOR INFORMATION	SE	SE
P1	23.02.2026	CS	ISSUED FOR INFORMATION	SE	SE

REV	DATE	BY	DESCRIPTION	CHK	APD

DRAWING STATUS: INFORMATION

Tier Environmental Ltd.
Unit 5 Office Village
Sandpiper Court
Chester Business Park
Chester | CH4 9QZ
t: 01925 818 388

CLIENT:
EEIP ARUNDEL PROPCO 2 HOLDINGS LTD

PROJECT:
DEACON BUSINESS PARK, KNOWSLEY

TITLE:
EXPLORATORY HOLE LOCATION PLAN

SCALE: 1:1000	CHECKED: SE	APPROVED: SE
CAD FILE: -	DESIGN/DRAWN: CS	DATE: 23.02.2026
PROJECT No: TE1704	DRAWING No: TE1704-TE-00-XX-DR-GE-005-V04	REV: p4



Proposed Site Plan
Scale 1:1000



- Dimensions are in millimeters, unless stated otherwise.
- It is the recipient's responsibility to print this document to the correct scale.
- All relevant drawings and specifications should be read in conjunction with this drawing.



SCHEDULE OF ACCOMMODATION
(Gross Internal Area)

Unit 1	
Warehouse Area	- 414,572 sq ft (38,515m²)
Office (2 storey)	- 25,295 sq ft (2,350m²)
Transport Office	- 2,390 sq ft (222m²)
Gatehouse	- 291 sq ft (27m²)
Total Area	- 442,548 sq ft (41,114m²)
Loading Docks	- 40
Level Access	- 3
HGV Parking	- 65
Car Parking	- 385
Plot Area	- 21.89 Acres (8.86 Hectares)
Site Density	- 46.41%

Parking Standards Knowsley Council	
Draft Ensuring a Choice of Travel Supplementary Planning Document (February 2010)	
B8- Storage and Distribution (max)	
1 space per 100 m² GFA	

P2	Dims added	CD	DB	15.12.22
P1	Issued For Planning	MS	AD	15.12.22
rev	amendments	by	ckd	date

Deacon Business Park, Knowsley

Proposed Site Plan

Information Container LOD:	LOD 200
----------------------------	---------



RIBA PoW Stage:	3 - Spatial Coordination
Document Suitability:	S3
Drawn / Checked:	MS / AD
Date:	13/10/2022
Scale:	As Drawn @A1
UMC Project Number:	21241
Document Reference:	Drawing no: Revision:
21241 - UMC - 0001 - SI - DR - A	0601 P2

PLANNING
THIS DRAWING IS TO BE USED FOR THE STATED PURPOSE
ONLY AND SHOULD NOT BE USED FOR ANY OTHER

APPENDIX B - PREVIOUS SITE INVESTIGATION REPORT (AVAILABLE AS A SEPARATE DOCUMENT)

APPENDIX C - DEFINITIONS OF TERMS USED IN QUALITATIVE AND QUANTITATIVE RISK ASSESSMENTS

CIRIA C552 Terminology

For the qualitative and quantitative assessment of risks posed by potential pollutant linkages have been undertaken using the risk matrix adapted from CIRIA C552 and outlined in the table below.

	Category	Definition
Potential severity	Severe	Acute (short term) risk to human health, Major pollution of sensitive controlled waters, ecosystems or habitat. Catastrophic damage to buildings or property or crops.
	Medium	Chronic (Medium / long term) risk to human health Pollution of sensitive controlled waters, ecosystems or species, Significant damage to crops, buildings or structures
	Mild	Easily preventable permanent health effects on humans. Pollution of non-sensitive controlled waters. Minor damage to buildings or structures.
	Minor	Easily preventable non-permanent health effects on humans, or no effects. Minor, low level and localised contamination of on-site soil. Easily repairable damage to buildings or structures.
Probability of risk	High Likelihood	Pollutant linkage may be present, and the risk is almost certain to occur , or there is evidence of harm already occurring.
	Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term.
	Low Likelihood	Pollutant linkages may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
	Unlikely	Pollutant linkage may be present but the circumstances under which harm would occur are improbable.

		Potential Severity			
		Severe	Medium	Mild	Minor
Probability of risk	High Likelihood	Very high risk	High risk	Moderate risk	Moderate / low risk
	Likely	High risk	Moderate risk	Moderate / low risk	Low risk
	Low Likelihood	Moderate risk	Moderate / low risk	Low risk	Very low risk
	Unlikely	Moderate / low risk	Low risk	very low risk	Very low risk

APPENDIX D - HUMAN HEALTH ASSESSMENT CRITERIA

HUMAN HEALTH ASSESSMENT CRITERIA

Context

Contaminated Land is defined under law through Part IIA of the Environmental Protection Act 1990, implemented through Section 57 of the Environment Act 1995 and associated guidance ("Part IIA"). These specify that a "suitable for use" approach is to be applied in the assessment of potentially contaminated land, implemented through a phased programme of site investigation and risk assessment appropriate to the site under consideration.

The assessment of potential risks posed by contaminated land is based upon the assessment of plausible contaminant source - pathway - receptor linkages ("pollutant linkages") for the current and/or proposed future use of the site. The process for the assessment of contaminated land adopted in this report is in line with guidance issued by the [Environment Agency Land contamination risk management \(LCRM\)](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/281222/Environment_Agency_Land_contamination_risk_management_LCRM.pdf) - GOV.UK (www.gov.uk)

Land contamination can harm:

- human health
- drinking water supplies, groundwater and surface water
- soils
- ecosystems including wildlife, animals and wetlands
- property

It can also affect the current and future land use. Dealing with land contamination helps make the environment clean and safe. Through regeneration it can:

- enhance the health and wellbeing of all
- add to the economic, ecological and amenity value of the area

Use land contamination risk management (LCRM) to:

- identify and assess if there is an unacceptable risk
- assess what remediation options are suitable to manage the risk
- plan and carry out remediation
- verify that remediation has worked

You can use LCRM in a range of regulatory and management contexts. For example, voluntary remediation, planning, assessing liabilities or under the Part 2A contaminated land regime. The Environment Agency expects you to follow LCRM if you are managing the risks from land contamination.

We support the use of the National Quality Mark Scheme (NQMS). You can use it for any type of land contamination report.

Using the NQMS:

- will make sure all legislative requirements and necessary standards related to managing land contamination are met
- can provide increased confidence by submitting reports of the quality we expect
- can result in cost and time savings by 'getting it right first time'

LCRM is made up of 4 guides.

1. LCRM: Before you start.
2. LCRM: Risk assessment.
3. LCRM: Options appraisal.
4. LCRM: Remediation and verification.

We use a staged risk based approach. There are 3 stages, and each stage is broken down into tiers or steps.

Stage 1: Risk assessment

You will use a tiered approach to risk assessment. The 3 tiers are:

1. Preliminary risk assessment.
2. Generic quantitative risk assessment.
3. Detailed quantitative risk assessment.

Stage 1 includes information for intrusive site investigations.

Stage 2: Options appraisal

There are 3 steps to follow.

1. Identify feasible remediation options.
2. Do a detailed evaluation of options.
3. Select the final remediation option.

Stage 3: Remediation and verification

There are 4 steps to follow.

1. Develop a remediation strategy.
2. Remediate.
3. Produce a verification report.
4. Do long term monitoring and maintenance, if required

You must always start with a preliminary risk assessment.

The risk assessment stage is an iterative process. You can do the 3 tiers in order or progress from a preliminary risk assessment to a detailed quantitative risk assessment. As part of a generic or detailed quantitative risk assessment you will need to collect detailed information about the site. This is usually through an intrusive site investigation.

Depending on the level of risk or regulatory requirements, you can proceed from a preliminary risk assessment to the options appraisal stage. If you proceed direct to the options appraisal stage, you still need to collect the detailed site investigation information required by the generic and detailed quantitative risk assessments. This is to confirm that your approach is viable and acceptable.

Following the risk assessment stage, if you conclude that the risks are acceptable, with agreement from the relevant regulator, you can end the process.

If there are unacceptable risks, then remediation or mitigation is required. Follow stages 2 and 3 in order.

In stage 2 options appraisal, you will:

- look at the most feasible options
- produce a shortlist of options
- use evaluation criteria to assess them
- select which ones are the most suitable to take forward to stage 3

In stage 3 remediation and verification, you will produce a remediation strategy, do the remediation and then produce a verification report.

You will decide at the options appraisal stage if long term monitoring and maintenance is the remediation option. You may need to do post-remediation monitoring for further verification.

The risk assessment and subsequent investigation, remediation and verification must address all potential sources of pollutants that may be present on the site (the "hazards"), all receptors that may be harmed by these (e.g., human health, controlled waters, ecological receptors) and the pathways by which the contamination may be transported from the contaminant source(s) to the receptor(s). This is defined within the conceptual model for the site, which represents the characteristics of the site in a form that shows the possible pollutant linkages. As further information becomes available (for example, through site investigation), so the conceptual model will be refined.

Remedial action can be specified at any phase within this assessment process to break the identified pollutant linkage in determining whether or not to undertake further assessment or to undertake remediation, the potential cost-savings arising from a more thorough assessment of the pollutant linkages and more tightly defined remedial strategy must be considered against the direct costs involved in the work and the time that this will take to execute and gain regulatory approval.

A different approach to the statistical appraisal of data is required depending on whether the assessment is being undertaken to assess land as Contaminated Land in accordance with the regulations or whether the assessment is to assess whether the site is suitable for new development in accordance with the Planning regime. The statistical approach to assessment is discussed further in CL:AIRE:2020 "Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration".

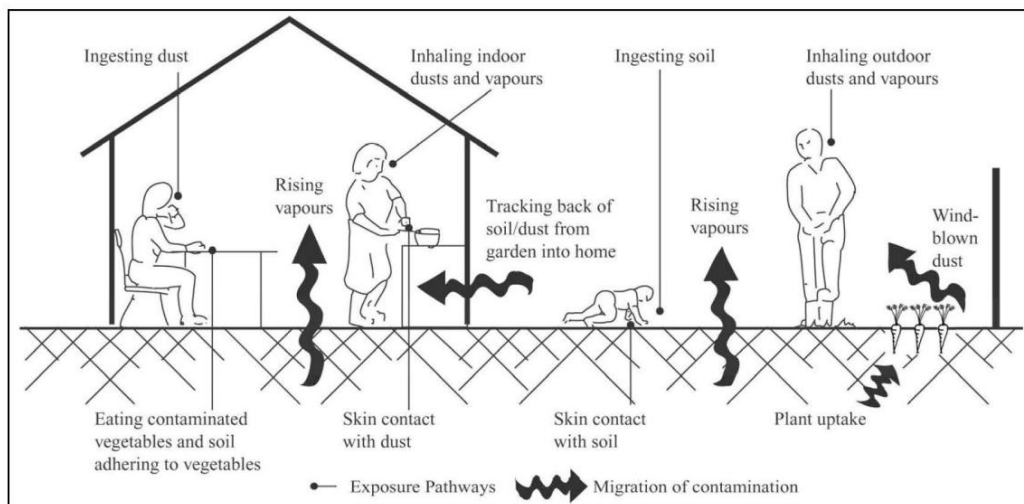
Some form of Detailed Quantitative Risk Assessment (DQRA) will be essential for those cases where appropriate GAC values cannot be established for the contaminant linkages under consideration.

Generic Assessment Criteria for Human Health Risk Assessment

In March 2002, the Department for Environment, Food and Rural Affairs (DEFRA) and the Environment Agency (EA) published the Contaminated Land Exposure Assessment (CLEA) Model and a series of related reports and guidance. These were designed to provide a scientifically based framework for the assessment of chronic risks to human health from contaminated land. The initial documents (CLR7 – 10) were withdrawn and replaced with revised guidance issued by the Environment Agency including:

- “Using Soil Guideline Values”; EA, 2009; [Land contamination: using soil guideline values \(SGVs\) - GOV.UK \(www.gov.uk\)](http://www.gov.uk/government/publications/using-soil-guideline-values)
- “Human Health toxicology assessment of contaminants in soil” EA, 2009; <https://www.gov.uk/government/publications/human-health-toxicological-assessment-of-contaminants-in-soil>
- “Update technical background to the CLEA model” 2009; <https://www.gov.uk/government/publications/updated-technical-background-to-the-clea-model>
- CLEA Software (Version 1.05) Handbook 2015; <https://www.gov.uk/government/publications/contaminated-land-exposure-assessment-clea-tool>
- Compilation of Data for priority Organic Contaminants for Derivation of Soil Guideline Values; Science Report SC050021/SR7, 2008; and,
- “Professional Guidance: Comparing Soil Contamination Data with a Critical Concentration”. CL:AIRE:2020 <https://www.claire.co.uk/component/phocadownload/category/9-other-cl-aire-documents?download=745:2020-stats-guidance>

The CLEA model and associated guidance was developed to calculate an estimated tolerable daily intake (TDI) of contaminants for site users given a set of ‘typical’ human health exposure pathways which are detailed in “SR3: Updated technical background to the CLEA model”



(Science Report SC050021/SR3, EA, 2009) and reproduced below.

Ingestion

- Outdoor soil;
- Indoor dust;
- Home grown produce;
- Soil attached to home grown produce.

Dermal Contact

- Outdoor soil;
- Indoor dust.

Inhalation

- Outdoor dust;
- Indoor dust;
- Outdoor vapour;
- Indoor vapour.

It should be noted that the CLEA model does not include an exhaustive list of potential exposure pathways, e.g. certain compounds can pass through plastic water pipes into drinking water supply.

The potential significance of each of the exposure pathways is dependent upon the type of land use and the nature of the contaminant being considered. The CLEA model considers principal 'default' land use scenarios and makes a series of assumptions with regards to building type (where applicable), identification of the critical human receptor group, exposure frequency and duration. The definitions of the principal land use types given in SR3 (EA, 2009) are:

Residential land use;

- A typical residential property consisting of a two-storey terraced house built on a ground-bearing slab of 0.15m thickness with a private garden consisting of lawn, flowerbeds, and a small fruit and vegetable patch. The occupants are assumed to be parents with young children, who make regular use of the garden. The critical receptor is a 0 – 6-year-old female.
- Active exposure pathways are ingestion of outdoor soil, ingestion of indoor dust, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and indoor dust and vapour

Allotments

- A plot of open space commonly made available by the Local Authority to tenants to grow fruit and vegetables for their own consumption. There are usually several plots to a site and the overall site area may cover more than one hectare. The tenants are assumed to be the parents or grandparents and that young children make occasional accompanied visits to the plots. The critical receptor is a 0 – 6-year-old female and there is no building present on site.
- Active exposure pathways are ingestion of outdoor soil, ingestion of home grown produce and soil adhering to home grown produce; direct dermal contact with outdoor soil; inhalation of outdoor vapour.

Commercial and industrial land use.

- A typical commercial or light industrial property consisting of a three-story office building (pre-1970) with a ground bearing floor slab at which employees spend most time indoors and are involved in office based or related light physical work. The critical receptor is a working female adult aged 16 – 65 years.
- Active exposure pathway is ingestion of outdoor soil, ingestion of indoor dust; direct dermal contact with outdoor soil and indoor dust; inhalation of outdoor dust and vapour and inhalation of indoor dust and vapour.

Soil Guideline Values

Based on the assumption of each land use type, the EA and DEFRA developed and published Soil Guideline Value (SGV) using the CLEA model for a number of principal contaminants and 'default' end-use scenarios of residential, allotments and commercial/industrial use. The primary purpose of the SGVs is as trigger value for the tolerable daily intake (TDI), below which it can be assumed that the soil does not pose an unacceptable risk to the identified receptor. Where soils contamination is present above this level further assessment may be required. SGVs were developed for the following contaminants:

- Heavy metals and other inorganic compounds: arsenic, cadmium, chromium, cyanide, lead (now withdrawn), mercury, nickel and selenium.
- Benzene, ethylbenzene, toluene and xylenes.
- Phenol.
- Dioxins and dioxin-like polychlorinated biphenyls (PCBs)
- Polycyclic aromatic hydrocarbons (PAHs) – 11 substances

LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment

In addition, in 2009 CIEH through LQM and EIC published generic assessment criteria (GACs) for 82 substances including metals, petroleum hydrocarbons, PAHs and explosive substances for a variety of soil types and the three 'default' land uses – (residential, allotments and commercial end-uses) as described in SR3 (EA, 2009). These have been superseded as described below.

Category 4 Screening Values

In 2013 "SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination" (CL:AIRE 2013) was issued which detailed findings of a research project undertaken by CL:AIRE to set out the framework by which potential Category 4 Screening Levels (pC4SL) may be derived for 6 contaminants of concern, Arsenic, Benzene, Benzo(a)pyrene, Cadmium, Chromium VI and Lead.

This was supplemented in 2014 by "SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination – Policy Companion Document" (DEFRA, 2014). SP1010 proposed several updated toxicology information relating to contaminant behaviour updated assumptions relating to the modelling of human exposure to soil contaminants, derivation of separate C4SLs for residential with the consumption of home grown produce, residential without the consumption of home grown produce, and two new land uses: public open spaces near residential housing (POS resi) and public parks (POS park).

Public Open Space: Residential

- For public open space in close proximity to residential housing and the central green area around which houses are located, as on many housing estates from the 1930s to 1970s. It is also applicable for smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting. It is considered to be a generally grassed area up to 0.5ha with up to 50% bare soil. The land use is an important resource

for children and the area is near the homes. The critical receptor is a female child age >3 - <9 years old (CLEA age class 4 – 9) as younger children are unlikely to play outdoors unsupervised.

- Active exposure pathways are ingestion of outdoor soil, ingestion of indoor dust; direct dermal contact with outdoor soil and indoor soil derived dust; inhalation of outdoor and indoor dust and inhalation of outdoor vapour.

Public Open Space: Park

- A public park is defined as an area of open space provided for recreational use and usually owned and maintained by the Local Authority. It is anticipated the park could be used for a wide range of activities, including the following:
 - Family visits and picnics;
 - Children's play area;
 - Sporting activities such as football on an informal basis (i.e. not a dedicated sports pitch); and
 - Dog walking.
- The park is modelled as an area >0.5 ha of predominantly grasses open space with no more than 25% of exposed soil.
- The critical receptor is a female child with CLEA age classes 1 – 6.
- Active exposure pathways are: ingestion of outdoor soil; direct dermal contact with outdoor soil; inhalation of outdoor dust and inhalation of outdoor vapour.

Furthermore, the C4SLs are based on a different toxicological benchmark, the 'low level of toxicological concern' (LLTC). This difference in approach was adopted because the C4SLs were primarily intended for use under Part 2A of the EPA 1990 to quickly screen out Category 4 sites where there is "*no risk or that the level of risk posed is low*". SGVs and LQM GACs are based on the more conservative 'minimal or tolerable level of risk' as defined in SR2 (EA, 2009) and were derived for assessment of contamination for the Planning process.

LQM/CIEH Suitable 4 Use Levels (S4ULs)

The publication of the C4SLs resulted in considerable and inconclusive debate about the applicability of the lower level of protection of the C4SL, which are underlain by the LLTC, outside of the Part 2A context for which they were derived. In 2014 LQM/CIEH presented a Suitable 4 Use Levels (S4ULs), which incorporate the updated assumption exposure derived for the production of the C4SLs but within the context of deriving screening criteria above which further assessment of the risks or remedial action may be needed. The S4ULs replace the 82 substances, species and fractions and congeners contained in the previous LQM/CIEH GACs issued in 2009. Additionally, following changes and new land uses proposed in the C4SL research project, S4ULs have also been derived for the majority of substances for which the EA derived SGVs in 2009 with the exception of lead (see below).

Lead

The C4SL for lead provides a technically robust and conservative assessment tool using significantly updated toxicological modelling than the withdrawn SGV and derived in line with current science of lead toxicology.

EIC/AGS/CL:AIRE Soil Generic Assessment Criteria (2010)

In some instances, EIC/AGC/CL:AIRE GACs for certain VOC / SVOC potential contaminants of concern have been used *in lieu* of available LQM / CIEH S4UL values.

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Metals/metalloids																			
Arsenic	37			40			43			640			79			170			LQM (2014)
Beryllium	1.7			1.7			35			12			2.2			63			LQM (2014)
Boron	290			11000			45			240000			21000			46000			LQM (2014)
Cadmium	11			85			1.9			190			120			560			LQM (2014 errata)
Chromium III	910			910			18000			8600			1500			33000			LQM (2014)
Chromium VI	6			6			1.8			33			7.7			220			LQM (2014)
Copper	2400			7100			520			68000			12000			44000			LQM (2014)
Lead	200			310			80			2330			630			1300			C4SL
Mercury (elemental)	1.2			1.2			21			58 (25.8)			16			30 (25.8)			LQM (2014)
Mercury (Inorganic)	40			56			19			1100			120			240			LQM (2014)
Methylmercury	11			15			6			320			40			68			LQM (2014)
Nickel	130			180			53			980			230			800			LQM (Revised 2015)
Selenium	250			430			88			12000			1100			1800			LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Vanadium	410			1200			91			9000			2000			5000			LQM (2014)
Zinc	3700			40000			620			730000			81000			170000			LQM (2014)
Other																			
Total Sulphate	2,400			2,400			2,400			2,400			2,400			2,400			BRE (2005)
Water Soluble Sulphate (g/l)	0.5			0.5			0.5			0.5			0.5			0.5			BRE (2005)
PAHs																			
Acenaphthene	210	510	1100	3000 (57)	4700(141)	6000 (336)	34	85	200	84000 (57)	97000 (141)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Acenaphthylene	170	420	920	2900 (86.1)	4600 (212)	6000 (506)	28	69	160	8300 (86.1)	97000 (212)	100000	15000	15000	15000	29000	30000	30000	LQM (2014)
Anthracene	2400	5400	11000	31000 (1.17)	35000	37000	380	950	2200	520000	540000	540000	74000	74000	74000	150000	150000	150000	LQM (2014)
Benzo(a)anthracene	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	LQM (2014)
Benzo(a)pyrene	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	LQM (2014)
Benzo(b)fluoranthene	2.6	3.3	3.7	3.9	4	4	0.99	2.1	3.9	44	44	45	7.1	7.1	7.1	13	15	16	LQM (2014)
Benzo(g,h,i)perylene	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	LQM (2014)
Benzo(k)fluoranthene	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	LQM (2014)
Chrysene	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Dibenz(a,h)anthracene	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.61	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	LQM (2014)
Fluoranthene	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	63	6300	6400	LQM (2014)
Fluorene	170	400	860	2800 (30.9)	3800 (76.5)	4500 (183)	27	67	160	63000 (30.9)	68000	71000	9900	9900	9900	20000	20000	20000	LQM (2014)
Indeno(1,2,3-cd)pyrene	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	LQM (2014)
Naphthalene	2.3	5.6	13	2.3	5.6	13	4.1	10	24	190 (76.4)	460 (183)	1100 (432)	4900	4900	4900	1200 (76.4)	1900 (183)	3000	LQM (2014)
Phenanthrene	95	220	440	1300 (36)	1500	1500	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	LQM (2014)
Pyrene	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	LQM (2014)
Coal Tar (BaP as surrogate marker)	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	LQM (2014)
BTEX and TPH																			
Benzene	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	LQM (2014)
Toluene	130	290	660	880 vap (869)	1900	3900	22	51	120	56000 vap (869)	110000 vap (1920)	180000 vap (4360)	56000	56000	56000	87000 vap (869)	95000 vap (1920)	100000 vap (4360)	LQM (2014)
Ethylbenzene	47	110	260	83	190	440	16	39	91	5700 vap (518)	13000 vap (1220)	27000 vap (2840)	24000	24000	25000	17000 vap (518)	22000 vap (1220)	27000 vap (2840)	LQM (2014)
Xylene - o	60	140	330	88	210	480	28	67	160	6600 (478)	15000 (1120)	33000 (2620)	41000	42000	43000	17000 (478)	24000 (1120)	33000 (2620)	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Xylene - m	59	140	320	82	190	450	31	74	170	6200 (625)	14000 (1470)	31000 (3460)	41000	42000	43000	17000 (625)	24000 (1470)	32000 (3460)	LQM (2014)
Xylene - p	56	130	310	79	180	430	29	69	160	5900 (576)	14000 (1350)	30000 (3170)	41000	42000	43000	17000 (576)	23000 (1350)	31000 (3170)	LQM (2014)
Aliphatic EC 5-6	42	78	160	42	78	160	730	1700	3900	3200 (304)	5900 (558)	12000 (1150)	570000 (304)	590000	60000 0	95000 (304)	130000 (558)	180000 (1150)	LQM (2014)
Aliphatic EC >6-8	100	230	530	100	230	530	2300	5600	13000	7800 (144)	17000 (322)	40000 (736)	600000	610000	62000 0	150000 (144)	220000 (322)	320000 (736)	LQM (2014)
Aliphatic EC >8-10	27	65	150	27	65	150	320	770	1700	2000 (78)	4800 (190)	11000 (451)	13000	13000	13000	14000 (78)	18000 (190)	21000 (451)	LQM (2014)
Aliphatic EC >10-12	130 (48)	330 (118)	760 (283)	130 (48)	330 (118)	760 (283)	2200	4400	7300	9700 (48)	23000 (118)	47000 (283)	13000	13000	13000	21000 (48)	23000 (118)	24000 (283)	LQM (2014)
Aliphatic EC >12-16	1100 (24)	2400 (59)	4300 (142)	1100 (24)	2400 (59)	4300 (142)	11000	13000	13000	59000 (24)	82000 (59)	90000 (142)	13000	13000	13000	25000 (24)	25000 (59)	26000 (142)	LQM (2014)
Aliphatic EC >16-35	65000 (8.48)	92000 (21)	11000 0	65000 (8.48)	92000 (21)	110000	26000 0	270000	27000 0	160000 0	1700000	180000 0	250000	250000	25000 0	450000	480000	490000	LQM (2014)
Aliphatic EC >35-44	65000 (8.48)	92000 (21)	11000 0	65000 (8.48)	92000 (21)	110000	26000 0	270000	27000 0	160000 0	1700000	180000 0	250000	250000	25000 0	450000	480000	490000	LQM (2014)
Aromatic EC 5-7	70	140	300	370	690	1400	13	27	57	26000 (1220)	46000 (2260)	86000 (4710)	56000	56000	56000	76000 (1220)	84000 (2260)	92000 (4710)	LQM (2014)
Aromatic EC >7-8	130	290	660	860	1800	3900	22	51	120	56000 (869)	110000 (1920)	180000 (4360)	56000	56000	56000	87000 (869)	95000 (1920)	100000 (4360)	LQM (2014)
Aromatic EC >8-10	34	83	190	47	110	270	8.6	21	51	3500 (613)	8100 (1500)	17000 (3580)	5000	5000	5000	7200 (613)	8500 (1500)	9300 (3580)	LQM (2014)
Aromatic EC >10-12	74	180	380	250	590	1200	13	31	74	16000 (364)	28000 (899)	34000 (2150)	5000	5000	5000	9200 (364)	9700 (899)	10000	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Aromatic EC >12-16	140	330	660	1800	2300 (419)	2500	23	27	130	36000 (169)	37000	38000	5100	5100	5000	10000	10000	10000	LQM (2014)
Aromatic EC >16-21	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	LQM (2014)
Aromatic EC >21-35	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >35-44	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
Aromatic EC >44-75	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	LQM (2014)
VOCs																			
1,2-dichloroethane (1,2-DCA)	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	LQM (2014)
1,1,1-trichloroethane	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	140000	57000 (1425)	76000 (2915)	100000 (6392)	LQM (2014)
1,1,2,2,tetrachloroethane	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	LQM (2014)
tetrachloroethene	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	45	95	1400	1400	1400	810 (424)	1100 (951)	1500	LQM (2014)
tetrachloromethane (Carbon tetrachloride)	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	LQM (2014)
Trichloroethene	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	LQM (2014)
Trichloromethane (chloroform)	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Chloroethene (Vinyl chloride)	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	LQM (2014)
2,4,6 Trinitrotoluene (TNT)	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	LQM (2014)
RDX	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000 (18.7)	51000	53000	LQM (2014)
HMX	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	23000 (0.35)	23000 (0.39)	24000 (0.48)	LQM (2014)
Aldrin	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	LQM (2014)
Dieldrin	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	LQM (2014)
Atrazine	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	LQM (2014)
Dichlovos	0.032	0.066	0.014	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	LQM (2014)
Alpha-Endosulfan	7.4	18	41	160 (0.003)	280 (0.007)	410 (0.016)	1.2	2.9	6.8	5600 (0.003)	7400 (0.007)	8400 (0.016)	1200	1200	1200	2400	2400	2500	LQM (2014)
alpha-Hexachlorocyclohexane	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	LQM (2014)
beta-hexachlorocyclohexanes	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	LQM (2014)
gamma-hexachlorocyclohexanes	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Chlorobenzene	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	1300 (675)	2000 (1520)	2900	LQM (2014)
1,2-Dichlorobenzene	23	55	130	24	57	130	94	230	540	2000 (571)	4800 (1370)	11000 (3240)	90000	95000	98000	24000 (571)	36000 (1370)	51000 (3240)	LQM (2014)
1,3-Dichlorobenzene	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	LQM (2014)
1,4-Dichlorobenzene	61	150	350	61	150	350	15	37	88	4400 (224)	10000 (540)	25000 (1280)	17000	17000	17000	36000 (224)	36000 (540)	36000 (1280)	LQM (2014)
1,2,3-Trichlorobenzene	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	770 (134)	1100 (330)	1600 (789)	LQM (2014)
1,2,4-Trichlorobenzene	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	1700 (318)	2600 (786)	4000 (1880)	LQM (2014)
1,3,5-Trichlorobenzene	0.33	0.81	1.9	0.33	0.81	1.9	4.7	12	28	23	55	130	1700	1700	1800	380 (36.7)	580 (90.8)	860 (217)	LQM (2014)
1,2,3,4-Tetrachlorobenzene	15	36	78	24	56	120	4.4	11	26	1700 (122)	3080 (304)	4400 (728)	830	830	830	1500 (122)	1600	1600	LQM (2014)
1,2,3,5-Tetrachlorobenzene	0.66	1.6	3.7	0.75	1.9	4.3	0.38	0.9	2.2	49 (39.4)	120 (98.1)	240 (235)	78	79	79	110 (39)	120	130	LQM (2014)
1,2,4,5-Tetrachlorobenzene	0.33	0.77	1.6	0.73	1.7	3.5	0.06	0.16	0.37	42 (19.7)	72 (49.1)	96	13	13	13	25	26	26	LQM (2014)
Pentachlorobenzene	5.8	12	22	19	30	38	1.2	3.1	7	640 (43)	770 (107)	830	100	100	100	190	190	190	LQM (2014)

Parameter	Residential with homegrown produce			Residential without homegrown produce			Allotment			Commercial / Industrial			Public Open Space near Residential			Public Open Space - Park			Source
	(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			(mg/kg, unless otherwise stated)			
SOM	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	1%	2.50%	6%	
Hexachlorobenze ne	1.8 (0.2)	3.3 (0.5)	4.9	4.1 (0.2)	5.7 (0.5)	6.7 (1.2)	0.47	1.1	2.5	110 (0.2)	120	120	16	16	16	30	30	30	LQM (2014)
Phenol	120	200	380	440 ^{dir} (460)	690	1200	23	42	83	440 ^{dir} (26000 ^f)	690 ^{dir} (30000)	1300 ^{dir} (34000)	440 ^{dir} (10000)	690 ^{dir} (10000)	1300 ^{dir} (10000)	440 ^{dir} (7600)	690 ^{dir} (8300)	1300 ^{dir} (9300)	LQM (2014 errata)
Chlorophenols (excluding pentachlorophen ol)	0.87 (g)	2	4.5	94	150	210	0.13 (g)	0.3	0.7	3500	4000	4300	620	620	620	1100	1100	1100	LQM (2014)
Pentachlorophen ol	0.22	0.52	1.2	27 (16.4)	29	31	0.03	0.08	0.19	400	400	400	60	60	60	110	120	120	LQM (2014)
Carbon Disulphide	0.14	0.29	0.62	0.14	0.29	0.62	4.8	10	23	11	22	47	11000	11000	12000	1300	1900	2700	LQM (2014)
Hexachlorobutadi ene	0.29	0.7	1.6	0.32	0.78	1.8	0.25	0.61	1.4	31	66	120	25	25	25	48	50	51	LQM (2014)

(g) derived based on 2,3,4,6-tetrachlorophenol; dir - based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term exposure provided for illustration only); (vap) calculated for vapour phase only. SOM – Soil Organic Matter; (4.5) solubility. (f) This value also exceeds the vapour saturation limit of 24,200 mg/kg.

APPENDIX E - CONTROLLED WATERS RISK ASSESSMENT

CURRENT GUIDANCE FOR CONTROLLED WATERS RISK ASSESSMENT

Regulatory Context

Government policy is based upon a “suitable for use approach,” which is relevant to both the current use of land and also to any proposed future use. When considering the current use of land, Part IIA of the Environment Protection Act 1990 (EPA 1990) provides the regulatory regime, which was introduced by Section 57 of the Environment Act 1995, which came into force in England on 1 April 2000. The main objective of introducing the Part IIA regime is to provide an improved system for the identification and remediation of land where contamination is causing unacceptable risks to human health, controlled waters or the wider environment given the current use and circumstances of the land. Part IIA provides a statutory definition of contaminated land under Section 78A(2) as:

“any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reason of substances in, on, or under the land, that:

(a) Significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) Pollution of controlled waters is being, or is likely to be, caused.”

Part IIA provides a statutory definition of the pollution of controlled waters under Section 78A(9) as:

“the entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter”

Controlled Waters are defined Section 104 of the Water Resources Act 1991. In summary, they comprise relevant territorial waters which extend seaward for three miles from the low-tide limit from which the territorial sea adjacent to England and Wales is measured.

The Environment Agency has powers under Part 7 of The Water Resources Act (1991) to take action to prevent or remedy the pollution of controlled waters, including circumstances where the pollution arises from contamination in the land. This is reinforced in The Contaminated Land (England) (Amendment) Regulations 2012 and Contaminated Land Statutory Guidance (DEFRA, 2012) which came into force in early April 2012.

Part IIA introduces the concept of a contaminant linkage; where for potential harm to exist there must be a connection between the source of the hazard and the receptor via a pathway. Risk assessment in contaminated land is therefore directed towards identifying the contaminants, pathways and receptors that can provide contaminant linkages. This is known as the contaminant-pathway-receptor link (CPR or contaminant linkage).

Part IIA places contaminated land responsibility as a part of the planning and redevelopment process, rather than Local Authority or Environment Agency directly, except in cases of very high pollution risk or where harm is occurring. In the planning process, guidance is provided by National Planning Policy Framework (NPPF) of March 2012. The NPPF requires that a site which has been developed shall not be capable of being determined “contaminated land” under Part IIA. Therefore, appropriate risk-based investigation is required to identify the contaminant linkages that can then be assessed and then mitigated using methods that can be agreed with the planners.

Source Protection Zones

Source Protection Zones (SPZs) are defined by the Environment Agency (for England and Wales), SEPA (Scotland) and the Environment and Heritage Service (Northern Ireland) for groundwater sources such as wells, boreholes and springs that are used for public drinking water supply. The zones show the risk of contamination from activities that might cause groundwater pollution in the area. The size and shape of a zone depends upon subsurface conditions, how the groundwater is removed, and other environmental factors.

SPZs are classified into four categories:

- **Zone 1 (Inner protection zone).** Any pollution that can travel to the abstraction point within 50 days from any point within the zone is classified as being inside Zone 1. This applies at and below the groundwater table. This zone also has a minimum 50 m protection radius around the abstraction point. These criteria are designed to protect against the transmission of toxic chemicals and water-borne disease.
- **Zone 2 (Outer protection zone).** The outer zone covers pollution that takes up to 400 days to travel to the abstraction point, or 25% of the total catchment area, whichever area is the largest. This travel time is the minimum period over which the Environment Agency considers that pollutants need to be diluted, reduced in strength or delayed by the time they reach the abstraction point.
- **Zone 3 (Total catchment).** This is the total area needed to support removal of water from the abstraction point, and to support any discharge from this.
- **Zone of special interest.** This may occasionally be defined as a special case. This is usually where local conditions mean that industrial sites and other potential sources of contamination could affect the groundwater source, even though they are outside the normal catchment area.

Groundwater Vulnerability Assessments

From 1 April 2010 The Environment Agency Groundwater Protection Policy began to use aquifer designations which are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) but also their role in supporting surface water flows and wetland ecosystems.

The aquifer designation data is based on geological mapping provided by the British Geological Survey. It is updated regularly to reflect their ongoing programme of improvements to these maps. The maps are split into two different types of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock - solid permeable formations e.g. sandstone, chalk, and limestone.

The maps display the following aquifer designations:

Table 1. Aquifer Classification ("Geological Classification").

Classification	Definition
Principal Aquifers (Highly Permeable)	These are layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.
Secondary A Aquifers	Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.
Secondary B Aquifers	Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.
Secondary Undifferentiated Aquifers	This has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.
Unproductive Strata	These are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Environment Agency Guidance

The Environment Agency's stance on groundwater resources is:

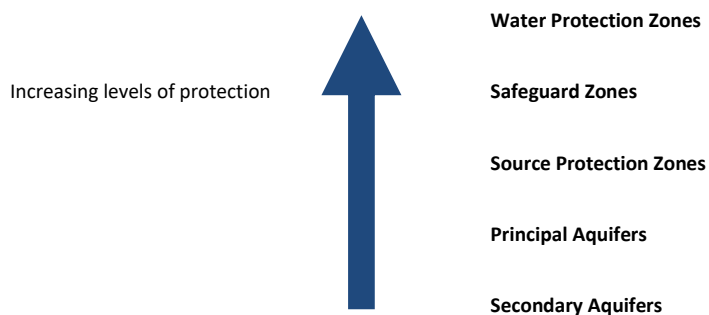
"to protect and manage groundwater resources for present and future generations in ways that are appropriate for the risks we identify"
(Groundwater Protection: Policy and Practice GP3, 2012).

At present, the legislation and guidance pertaining to the protection of controlled waters in the UK is complex; however, the core objectives seek to enforce the position given above.

In 1992, the National Rivers Authority published their Policy and Practice for the Protection of Groundwater (PPPG), this document introduced areas of focus for developments such as Source Protection Zones (SPZs) and Groundwater Vulnerability Maps. The Policy was revised in 1998, since which there have been substantial changes in legislation, driven by key European Directives relating to groundwater include the Groundwater Directive (80/68/EEC) and the Water Framework Directive (2000/60/EC). Aspects of these directives are controlled by primary UK legislation such as the Water Resources Act 1991 as amended by the Water Act 2003. Gaps in the 1998 PPPG that emerged as the result of further legislative changes were addressed in the Environment Agency Policy document Groundwater Protection: Policy and Practice (GP3), Version 1 of November 2012. The three main parts of GP3 were:

- Groundwater principals;
- Position statements and legislation; and
- Technical information.

The Environment Agency has a tiered risk based approach to drinking water protection as summarised below:



Controlled Waters Risk Assessment

A number of tools are available (as detailed in GP3) in order for a developer of a potentially contaminated site to fulfil their obligations under the legislation. A site assessment would be required in order to identify any potential risks to controlled waters and to derive suitable clean up criteria, if required, to ensure the protection of controlled waters.

There are three main stages to any risk assessment of controlled waters:

1. Risk Screening (devise Conceptual Site Model, making reference to groundwater vulnerability maps, site setting, controlled waters context etc)
2. Generic Risk Assessment (EA Remedial Targets Methodology Tier 1 / Comparison of groundwater data with relevant standards)
3. Detailed Quantitative Risk Assessment (Consideration of aquifer properties and site specific parameters, EA Remedial Targets Methodology Tiers 2 & 3)

Risk Screening

Here, the Conceptual Site Model (CSM) is a critical tool to assessing any potentially contaminated site. The information from a robust CSM can be used to establish any pathways or receptors that do not require further assessment at an early stage. For example, it may be possible to confirm the absence of a particular sensitive controlled water receptor (such as a surface water feature) within the vicinity of the site thereby breaking the associated source-pathway-receptor pollutant linkage. Information from subsequent tiers of risk assessment, such as following intrusive investigations, are used to update the CSM accordingly.

Generic Risk Assessment - England and Wales

When undertaking the Generic Hydrogeological Risk Assessment (EA Remedial Targets Methodology Tier 1), comparison of chemical analytical results is made with those screening criteria.

In accordance with Part 2A of the Environmental Protection Act 1990, Tier Environmental has made regard to all of the Water Quality Standards (WQS) that are relevant to the specific site and a judgment has been made against the most stringent of those relevant standards:

- EQS Directive 2008/105/EC
- Priority Substances Directive 2013/39/EU
- Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015
- UK Drinking Water Standards (UK DWS)
- World Health Organisation (WHO Guidelines) for Drinking Water Quality
- Council Directive 98/83/EC on the quality of water intended for human consumption (Drinking water directive)

In some instances, the laboratory method detection limit is greater than the appropriate EQS/UKDWS value. In these instances, only measured concentrations in excess of the laboratory method detection limit have been considered likely to potentially represent a possible significant risk to controlled waters.

Please note that there is no quantitative criterion for total petroleum hydrocarbons (TPH), or speciated TPH fractions. Historically, standards provided for petroleum hydrocarbons ranges from 10µg/l (Private Water Supply Regulations 1991, removed from the 2009 regulations) to 50µg/l-1000µg/l (Surface Waters (Abstraction for Drinking Water) Regulations 1989) which related to the degree of treatment of water prior to use as drinking water. Over time, the legislative standards have been rescinded and no alternative standard provided, although the Environment Agency planned to release speciated TPH criteria (Fretwell et al., 2009).

In order to assess whether there is a potentially unacceptable risk of pollution of controlled waters, the results of the groundwater chemical analysis for TPH and BTEX were evaluated against Water Quality Standards (WQS) appropriate to the conceptual model for the site:

Table 2. Summary of Selected TPH and BTEX Water Quality Standards Selected for Tier 1 Screening

Determinand	Units	WQS Selected	Source of WQS
Aliphatics >C5-C6	µg/l	15000	Table 5.4 of CL:AIRE 2017#
Aliphatics >C6-C8	µg/l	15000	Table 5.4 of CL:AIRE 2017#
Aliphatics >C8-C10	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C10-C12	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C12-C16	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aliphatics >C16-C21	µg/l	-	Table 5.4 of CL:AIRE 2017#
Aliphatics >C21-C35	µg/l	-	Table 5.4 of CL:AIRE 2017#
Aromatics >C5-EC7	µg/l	10	Table 5.4 of CL:AIRE 2017#
Aromatics >EC7-EC8	µg/l	700	Table 5.4 of CL:AIRE 2017#
Aromatics >EC8-EC10	µg/l	300	Table 5.4 of CL:AIRE 2017#
Aromatics >EC10-EC12	µg/l	100	Table 5.4 of CL:AIRE 2017#

Aromatics >EC12-EC16	µg/l	100	Table 5.4 of CL:AIRE 2017#
Aromatics >EC16-EC21	µg/l	90	Table 5.4 of CL:AIRE 2017#
Aromatics >EC21-EC35	µg/l	90	Table 5.4 of CL:AIRE 2017#
Benzene	µg/l	10	Priority Substance Water Framework Directive 2015 and Table 5.3 of CL:AIRE 2017#
Toluene	µg/l	74	Table 1 Water Framework Directive 2015 and Table 5.3 of CL:AIRE 2017#
Ethylbenzene	µg/l	20	R&D Technical Report P2-115/TR4, 2002
Total xylenes	µg/l	30	DoE (1997c) Hedgecott S. and Lewis S, An update on proposed environmental quality standards for xylenes in water, final report to the Department of the Environment. Report No. DoE 4273/1. Medmenham: WRc; and; Table 5.3 of CL:AIRE 2017#

Notes - # = CL:AIRE document 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' (ISBN 978-1-905046-31-7, dated 2017),

Table 5.3 was referenced in the first instance from the CL:AIRE document 'Petroleum Hydrocarbons in Groundwater: Guidance on assessing petroleum hydrocarbons using existing hydrogeological risk assessment methodologies' (ISBN 978-1-905046-31-7, dated 2017), the to select appropriate Freshwater EQS values for benzene, toluene and total xylenes. The selected value for Ethylbenzene was derived from the proposed EQS value of 20µg/l from the Environment Agency R&D Technical Report P2-115/TR4, 2002. This represents a more conservative value than the 300µg/l value in Table 5.3.

With respect to speciated TPH CWG fractions, Table 5.3 states and refers the reader to 'See Table 5.4'. On this basis, Tier Environmental selected the World Health Organization (WHO) guide values for TPHCWG fractions in drinking water that are presented in Table 5.4 which may be considered appropriately protective of the controlled waters environment based on the conceptual site model.

Generic Risk Assessment is generally undertaken via comparison of reported leachate and/or groundwater concentrations against selected assessment criteria for the potential contaminants of concern identified for the site from a preliminary desk based assessment.

The selected Generic Assessment Criteria (GAC) derived from a Water Quality Standard (WQS) for any specific substance may not necessarily be a simple number and can often be found to be expressed as:

- Annual mean concentration;
- Maximum allowable concentration;
- 95th percentile concentration for *n* samples;
- Total concentration;
- Dissolved concentration (applicable to filtered samples)

The values may sometimes be expressed for individual substances (e.g. arsenic or for groups of substances e.g. total xylenes or sums of certain PAHs).

Environmental Quality Standards (EQS) have been used where available for Priority Substances and Priority Hazardous Substances set at a European level:

- Priority Substances Directive 2013/39/EU;
- Amending 2008/105 and 2000/118/EC

In addition, EQS values derived for Specific Pollutants have been used as presented in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

For assessing risks to potable water abstraction supplies, UK Drinking Water Standards presented in the Water Supply (Water Quality) Regulations 2000 (SI/2000/3184) (as amended) have been applied.

In selecting a GAC for a particular site, Tier Environmental considers the following factors:

- Current use/function of the groundwater (e.g. drinking water, irrigation water, industrial use, base-flow to rivers and streams);
- Plausible, proposed or planned future uses of the water and nearby waters;
- Sensitivity of the critical receptor (e.g. human health, aquatic life); and,
- Requirements to trigger action under the legal context

In accordance with Part 2A:

"in deciding whether pollution of controlled waters is occurring, the assessor will have regard to all of the water quality standards that are relevant to the specific site and make a judgment against the most stringent of those relevant standards"

Should the Level 1 or 2 assessments indicate threshold levels to be exceeded, then there are three alternative ways in which to proceed:

- To devise suitable remedial solutions;
- To carry out more investigation, sampling, and analysis;
- To conduct a site-specific Detailed Quantitative Risk Assessment (DQRA) to whether or not the soil materials are suitable for their site-specific intended use or to devise a site-specific clean-up level.

Detailed Quantitative Risk Assessment (DQRA)

The decision to carry out a DQRA will be informed by the initial qualitative and generic assessment. The scope of any such assessment will be accurately defined by the outcomes of the former two stages. The robust CSM will be sufficiently refined by this stage that only certain contaminants of concern, certain pathways and certain receptors will require further assessment.

Additional site specific data is normally required for this stage of assessment, as explained above, more processes that are capable of affecting contaminant concentrations are considered (such as dilution and attenuation).

Remediation criteria derived will therefore be specific to each site and will be based on a detailed assessment of the potential impact at the identified receptor or compliance point. A greater level of confidence can be placed on the predicted impact on the compliance point following a DQRA.

Hazardous and Non Hazardous Substances

The Groundwater (England and Wales) Regulations 2009 control the disposal to the hydrogeological environment of potentially polluting substances which are divided into Hazardous Substances and Non-hazardous Contaminants (this roughly approximates to the former List 1 and List 2 substances).

Hazardous Substances are the most damaging and toxic and must be prevented from directly or indirectly entering the groundwater environment. Hazardous Substances include mineral oils and hydrocarbons, pesticides, biocides, herbicides, solvents and some metals. Discharge of Hazardous Substances to Controlled Waters must be prevented.

Non-hazardous Pollutants are any contaminants other than Hazardous Substances. Non-hazardous Pollutants are potentially toxic but are less harmful than Hazardous Substances, but their direct discharge to groundwater is generally not permitted and any indirect discharge to groundwater must be limited and be controlled by technical precautions in order to prevent pollution. Non-hazardous Pollutants include ammonia and nitrites, many metals and fluorides.

APPENDIX F - CHEMICAL TEST SAMPLING

Samples were selected by a representative of Tier Environmental during the site investigation works in accordance with the sampling approach described elsewhere in this report.

Samples for chemical analysis

All samples for chemical analysis were placed into clean new containers as summarised in Table 1. Unless explicitly stated elsewhere in this report, no preservatives were used to eliminate the risk that preservatives cause contaminant dissolution or analytical interference. Containers for VOC analysis were fully filled to exclude headspace.

Soil samples were dispensed as soon as possible after collection using reusable stainless steel spatulas, trowels, or similar implements.

Ground water samples were collected from boreholes using single-use Teflon bailers or dedicated Waterra tubing with foot valves, except as otherwise noted within this report. Caution was taken to avoid excessive agitation during collection

New disposable gloves were used by the engineer for the collection of each sample.

Reusable equipment was washed down with distilled or deionised water between samples, except where tarry or similarly sticky materials were present. In such cases specific cleaning procedures were adopted as specifically described elsewhere in this report.

All sub-samples taken for chemical analysis were placed into refrigerators or cool boxes containing frozen ice packs immediately after aliquoting. All samples were transferred in cool boxes containing frozen ice packs to the relevant UKAS/MCERTS accredited laboratory as soon as possible. Recommended maximum holding times before analysis are summarised in Table 1.

Table 1. Sample containers and holding times.

Analysis	Container/special requirements	Max. holding time at 4°C before analysis
Soil and sediment samples		
VOCs	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner. Must be fully filled.	14 days
TPHCWG	30-60 g brown or green glass jar with VOC-resistant cap and inert cap liner PLUS 250-500 g brown or green glass jar with unwaxed cap liner. ¹ The former must be fully filled.	14 days
All other organics	250-500 g brown or green glass jar with unwaxed cap liner.	7 days
Inorganics	Air-tight 0.5-2.0 kg plastic container (250-500 g brown or green glass jar may also be used).	14 days ²
Water samples		
VOCs	40-50 ml glass vial with VOC resistant screw cap and inert liner. Must be fully filled.	14 days
TPHCWG	40-50 ml glass vial with VOC resistant screw cap and inert liner PLUS 500-1000 ml brown or green glass bottle with screw cap and unwaxed liner. ¹ The former must be fully filled; the latter should be filled if possible.	14 days
All other organics	500-1000 ml brown or green glass bottle with screw cap. Fill if possible.	7 days
Inorganics	500-1000 ml translucent or opaque screw cap plastic <i>or</i> brown or green glass bottles. Fill if possible.	14 days ³

¹ The smaller vessel is used for analysis of the volatile components within the TPH mixture and the larger one is for the non-volatile components.

² 14 days is set as a reasonable limit for all routine analyses of soil for those inorganic components vulnerable to chemical and/or biological breakdown. Samples for sulphate analysis are vulnerable to biological sulphate-reduction but can be held for up to 28 days. For total metals, a holding period of up to 6 months is acceptable.

³ 14 days applies for all routine analyses of most inorganic components that may be vulnerable to chemical and/or biological reactions. In the specific cases of sulphide, nitrite, nitrate and phosphate analyses, storage time must not exceed 48 hours. For total metals, a holding time of up to 6 months is acceptable.

Tier Environmental standard analytical suites

The analyses included with Tier Environmental's standard analytical suites for soil, soil leachate and water samples are presented in Table 2. Other individual analyses were specified as described within this report.

Table 2. Tier Environmental Standard Analytical Suites.

Parameter	Sample type					
	Soil		Leachate ¹		Water	
		LoD ² (mg/kg or as stated)		LoD (µg/l or as stated)		LoD (µg/l or as stated)
Metals and metalloids						
Arsenic	✓	1	✓	10	✓	10
Cadmium	✓	1	✓	5	✓	5
Chromium	✓	1	✓	5	✓	5
Mercury	✓	1	✓	1	✓	1
Lead	✓	1	✓	4	✓	4
Selenium	✓	2	✓	10	✓	10
Copper	✓	1	✓	1	✓	1
Nickel	✓	1	✓	50	✓	50
Zinc	✓	1	✓	8	✓	8
Other inorganics						
Ammonia (as NH ₄ -N)					✓	15
Total sulphate	✓	100			✓	50 mg/l
Water-soluble sulphate	✓	0.1 g/l				
Hardness (as CaCO ₃)					✓	1 mg/l
Organics						
Monohydric phenol	✓	1	✓	0.5	✓	0.5
Speciated PAHs (USEPA 16)	✓	0.1	✓	0.01	✓	0.01
Total Organic Carbon	✓	0.1 wt%				
Others						
Electrical conductivity					✓	NA
pH	✓	NA	✓	NA	✓	NA

NA - Not applicable

¹ Leachate preparation according to NRA (1994), 10:1 liquid to solid ratio.

² The table presents the desired limit of detection for the analysis. Higher LoDs may be reported on analytical data sheets due to interference between analytes within specific samples or if the laboratory needed to dilute samples to achieve results within the calibrated range for that instrument.

Analytical QA procedures

Introduction

Quality Assurance (QA) is a system of review and audit that assesses the effectiveness of that product and assures the producer and user that defined standards of quality have been met. If we consider site investigation and chemical analysis, QA is the management system that ensures these measures are in place and working as intended.

QA within the laboratory form part of relevant certification programmes (such as UKAS and MCERTS) and, indeed, will be undertaken in some form by any reputable analyst, whether for a certified technique or not. Laboratory QA/QC is beyond the control of Tier Environmental and will not be considered further in this document, although the relevant laboratory documentation can be obtained upon request. QA must also form part of the design and execution of a site investigation.

Two parameters often used to assess measurement quality objectives are bias and precision. Bias is a systematic deviation in the data. For example, a positive bias (concentrations higher than in reality) would be introduced if sampling bottles were a source of the analyte and this fact was unknown. Precision is the variation in the measurements around a central 'expected' value. This could be due both to real variability in the environmental medium being measured and random errors in the analytical process. Both precision and bias can be assessed by the use of appropriate blanks and replicates within the site investigation programme.

The objectives of the QA activities undertaken in this present site investigation were to recognise and quantify systematic bias within the analytical dataset and to obtain an indication of precision. In environmental samples, much of the observed variability is likely to result from heterogeneity in the sampled medium, particularly for soil and sediment samples.

Such QA practice within the sampling programme is required by current guidance (e.g., Environment Agency report P5-065/TR (2000); Environment Agency LFTGN02 (2002); BS 10175:2026).

Alternative QA procedures to the generic approach presented in this appendix may be specified for a project, provided case-specific justification is given.

QA checking procedure (data validation)

The responsible Engineer and Project Reviewer are required to undertake data validation and provide comment on data quality within the main body of the report(s) issued, when noteworthy matters arise. This QA checking should involve:

Confirming that data reported by the laboratory have achieved the standards specified by the certification scheme (MCERTS or UKAS). This will be indicated on the analytical certificates issued by the laboratory.

Checking that the limit of detection (LoD) and limit of quantification (LoQ) achieved by the laboratory for an individual analyte is appropriate for the purposes of the report. LoD and LoQ will vary dependent upon analyte concentrations, sample matrix properties and interference from co-contaminants.

A check that the reported range of concentrations are reasonable for the analyte. For example, the dissolved concentration of an analyte in a water sample should not exceed saturation. If it does, then this merits further consideration (e.g., was colloidal organic matter or other solid-phase material present or could there have been unobserved free-phase organic liquid?) and explicit comment. At its simplest, there may be a unit error.

Where analysis involves reporting of Tentatively Identified Compounds (TICs; normally by mass spectrometry), the reviewers should check that these might reasonably be expected at the site under consideration. The uncertainties in identification by MS mean that it is not uncommon that TICs are incorrectly assigned. In cases of doubt, the analytical laboratory can re-check the raw data and confirm.

A review of the analytical precision by comparing data obtained for duplicate samples. There is no absolute threshold - variability is entirely dependent upon the sample matrix and manner in which the contaminant has entered the sample. Variability that cannot reasonably be assigned to such factors (for example a very high apparent variability in data for sediment-free water samples) should be reviewed with the laboratory. Variability that is attributable to the sample matrix can nevertheless provide important pointers to improve understanding of contaminant transport pathways and the risks posed by pollutant linkages (e.g., soil heterogeneity, the association of contamination with particular soil fractions, the presence of residual NAPL within soil pores or the role of suspended sediments in contaminant transport).

Confirmation that no errors have been introduced by data transcription, unit conversion or corrections between preliminary and certificates issued by the laboratory. The reviewer should audit a proportion (typically 5-10%) of all data from the original (final) certificates of analysis through to the equivalent values in the report for those specific samples.

It is important to consult the analytical laboratory if apparent QA issues arise. Many apparent concerns can be adequately resolved on the basis of revisiting the raw analytical data or by obtaining a better understanding of the inherent limitations of the analysis for a particular matrix or sample type.

APPENDIX G - COMPLYING WITH CONTROL OF ASBESTOS REGULATIONS 2012

Complying with Control of Asbestos Regulations (CAR): Risk Assessments, Licensing and Training

This appendix outlines CAR risk assessments and where they should be applied in relation to assessing and remediating brownfield sites. The information below details the different classifications of work with asbestos under CAR, summarises the legal requirements for asbestos awareness training for all involved in the investigation and management of asbestos containing soil (ACS), and details the potential requirements for suitable proficiency training relating specifically to ACS.

CAR RISK ASSESSMENTS

A CAR Risk Assessment is required for any work which may expose employees to asbestos. It is recommended that a precautionary approach is adopted if there is any doubt about risks associated with asbestos.

There are three main activities for potential asbestos exposure during work on brownfield sites:

- Site reconnaissance visits;
- Site investigation works; and
- Site remediation.

CAR risk assessments are needed at each stage but may be incorporated during the site investigation stage into the overarching health and safety risk assessments.

The CAR risk assessment must:

- Identify the type of asbestos to which employees are liable to be exposed, where possible, or assume it is present in different forms;
- Determine the type and extent of exposures to asbestos that may occur during the work
- Identify the steps to be taken to prevent exposure or reduce it to the lowest level reasonably practicable; and,
- Consider the effects of control measures that have been or will be taken.

The CAR risk assessment should include any information used to inform the risk assessment such as asbestos reports or desk study information. In the event that this information is not available, the assessor should be assumed that all forms of asbestos may be present on site.

For all investigation and remediation of ACSs, a detailed written work plan should be produced and followed as detailed on the HSE website and in the CAR.

The CAR risk assessments for specific investigations or remediation projects, will determine whether or not work is 'licensable work' (LW), notifiable non-licensable work' (NNLW) or 'non-licensed work' (NLW). In addition, training requirements are also defined by the CAR risk assessment.

Some examples of control measures that apply during site reconnaissance, site investigation works, and site remediation are given below and should be applied depending on the asbestos risks identified for the site at each stage of investigation:

- Avoiding stirring up dust;
- Cleaning footwear after site works;
- Removing and bagging any overalls for disposal/laundry;
- Respirators and hygiene facilities for high risk sites;
- Segregated welfare units;
- Wetting ground
- Minimising soil disturbances;
- Implementation or retention of capping/break layers;
- Implementation of awareness training;
- Air monitoring;
- Managing stockpiles;
- Area segregation;
- Wheel washing
- Road washing/cleaning

It is important to note that during site reconnaissance visits, site investigation works and site remediation that asbestos should not be considered in isolation and control measures are likely to form part of a wider health and safety precautions.

Respiratory protective equipment (RPE)

RPE is the last line of defence and its requirement would be defined by the CAR risk assessment. HSE (2013b) advises that RPE should have an assigned protection factor of 20 or more for all work with asbestos. In certain instances, full face-piece, positive pressure respirators with a protection factor of 40 are necessary (to EN 12942:1998, TM3).

Suitable types of RPE for most **short** duration non-licensed asbestos work:

- Disposable respirator to standards EN149 (type FFP3) or EN1827 (type FMP3)
- Half mask respirator (to standard EN140) with P3 filter
- Semi-disposable respirator (to EN405) with P3 filter

These filters are not suitable for people with beards/stubble or for long or continuous use.

LICENSING

CAR defined certain types of activities involving asbestos as 'licensable work' (LW) or as 'notifiable non-licensable work' (NNLW). All other work would be 'non-licensable work' (NLW).

LW is defined as:

- work where exposure is not 'sporadic and low intensity'
- work where the risk assessment cannot demonstrate that the control limits (four hour and 10 minute limits) will not be exceeded
- work on asbestos coating
- work on AIB or insulation where risk assessment is either of first two points above or not of short duration (where short duration is defined for any work liable to disturb asbestos as taking less than two hours per week (including ancillary work) and no one person carries out that work for more than one hour').

NNLW includes work with:

- AIB or asbestos insulation of short duration that is not licensable
- fire-damaged asbestos cement or asbestos cement damaged so as to create significant dust and debris
- asbestos ropes, yarns, woven cloths in poor condition or handling cutting or breaking up the materials
- asbestos papers, felts and cardboard in poor condition, unencapsulated or not bound into another material.

Work with weathered asbestos cement, air monitoring and collecting samples of ACM in buildings would not normally be notifiable.

It is impossible to specify definitively what activities will and will not be licensable. This decision should be made as part of the CAR risk assessment. CAR is not primarily aimed at work with ACSs and there is little published information on airborne asbestos concentrations during work with ACSs. Nevertheless, CAR will require some remediation projects, and occasionally site investigations, to be LW. Investigations on other sites may involve NNLW. The decision as to whether work is LW or NNLW should be made during the CAR risk assessment by those in charge of the brownfield site investigations and remediation projects.

TRAINING REQUIREMENTS

Asbestos health and safety courses are offered by a number of providers in the UK. Training courses that include the problem of identifying ACMs in soil should be undertaken at regular intervals by those involved in the investigation, assessment and management of sites where ACs are known or suspected. It is the role of the employer to identify the level of training required for an employee based on their role, experience and duties. Reference to Regulation 10 of CAR should be referred to for more information on training requirements.

Recognising asbestos within soils is challenging due to the heterogeneity of such soils and the discolouration of asbestos by smeared soil. Specific training for ground workers should include understanding fibre release potential, potential control measures in the field, how to take representative ACSs safely, sample labelling and what analytical tests are available and when they should be implemented.

Health and safety training required under CAR includes asbestos awareness, non-licensable work (including notifiable non-licensable work) and licensable work with asbestos.

In addition to health and safety training, some staff involved in the technical identification on site of ACMs, sampling and analysis may require technical proficiency training (competency training).

Training vs. Competence

HSE (2005) identifies that 'training alone does not make people competent. Training must be consolidated by practical experience so that the person becomes confident, skilful and knowledgeable in practice on the job'. It is critical that ACS surveyors demonstrate competency with details of relevant field experience alongside training and examples of previous works/references.