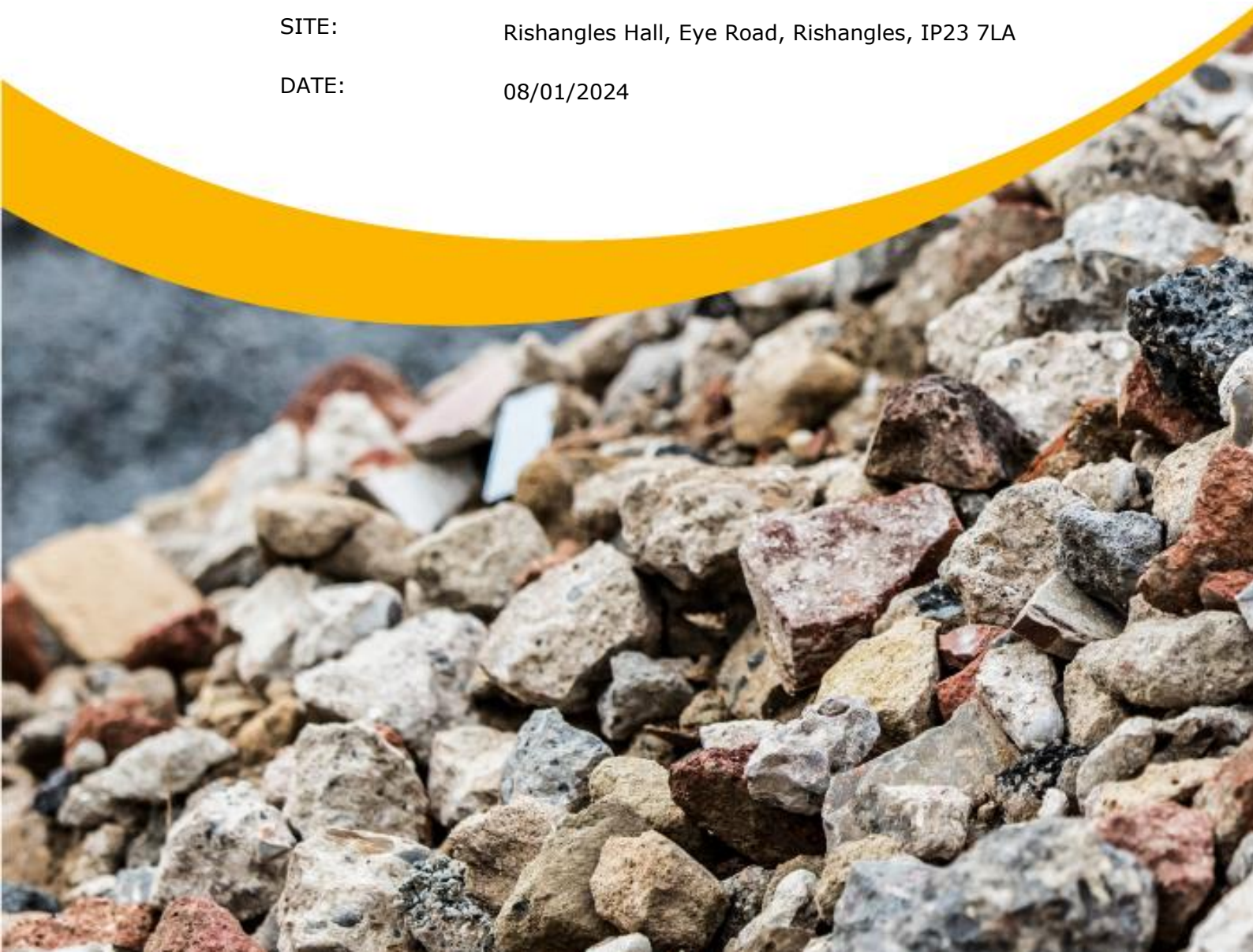
GEOSPHERE ENVIRONMENTAL

REPORT NUMBER:	8062,GI,RMS,RMS,PC,HS,08-01-24,V1
SITE:	Rishangles Hall, Eye Road, Rishangles, IP23 7LA
DATE:	08/01/2024



DOCUMENT CONTROL SHEET

Report Number:	8062,GI,RMS,RMS,PC,HS,08-01-24,V1
Client:	Mrs. Jane Smith c/o Peter Wells Architects Ltd
Project Name:	Rishangles Hall, Eye Road, Rishangles, IP23 7LA
Project Number:	8062,GI,RMS
Report Type:	Remediation Method Statement
Status:	Final
Date of Issue:	08 January 2024

Issued By:

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VERSION RECORD

Version	Date	Document Revision Details	Prepared By:	Admin
1	08/01/24	Original Version	PC	HP

CONTENTS

1. INTRODUCTION

Geosphere Environmental Ltd was appointed by the Client: Mrs. Jane Smith c/o Peter Wells Architects Ltd, to provide a Remediation Method Statement (RMS) for a proposed development at Rishangles Hall, Eye Road, Rishangles, IP23 7LA.

A previous ground investigation, undertaken in 2023 at the site, identified elevated Total Petroleum Hydrocarbons (TPH) concentrations within soils within the locality of WS09. An additional area, WS13, was identified to also have a marginal exceedance of Lead but was located beneath proposed hard standing and therefore was discounted as a significant risk as any pathways between source and end users had been broken.

Asbestos fibres were detected in a single window sample location, WS10 below the concrete slab in the barn, and within surface samples taken from along the length of an unsurfaced track. Fragments of asbestos containing material (ACM) as fibre-cement were also noted along the track.

This ground investigation is detailed further in Section 2 of this report.

1.1 Objectives

The objective of this RMS is to provide an economic and feasible methodology to break the identified contaminant source-pathway-receptor linkage and record the works, in line with current UK government guidelines.

The proposed methodology has the following key objectives:

- To limit direct and indirect exposure of the identified contamination to groundworkers and future residents;
- To reduce the risk from the identified contamination to future planting in gardens and landscaped areas; and
- To reduce the risk from the identified contamination to controlled waters.

This report also includes a Discovery Strategy, recommended to be put in place during the construction phase of the development, in case any unexpected suspected gross contamination should be encountered during any further ground works at the site.

2. PREVIOUS REPORTS

The following reports are relevant to this RMS and have previously been produced for the site:

- ***'Phase 1 – Contaminated Land Assessment',*** report reference: IE19/100 prepared by JPC Environmental Services dated January 2020;
- ***'Phase 2 – Ground Investigation',*** report reference: 7213,GI/GROUND/PC,TP/03-01-24,V2 prepared by Geosphere Environmental Ltd dated 03 January 2024.

It is recommended that the above reports are read in conjunction with this report where necessary. This section shall only detail the findings of the last report that directly recommended this method statement be produced.

2.1 Phase 2 Ground Investigation

The intrusive ground investigation identified the following potential contaminants within soils at the site which required remediation:

- Asbestos; and
- Elevated TPH at location WS09.

Asbestos was identified as cement bound fragments along the surface of the track and as fibre bundles within each of four soil samples taken from along the track. This track was noted to be outside the fence-line of the proposed residential property, but still within the planning red-outline boundary. Beyond the track, asbestos fibres were also detected within a single sample taken from WS10.

Out of the five samples where asbestos was detected during the initial screening, it was present at a quantifiable concentration within just two samples, HP02 and HP03, both at a concentration of 0.001%. The other three results were reported at less than the laboratory analytical limit of detection (LOD) i.e. <0.001%.

The elevated TPH was considered to be an isolated exceedance of the applied screening criteria, and not indicative of gross contamination at the site as it was only recorded within a single location, WS09. WS09 was located within an area proposed to be soft landscaping in the final development and mitigation / remediation was recommended.

3. PROPOSED SOIL REMEDIATION WORKS

3.1 Objectives of the Remediation

The objective of the overall remediation works is to provide an economic and feasible methodology, in line with current UK government guidelines, by breaking the source-pathway-receptor linkage and mitigating identified significant risks associated with former uses of the site.

The proposed scheme has the following key objectives:

- To limit the potential exposure to asbestos to end users and construction workers; and
- To limit the exposure to potential contaminants at WS09 to end users and groundwater.

3.2 Asbestos

3.2.1 Key Regulations and Guidelines

All works involving asbestos in the UK must comply with the requirements of the 'Control of Asbestos Regulations (CAR)', 2012 (ref. **R.6**). The regulations apply to all asbestos works and are not specific to work with asbestos in soil. To assist with interpretation of the regulations, in 2016, CL:AIRE produced 'Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance (CAR_SOIL™)' (ref. **R.7**).

In 2021, the Network for Industrially Co-ordinated Sustainable Land Management in Europe (NICOLE), undertook a review of best practice principles in asbestos in soil management across Europe (ref. **R.8**). The review concluded that there were many inconsistencies in the adopted screening criteria between European countries and highlighted that the management of asbestos in soils was often driven by stakeholder perception as opposed to risk-based assessment (i.e., hazard based rather than risk-based).

The underlying principles of the contaminated land Risk Assessment process in the UK require risk to be determined as a factor of hazard severity and likelihood of exposure. Therefore, whilst asbestos is recognised to be a significant hazard, consideration must also be given to the likelihood of exposure and any mitigating controls/factors that would influence it.

The NICOLE review concluded that there was opportunity for European Regulations to learn from the national guidelines of countries outside of Europe, such as the USA and Australasia. In 2016, the Australasian Land and Groundwater Association (ALGA) and Building Research Association of New Zealand (BRANZ) produced the 'New Zealand Guidelines for Assessing and Managing Asbestos in Soil' (BRANZ, 2016) (ref. **R.9**). This guideline provides quantitative criteria for the protection of human health for asbestos in soil in a range of land-development scenarios.

3.2.2 Adopted Screening Criteria

In the absence of published UK-specific guidelines, for the purpose of loose asbestos fibres risk assessment, the widely adopted Tier 1 UK screening criteria of no greater than 0.001% w/w has been adopted. This guideline is also consistent with the aforementioned BRANZ screening criteria and is more conservative than other European guidelines. This criteria has not been exceeded within any of the recorded samples.

In lieu of UK remediation targets for bonded asbestos, it is proposed that the risk-based criteria provided in BRANZ are adopted for the purpose of Risk Assessment and remediation. This table is included as Appendix 5, but in summary for a residential setting these criteria are:

- ACM (bonded) <0.01% w/w; and
- No visible asbestos within the upper 100mm soils.

3.2.3 Asbestos Picking of Soils

Loose asbestos fibres were not recorded at concentrations above the screening criteria, however the presence of bound asbestos fragments and the potential for disturbance via vehicle movement along the track is a risk that should be addressed via visual screening/picking of ACM fragments, and if necessary (see discussion below)*, below the concrete slab around WS10. The process for this is detailed below:

1. The remediation area should be divided into a grid. The grid should be walked north to south and east to west and any visible fragments of ACM at the surface collected, marked on a plan, and disposed of in accordance with the practices set out in Section 4 below. A minimum of two passes should be made at each grid section.

2. The surface of the site should then be raked to approx. 50-100mm depth, using a mechanical excavator toothed bucket/hand tools or similar, to remove vegetation that may be obscuring surface fragments of ACM.

3. Step 1 should then be repeated.

4. Once all visible ACM has been picked from the raked surface, these soils should be scraped back and temporarily stockpiled. Stockpiling should be in accordance with best practice as detailed in CAR-SOIL™. Soils should be stockpiled in such a way that cross contamination of additional soils (e.g. those below the stockpile) does not occur.

5. The raking process described in Step 2 and inspection process in Step 1 should be repeated in up to 100mm layers to a depth of 300mm below existing ground level, or the top of natural soils, whichever is shallower.

6. The treated soils can then be placed back in the areas from which they arose. Emplaced soils should be compacted (as required) to a suitable specification for use.

**Asbestos fibres were recorded at levels below the screening criteria of 0.001% within WS10 and no cement bound fragments were noted. This area is located beneath the concrete floor slab of the existing barn, to be demolished. If the floor slab is to remain in-situ post development, then the pollutant pathways between potentially contaminated underlying soils and receptors would be broken. As such, no further remedial works would be required for this area of the site. However, if the slab is to be removed then the Discovery Strategy should be implemented and, should any suspected ACM fragments be noted then the grid picking methodology detailed above should be extended across the affected area to minimise disturbance and ensure that vehicles tracking/working in these areas of the site during development do not track/cross-contaminate other areas of the site with asbestos.*

3.3 Soil Cover System – TPH Hotspot

An over-arching approach is proposed, to deal with the hazard of potentially unsuitable quality soils within the soft landscaped portions of the subject area:

- This approach comprises creation of a "soil cover system" via:
    - (i) removal of existing Made Ground to 600mm below finished ground level from a 3m x 3m* square centred on WS09; and
    - (ii) replacement with suitable quality soils.
- The resultant WS09 void to be backfilled with chemically suitable soil for the proposed residential end use;
- Validation testing of any imported (and re-used/site-won) material will be required to confirm chemical suitability to the adopted guideline values (see below);
- Where natural soils are encountered at depths shallower than 0.6m below finished ground level (bfgl), excavation (remediation) can halt at this natural stratum. A single laboratory test of the natural material should be obtained to confirm its chemical suitability;
- If Made Ground soils extend beyond the required 600mm depth of cover from finished ground level, the emplacement of an anti-dig membrane will be required, this is further detailed in Section 3.4.

**The historic barn to the south of WS09 is to remain in-situ and be converted as part of the proposed development, therefore excavation in this direction may be restricted but should be extended as close to the specified dimensions as practicable.*

3.4 Anti-dig Membrane

Emplacement of a permeable 'anti-dig' membrane between the 'clean' cover system of imported / emplaced soils and underlying Made Ground is possible to prevent long-term natural and anthropogenic causes of mixing or exposure.

The membrane should cover the base and sides of the excavations and sections of membrane should overlap by at least 300mm. Good practice includes temporarily anchoring the membrane up and over the sides of the excavation while the replacement soils are emplaced, then trimming the membrane to make good in advance of final soil/landscaping covering.

An example of a suitable membrane material or supplier can be provided to the Client upon request.

The emplacement of this membrane must be recorded (photographs) as part of the construction / landscaping process for inclusion within the validation / verification report.

3.5 Sampling of Imported and Emplaced Soils

Validation confirmation of depth (600mm or less, where natural soils are consistently encountered) of the imported or site-won and emplaced soils should be undertaken (nominally by hand-tool-excavated pits) followed by chemical analyses to confirm suitability.

If topsoil and subsoil has been emplaced a sample of each will be required.

The results of the soil analyses of imported soils would be compared to current soil quality screening values for residential end-use scenarios, such as:

- The LQM/CIEH S4ULs for Human Health Risk Assessment;
- Defra/CL:AIRE Final C4SL for lead; and
- The EIC/AGS/CL:AIRE Generic Assessment Criteria (GAC).

The chemical criteria for imported and / or emplaced or re-used soils, that are to be used onsite, are based upon the industry-recognised soil quality values, summarised in Appendix 4.

Further to the above, soils used for backfilling should be compacted in layers to avoid subsequent settlement but not over-compacted to prevent root development or waterlogging. As a guide, but to be detailed by the landscape designers, soil cover systems can comprise a combination of suitable quality topsoils and subsoils.

BS3882;2015 and BS8601;2013 provide guidance of the quality of these soils from the aspect of nutrient content and other quality factors. These are outside the scope of assessment here. The details provided below and in Appendix 4 determine the quality requirements from a human health Risk Assessment aspect only.

All soils emplaced in soft landscaping will require the following chemical analyses of a representative number of samples:

- Metals screen - arsenic, cadmium, chromium, lead, mercury, selenium, boron (water soluble), copper, nickel, vanadium and zinc;
- Organics screen – Total extractable hydrocarbons (EPH, C10-C40) or speciated total petroleum hydrocarbons (TPH) – with specific carbon banding; benzene, toluene, ethylbenzene and xylenes (BTEX); polyaromatic hydrocarbons (PAH) – USEPA 16 suite;
- Inorganics screen - cyanide (total), sulphate (water soluble) and sulphate (total);
- Others – asbestos screen, pH and TOC/SOM.

This soil sampling and analysis can sometimes be undertaken at the soil source, if consistent (i.e., British Sugar topsoils) and be acceptable to Third Parties or Stakeholders. It may be possible to then exclude part of the onsite sampling regime, subject to agreement with stakeholders and Regulatory Authorities. If a reliable or consistent source of suitable quality soil (top- and / or sub-soil) cannot be obtained or proven at source then it will be necessary to sample the imported soils following delivery/emplacement.

Standard practice is to sample the soils after emplacement and prove the depth of emplacement, unless a particularly high-quality source of imported soil is utilised.

3.5.1 Sampling Frequency

For a frequency of soil sampling and analysis of imported soils, suitable guidance is the NHBC Standards regarding "Verification of cover systems – testing criteria for subsoil and topsoil". In this instance, utilising the scheme of suggested frequency testing for chemical analysis of capping materials of unknown sources, sampling should be undertaken on a per strata basis.

3.5.2 Material Transfer Retention

All soils disposed of offsite must be subject to a suitable duty of care. "Waste transfer tickets" or waste transfer documentation should be retained and versions obtained that are counter-signed by the receiving facility. This helps prove that the waste soils were transferred to a suitably licenced facility. The tickets must have an applicable EWC code for the waste; this will normally be 17 05 03 or 17 05 04.

Imported soil records (if applicable) must also be retained and be available for the Verification Report, to confirm the source(s).

3.5.3 Visual Inspection

Following completion of the asbestos picking exercise, the picked soils should be visually inspected by a suitably qualified and experienced consultant to confirm the removal of bulk ACM contamination. Once validated, these soils can be replaced back in the track area.

3.6 Photographs

Photographs, including scales where possible, should be obtained during the validation phase, to indicate the depth of material removed and the depth of soils that are either imported or relocated. These can be obtained during and following excavation, during and/or post soil placement, to assist the verification and validation.

Photographs should also be collected during and after the asbestos picking phase of works.

3.7 Validation / Verification Completion Report

Following the remedial works detailed in this report, a Validation or Completion Report will be prepared that will detail:

- An account of the completed soil remediation works;
- Any variation from the agreed strategy;
- Details of the soil disposal – waste tickets;
- Photographic records of the site works;
- Validation laboratory analysis results of imported/site-won soils emplaced in residential gardens;
- Certification provided with any imported soils;
- The requirements for any further environmental works.

The report will be issued to the Regulatory Authorities for their approval.

3.8 Site Management

All works should be undertaken in line with current industry good practise and include appropriate facilities and environmental controls. Further guidance can be found in the Health and Safety Executive Guidance Document HSG66 - Protection of workers and the general public during the development of contaminated land and CAR-SOIL™.

The picking of fragments of cement-bound chrysotile asbestos is understood to constitute non-licensed works under the Asbestos Regulations (2012). Further, on the basis that the works would constitute asbestos removal works of a non-degraded material (CAR-SOIL™, paragraph 107 – see below), the works are considered to be non-notifiable.

CAR-SOIL™, 107: ""*Degraded" at the outset means materials which are not generally intact. It applies to the current condition of the material (and not the original state) e.g., fragments of asbestos cement would be regarded as intact units".*

However, workers must be trained and competent, and appropriate measures must be used to eliminate asbestos exposure or reduce it to as low as is reasonably practicable.

4. DISCOVERY STRATEGY

There is the possibility that other sources of contamination may be present on the site which were not encountered during the investigation. Should such contamination be identified or suspected during the site clearance or groundworks, these should be dealt with accordingly. Several options are available for handling this material, which include:

- Having a suitably experienced Geo-Environmental Consultant / Engineer on call, to assess any suspected contaminated material on the site;
- Sampling of any suspected contaminated material should be undertaken for verification purposes;
- If it is not feasible to keep the suspected material in-situ, then these should be removed and temporarily stored in a fenced area, whilst verification is undertaken. The storage area should be secured and contained, to ensure that contamination does not migrate and affect other areas of the site. Depending upon the amounts of material under consideration, this could be either a skip or a lined area;
- If the suspected contaminated material is dry or is suspected to contain asbestos, the material should be covered to prevent airborne contamination in the form of dust or fibres;
- Upon verification of the suspected contamination the impacted material may be either treated or removed from site following suitable waste management licensing or obtaining appropriate consents or agreements with relevant Regulatory Authorities;
- All contaminated material to be removed from site, should be disposed of at a suitably licensed tip; and
- Following excavation and removal, any open excavations or service trenches should be backfilled with soil that is suitable and certified as 'clean', (this may be either site-won or imported).

This Discovery Strategy is applicable during both the remedial works and the construction phase of the development. Should, for example, asbestos be identified in the excavation of a service run then the above procedures should be followed.

APPENDICES

Appendix 1 – Report Limitations and Conditions

General Limitations and Exceptions

This report was prepared solely for our Client for the stated purposes only and is not intended to be relied on by any other party or for any other use. No extended duty of care to any third party is implied or offered.

Geosphere Environmental Ltd does not purport to provide specialist legal advice.

The Executive Summary, Conclusions and Recommendations sections of the report provide an overview and guidance only and should not be specifically relied upon, until considered in the context of the whole report.

Interpretations and recommendations contained within the report represent our professional opinions, which were arrived at in accordance with currently accepted industry practices at the time of reporting and based upon current legislation in force at that time.

Environmental and Geotechnical Reporting (including Phase 1, Phase 2 and Site Walkovers) Limitations and Exceptions

The comments given in this report and the options expressed herein, are based upon the readily available information collated for the report and an assessment based upon the current guidance which for Phase 1 / Phase 2 report is primarily the Contaminated Land Research (CLR) Report and notable, CLR report 3, 'Documentary research on industrial sites'.

The report has been prepared in relation to the proposed end use and should another end use be intended; reassessment may be required.

No warranty is given as to the possibility of future changes in the condition of the site.

The opinions expressed cannot be absolute, due to the limitation of time and resources imposed by the agreed brief.

With regards to any aspect of land contamination referred to, this is limited to those aspects specifically stated and necessarily qualified. No liability shall be accepted for other aspects which may be the result of gradual or sudden pollution incidents, past or present land uses and the potential for associated contamination migration.

Any Desk Study Report / data has been produced largely from the information purchased from The Landmark Information Group. The information is not necessarily exhaustive and further information relevant to the site may be available from other sources. The information purchased has been assumed to be correct and free from errors. However, there is the possibility that some data may be missing from the report including (but not limited to) unrecorded land uses both onsite and offsite or unrecorded pollution events. No attempt has been made to verify the information.

The accuracy of any map extracts cannot be guaranteed. It is possible that different conditions existed onsite, between and subsequent to the various map surveys provided.

Any site walkover undertaken is a snapshot of the site recording the visually evident conditions at the time of the walkover in the areas readily accessible. It is possible that after the walkover, the site was altered (for example by fly-tipping or groundworks) or before the walkover, the site conditions changed removing evidence of potentially contaminative features (such as oil tanks removed).

Any intrusive works only cover a tiny proportion of the site. Where exploratory holes are positioned by Geosphere Environmental Limited, they are located to give as good a coverage of the site as possible and to target features / proposed land use where applicable, whilst allowing for areas that cannot be accessed, Client requested locations and other site / time / budget constraints. Whilst assumptions may have been drawn between exploratory holes on the ground conditions and / or extent or otherwise of any contamination, this is for guidance only and no liability can be accepted on its accuracy.

Any conceptual model is based upon the information available at the time of conducting this assessment and is an interpretive assessment of the conditions at the site. Redevelopment and / or further investigation of the site may reveal additional information and therefore alter the conceptual model and the report conclusions.

Appendix 2 – References

R.1. Land Contamination Risk Management (LCRM), 2020.

R.2. British Standards Institute: BS 10175 'Code of practice for the investigation of potentially contaminated sites', BSI 2011.

R.3. British Standards Institute: BS 5930 'Code of practice for site investigations', 2015.

R.4. The Environmental Protection Act, Part IIA, Section 78, 1990.

R.5. Environment Act 1995, Section 57, DoE 1995.

R.6. Health and Safety Executive, Control of Asbestos Regulations (CAR), 2012.

R.7. CL:AIRE, 'Control of Asbestos Regulations 2012: Interpretation for Managing and Working with Asbestos in Soil and Construction & Demolition materials: Industry Guidance' (CAR_SOILTM), 2016.

R.8. Network for Industrially Co-ordinated Sustainable Land Management in Europe (NICOLE), 'Asbestos in Soil – a pan European perspective', 2021.

R.9. Australasian Land and Groundwater Association (ALGA) and Building Research Association of New Zealand (BRANZ), 'New Zealand Guidelines for Assessing and Managing Asbestos in Soil' (BRANZ), 2016.

Appendix 3 – Drawings

Remediation Area Plan – 6405,RMS,VA/001/Rev0

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LEGEND

3x3m Cover System

Asbestos Grid Picking Area

SOURCE

Client provided background image

PROJECT

Rishangles Hall, Eye Road, Rishangles, IP23 7LA

TITLE

Proposed Remediation Plan

DRAWING NUMBER

8062,GI,RMS/001/Rev0

SCALE	DATE
NTS	03/01/2024
DRAWN BY	**CHECKED BY**
PC	HS

Appendix 4 – Soil Quality Criteria

Soil Quality Criteria		
Analyte	**Land Use: Residential with Plant Uptake (1% SOM¥)**	
Metals	**(mg/kg)**	**Source**
Arsenic (Inorganic)	37	LQM/CIEH S4UL
Beryllium	1.7	LQM/CIEH S4UL
Cadmium	11	LQM/CIEH S4UL
Chromium (III)	910	LQM/CIEH S4UL
Chromium (VI)	6	LQM/CIEH S4UL
Copper	2400	LQM/CIEH S4UL
Lead	210	pC4SL (upper bound)
Mercury (Elemental)	1.2	LQM/CIEH S4UL
Mercury (Inorganic)	40	LQM/CIEH S4UL
Nickel	180	LQM/CIEH S4UL
Selenium	250	LQM/CIEH S4UL
Vanadium	410	LQM/CIEH S4UL
Zinc	3700	LQM/CIEH S4UL
TPH	**(mg/kg)**	**Source**
Aliphatic EC 5 - 6	42	LQM/CIEH S4UL
Aliphatic EC> 6 - 8	100	LQM/CIEH S4UL
Aliphatic EC> 8 - 10	27	LQM/CIEH S4UL
Aliphatic EC> 10 - 12	130	LQM/CIEH S4UL
Aliphatic EC> 12 - 16	1100	LQM/CIEH S4UL
Aliphatic EC> 16 - 35	1100 (nominal value)	LQM/CIEH S4UL
Aliphatic EC> 35 - 44	1100 (nominal value)	LQM/CIEH S4UL
Aromatic EC 5 - 7 (Benzene)	70	LQM/CIEH S4UL
Aromatic EC> 7 - 8 (Toluene)	130	LQM/CIEH S4UL
Aromatic EC> 8 - 10	34	LQM/CIEH S4UL
Aromatic EC> 10 - 12	74	LQM/CIEH S4UL
Aromatic EC> 12 - 16	140	LQM/CIEH S4UL
Aromatic EC> 16 - 21	1100*	LQM/CIEH S4UL
Aromatic EC> 21 - 35	1100*	LQM/CIEH S4UL
Aromatic EC> 35 - 44	1100*	LQM/CIEH S4UL
Aliphatic + Aromatic EC> 44 - 70	1600*	LQM/CIEH S4UL
PAH	**(mg/kg)**	**Source**
Acenaphthene	210*	LQM/CIEH S4UL
Acenaphthylene	170*	LQM/CIEH S4UL
Anthracene	2400*	LQM/CIEH S4UL
Benz [a] anthracene	7.2	LQM/CIEH S4UL
Benzo [a] pyrene (only)	2.2	LQM/CIEH S4UL
Benzo [b] fluoranthene	2.6	LQM/CIEH S4UL
Benzo [ghi] perylene	320	LQM/CIEH S4UL
Benzo [k] fluoranthene	77*	LQM/CIEH S4UL
Chrysene	15	LQM/CIEH S4UL
Dibenz [ah] anthracene	0.24	LQM/CIEH S4UL

Soil Quality Criteria		
Analyte	**Land Use: Residential with Plant Uptake (1% SOM¥)**	
Fluoranthene	280*	LQM/CIEH S4UL
Fluorene	170*	LQM/CIEH S4UL
Indeno [123-cd] pyrene	27	LQM/CIEH S4UL
Naphthalene	2.3	LQM/CIEH S4UL
Phenanthrene	95*	LQM/CIEH S4UL
Pyrene	620*	LQM/CIEH S4UL
Coal Tar (bap as surrogate) marker)	0.79	LQM/CIEH S4UL
BTEX	**(mg/kg)**	**Source**
Benzene	0.087	LQM/CIEH S4UL
Toluene	130*	LQM/CIEH S4UL
Ethylbenzene	47	LQM/CIEH S4UL
Xylenes (O)	60	LQM/CIEH S4UL
Xylenes (M)	59	LQM/CIEH S4UL
Xylenes (P)	56	LQM/CIEH S4UL
Other	**(mg/kg)**	**Source**
Asbestos Fibres	<0.01	N/A
Notes: *denotes a nominal concentration less than screening values *or* a screening value for "with plant uptake" to reduce risk of importing potential hazardous classification soils.		

Appendix 5 – BRANZ Asbestos in Soil Criteria

		Residential [1]	**High-density residential** [2]	**Recreational** [3]	**Commercial and industrial** [4]
ACM (bonded)		0.01%	0.04%	0.02%	0.05%
FA and/or AF [5]		0.001%			
All forms of asbestos – surface		No visible asbestos on soil surface [6]			
Capping requirements for residual contamination above selected soil guideline value					
Depth [7]	Hard cap	No depth limitation, no controls – except for long-term management			
	Soft cap	≥0.5 m			≥0.2 m

1. Residential: Single dwelling site with garden and/or accessible soil. Also includes day-care centres, preschools, primary and secondary schools and rural residential.
2. High-density residential: Urban residential site with limited exposed soil/soil contact, including small gardens. Applicable to urban townhouses, flats and ground-floor apartments with small ornamental gardens but not high-rise apartments (with very low opportunity for soil contact).
3. Recreational: Public and private green areas and sports and recreation reserves. Includes playing fields, suburban reserves where children play frequently and school playing fields.
4. Commercial and industrial: Includes accessible soils within retail, office, factory and industrial sites. Many commercial and industrial properties are well paved with concrete pavement and buildings that will adequately cover/cap any contaminated soils.
5. FA and/or AF: Where free fibre is present at concentrations at or below 0.001% w/w, a proportion of these samples should be analysed using the laboratory analysis method described in section 5.4.4 (≥10% of samples). This is due to limitations in the AS 4964-2004 and WA Guidelines 500 ml sample method for free fibre (see Section 5.4 for more information).
6. Surface: Effective options include raking/tilling the top 100 mm of asbestos-contaminated soil (or to clean soil/fill if shallower to avoid contaminating clean material at depth) and hand picking to remove visible asbestos and ACM fragments or covering with a soft cap of virgin natural material (VNM) 100 mm thick delineated by a permeable geotextile marker layer or hard cap. Near-surface fragments of ACM can become exposed in soft soils such as sandy pumiceous soils after periods of rain.
7. Depth: Capping is used where contamination levels exceed soil guideline values. Considerations of depth need to incorporate the type and likelihood of future disturbance activities at the site and site capping requirements (see Section 6.1). Ideally, any capping layer should be delineated by a permeable geotextile marker layer between the cap and underlying asbestos/contaminated material. Institutional controls must be used to manage long-term risks, particularly where the cap may be disturbed (see Section 7). Two forms of capping are typically used:
    a) Hard cap comprises surfaces that are difficult to penetrate and isolate the asbestos contamination, such as tar seal or concrete driveway cover. This would typically not include pavers or decking due to maintenance and coverage factors.
    b) Soft cap consists of a layer(s) of material which either comprise virgin natural material or soils that meet the asbestos residential soil guideline value from an onsite source. Use of onsite soils may require resource consent.

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Ec Ecology.

Fr Flood Risk.

Ge Geotechnical.

En Environmental.

Kw Knotweed.

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