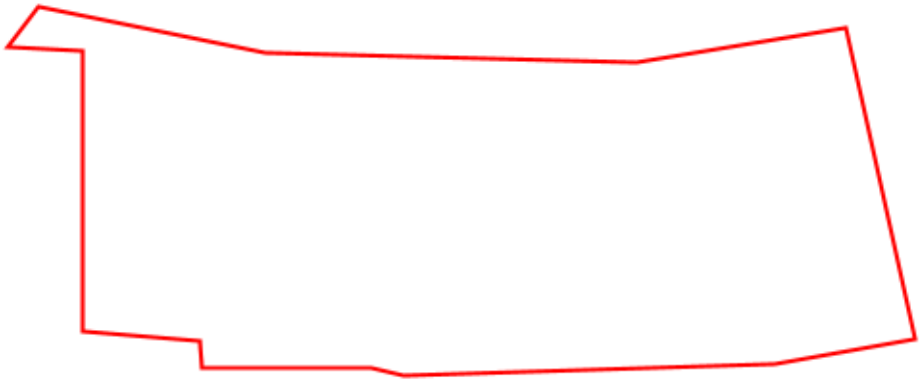
A REMEDIATION METHOD STATEMENT AND VALIDATION PLAN TO SUPPORT THE CONSTRUCTION OF A RESIDENTIAL DEVELOPMENT AT:

LAND ADJACENT TO 72 STATION ROAD, SURFLEET



CLIENT:	**Mike Yould Developments Limited**
REFERENCE:	**TJS/22.067/RMS**
DATE:	**22 July 2022**

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CONTENTS

1.	INTRODUCTION		1
2.	BACKGROUND		2
3.	REMEDIATION STRATEGY		3
	3.1	GENERAL	3
	3.2	OBJECTIVES	3
	3.3	REMEDIATION METHOD	3
4.	VALIDATION PLAN		6
	4.1	SOURCE REMOVAL	6
	4.2	COVER SYSTEM	7
	4.3	WATER SUPPLY PIPES	8
5.	SOIL MANAGEMENT		8
	5.1	SOIL WASTE DISPOSAL	8
	5.2	USE OF SITE WON MATERIAL	9
	5.3	USE OF IMPORTED MATERIAL	9
	5.4	SAMPLING & ANALYSIS REQUIREMENTS FOR IMPORTED MATERIAL	10
6.	UNEXPECTED CONTAMINATION		12
7.	SAFE SYSTEMS OF WORK FOR CONSTRUCTION WORKERS		12
8.	VERIFICATION REPORT		13

APPENDICES

APPENDIX A: REFERENCES

APPENDIX B: SCREENING CRITERIA FOR IMPORTED SOIL

APPENDIX C: DRAWINGS

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1. INTRODUCTION

A F Howland Associates Limited (AFHA) was instructed by Mike Yould Developments Limited (the "Client") to prepare a Remediation Method Statement and Validation Plan to support the construction of a residential development at Land Adjacent to 72 Station Road, Surfleet, Lincolnshire, PE11 4DB (Drawing 22.067/01).

This report presents the remediation strategy to be adopted by the Client or appointed Contractor, and the steps to be taken to provide verification that this has been completed. The strategy is based on the findings of intrusive ground investigations (AFHA, 2017b; AFHA 2022) which should be referred to for background information to the site and the results of the contamination risk assessments.

The report has been prepared in general accordance with accepted best practice and methodologies (BSI, 2017) (Environment Agency, 2020) (DCLG, 2013). It is intended for the sole and exclusive use of the Client and its advisors. Other parties using the contained information do so at their own risk and any duty of care to those parties is specifically excluded subject to copyright as detailed below.

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2. BACKGROUND

Historical information presented in the Desk Study (AFHA, 2017a) indicates that the site was formerly open fields before being developed into a nursery in the early 1900s. The site was re-configured in the mid-1900s, and included a large central glasshouse, and two boiler houses. The site was cleared prior to the ground investigation in 2022.

Two phases of ground investigation have been carried out (AFHA, 2017; AFHA, 2022), which included a number of exploratory holes advanced across the site. The results of the investigations concluded that:

- Lead was present at concentrations above screening levels for a residential end use in multiple exploratory holes across the centre south and east of the site.
- Arsenic and beryllium were also elevated against screening levels for a residential end use in TP111 in the north of the site.
- Asbestos fibres were present in a small number of locations, generally associated with historical trackways or the locations of outbuildings. Both loose chrysotile and amosite asbestos fibres were detected at low concentrations, and further risk assessment demonstrated that the risk from chrysotile was tolerable. However, the risk from amosite fibres was determined to be unacceptable.
- Controlled waters were unlikely to be at risk from mobile or leachable contamination.
- The made ground contained marginally elevated concentrations of polyaromatic and long chain petroleum hydrocarbons, which could pose a permeation risk to water supply pipes.
- A viable risk from radon or hazardous ground gas was not identified.

Given the potential chronic risks to human health associated with the metals and amosite fibres within the made ground, remediation was recommended. Given the most recent investigation was carried out at a high resolution, a targeted or plot specific remediation approach is considered to be the most effective solution.

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3. REMEDIATION STRATEGY

3.1 GENERAL

The remediation method and validation plan presented below is based on the Client's preferred strategy for the site. It has been developed on a plot specific basis, with targeted measures in order to ensure that the remediation can be efficiently incorporated into the proposed construction.

It should be noted that the Client, or Contractor appointed to carry out the remediation, is responsible for the site specific construction methodology to achieve the requirements of this strategy, as well as all necessary health and safety procedures and risk assessments required under CDM regulations (2015). The Client/Contractor should also consider appropriate contingency arrangements for the discovery of unexpected contamination during construction. These points are discussed further in the following sections.

3.2 OBJECTIVES

Remediation strategies can address any of the three elements in the pollutant linkage of "*source-pathway-receptor*". In this instance, the source is the made ground, the primary receptor is a future residential end user, and the pathway is the route of exposure to the contaminant by ingestion, dermal contact, inhalation (dusts and vapours), or permeation through water supply pipework material. The objective of the remediation is to protect human health in the long term (chronic exposure) from the elevated concentrations of metals and amosite asbestos fibres in garden areas and the potential permeation risk from hydrocarbon contamination.

On the premise that the receptor cannot be removed, the remediation requires either that the source is removed or the pathway is broken. The remediation method presented below aims to reduce the likelihood of exposure by source removal where asbestos contamination has been identified, and the creation of a cover system in specific plots in order to break the exposure pathway.

3.3 REMEDIATION METHOD

3.3.1 Source Removal

Loose amosite asbestos fibres were recorded in samples recovered from TP111 in the north of the site, and TP105 in the centre south of the site. TP111 also recorded the

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presence of a fragment of asbestos containing material, elevated concentrations of arsenic and beryllium, and significantly higher concentrations of lead compared to other locations across the site.

On this basis, it was considered that the removal of these localised "hotspots" of contamination was prudent in order to remove the need for an engineered break layer in these plots to prevent soil mixing, and to allow a standardised thickness of cover soil across all plots.

Firstly, the locations of TP105 and TP111 (as shown on Drawing 22.067/RMS/02) will be located on-site using RTK GPS equipment. This will be followed by the excavation of the made ground over an initial 5 x 5 m square. The excavation will continue with depth until the underlying natural soil is encountered. This is expected at approximately 600 mm and 550 mm depth in TP105 and TP111 respectively.

Where the same type of made ground remains in the sidewalls of the excavation, the excavation will be extended until all of the potentially affected material is removed, and the supervising geo-environmental engineer should be consulted in this regard.

After the initial excavation work is complete, the excavation will be validated following the procedures outlined in Section 4 below. Additional phases of excavation and validation may be necessary until the contaminated soil is fully removed.

3.3.2 Clean Cover System

After the removal of the "hotspots" of contamination in the locations specified above, a clean cover system will be applied to all areas of soft landscaping in Plots 5 to 7, as shown on Drawing 22.067/RMS/02. Elevated concentrations of lead were not recorded in the location of Plot 1 during ground investigation, and therefore a cover system is not required providing that the asbestos containing soil in TP105 is fully removed.

As the general risk from lead contamination in the east and centre south of the site will persist even after the removal of the specific "hotspots" at TP105 and TP111, all of the garden and soft landscaping areas in Plots 5 to 7 will be capped with a minimum of 480 mm of "suitable for use" cover soil (BRE, 2004). A schematic diagram of the cover system is presented in Figure 1 below.

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In order to achieve the required cover thickness, the cover soil may include topsoil, subsoil or an 'as-dug' granular fill, all of which should be confirmed to be "suitable for use" in accordance with the requirements provided in Section 5. The cover soil should include at least 150 mm of topsoil to ensure a suitable growing medium.

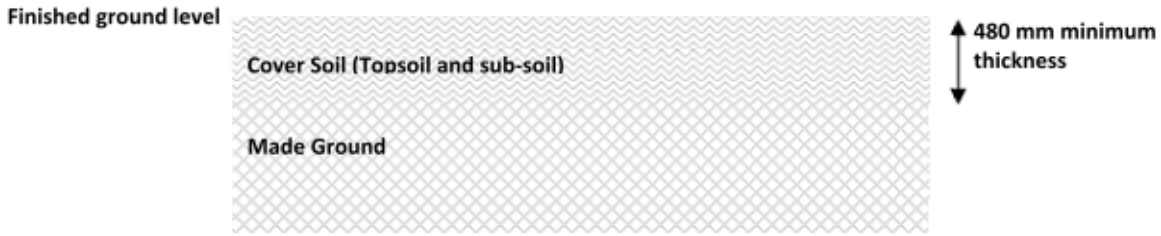


Figure 1: Schematic diagram of the cover system to be placed in the soft landscaping areas

It is understood that the finished external levels will need to be raised in Plots 5 to 7 relative to existing levels. Therefore, minimal excavation of the existing made ground is expected to be necessary in order to accommodate the cover system. However, if the level of the existing made ground needs to be reduced, the resulting spoil will be removed for off-site disposal.

The proposed landscaping plan for the development indicates that trees are to be planted in Plots 5 to 7. Where this is the case, the depth of the cover soil will be locally deepened to 0.8 m below ground level in order to ensure that "suitable for use" soil is present within the rooting zone of the tree.

Where driveways, paths or patios (hard landscaping) are proposed to be constructed, these should be constructed to a specification which ensures they are "permanent" and are not able to be easily removed by future occupiers to expose the made ground beneath. A schematic diagram showing the minimum thicknesses of materials required is provided in Figure 2 below.

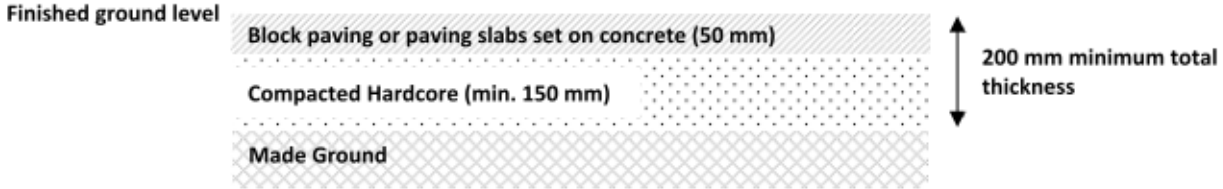


Figure 2: Schematic diagram for the minimum construction thicknesses required for areas of hard landscaping

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3.3.3 Water Supply Pipes

Where water supply pipework will be installed within made ground in the south of the site in the former location of the fan heaters (as shown on Drawing 22.067/RMS/02), it is recommended that these are laid within the natural soil 0.7 m below existing ground level. If this is not achievable, or installation in the made ground is required, the water supply pipes should be placed within a clean fill surround to prevent direct contact with the made ground.

The final specification and installation details for water supply pipes will be confirmed with the Local Water Authority prior to installation.

4. VALIDATION PLAN

4.1 SOURCE REMOVAL

Control Point 1

The supervising Geo-environmental Engineer will confirm that TP105 and TP111 have been located correctly and that the dimensions of the initial excavation achieve, or exceed, the requirements of the remediation strategy presented above. This includes confirmation that natural soil is exposed throughout the base of the excavation.

Control Point 2

Once control point 1 is complete, the supervising Geo-environmental Engineer will obtain validation samples from each of the four sides of the excavation, plus a sample of the natural soil from the base of the excavation for subsequent laboratory testing. The laboratory testing will include for an asbestos fibre screen, along with the total concentration of lead.

Control Point 3

The results of the validation testing will be reviewed to confirm the following remedial targets have been achieved:

- No loose asbestos fibres or fragments of asbestos containing materials remain within the sidewalls of the hotspot excavations,

- The lead concentrations within the sidewalls of the hotspot excavations are less than the maximum concentration recorded across the wider site – 680 mg/kg.

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If these remedial targets are achieved, no further source removal will be required, and the excavation will be able to be reinstated. If the laboratory analysis results record loose asbestos fibres, additional excavation will be required and control points 1 and 2 will be repeated. Alternatively, if no loose asbestos fibres are recorded, but lead concentrations exceed 680 mg/kg, the excavation can be extended, or the cover system thickness increased proportionally.

Control Point 4

The Client will provide the supervising Geo-environmental Engineer with the following:

- The supplier and/or source of the material to be used for reinstatement,
- Laboratory analysis certificates for the reinstatement material to confirm chemical suitability as specified in Section 5.
- Photographs showing the reinstatement of the excavation to ground level

4.2 COVER SYSTEM

Control Point 1

Prior to the construction of the cover system in each area, the following information will be provided to the supervising Geo-environmental Engineer:

- The supplier and/or source of the cover soil and hardcore to be used in the construction of the cover system and hard landscaping areas respectively,
- Laboratory analysis certificates to confirm the chemical suitability of the imported material, as specified in Section 5.

Control Point 2

After placement of the cover soil in each plot, two hand dug trial pits will be carried out within each rear garden area, and one in each front garden area, in order to provide a record the following:

- the overall soil profile,
- total thickness of the cover soil and of any constituent materials (e.g. topsoil, subsoil or 'as-dug' granular fill),
- the thicknesses of the materials used for the construction of patios and/or driveways,

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- Descriptions of the constituent materials for comparison with the descriptions provided in the laboratory analysis certification,
- Photographs of each validation trial pit and an overview of each garden area.

4.3 WATER SUPPLY PIPES

Verification of the installation of the water supply pipes should include:

- A visual inspection of the trench to provide photographs of the pipes and surrounding natural soil.

And, if made ground is present at the pipe level:

- Photographs showing the bedding of the pipework using a clean fill surround,
- Confirmation of the source and supplier of the clean fill surround,
- Confirmation of the chemical suitability of the clean fill surround,

Alternatively, if the local water authority do not require remediation of this area, a written record of this should be provided to the supervising Geo-environmental Engineer for inclusion within the Verification Report.

5. SOIL MANAGEMENT

5.1 SOIL WASTE DISPOSAL

As a result of the remediation strategy detailed above, it is likely that waste soil will be generated which will require appropriate disposal. It is the responsibility of both the Client and Contractor (the Waste Producer) to ensure that the requirements of all pertinent waste legislation are adhered to at all times.

In accordance with the requirements of WM3 v1.2 (Environment Agency, 2021) it is the responsibility of the Waste Producer to ensure that all waste soil generated through the remediation scheme has been classified appropriately, and this information should form part of a package of information provided to the Waste Receiver.

Registered waste carriers will be employed by the Client or appointed Contractor to transport waste soil for disposal at an appropriately permitted receiver site. Copies of all waste transfer or consignment notes will be retained by the Client or Contractor and

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issued to the supervising Geo-environmental Engineer for inclusion within the Verification Report. The consignment notes should be completed fully by the haulier, and include full details of the Waste Receiver and disposal point.

5.2 USE OF SITE WON MATERIAL

The use of site-won material is not permitted as part of the remediation scheme unless the specific batch of soil can be demonstrated to be chemically "suitable for use", and the movement of this soil around the site is documented within a Materials Management Plan.

If the Client requires the use of site-won material as part of the remediation scheme, the advice of the supervising Geo-environmental Engineer should be sought in order to ensure that the appropriate safeguards can be implemented to allow the safe re-use of materials in accordance with current guidance and legislation.

5.3 USE OF IMPORTED MATERIAL

All imported materials need to be "suitable for use" and meet the criteria set out below.

All imported materials will be 'products' provided by a reputable supplier. No soil, natural or otherwise, will be imported directly from a third party site without an approved materials management plan which includes for the direct transfer of soils from third party sites (e.g. DoW:CoP). If this is required, all related documentation should be supplied to the supervising Geo-environmental Engineer in advance of importation.

Imported Granular Material

All imported granular backfill material shall be natural soil, and where possible be 'as dug' or 'as raised' first generation material (e.g. Class 1A granular fill). Where this material is sourced from a reputable supplier and/or from a source that is unlikely to have been impacted by contamination, the source would be classified as 'greenfield' material, and all validation sampling will be undertaken as outlined in Section 5.4.

Imported Topsoil or Subsoil

Any imported topsoil or subsoil used within the remediation scheme must be certified as 'suitable for use' and accompanied by appropriate certification providing details of its chemical characteristics. This information should be specific to the supplier and batch from which the material has been sourced.

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Prior to the importation of the cover soil, the Client will advise the supervising Geo-environmental Engineer of the volume of soil to be imported, along with the details of the product, supplier and source to allow an appropriate sampling regime which meets current guidance (as per Section 5.4). It should be noted that if multiple sources or products are used, each will be subject to the same sampling frequency.

Where provided by the Supplier, the chemical analysis of the soil to be imported will be recent (less than 6 months old), specific to the batch of material which is to be imported, and include for a suite of potential contaminants in soil, as provided in Table B1 in Appendix B. The material will also need to have been sampled at an appropriate frequency (see Section 5.4).

If the supplier is unable to provide the required information, the material could either be sampled by AFHA at source prior to importation, or once it has been imported to site and laid. If AFHA are to sample the material at source, the batch will need to be 'ring-fenced' and appropriate chain of custody documentation will then be required to ensure that the batch tested is that delivered to site.

Any breaches of screening criteria will result in the material being classified as 'not suitable for use'. In this eventually, the material should not be imported to site and an alternative supply should be sought. If the material has already been laid, it will need to be removed from site and a compliant material imported.

All delivery tickets should be fully completed and the documentation shall form a complete chain of custody to ensure that the batch tested is that delivered to site. The delivery notes shall be collated and retained by the Client or Contractor, with copies supplied to the supervising Geo-environmental Engineer.

5.4 SAMPLING & ANALYSIS REQUIREMENTS FOR IMPORTED MATERIAL

In general accordance with guidance provided by the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG, 2021), the validation sampling requirements to be followed are:

- First generation quarried material (e.g. Class 1A granular fill) – 3 No. samples analysed for each source, with testing for metals/metalloids as per Table 5.4.1 below.

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Determinand
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Chromium - Hexavalent
Copper
Lead
Mercury
Nickel
Selenium
Vanadium
Zinc

Table 5.4.1: Determinands required for the analysis of first generation quarried material

- Recycled/crushed hardcore, stone or brick – 1 sample per 500 m^3 (minimum of 3 No. analysed for each source) for a full generic contamination suite as specified in Table 5.4.2 below.
- Greenfield/manufactured topsoil or subsoil– 1 sample analysed per 250 m^3 (minimum of 3 No. analysed for each source) for a full generic contamination suite as specified in Table 5.4.2 below.
- Imported recycled/screened topsoil or subsoil – 1 sample analysed per 100 m^3 (minimum of 6 No. analysed for each source), for a full generic contamination suite as specified in Table 5.4.2 below.

Determinand
Antimony
Arsenic
Beryllium
Cadmium
Chromium
Chromium - Hexavalent
Copper
Lead
Mercury
Nickel
Selenium
Vanadium
Zinc
Phenols - Total (monohydric)
PAH - Speciated (USEPA-16)
Petroleum Hydrocarbons (TPH CWG) & BTEX
Asbestos fibre screen
pH
Organic Matter

Table 5.4.2: Determinands required for the analysis of imported hardcore, topsoil & subsoil

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6. UNEXPECTED CONTAMINATION

In order to comply with the requirements of the planning permission for the site, if any unexpected contamination is identified by the Client or Contractor, work in the affected area(s) will cease, and the supervising Geo-environmental Engineer and the Environmental Protection Officer (EPO) at South Holland District Council will be notified in writing. The supervising Geo-environmental Engineer will provide an initial assessment of the discovery, followed by inspection and sampling as appropriate and as agreed with the EPO, depending on the nature and relative severity of the contamination encountered.

7. SAFE SYSTEMS OF WORK FOR CONSTRUCTION WORKERS

Given the results of the contamination analysis of the made ground undertaken to date, it is considered that general risks from occupational exposure to contaminated soil can be largely mitigated through construction best practice and the adoption of standard health and safety management practices in accordance with CDM Regulations 2015 and the Health and Safety at Work Act 1974.

Due to the presence of asbestos containing soil, and the disturbance of the made ground during remediation, the requirements of the Control of Asbestos Regulations (CAR) (2012) need to be adhered to. Under these regulations, a duty is placed on the employer or Principal Contractor to prevent the exposure of their employees and members of the public to asbestos fibres, so far as is reasonably practicable, and this should be the first consideration. If this is not possible, the exposure must be reduced to the lowest level reasonably practicable.

Typical control measures may include:

- damping down of the soil surface and wetting roadways and hardstanding, particularly during dry weather, and when excavations and vehicle movements are taking place,
- covering and damping down of stockpiled materials,
- for those in direct contact with ACS where soil dust generation could occur, disposable coveralls and appropriate respiratory protective equipment (RPE) should be used to reduce the likelihood of asbestos fibre inhalation,

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- The excavation, storage and removal of the soil should be carried out in a safe manner, to ensure that no dust is generated.

However, it should be noted that the control measures outlined above are not exhaustive and are provided as examples only. The Client or Contractor may wish to consult a Health & Safety Consultant to ensure that the Client's obligations under CAR 2012 are appropriately discharged. The details of the working practices and mitigation measures to be implemented should be provided to the Environmental Protection Officer at South Holland District Council prior to the commencement of the remediation (as stipulated in a consultation response dated 12 July 2022).

8. VERIFICATION REPORT

A verification report will be prepared on completion of the remediation. This will include copies of all waste transfer notices, soil delivery tickets and soil certification as necessary, along with logs from the verification pits. The results of the validation sampling of imported soil will also be presented alongside an assessment against GAC, and a plan showing the location of where the validation pits were carried out.

If necessary, the validation report will also include details of any unexpected contamination recorded during the course of the construction work.

Providing the methodology described above is adhered to, it is considered that the remediation strategy proposed will be sufficient to resolve the risks to end-users of the development from exposure to contaminated soil, and the site will be suitable for the proposed development.

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22 July 2022

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APPENDIX A: REFERENCES

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APPENDIX B: SCREENING CRITERIA FOR IMPORTED SOIL

Human Health Screening Criteria

Determinand	Screening Criteria (mg/kg)[1]		
	1%SOM	2.5%SOM	6%SOM
Total Phenols			
Total Phenols	280	550	1100
Speciated PAHs			
Naphthalene	2.3	5.6	13
Acenaphthylene	170	420	920
Acenaphthene	210	510	1100
Fluorene	170	400	860
Phenanthrene	95	220	440
Anthracene	2400	5400	11000
Fluoranthene	280	560	890
Pyrene	620	1200	2000
Benzo(a)anthracene	7.2	11	13
Chrysene	15	22	27
Benzo(b)fluoranthene	2.6	3.3	3.7
Benzo(k)fluoranthene	77	93	100
Benzo(a)pyrene	2.2	2.7	3
Indeno(1,2,3-cd)pyrene	27	36	41
Dibenz(a,h)anthracene	0.24	0.28	0.3
Benzo(ghi)perylene	320	340	350
Heavy Metals / Metalloids			
Antimony	141	NV	222
Arsenic	37		
Beryllium	1.7		
Cadmium	11		
Chromium (hexavalent)	6		
Chromium	910		
Copper	2400		
Lead	200		
Mercury (elemental)	1.2		
Nickel	130		
Selenium	250		
Vanadium	410		
Zinc	3700		

Table B1: Human Health Screening Criteria for Imported Soil

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APPENDIX B: SCREENING CRITERIA FOR IMPORTED SOIL (CONTINUED)

Human Health Screening Criteria (Continued)

Determinand	Screening Criteria (mg/kg)[1]		
	1%SOM	2.5%SOM	6%SOM
Monoaromatics			
Benzene	0.087	0.17	0.37
Toluene	130	290	660
Ethylbenzene	47	110	260
p & m-xylene	56	130	310
o-xylene	60	140	330
Petroleum Hydrocarbons (TPH-CWG)			
Aliphatic >EC5 - EC6	42	78	160
Aliphatic >EC6 - EC8	100	230	530
Aliphatic >EC8 - EC10	27	65	150
Aliphatic >EC10 - EC12	48 (vap)	118 (vap)	283 (vap)
Aliphatic >EC12 - EC16	24 (sol)	59 (sol)	142 (sol)
Aliphatic >EC16 - EC35	8.5 (sol)	21 (sol)	110000
Aromatic >EC5 - EC7	70	140	300
Aromatic >EC7 - EC8	130	290	660
Aromatic >EC8 - EC10	34	83	190
Aromatic >EC10 - EC12	74	180	380
Aromatic >EC12 - EC16	140	330	660
Aromatic >EC16 - EC21	260	540	930
Aromatic >EC21 - EC35	1100	1500	1700
Asbestos Screen	No Fibres or ACM Detected		

Table B1 (continued): Human Health Screening Criteria for Imported Soil

NOTES AND ABBREVIATIONS

1. SOM to be derived for all samples to allow comparison with the appropriate screening criteria
2. All imported soil to be tested as per the requirements of the specification provided in Section 5. Based on accepted generic assessment criteria for the assessment of chronic human health risks – Category 4 Screening Levels (DEFRA, 2014) and Suitable 4 Use Levels (LQM, 2015).

NV - No value for this soil organic matter (SOM) content, use 1% or 6% whichever is closest

SOM - Soil Organic Matter sol – solubility saturation limit vap – vapour saturation limit

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APPENDIX C: DRAWINGS

Drawing 22.067/01	Site Location Plan
Drawing 22.067/RMS/02	Remediation Plan

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North

Circle indicates approximate location of site

Scale 1: 50,000 @ A4

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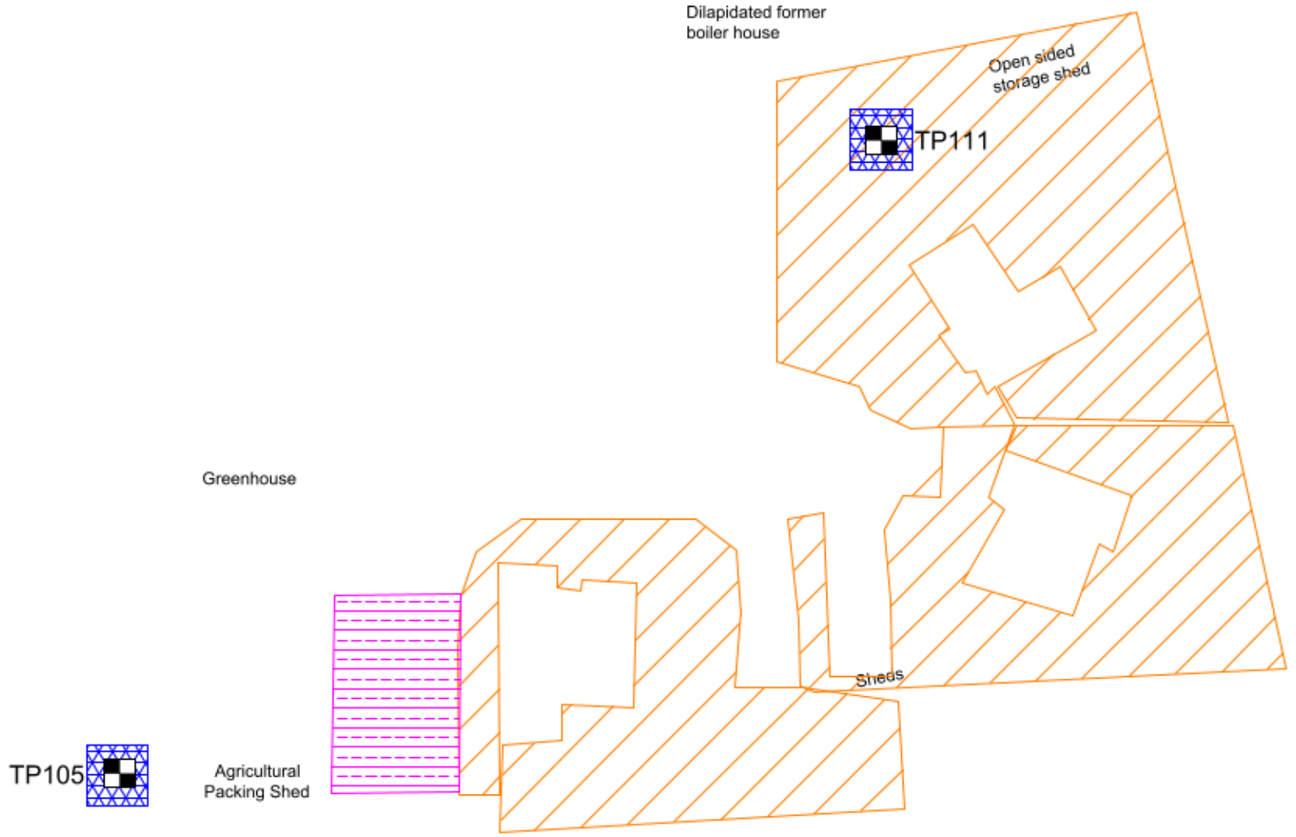
A F Howland Associates
Geotechnical Engineers

Site: Land Adjacent to 72 Station Road, Surfleet, PE11 4DB

SITE LOCATION PLAN

Client : Mike Yould Developments Limited

Date : May 2022 **Dwg :** 22.067/01



Key:

- Trial pit location and reference (AFHA, 2022)
- Front and rear garden areas requiring the application of a cover system comprising a minimum of 480 mm of cover soil
- Area where water supply pipes are to be laid within natural soil or placed within a clean fill surround
- Area where removal of the made ground is required over an initial 5 x 5 m square (extents may increase subject to the findings of the validation)

Notes:

1. Remediation strategy to be finalised and agreed with the Local Planning Authority prior to construction.

2. The remediation is to be carried out in accordance with the requirements of the Remediation Method Statement (ref: TJS/22.067/RMS).

3. All remediation work is to be validated by A F Howland Associates Limited (AFHA) at the specified control points. The Client is to liaise with AFHA to ensure that validation can occur at the appropriate stage of the work.

4. If the made ground is not removed from Plot 1 and fully validated, a cover system will be required (not shown on this drawing).

5. The Client is to ensure that cross contamination cannot occur between he areas requiring remediation and the areas where contamination has not been recorded.

6. The Client is to employ licenced waste carriers to remove all waste soil and keep copies of the waste transfer noticies.

7. All imported materials to be used within the cover system need to be "suitable for use" and meet the requirements of the Remediation Method Statement.

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Rev	Date	Revision Description	Drwn	Chkd

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Client: Mike Yould Developments Limited

Site:
Land Adjacent to 72 Station Road, Surfleet, PE11 4DB

Job No.: 22.067

Drawing Title:
REMEDIATION PLAN

Date: July 2022

Drawing No: 22.067/RMS/02

Scale: 1:500 @ A3



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