STAGE 2 GEO-ENVIRONMENTAL REPORT

AT

JILL LANE

MIRFIELD

ON BEHALF OF

PAMELA DEWS

ARP GEOTECHNICAL LTD

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1.0 EXECUTIVE SUMMARY

The pertinent conclusions of the report are tabulated below. However, the information below is not exhaustive, and it is recommended the report is read in its entirety.

Proposed Development	Residential dwelling with private garden.
Existing Site Description	Open-ended metal barn on the east of the site, within a larger field that extends beyond the boundary. Compacted brick and stone crush forms the floor of the barn.
Archive Maps & Images	No development shown on the site prior to the existing barn, which was constructed around the year 2000.
Geology Maps	Mudstones, siltstones and minor sandstones of the Pennine Lower Coal Measures. No superficial deposits or any faults indicated on or near the site.
Coal Mining	Risk from shallow underground mining identified – a rotary borehole investigation is imminent and will be reported separately. In addition, a mine shaft is recorded by the Coal Authority as being present on the site, but excavations have not revealed its position. Mitigation measures are required (see Section 9.2 of this report for further details).
Hazardous Gases	Basic radon protection recommended for the site. As coal/possible workings underlie the site, and as there are historical landfills located within 250m of the site, monitoring wells will be installed into the imminent rotary boreholes, and the findings of monitoring will be reported separately on completion.
Ground Conditions	Up to 0.35m thickness of crushed fill present in TP2 and TP3 (below a thin topsoil in TP3), with only topsoil present at the surface of TP1. Natural clays are present beneath, to depths of between 1.4m and 1.7m, onto weathered mudstones. No groundwater ingress.
Ground Contamination	Made ground contains elevated PAH (including benzo(a)pyrene up to 10mg/kg) and sporadic chrysotile asbestos. The overlying topsoil to this material (found at TP3 only) also contained microscopic

	chrysotile asbestos, and elevated lead (370mg.kg).
Remediation Strategy	Either all the existing topsoil should be removed from the site, or further sampling and testing on a closer grid carried out to determine any areas of topsoil that may be retained. For the made ground, 600mm of clean soil cover should be provided in soft areas, retained below hardstand areas. Hard break or geogrid/geotextile required below the soft cover if placed above made ground.
Foundations	Firm natural clays considered suitable for the use of strip/trench fill foundations. If not already available, a tree survey may be required to enable a foundation schedule to be prepared.
Excavations	Likely to remain dry and largely stable. If any ingress does occur, this should be controllable by pumping from an artificial sump area.
Concrete	GEN1 designation for unreinforced buried concrete. For any reinforced concrete, other design-specific mixes will apply.
Soakaways	The disposal of surface water using soakaways is unlikely to be practical on the site, given the presence of low permeability strata.
Road Pavement	A design CBR value of 3% Is considered applicable on the natural clay.

2.0 TERMS OF REFERENCE

2.1 Pamela Dews is considering re-developing the site at Jill Lane, Mirfield with a single residential dwelling. It was considered appropriate to provide information to aid viability assessment and design of any subsequent development. In September 2024, ARP Geotechnical Ltd issued a Stage 1 Desk Study Report (Reference PWS/01r1). This involved an assessment of the geological and coal mining aspects, Ordnance Survey archive maps, radon gas, indicative flood risk, hydrogeology, landfill, and other environmental issues, primarily by assessment of a Landmark Envirocheck Report. In addition to comments and conclusions on a wide range of environmental and geotechnical issues, the report also provided recommendations for intrusive investigation and assessment.

2.2 ARP Geotechnical Ltd was appointed by Pamela Dews to undertake the recommended further works, with the intrusive investigation comprising trial pits to assess the ground conditions.

2.3 The investigation was implemented generally in accordance with BS 5930:2015 +A1:2020 "Code of practice for site investigations", NHBC Standard Chapter 4.1 "Land quality - managing ground conditions", Environment Agency LCRM “Land Contamination Risk Management" and BS10175 : 2011 + A2 : 2017 "Investigation of potentially contaminated sites - Code of practice". This report is limited to the data obtained as part of this investigation. It should be noted that there is a possibility of variation in ground conditions between test locations and interpretation of strata is given for guidance only. No liability is accepted for changes to site conditions, including groundwater levels, after the preparation of this report.

2.4 The findings or contents of the Stage 1 Desk Study Report are not reproduced here in full, and it is recommended that this report is read in conjunction with the Stage 1 Report.

2.5 The general observation and assessment of the ground surface, and the identification/classification of vegetation is made in general terms only. It would be prudent for a specialist to undertake a more detailed survey, including for any invasive/harmful weeds.

2.6 The assessment of any topsoil is carried out in terms of potential chemical effects on human health only, and no account is taken of aesthetic or horticultural properties. Such considerations should be referred to a horticulturist or landscape architect.

2.7 The report has been prepared for the use and reliance of the Client only. The report shall not be relied upon or transferred to any other parties without the written agreement of ARP Geotechnical Ltd. For the avoidance of any doubt, where ARP Geotechnical Ltd enters into a letter of reliance for the benefit of a third party, that third party will be permitted to rely on the report. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party without ARP Geotechnical Ltd.'s consent.

2.8 Attention is drawn to the requirements of the Construction Design and Management Regulations 2015, and in particular the duties and obligation of the Client.

2.9 The report refers to, and includes, a copy of an indicative proposed layout. This is only for the purposes of generating a conceptual site model for the contamination risk assessment. Unless the proposed layout changes significantly, such that the conceptual model and risk assessment is affected, there is no requirement to re-issue this report when the layout is revised.

3.0 THE SITE

Site Location

3.1 The site, which is centred on Ordnance Survey Grid Reference SE 21675 2132, is located off Jill Lane, in Northorpe, near Mirfield, Kirklees, West Yorkshire. The site has overall dimensions of approximately 60m (northwest – southeast) by 15m (north – south).

3.2 A site location plan, aerial photograph and proposed site layout, are presented in Appendix A.

Site Description

3.3 The east of the site is predominantly occupied by an open-ended barn of steel frame and corrugated sheet metal construction. The barn is within a larger field that extends beyond the boundary of the site. Compacted brick and stone crush forms the floor of the barn. Immediately south of the barn is an empty old lorry trailer. The western half of the site is an undeveloped field covered by grass, with a grass access extending to Jill Lane. A small beck runs along the boundary of the field along its western and southern extents.

Site History

3.4 Ordnance Survey archive maps show no development on the site prior to the existing barn, which was constructed around the year 2000.

4.0 ENVIRONMENTAL SETTING

4.1 The environmental setting for the site was established by the Stage 1 Desk Study Report undertaken by ARP Geotechnical Ltd under reference PWS/01r1 and dated September 2024. The findings of the Desk Study Report are summarised below.

Geology

4.2 Undifferentiated strata (mudstones, siltstones and minor sandstones) of the Pennine Lower Coal Measures of the Carboniferous Period. No superficial deposits are indicated on or near the site. The maps do not indicate any potential for the site to be adversely affected by any faults.

Coal Mining

4.3 A Coal Mining Risk Assessment (CMRA) was undertaken by ARP in September 2023 (reference PWS/01/JRjcl1). The report concluded that a rock drilling investigation should be carried out to check for any evidence of workings in two shallow coal seams beneath the site. This investigation is programmed for the near future and will be reported separately. In addition, the CMRA identified the presence of a mine shaft on the site. This was subsequently investigated by ARP (report reference PWS/01/WWjcl4 dated 17th June 2024) and the shaft was proved not to be present within around 90% of the area covered by the shaft location error radius. The remaining 10% could not be searched due to access restrictions and, therefore, mitigation measures were provided, to be used in the event that the shaft was subsequently uncovered.

Hydrogeology

4.4 The Landmark Envirocheck Report indicates the Bedrock Aquifer Designation to be "Secondary A". There are no active groundwater abstractions within 1km down hydraulic gradient of the site, and the site is not within a groundwater Source Protection Zone.

Hydrology

4.5 The general area slopes west to east and north to south. The nearest downslope surface water is an un-named watercourse located 7m outside the western and southern boundaries. The site is not in an area shown to be at risk from river flooding.

4.6 There are no surface water abstractions within 1km of the site.

Other Relevant Environmental Data

4. 7 There are two recorded landfill sites within 250m of the site. The nearest, located 200m to the east, relates to a sewage farm refuse tip for household, commercial and industrial waste. The recorded first input date is 1st April 1996, (now closed). The next nearest is 226m to the northeast, relating to a landfill taking non-biodegradable waste (not construction) from as early as June 1994 (now expired).

4.8 No radon protective measures are stated to be necessary for new dwellings or extensions on the site. However, the site is in an intermediate probability radon area, as between 1% and 3% of homes are above the action level. In these circumstances of apparent conflict, it may be prudent to assume basic radon protection is required, to prevent future conveyancing difficulties.

Potential Contamination Sources

4.9 The following potential sources of contamination were identified in the Stage 1 Desk Study Report

4.9.1 Possible made ground – metals, inorganics, total petroleum hydrocarbons (TPH), polyaromatic hydrocarbons (PAH), phenol, asbestos.

4.9.2 Possible asbestos within existing buildings.

4.9.3 Possible harmful gases from coal/workings underlying the site, and from the historical landfill sites located within 250m to the east and northeast of the site: - methane, carbon dioxide .

5.0 SITE INVESTIGATION

5.1 A site investigation was undertaken by ARP Geotechnical Ltd on 1st September 2024. The purpose of the investigation was to produce an assessment of the site in accordance with BS10175 : 2011 + A2 : 2017 "Investigation of potentially contaminated sites - Code of practice", and to provide geotechnical information to aid design of the development.

5.2 Trial pits were sampled on an approximate 25m spacing, to satisfy the requirements of the British Standard. Three trial pits (TP1 to TP3) were excavated, to depths of between 2.1m and 3.5m. The trial pits and boreholes were organised, supervised and logged by an Engineer from ARP Geotechnical Ltd. Justifications for the trial pit locations are given below.

LOCATION	REASON
TP1	Part of grid and check for / sample any made ground below the existing site access track.
TP2	Part of grid and check for / sample any made ground forming the barn development platform.
TP3	Part of grid

5.3 The trial pit location plan and logs are included in Appendix B.

5.4 Chemical analysis of six soil samples, for metals, inorganics, speciated PAH, TPH, phenols, and asbestos, was undertaken by the UKAS accredited Eurofins Chemtest Laboratory in Newmarket. The test certificates are included in Appendix C.

5.5 Analysis for Atterberg Limits and moisture content was undertaken by the UKAS accredited TTL Laboratory in Doncaster. Geochemical testing comprising pH and water-soluble sulphate was undertaken by Chemtest. The test certificates are included in Appendix C.

6.0 SUMMARY OF GROUND CONDITIONS

6.1 TP1 was located on the existing access track into the site, which will link the main area of the site with Jill Lane. The location of the pit was selected, in part, to check for and sample any made ground that might be present forming the track. However, TP1 did not reveal any made ground, only topsoil (0.3m thick) onto firm natural clay. Beneath the clay, from 1.5m depth, extremely weak weathered mudstone was present, recovered as mudstone cobbles with some clay matrix. By 2.5m depth, the weathering had decreased so that the mudstone was recovered only as gravel and cobbles, with no clay. This continued to the base of the pit at 3.5m depth, where the mudstone was becoming hard to dig.

6.2 TP2 was located directly adjacent to the existing barn, on what could be seen to be the development platform on which the barn was constructed. Granular fill material of crushed brick and stone was evident forming the floor inside the barn, and this was seen to be present outside the barn in TP2, to a depth of 0.35m. Natural firm clays were present beneath, onto weathered mudstone from 1.7m depth, arising as cobbles of mudstone with some clay matrix. This continued to the base of the pit at 2.4m depth, where the mudstone was becoming hard to dig.

6.3 TP3 was located in the southwest of the main area and revealed 0.15m thickness of topsoil onto 0.2m thickness of granular made ground. Below, firm natural clays were present to 1.4m depth, overlying weathered mudstone to the base of the pit at 2.1m depth, where the mudstone was becoming hard to dig.

6.4 In summary of the above, up to 0.35m thickness of granular made ground (crushed development platform fill) was present in TP2 and TP3 (below a thin topsoil in TP3), and only topsoil was present at the surface of TP1. Natural clays were present beneath, to depths of between 1.4m and 1.7m, onto weathered mudstones. No groundwater ingress was noted.

6.5 The excavations generally remained stable for the short period of exposure, and the pits were backfilled with the arisings on completion.

Gas Monitoring

6.6 Gas monitoring will need to be carried out, to assess any gas migration from coal/workings underlying the site, and from the historical landfill sites located within 250m to the east and northeast of the site. Monitoring wells will be installed into the imminent rotary boreholes, and the findings will be reported separately on completion of the monitoring.

Coal Mining

6.7 A Coal Mining Risk Assessment (CMRA) undertaken by ARP (reference PWS/01/JRjcl1). The report concluded that a rock drilling investigation should be carried out to check for any evidence of workings in two shallow coal seams beneath the site. This investigation is programmed for the near future and will be reported separately. In addition, a shaft was recorded as being present on site, although excavations to locate the shaft did not reveal its location.

6.8 If, during site preparation, the shaft is uncovered and found to be within the proposed drive or parking area, then the shaft will be capped. The cap dimensions will be twice the shaft diameter. The capping detail will be finalised once the shaft is located, to reflect the actual dimensions and proposed makeup of the drive/parking. Approval for this detail will be required from the Coal Authority.

7.0 CONTAMINATION ANALYSIS

Screening Values - Soils

7.1 In March 2014, DEFRA published Category 4 Screening Levels (C4SLs) for six contaminants: arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead for soils which should be used in contamination assessment for proposed development. Two further C4SLs for naphthalene and inorganic mercury were added in 2024. The values are based on the toxicological benchmark of a "low level of toxicological concern" (LLTC) rather than the previous regulatory approach of "minimal or tolerable level of risk". As the C4SLs are less protective of health than the previous approach, the Chartered Institute of Environmental Health (CIEH) has advocated an alternative approach based on minimal risk, but with some adjustment of exposure parameters to more realistic scenarios than those previously used. To this end, the CIEH has collaborated with Land Quality Management to publish "Suitable 4 Use Levels" (S4Uls) "The LQM/CIEH S4Uls for Human Health Risk Assessment", November 2014 (LQM/CIEH). However, DEFRA has reiterated its intention that the C4SLs should be used in generic risk assessment for proposed development, and there is indication that other parties will collaborate, in the near future, to extend the range of C4SL determinands beyond the eight published so far.

7.2 Soil contamination test results in this report have been compared first against the more conservative S4UL, and where a C4SL exists for the same determinand, consideration given to the use of the C4SL for any exceedances of the S4UL, within the site-specific context (including the use of benzo(a)pyrene as a surrogate marker for genotoxic PAH compounds, where appropriate). Where no S4UL exists for a determinand, for example lead, the C4SL has been used. The LQM/CIEH screening values have been calculated for soil organic matter contents of 1% and 2.5%, as well as 6%, and the appropriate screening value is used for the organic matter content of the soil. All the C4SL values published are for a soil organic matter content of 6%.

7.3 A table showing the screening values utilised is included in Appendix C.

Soils Analysis

7.4 Six soil samples were issued to DETS for the suite of testing (As, Cd, Cr (VI), Cr(III), Cu, Hg, Ni, Pb, Se, Zn, Total Sulphate, Water Soluble Sulphate, pH, Phenol-monohydric, Speciated PAH, Total TPH, Asbestos, and Organic Matter). The testing comprised:

- Two samples of Topsoil from TP1 and TP3 (TP3 overlies made ground)
- Three samples of Made Ground from TP2 (2No. samples) and TP3 (1No. sample)
- One sample of natural clay from TP1

7.5 Statistical analysis of the results was not possible given the small number of samples obtained, although appropriate for the site circumstances.

Topsoil

7.6 A results summary table for determinands within the topsoil found to be above screening values is given below

Sample	Lead	Asbestos
TP1, 0.2m	37	None Detected
TP3, 0.1m	370	Chrysotile (0.001%)
Screen Values	**200**	

All values in mg/kg unless indicated otherwise

Exceedance

7.7 It can be seen from the table that lead is well in excess of the 200mg/kg screening value in TP3, and this sample also was found to contain microscopic chrysotile (white asbestos) with a quantification of 0.001%. It should be noted that the topsoil in TP3 was found to be sitting above some of the granular made ground that makes up the development platform of the barn.

Made Ground

7.8 A results summary table for determinands within the made ground found to be above screening values is given below.

Sample	Lead	Organic Matter (%)	Benzo[a]an -thracene	Benzo[b]flu -oranthene	Benzo[a]pyr -ene	Dibenz(a,h) - Anthracene	Asbestos
TP2, 0.2m	70	10	1.4	1.7	1.4	< 0.10	None Detected
TP2, 0.3m	47	3.6	12	12	10	1.1	Chrysotile Cement (1.1%)
TP3, 0.3m	48	9.0	2.3	3.5	3.0	0.40	None Detected
Screen Values	**200**	**N/A**	**11**	**3.3**	**2.7**	**0.28**	

All values in mg/kg unless indicated otherwise

Exceedance

Screening values are based on the lowest Organic Matter content detected, of 3.6%

7.9 It can be seen from the table that concentrations of the PAH compounds benzo[a]anthracene (BaA), benzo[b]fluoranthene (BbF), benzo[a]pyrene (BaP), and dibenz(a,h)anthracene (DahA) have exceedances within the made ground. In addition, chrysotile cement (white asbestos) was detected within one of the samples (1.1% quantification). Double plot ratios for the PAH compounds indicate the PAH to be as a result of the presence of coal fragments, with the exception of the sample from TP2 at 0.3m, where the PAH is likely to be present as a result of coal tar/creosote (most likely a fragment of tarmac within the fill).

Natural Clay

7.10 Testing on the natural clay revealed no exceedances of any screening values, with the exception of slightly elevated lead, at 230mg/kg (the screening value is 200mg/kg). However, as the natural clay will eventually be below topsoil cover, and as only one sample was tested (the likelihood is that testing of additional samples would show an overall statistically lower concentration), the slight exceedance is not considered significant.

Updated Risk Assessment and Conceptual Model

7.11 The categorisations of risk adopted in this report are adapted from CIRIA Report C552 (Contaminated Land Risk Assessment: A Guide to Good Practice, 2001). This approach assesses the potential severity of any pollution event and the probability of the event occurring, to arrive at a risk category, for the various potential source - pathway - receptor linkages. The relevant tables used, with the definitions, are presented in Appendix D.

7.12 The updated source – pathway – receptor matrix is presented below, taking into account the findings of the investigation. Any pathways in italics are deemed not to be viable and the reason given.

Viable Source - Pathway - Receptor Matrix (Finished Development)

Contamination Sources	Pathways	Receptors	Severity of Consequence	Probability of Event	Risk
Made Ground Topsoil at TP3:- lead (370mg/kg) & chrysotile asbestos Made Ground:- PAH compounds (BaP at max. 10mg/kg) and sporadic chrysotile	• Inhalation, ingestion and dermal contact with soil and dust	**Humans:-** • Future occupants • Maintenance workers • Adjacent residents and general public	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Fruit and vegetable intake, with soil	**Humans (as above)**	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• *Vapour inhalation outdoor (not applicable to the determinands)*	**Humans (as above)**	**Pathway not applicable**		
	• Vapour inhalation indoor *(not applicable to the determinands)*	**Humans (as above)**	**Pathway not applicable**		
	• *Migration in surface water (concentrations and volume mean this pathway is not significant)*	• Surface water (nearest downslope) is 7m to west and south. There are no abstractions within 1km.	**Pathway not significant**		
	• Migration in groundwater *(concentrations and volume mean this pathway is not significant)*	• Groundwater (Secondary A Aquifer, abstraction 765m to the west)	**Pathway not significant**		
	• Root uptake	**Vegetation:-** • Landscape areas • Private gardens	**Medium**	**Low Likelihood**	**Moderate/ Low**
	• Migration	**Services/Utilities:-** • Potable water supply	**Medium**	**Low Likelihood**	**Moderate/ Low**
Possible shallow workings/coal and landfills within 250m:- methane and carbon dioxide	• Asphyxiation • Explosive risk	• Construction/de-molition workers • Future occupants • Buildings	**Severe**	**Low Likelihood**	**Moderate**
Possible asbestos within existing buildings, and sporadic chrysotile detected within made ground and topsoil	• Inhalation	• Future occupants • Maintenance workers • Adjacent residents and general public	**Severe**	**Low Likelihood**	**Moderate**

7.13 It can be seen from the above matrix that several pathways to receptors are operative, and this may affect users of the finished development. Some form of remedial action is, therefore, considered necessary to allow residential development without excess risk.

Risk Based Assessment of Remedial Options

Asbestos Within Existing Buildings

7.14 Provided an asbestos survey is carried out prior to any demolition or work on the existing building on the site, and any identified asbestos is removed and disposed to a licenced facility, then the risk to receptors is low. The work should be carried out by appropriately qualified Contractors.

Landfill and Mine Gases

7.15 To address the potential risk from landfill and mine gases, monitoring of borehole wells is in progress. This will determine whether or not protection measures are likely to be necessary. This will be confirmed by separate letter report on completion of the monitoring.

Made Ground Topsoil at TP3: Ingestion, Dust Inhalation, Dermal Contact, Root Uptake, and Fruit and Vegetable Intake With Soil

7.16 The topsoil at/around TP3 (and any other locations where it may overlie the development platform fill) is not suitable for re-use on the site. As topsoil is a poor engineering material and cannot be placed under a soil cover system due to the potential for gas generation, the only economical option is likely to be removal from site.

Made Ground - Ingestion, Dust Inhalation, Dermal Contact, Root Uptake, and Fruit and Vegetable Intake, With Soil

7.17 This pathway is automatically blocked where buildings or hardstanding will be present above the material. However, in garden areas, provision of a clean soil cover system comprising a minimum 0.6m thickness will be required, to reduce the risk to future users of the site to acceptable levels from these pathways. This assumes a worst-case double dig scenario (i.e. 2 x spade depths).

Migration to Utilities

7.18 Any migration to utilities is unlikely to be significant. However, the local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

Risks During Construction Period

7.19 It is also necessary to consider the effects of the contamination present on the site in relation to the risks to adjacent residents, construction workers and the general public during construction. This is assessed in the following matrix.

Source	Pathway	Potential risk	Risk after employing suitable Health and Safety plan.
Existing made ground and topsoil overlying the made ground	Inhalation	Moderate	Damping down of the site during dry periods and timely placement of the existing made ground below barriers should block this pathway and reduce the risk to negligible.
Existing made ground and topsoil overlying the made ground	Ingestion	Moderate	Site fencing will exclude access to members of the public. Existing made ground will be contained within the site boundary, and placed below barriers as soon as possible. Washing facilities and a clean mess room should be provided. These measures should block this pathway and reduce the risk to negligible.
Existing made ground and topsoil overlying the made ground	Contact	Moderate	Education of workers to use adequate hygiene and PPE should block this pathway and reduce the risk to negligible.
Existing made ground and topsoil overlying the made ground	Surface water	Moderate	Preventing surface water run off by minimising open exposure times of the existing made ground, and using bunds or cut off trenches as necessary should block this pathway and reduce the risk to negligible. Any rolling of material into the watercourse should be prevented by diligence and gravel boards, if required.
Asbestos in existing buildings	Inhalation	High	Provided an asbestos survey is carried out, and any identified asbestos is removed from site prior to any other works commencing, the pathway is blocked and the risk is negligible.

7.20 Provision of all the above measures will ensure that all the identified pathways for the contamination will be blocked.

Summary of Contamination Assessment and Remedial Options

7.21 The ground investigation revealed up to 0.35m thickness of granular made ground (crushed development platform fill) to be present in TP2 and TP3 (below a thin topsoil in TP3), and only topsoil was present at the surface of TP1. Natural clays were present beneath, to depths of between 1.4m and 1.7m, onto weathered mudstones. The made ground was found to contain elevated concentrations of PAH compounds (including benzo(a)pyrene at up to 10mg/kg) and sporadic chrysotile asbestos cement. The overlying topsoil to this material (found at TP3 only) also contained microscopic chrysotile asbestos fibres, as well as elevated lead (370mg.kg). Topsoil elsewhere, where sitting on natural clay, was found to be uncontaminated.

7.22 The contamination risk assessment, and assessment of remedial options, has indicated that, provided that the following remedial measures are adopted then the risks to the identified receptors are deemed acceptable for the proposed residential development with private gardens.

7.23 An asbestos survey should be carried out prior to any demolition or work on the existing buildings on the site, and any identified asbestos should be removed and disposed to a licenced facility. The work should be carried out by appropriately qualified Contractors.

7.24 Either all the existing topsoil should be removed from the site, or further sampling and testing on a closer grid carried out to determine any areas of topsoil that may be retained. The receiving tip may require Waste Classification, Waste Acceptance Criteria testing and asbestos quantification. Independent validation inspection will be required, to verify removal of all the affected topsoil. The disposal/transfer documents should be retained for inclusion in the Validation Report.

7.25 Where any proposed garden or landscape areas overlie the existing made ground, a minimum 0.60m thickness of uncontaminated soils (topsoil and subsoil) should be provided. As chrysotile fibres have been identified, it is recommended that the soil cover system be underlain by a minimum 100mm thick hard break layer of coarse stone, or a robust geogrid/geotextile.. In areas of hardstanding or building footprints, the soil cover system is not required.

7.26 If cohesive material is used within the soil cover system, external levels and surface water drainage will need to be carefully designed to avoid localised surface water ponding.

7.27 Any imported soils used within the cover system will need to be verified as suitable by inspection and testing, in accordance with guidance supplied in the document produced by the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG): "Guidance on the Verification Requirements for Cover Systems".

7.28 The local water company are likely to require details of the contaminants present on the site, to make a judgment on any requirement for protection of buried water supply pipes from chemical attack/ingress.

7.29 A Contamination Remediation Statement is included in Appendix E.

8.0 GEOTECHNICAL TESTING

8.1 Selected samples of the natural strata were delivered to the UKAS accredited TTL Laboratory in Doncaster for testing with regard to plasticity indices and moisture content. Test certificates are presented in Appendix C and a summary of the results, including Modified Plasticity Indices, is given below.

Location	Depth (m)	MC	LL	PL	PI	<425µm	I'p
TP1	1.3	27	49	27	22	64	14.1
TP2	1.0	20	38	23	15	86	12.9
TP3	1.2	19	45	24	21	88	18.5
	No. of results	3	3	3	3	3	3
	Min.	19	38	23	15	64	12.9
	Max.	27	49	27	22	88	18.5

I'p	VCP
>40%	High
20% - <40%	Medium
10% - <20%	Low

MC = Moisture Content (%)	LL = Liquid Limit (%)	PL = Plastic Limit (%)
PI = Plasticity Index (%)	I'p = Modified PI (%)	VCP = NHBC Standard Chapter 4.2 Volume Change Potential

8.2 The plasticity test data shows clays of intermediate plasticity, in accordance with BS 5930:2015 +A1:2020 "Code of Practice for Site Investigations". When the percentage retained on the 425 micron BS sieve is considered, the Modified Plasticity Index, in accordance with NHBC Standard Chapter 4.2 "Building Near Trees" is a maximum of 18.5. In accordance with the Standard, this equates to LOW Volume Change Potential.

8.3 Geochemical testing (water soluble sulphate and pH) was undertaken on selected samples by Chemtest, comprising 3No. samples of natural strata and 3No. samples of made ground. In accordance with the BRE Special Digest 1 "Concrete in aggressive ground", the characteristic values for the two materials are given below:

Characteristic Values

Material	pH	SO_4
Made Ground	7.3	230
Natural Strata	6.5	48

SO_4 = Sulphate content in mg/l on a 2:1 water : soil extract pH = Acidity

8.4 The geochemical analyses show the natural strata to have low water soluble sulphate content and slightly acidic pH. The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1. Testing on the made ground also indicates class AC-1. Therefore, the use of GEN1 designated concrete will be satisfactory for unreinforced buried concrete on the site, in accordance with BS 8500-1:2015+A2:2019. For any reinforced buried concrete, other design-specific mixes will apply.

9.0 GEOTECHNICAL ASSESSMENT

Coal Mining

9.1 A Coal Mining Risk Assessment (CMRA) undertaken by ARP (reference PWS/01/JRjcl1). The report concluded that a rock drilling investigation should be carried out to check for any evidence of workings in two shallow coal seams beneath the site. This investigation is programmed for the near future and will be reported separately.

9.2 In addition, the CMRA identified the presence of a mine shaft on the site. This was subsequently investigated by ARP (report reference PWS/01/WWjcl4 dated 17th June 2024) and the shaft was proved not to be present within around 90% of the area covered by the shaft location error radius. The remaining 10% could not be searched due to access restrictions and, therefore, mitigation measures were provided, as outlined below:

Proposed Building

9.2.1 As part of the preparatory works for construction of the proposed building, the footprint (and a suitable offset beyond of around 1m) will be cleared to expose natural strata. If no shaft is revealed within this area, then no mitigation measures are required for the building foundations.

9.2.2 If the shaft is uncovered within this exposed area, then the shaft will need to be grouted and capped. The cap dimensions will be twice the shaft diameter. The proposed building foundations will need to be designed by a Structural Engineer and avoid imposing any load on the shaft cap. The precise location of the shaft, the depth to rockhead, and diameter at rockhead, will need to be taken into account, along with the position of the building foundations, to form a bespoke design. The shaft cap detail and foundation detail will need to be approved by the Coal Authority and Building Control.

Drive/Parking Area

9.2.3 Although already cleared as part of the preparatory works for construction of the proposed drive/parking, the area will be cleared to expose natural strata. If the shaft is not located anywhere during this site preparation, then no mitigation measures are proposed. However, this assumes full coverage:- if the preparatory works exclude any of the shaft error radius zone (i.e. due to overhead power line restrictions or vegetation), then a double geogrid system will need to be used within the error radius zone. These measures would need to be approved by the Coal Authority.

9.2.4 If, during site preparation, the shaft is uncovered and found to be within the proposed drive or parking area, then the shaft will be capped. The cap dimensions will be twice the shaft diameter. The capping detail will be finalised once the shaft is located, to reflect the actual dimensions and proposed makeup of the drive/parking. Approval for this detail will be required from the Coal Authority.

9.3 There will be no significant arisings of coal during proposed development works, and it will not be possible to win any coal from the site before development.

Foundations

9.4 The made ground on the site is not considered suitable for support of foundation loads. The underlying firm natural clays are considered suitable, for the use of strip/trench fill foundations. An allowable bearing pressure of 100kN/m^2 is considered applicable.

9.5 The clays were shown to be of low volume change potential. Therefore, in accordance with NHBC Standard Chapter 4.2 "Building Near trees", in the absence of trees, a minimum foundation depth of 0.75m below existing or proposed ground level is applicable, whichever is the lower. However, in the presence of any proposed, existing or removed trees, the foundation may need to be deepened, depending on the type of tree and its distance from the

face of the foundation. If not already available, a tree survey may be required to enable a foundation schedule to be prepared. The tree survey will also need to consider trees on third party properties.

9.6 The foundation should be taken below the depth of any existing foundations or obstructions, onto natural ground. The whole plan area of the foundation should be placed on similar natural material.

9.7 If bedrock is encountered on part of a foundation excavation, the rest of the plot should be deepened to ensure founding on similar material. However, if rock is not encountered by 2.5m depth on the remainder of the plot, then the Engineer should be contacted for further advice.

9.8 If the imminent rotary borehole investigation finds shallow coal workings are present within influencing depth of the surface of the site, then grout injection via a grid of boreholes is likely to be required. Such treatment is commonplace and a recognised technique for treatment. Following the grouting, strip foundations, will need to be at least 300mm thick and reinforced with two layers of B503 mesh – one near the bottom and one near the top.

Excavations

9.9 It is likely that excavations into the natural strata will remain stable in the short term, requiring minimal trench support, in accordance with the prevailing statutory guidance. However, instability may be anticipated within the made ground.

9.10 No groundwater seepages were recorded during the investigation, which was undertaken at the end of the summer (1st September 2024). At other periods of the year, groundwater ingress cannot be ruled out, but if any occurs, this should be relatively slow and controllable by pumping from an artificial sump.

9.11 Excavations should be readily achieved using conventional hydraulic plant. However, excavations into intact bedrock (present from depths of between 2.1m and 3.5m) or any buried foundations and structures, are likely to require a hydraulic breaker.

Chemical Precautions

9.12 The Aggressive Chemical Environment for Concrete (ACEC) class is AC-1 for both the natural strata and made ground. Therefore, the use of GEN1 designated concrete will be satisfactory for unreinforced buried concrete, in accordance with BS 8500-1:2015+A2:2019. For any reinforced buried concrete, other design-specific mixes will apply.

Road Pavement Construction

9.13 For any areas of road pavement, including parking areas, the formation will be the natural clays. Based on the observed characteristics of the material, and the results of the plasticity testing, a design California Bearing Ratio (CBR) value of 3% is considered applicable, below any obvious soft spots, and at equilibrium moisture content. If considered necessary, this should be confirmed by testing at proposed subgrade level before construction.

Flooding and Soakaways

9.14 The site is not at risk from river flooding. The risks of flooding from other causes such as adverse topography or insufficient surface water drainage, are not considered here. If such risk needs to be quantified, a separate specialist Flood Risk and Drainage Report should be commissioned, if not already available.

9.12 BGS data indicates the general area has “limited potential for groundwater flooding”.

9.16 The disposal of surface water using soakaways is unlikely to be practical on the site, given the presence of low permeability strata.

Gas Protection

9.17 Basic radon protection is recommended for the site. This is usually achieved by incorporating an appropriate barrier within a solid floor system and extending the barrier through the cavity wall.

9.18 Gas monitoring will need to be carried out, to assess any gas migration from coal/workings underlying the site, and from the historical landfill sites located within 250m to the east and northeast of the site. Monitoring wells will be installed into the imminent rotary boreholes, and the findings will be reported separately on completion of the monitoring.

APPENDIX A

SITE LOCATION, SITE PLAN, INDICATIVE LAYOUT

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House 5-6 Northwest Business Park Servia Hill Leeds LS6 2QH
Telephone : 0113 245 8498 Fax : 0113 244 3864 E-Mail : leeds@arpassociates.co.uk

Project
JILL LANE, MIRFIELD

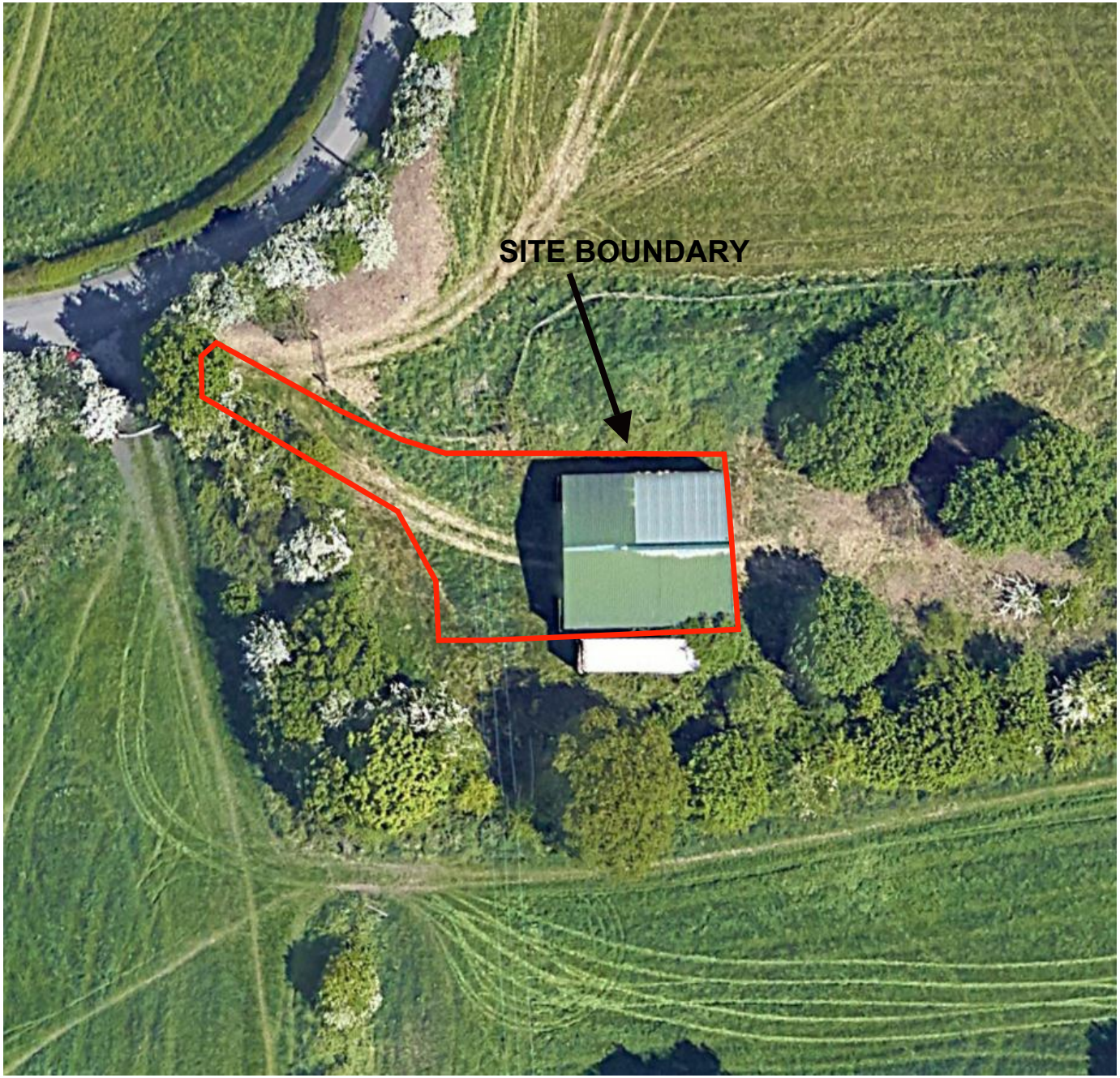
Client
PAMELA DEWS

Title
SITE LOCATION PLAN

Date
SEPTEMBER 2024

Drawn	Scale
MH	NTS

Job No.
PWS/01



ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House 5-6 Northwest Business Park Servia Hill Leeds LS6 2QH
Telephone : 0113 245 8498 Fax : 0113 244 3864 E-Mail : leeds@arpassociates.co.uk

Project
JILL LANE, MIRFIELD

Client
PAMELA DEWS

Title
AERIAL PLAN

Date
SEPTEMBER 2024

Drawn	Scale
MH	NTS

Job No.
PWS/01

NOTES
DO NOT SCALE FROM THIS DRAWING.
It is the Contractor's responsiblity to check all governing dimensions and verify all dimensions on site before commencing any work or making any shop drawings.
This drawing is to be read in conjunction with schedules of work, specifications, bills of quantities and other relevant information. Any discrepancies are to be reported to the Project Architect.
Work and materials are to be in accordance with the Building Regulations and to comply with the relevant British Standards.

ANE

Bin Collection

Bins

BOUNDARY - POST AND RAIL
FENCING WITH NATIVE HEDGING

N

Site Layout:1:200

Rev:	Date:	Notes:

FOX ARCHITECTURE & DESIGN
Fox Cottage, Whitley Road, Whitley
West Yorkshire, WF12 0LU
T 01924 459231
E info@foxarchitecture.co.uk
www.foxarchitecture.co.uk

Client: Ms P Dews

Project: House Proposal
Jill Lane
Mirfield

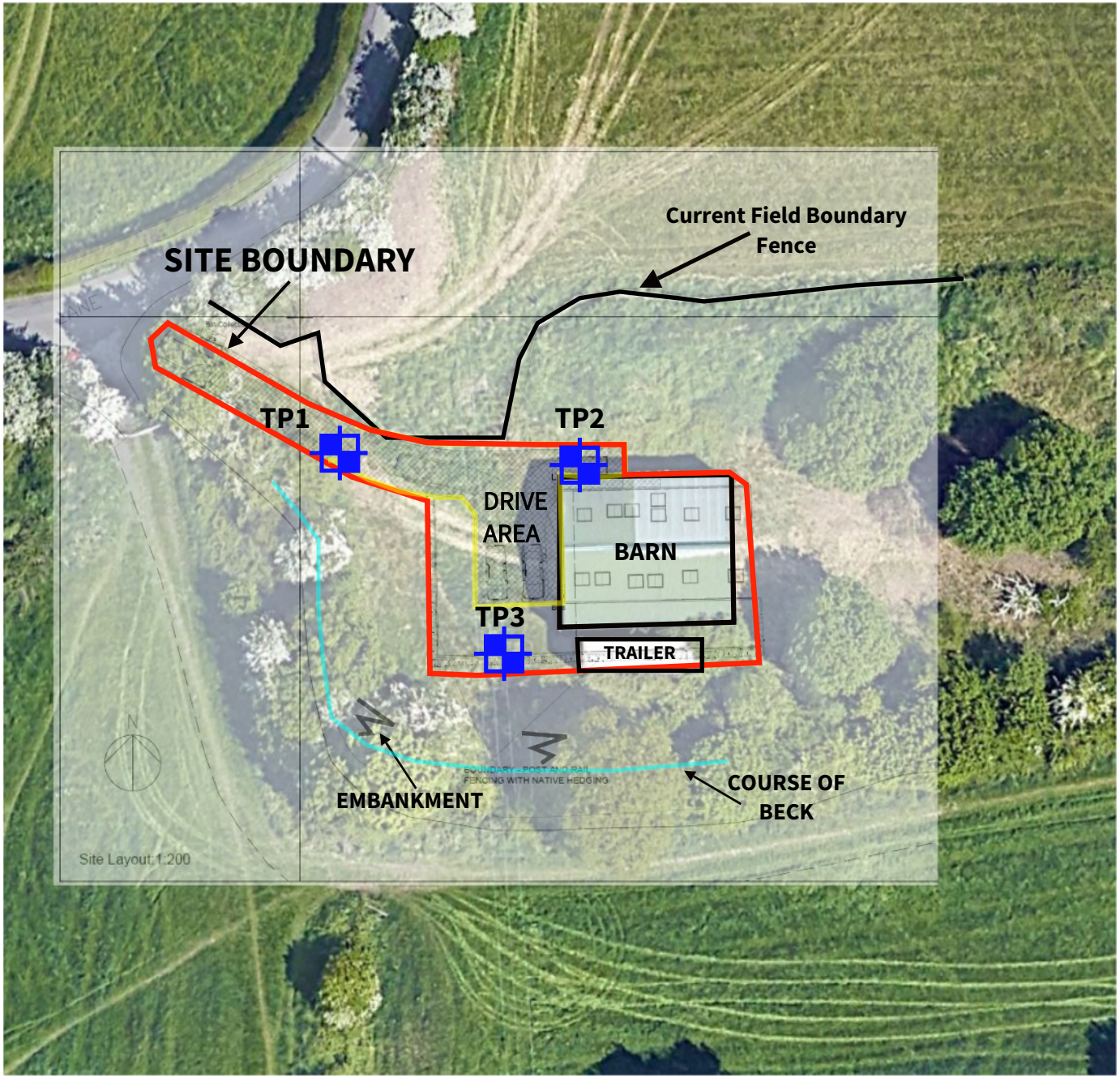
Drawing: Proposed Site Layout

Date:	Scale:
Sept 2023	1:200 @ A3

Drawing No:	Rev:
2317/110	

APPENDIX B

INVESTIGATION PLAN, LOGS & CROSS SECTIONS



0m 15m

KEY

ARP TRIAL PIT LOCATION SEPTEMBER 2024.

Error Radius

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House 5-6 Northwest Business Park• Servia Hill • Leeds LS6 2QH
Telephone : 0113 245 8498 Fax : 0113 244 3864• E-Mail : leeds@arpassociates.co.uk

Project
JILL LANE, MIRFIELD

Client
PAMELA DEWS

Title
PHASE 2 SITE INVESTIGATION PLAN

Date
JUNE 2024

Drawn	Scale
WW	**AS SHOWN**

Job No.
PWS/01

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Jill Lane, Mirfield	TP1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
13 Tonne JCB excavator with 1200mm toothed bucket.	1.20 x 3.50		P. Dews	PWS/01
	Location	**Dates** 01/09/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10-0.10 0.20-0.20	D D				(0.30) 0.30	Soft brown slightly gravelly sandy clayey TOPSOIL. Sand is fine to medium. Gravel is subangular of mudstone and sandstone. Frequent rootlets. Rare subangular fine to coarse gravel of brick.		
						Firm light brown grey mottled slightly gravelly CLAY. Gravel is subangular fine to coarse of mudstone.		
					(1.20) 1.50			
1.30-1.30	D					Weathered extremely weak thinly laminated light grey silty MUDSTONE. Recovered as subangular cobbles of mudstone with some clay.		
					(1.00) 2.50			
						Extremely weak thinly laminated dark grey MUDSTONE. Recovered as angular fine to coarse gravel and occsional angular cobbles.		
					(1.00) 3.50			
						Complete at 3.50m		

No image available

Remarks

Ground checked for services with CAT prior to excavation.
Pit walls stable. No groundwater recorded.
Hole finished at 3.50m depth becoming hard to dig.
Backfilled with arisings to surface.

Scale (approx)	Logged By	Figure No.
1:25	W.W	PWS/01.TP1

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Jill Lane, Mirfield	TP2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
13 Tonne JCB excavator with 1200mm toothed bucket.	1.20 x 2.00		P. Dews	PWS/01
	Location	**Dates** 01/09/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.20-0.20	D				(0.35)	MADEGROUND: loose brown slightly clayey sandy subangular to angular fine to coarse gravel with medium cobble content and low boulder content. Gravel is of brick, sandstone concrete. Cobbles are of brick, sandstone and concrete. Boulders are of sandstone, up to 0.4m. Rare fragments of metal pipe and plastic.		
0.30-0.30	D				0.35	Firm light brown grey mottled slightly gravelly CLAY. Gravel is subangular fine to coarse of mudstone.		
1.00-1.00	D				(1.35)			
					1.70	Weathered extremely weak thinly laminated light grey silty MUDSTONE. Recovered as subangular cobbles of mudstone with some clay.		
					(0.70)			
					2.40	Complete at 2.40m		

No image available

Remarks

Ground checked for services with CAT prior to excavation.
Pit walls experienced slight instability in the made ground. No groundwater recorded.
Hole finished at 2.4m becoming hard to dig.
Backfilled with arisings to surface.

Scale (approx)	Logged By	Figure No.
1:25	W.W	PWS/01.TP2

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Trial Pit Number
Jill Lane, Mirfield	TP3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
13 Tonne JCB excavator with 1200mm toothed bucket.	1.20 x 2.00		P. Dews	PWS/01
	Location	**Dates** 01/09/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15)	Soft brown slightly gravelly sandy clayey TOPSOIL. Sand is fine to medium. Gravel is subangular of mudstone and sandstone. Frequent rootlets. Rare subangular fine to coarse gravel of brick.		
0.10-0.10	D				0.15			
					(0.20)			
0.30-0.30	D				0.35	MADEGROUND: loose brown slightly clayey sandy subangular to angular fine to coarse gravel with low cobble content content. Gravel is of brick, sandstone concrete. Cobbles are of brick, and sandstone.		
						Firm light brown grey mottled slightly gravelly CLAY. Gravel is subangular fine to coarse of mudstone.		
					(1.05)			
1.20-1.20	D				1.40	Weathered extremely weak thinly laminated light grey silty MUDSTONE. Recovered as subangular cobbles of mudstone with some clay.		
					(0.30)			
					1.70	Extremely weak thinly laminated grey silty MUDSTONE. Recovered as angular fine to coarse gravel and occasional angular cobbles.		
					(0.40)			
					2.10	Complete at 2.10m		

No image available

Remarks

Ground checked for services with CAT prior to excavation.
Pit walls stable. No groundwater recorded.
Hole finished at 2.1m depth becoming hard to dig.
Backfilled with arisings to surface.

Scale (approx)	Logged By	Figure No.
1:25	W.W	PWS/01.TP3

APPENDIX C

LAB CERTS & SVS

ARP GEOTECHNICAL LIMITED
IMPORTED SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITH HOME-GROWN PRODUCE

Determinand	S4UL (unless stated otherwise) (mg/kg)			C4SL (mg/kg)		
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent) (MAFF)	400					
Chromium (hexavalent)	6			21		
Copper (MAFF)	80#					
Lead				200		
Inorganic Mercury	40			200		
Nickel (MAFF)	50#					
Selenium	250					
Zinc (MAFF)	200#					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Naphthalene	2.3	5.6	13	15	36	85
Acenaphthylene	170	420	920			
Acenaphthene	210	510	1,100			
Fluorene	170	400	860			
Phenanthrene	95	220	440			
Anthracene	2,400	5,400	11,000			
Fluoranthene	280	560	890			
Pyrene	620	1,200	2,000			
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			5
Indeno(1,2,3-cd)pyrene	27	36	41			
Dibenzo(a,h)anthracene	0.24	0.28	0.30			
Benzo(g,h,I)perylene	320	340	350			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

MAFF: Ministry of Agriculture, Fisheries and Food - "Code of Good Agricultural Practice for the Protection of Soil

#pH dependent. If exceeded, to be compared against appropriate MAFF value for the pH

Eurofins Chemtest Ltd
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Amended Report

Report No.:	24-29724-2		
Initial Date of Issue:	27-Sep-2024	**Date of Re-Issue:**	04-Oct-2024
Re-Issue Details:	This report has been revised and directly supersedes 24-29724-1 in its entirety		
Client	ARP Geotechnical Ltd		
Client Address:	5/6 Northwest Business Park Servia Hill Leeds Yorkshire LS6 2QH		
Contact(s):	William Watkins Mike Harper		
Project	PWS/01 Jill Lane, Mirfield		
Quotation No.:	Q24-33517	**Date Received:**	16-Sep-2024
Order No.:	PWS/01	**Date Instructed:**	16-Sep-2024
No. of Samples:	7		
Turnaround (Wkdays):	18	**Results Due:**	09-Oct-2024
Date Approved:	04-Oct-2024		

Approved By:

Details: David Smith, Technical Director

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: PWS/01 Jill Lane, Mirfield

Client: ARP Geotechnical Ltd				**Chemtest Job No.:**		24-29724	24-29724	24-29724	24-29724	24-29724	24-29724	24-29724
Quotation No.: Q24-33517				**Chemtest Sample ID.:**		1866907	1866908	1866909	1866910	1866911	1866912	1866913
				Client Sample ID.:		TP1	TP1	TP2	TP2	TP3	TP3	TP3
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.2	1.3	0.2	0.3	0.1	0.3	1.2
				Bottom Depth (m):		0.2	1.3	0.2	0.3	0.1	0.3	1.2
				Date Sampled:		12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024
				Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
ACM Type		U	2192		N/A	-	-	-	Cement	Fibres/Clumps	-	
Asbestos Identification		U	2192		N/A	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	Chrysotile	Chrysotile	No Asbestos Detected	
Asbestos by Gravimetry		U	2192	%	0.001				1.1	0.001		
Total Asbestos		U	2192	%	0.001				1.1	0.001		
Moisture		N	2030	%	0.020	17	19	22	16	22	19	16
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Stones and Roots	Stones and Roots	Stones and Roots	Stones and Roots	Stones	Stones and Roots	Stones
Soil Texture		N	2040		N/A	Loam	Loam	Loam	Loam	Loam	Loam	Loam
pH at 20C		M	2010		4.0	8.2	8.1	7.3	8.0	8.0	7.8	8.1
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	< 0.010	< 0.010	0.23	< 0.010	0.011	0.16	0.048
Sulphate (Total)		U	2430	mg/kg	100	450	1000	1600	1000	1700	1500	
Arsenic		M	2455	mg/kg	0.5	12	11	28	17	11	15	
Cadmium		M	2455	mg/kg	0.10	1.0	0.33	0.34	0.40	0.32	0.24	
Chromium		M	2455	mg/kg	0.5	22	20	21	62	24	22	
Copper		M	2455	mg/kg	0.50	21	26	38	33	35	23	
Mercury		M	2455	mg/kg	0.05	0.13	0.14	0.20	0.11	0.22	0.08	
Nickel		M	2455	mg/kg	0.50	24	17	21	35	18	14	
Lead		M	2455	mg/kg	0.50	37	230	70	47	370	48	
Selenium		M	2455	mg/kg	0.25	1.4	0.61	0.88	1.2	0.70	0.73	
Zinc		M	2455	mg/kg	0.50	83	120	100	130	180	74	
Chromium (Trivalent)		N	2490	mg/kg	1.0	22	20	21	62	24	22	
Chromium (Hexavalent)		N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	
Organic Matter		M	2625	%	0.40	2.8	4.1	10	3.6	6.0	9.0	
Total TPH >C6-C40	EH_1D_Total	U	2670	mg/kg	10	< 10	< 10	< 10	13	410	540	
Naphthalene		M	2800	mg/kg	0.10	0.21	< 0.10	0.31	0.50	0.36	< 0.10	
Acenaphthylene		N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.3	< 0.10	< 0.10	
Acenaphthene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.9	< 0.10	< 0.10	
Fluorene		M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10	2.3	< 0.10	< 0.10	
Phenanthrene		M	2800	mg/kg	0.10	1.0	0.97	1.9	19	1.3	1.1	
Anthracene		M	2800	mg/kg	0.10	0.27	0.20	0.51	5.9	0.36	0.46	
Fluoranthene		M	2800	mg/kg	0.10	1.8	1.8	3.4	30	3.2	4.3	
Pyrene		M	2800	mg/kg	0.10	1.5	1.5	2.7	24	2.8	3.8	
Benzo[a]anthracene		M	2800	mg/kg	0.10	0.84	0.73	1.4	12	1.6	2.3	
Chrysene		M	2800	mg/kg	0.10	0.83	0.80	1.5	11	1.8	2.3	
Benzo[b]fluoranthene		M	2800	mg/kg	0.10	1.2	1.1	1.7	12	2.5	3.5	
Benzo[k]fluoranthene		M	2800	mg/kg	0.10	0.39	0.41	0.54	4.4	0.91	1.2	

Results - Soil

Project: PWS/01 Jill Lane, Mirfield

Client: ARP Geotechnical Ltd				**Chemtest Job No.:**		24-29724	24-29724	24-29724	24-29724	24-29724	24-29724	24-29724
Quotation No.: Q24-33517				**Chemtest Sample ID.:**		1866907	1866908	1866909	1866910	1866911	1866912	1866913
				Client Sample ID.:		TP1	TP1	TP2	TP2	TP3	TP3	TP3
				Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):		0.2	1.3	0.2	0.3	0.1	0.3	1.2
				Bottom Depth (m):		0.2	1.3	0.2	0.3	0.1	0.3	1.2
				Date Sampled:		12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024	12-Sep-2024
				Asbestos Lab:		DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	DURHAM	
Determinand	**HWOL Code**	**Accred.**	**SOP**	**Units**	**LOD**							
Benzo[a]pyrene		M	2800	mg/kg	0.10	0.93	0.87	1.4	10	2.0	3.0	
Indeno(1,2,3-c,d)Pyrene		M	2800	mg/kg	0.10	0.70	0.54	0.89	5.2	1.4	1.9	
Dibenz(a,h)Anthracene		N	2800	mg/kg	0.10	< 0.10	0.13	< 0.10	1.1	< 0.10	0.40	
Benzo[g,h,i]perylene		M	2800	mg/kg	0.10	0.70	0.61	0.89	4.8	1.3	1.9	
Total Of 16 PAH's		N	2800	mg/kg	2.0	10	9.7	17	150	20	26	
Total Phenols		M	2920	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.77	

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	pH Meter	
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <30°C.	
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930	
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES	
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	
2455	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.	
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.	
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID	
2800	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-MS	Acenaphthene*; Acenaphthylene; Anthracene*; Benzo[a]Anthracene*; Benzo[a]Pyrene*; Benzo[b]Fluoranthene*; Benzo[ghi]Perylene*; Benzo[k]Fluoranthene; Chrysene*; Dibenz[ah]Anthracene; Fluoranthene*; Fluorene*; Indeno[123cd]Pyrene*; Naphthalene*; Phenanthrene*; Pyrene*	Dichloromethane extraction / GC-MS	
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.	

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
SOP	Standard operating procedure
LOD	Limit of detection

This report shall not be reproduced except in full, and only with the prior approval of the laboratory.
Any comments or interpretations are outside the scope of UKAS accreditation.
The Laboratory is not accredited for any sampling activities and reported results relate to the samples 'as received' at the laboratory.
Uncertainty of measurement for the determinands tested are available upon request .
None of the results in this report have been recovery corrected.
All results are expressed on a dry weight basis.

The following tests were analysed on samples 'as received' and the results subsequently corrected to a dry weight basis EPH, VPH, TPH, BTEX, VOCs, SVOCs, PCBs, Phenols.

For all other tests the samples were dried at ≤ 30°C prior to analysis.
All Asbestos testing is performed at the indicated laboratory .
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1.

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 30 days from the date of receipt.
All water samples will be retained for 14 days from the date of receipt.
Charges may apply to extended sample storage.

Water Sample Category Key for Accreditation

DW - Drinking Water
GW - Ground Water
LE - Land Leachate
NA - Not Applicable

Report Information

PL - Prepared Leachate
PW - Processed Water
RE - Recreational Water
SA - Saline Water
SW - Surface Water
TE - Treated Effluent
TS - Treated Sewage
UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up
MC - Mathematical Clean Up
FC - Florisil Clean Up

HWOL Acronym System

HS - Headspace analysis
EH - Extractable hydrocarbons – i.e. everything extracted by the solvent
CU - Clean-up – e.g. by Florisil, silica gel
1D - GC – Single coil gas chromatography
Total - Aliphatics & Aromatics
AL - Aliphatics only
AR - Aromatic only
2D - GC-GC – Double coil gas chromatography
#1 - EH_2D_Total but with humics mathematically subtracted
#2 - EH_2D_Total but with fatty acids mathematically subtracted
+ - Operator to indicate cumulative e.g. EH+EH_Total or EH_CU+HS_Total

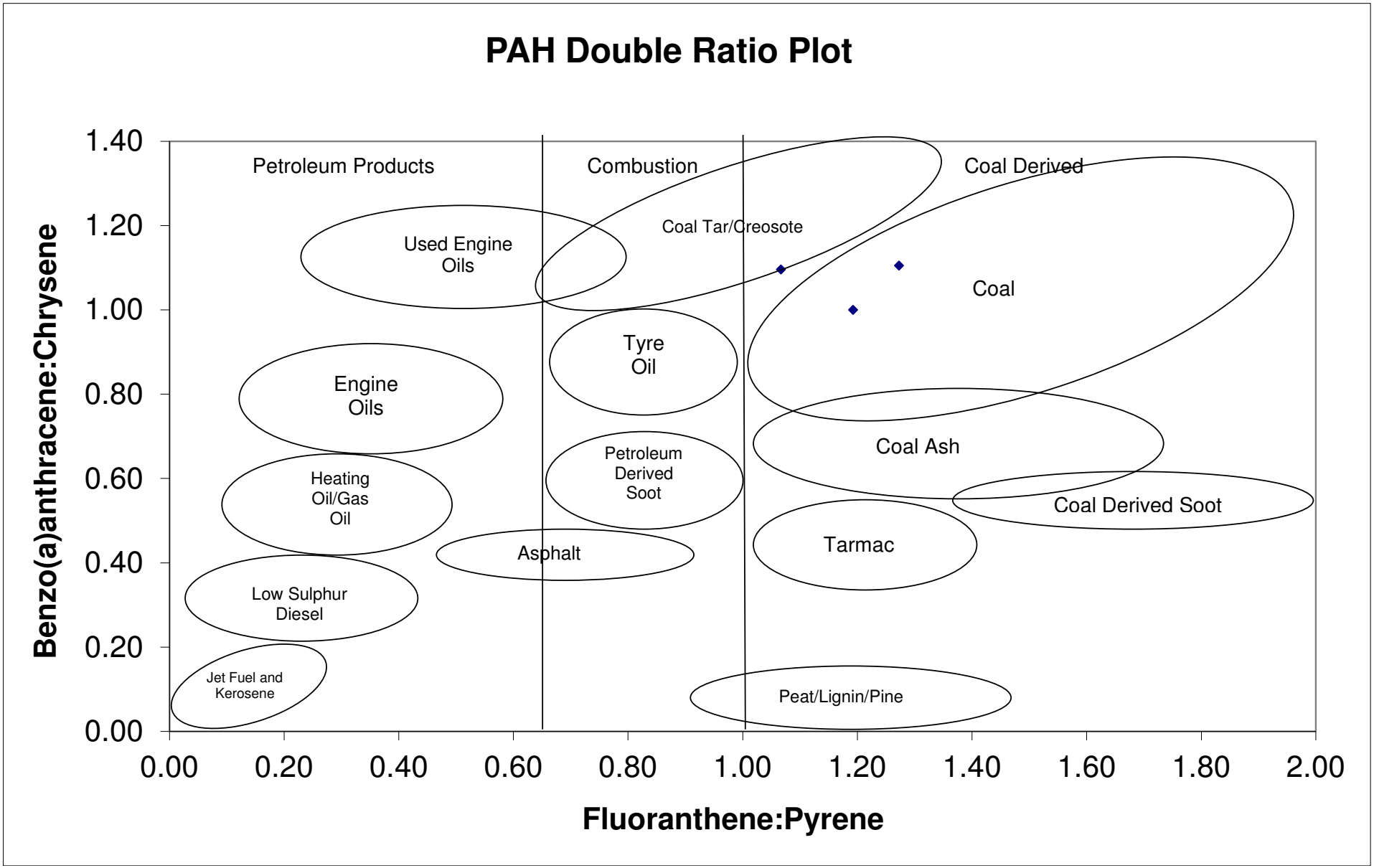
If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

ARP GEOTECHNICAL LIMITED

PAH DOUBLE PLOT RATIOS TO DETERMINE PAH ORIGINS

Site: Jill Lane, Mirfield **Client: Pamela Dews** **Job No: PWS/01**

Sample	Fluoranthene	Pyrene	Ratio Fl:Py	BAP Conc.	Benzo(a) anthracene	Chysene	Ratio B:Ch
TP2	3.4	2.7	**1.27**	1.4	1.4	1.5	**1.11**
TP2	30	24	**1.07**	10	12	11	**1.10**
TP3	4.3	3.8	**1.19**	3.0	2.3	2.3	**1.00**


PAH Double Ratio Plot
Petroleum Products
Combustion
Coal Derived
Used Engine Oils
Coal Tar/Creosote
Coal
Tyre Oil
Engine Oils
Coal Ash
Petroleum Derived Soot
Heating Oil/Gas Oil
Coal Derived Soot
Asphalt
Tarmac
Low Sulphur Diesel
Jet Fuel and Kerosene
Peat/Lignin/Pine
Benzo(a)anthracene:Chrysene
Fluoranthene:Pyrene
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
1.60
1.80
2.00

Certificate of Analysis

Certificate Number	24-20139	*Issued:*	25-Sep-24

Client The Testing Laboratory
Unit 2 James Road
Adwick-le-Street
Doncaster
DN6 7HH

Our Reference	24-20139
Client Reference ~	J286065
Order No ~	835
Contract Title ~	Jill Lane, Mirfield
Description	One Soil sample.
Date Received	20-Sep-24
Date Started	20-Sep-24
Date Completed	25-Sep-24
Test Procedures	Identified by prefix DETSn (details on request).

Notes Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved By

Kirk Bridgewood
General Manager

2139

Summary of Chemical Analysis
Soil Samples

Our Ref 24-20139
Client Ref ~ J286065
Contract Title ~ Jill Lane, Mirfield

Lab No	2397068
Sample ID ~	TP2
Depth ~	1.00
Other ID ~	
Sample Type ~	SOIL
Sampling Date ~	n/s
Sampling Time ~	n/s

Test	Method	LOD	Units	
Inorganics				
pH	DETSC 2008#		pH	6.5
Sulphate Aqueous Extract as SO4 (2:1)	DETSC 2076#	10	mg/l	23

Information in Support of the Analytical Results

Our Ref 24-20139
Client Ref ~ J286065
Contract ~ Jill Lane, Mirfield

Containers Received & Deviating Samples

Lab No	Sample ID ~	Date Sampled ~	Containers Received	Holding time exceeded for tests	Inappropriate container for tests
2397068	TP2 1.00 SOIL		PG	Sample date not supplied, Anions 2:1 (30 days), pH + Conductivity (7 days)	

Key: P-Plastic G-Bag

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377.
Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis.
The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :-
Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months

Key:
~ Sample details are provided by the client and can affect the validity of the results
***** -not accredited.
# -MCERTS (accreditation only applies if report carries the MCERTS logo).
$ -subcontracted.
n/s -not supplied.
I/S -insufficient sample.
U/S -unsuitable sample.
t/f -to follow.
nd -not detected.

End of Report

GQF-008-48
Issue 01 - Oct 22

Summary of Classification Test Results

Project No.
J286065

Project Name
Jill Lane,Mirfield

Hole No.	Sample				Soil Description	Density bulk Mg/m^3	Density dry Mg/m^3	w %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m^3	Remarks
	Ref	Top	Base	Type										
TP1		1.30		D	Multicoloured slightly sandy slightly gravelly CLAY			27	64	49	27	22		
TP2		1.00		D	Brown mottled grey slightly sandy slightly gravelly CLAY			20	86	38	23	15		
TP3		1.20		D	Multicoloured slightly sandy slightly gravelly CLAY			19	88	45	24	21		

All tests performed in accordance with BS1377:1990 unless specified otherwise

Date Printed 02/10/2024

Key

Density test
Linear measurement unless :
wd - water displacement
wi - immersion in water

Liquid Limit
4pt cone unless :
cas - Casagrande method
1pt - single point test

Particle density
sp - small pyknometer
gj - gas jar

UKAS TESTING
7758

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APPENDIX D

RISK CATEGORISATION TABLES

Severity of Consequence

Severe	Short term (acute) risks to human health, likely to result in significant harm. Major pollution of (watercourses or groundwater)
Medium	Long-term (Chronic) damage (significant harm) to human health. Pollution of sensitive water resources.
Mild	Pollution of non-sensitive water resources.
Minor	Non-permanent health effects easily prevented by use of personal protective equipment during site works.

Probability of Risk Event Occurring

High Likelihood	There is a pollutant linkage and an event that either appears very likely in the short term, almost inevitable in the long term, or there is evidence of harm or pollution at the receptor.
Likely	There is a pollution linkage and all the elements are present and in the right place, so that a risk event is possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which a risk event could occur. However, it is not certain that such an event would take place even over a longer period, and even less likely in the short term.
unlikely	There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the very long term.

Comparison of Probability Against Severity of Consequence

		Severity of Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**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**

Risk Categories - Definitions

Very High Risk	High probability that severe harm could arise to a receptor, or there is evidence that severe harm is already occurring. Urgent investigation is required and urgent remediation is likely to be required.
High Risk	Harm is likely to arise to a receptor. Urgent investigation is required and remediation may be necessary in the short term and likely over the longer term.
Moderate Risk	Possible that harm could arise to a receptor, but low likelihood that such harm would be severe. Harm is likely to be mild. Investigation normally required to clarify risk. Some remedial works may be required in the long-term.
Moderate/ Low Risk	Possible that harm could arise to a receptor, but where a combination of likelihood and consequence results in a risk that is above low, but is not of sufficient concern to be classified as mild. Limited further investigation may be required to clarify the risk. If necessary, remediation works are likely to be limited in extent.
Low Risk	Possible that harm could arise to a receptor. Such harm, at worst, would normally be mild.
Very Low Risk	Low possibility that harm could arise to a receptor. Such harm is unlikely to be any worse than mild.

APPENDIX E

REMEDIATION STATEMENT

CONTAMINATION REMEDIATION STATEMENT

FOR

JILL LANE

MIRFIELD

ON BEHALF OF

PAMELA DEWS

ARP GEOTECHNICAL LTD

CHARTERED CONSULTING ENGINEERS

Northwest House 5/6 Northwest Business Park Servia Hill Leeds LS6 2QH

0113 245 8498 leeds@arpgeotechnical.co.uk www.arpconsultingengineers.co.uk

CLIENT: PAMELA DEWS

JOB NUMBER: PWS/01

PROJECT: JILL LANE, MIRFIELD

REPORT TYPE: CONTAMINATION REMEDIATION STATEMENT

REPORT REFERENCE: PWS/01rem

	Name	**Signature**
Prepared By:	J Race BSc (Hons) CGeol FGS EurGeol	
Reviewed & Authorised By:	Mike Harper BSc(Hons) MSc CEnv MIEnvSc	

ISSUE	**DATE**	**STATUS**
1	8TH OCTOBER 2024	V1 FINAL

1.0 Introduction

1.1 This document has been prepared to provide information for the Client and other interested parties, such as the regulatory authorities, outlining how contamination encountered on the site will be managed to ensure that the site is environmentally suitable for the intended residential use. The document should be agreed, prior to implementation, with the relevant regulatory authorities, usually the local planning authority and building control provider.

2.0 The Site

2.1 The ARP Geotechnical Ltd Stage 1 Geo-environmental Report dated September 2024, under reference PWS/01r1 and the ARP Stage 2 Geo-environmental Report, dated October 2024, under reference PWS/01r2, makes an assessment of contamination, along with other aspects.

2.2 The conceptual site model is for residential with private gardens.

2.3 At the time of the investigation, the site comprised an open-ended metal barn on the east of the site, within a larger field that extended beyond the boundary. Compacted brick and stone crush formed the floor of the barn.

2.4 The geological maps show mudstones, siltstones and minor sandstones of the Pennine Lower Coal Measures. No superficial deposits, or any faults, are indicated on or near the site.

2.5 The site is underlain by a Secondary A Aquifer. There are no active abstractions within 1km down hydraulic gradient of the site.

2.6 The nearest downslope surface water is an un-named watercourse located 7m outside the western and southern boundaries. The site is not in an area shown to be at risk from river flooding. There are no abstractions within 1km.

2.7 Basic radon protection is recommended for the site. This is usually achieved by incorporating an appropriate barrier within a solid floor system and extending the barrier through the cavity wall. Gas monitoring will need to be carried out, to assess any gas migration from coal/workings underlying the site, and from the historical landfill sites located within 250m to the east and northeast of the site. Monitoring wells are to be installed into the imminent rotary boreholes, and the findings will be reported separately on completion of the monitoring.

2.8 Ordnance Survey Archive Maps show no development on the site prior to the existing barn, which was constructed around the year 2000.

2.9 The ground investigation revealed up to 0.35m thickness of granular made ground (crushed development platform fill) to be present in TP2 and TP3 (below a thin topsoil in TP3), and only topsoil was present at the surface of TP1. Natural clays were present beneath, to depths of between 1.4m and 1.7m, onto weathered mudstones. No groundwater ingress was noted.

2.10 Contamination testing showed the made ground to contain elevated concentrations of PAH compounds (including benzo(a)pyrene at up to 10mg/kg) and sporadic chrysotile asbestos cement. The overlying topsoil to this material (found at TP3 only) also contained microscopic chrysotile asbestos fibres, as well as elevated lead (370mg.kg). Topsoil elsewhere, where sitting on natural clays, was found to be uncontaminated.

3.0 Remediation Strategy

Contaminated Topsoil:

3.1 Either all the existing topsoil should be removed from the site, or further sampling and testing on a closer grid carried out to determine any areas of topsoil that may be retained. The receiving tip may require Waste Acceptance Criteria testing and asbestos quantification. The disposal/transfer documents should be retained for inclusion in the Validation Report.

3.2 Validation inspection will be required by the Engineer, to verify removal of all the affected topsoil. Further details are provided in Section 4.0.

Made Ground:

3.3 Where any garden or landscape areas overlie the existing made ground, a minimum 0.6m thickness of uncontaminated soils (topsoil and subsoil) should be provided. Provision of a 0.1m thick hard break layer of coarse crushed stone or rock or robust geotextile/geogrid is also recommended, below the base of the 0.6m clean cover soils. In areas of hardstanding or building footprints, the cover system or hard break layer are not required. Where the made ground is entirely removed, the hard break/geogrid/geotextile is not required. The proposed profile is provided on the table below.

Proposed profile in gardens/landscaping areas where existing made ground is being covered

Layer	Thickness (m)	Description
A	Minimum 0.15*	Topsoil
B	Minimum 0.45*	Subsoil
C	Minimum 0.1	Hard break layer **OR** robust geogrid/geotextile

* Individual layer minimum shown, but the combined thickness of Layer A and Layer B must be 0.6m.

3.4 Any soils used in the cover system, either site won or imported, will need to be verified as suitable by inspection and testing, in accordance with guidance supplied in the document produced by the Yorkshire and Lincolnshire Pollution Advisory Group (YALPAG): "Guidance on the Verification Requirements for Cover Systems". The measures described below will be required to ensure compliance with the document.

3.5 If removal of made ground from site is required to achieve the cover soil thickness, or opted for to ease construction and validation, the waste receiver may require a Waste Classification Report and Waste Acceptance Criteria Testing (WAC).

4.0 Validation

Contaminated Topsoil Removal

4.1 Either all the topsoil will be removed from site, or a delineated area of topsoil that has been determined in advance by a close grid of sampling and testing. Once the extent of the topsoil deemed to be contaminated has been removed from site, then the resulting excavation will need to be inspected by an Engineer. Where made ground or natural strata are present present below, this will be clearly evident and no sampling or testing is proposed in this circumstance, unless there is any doubt. The area will be photographed and all the details included within a Validation Letter Report.

4.2 On the edges of the excavation, butting up to areas of any topsoil deemed to be uncontaminated, samples will be taken for testing on an appropriate spacing (maximum 10m) and these will be issued to a UKAS accredited laboratory for testing for asbestos and lead. If any contamination is detected by this testing, further material may need to be removed.

4.3 The disposal/transfer documents should be retained for inclusion in the Validation Report.

Clean Soil Cover System to Existing Made Ground

4.4 Following placement of the cover soils in residential garden areas, it will be necessary to confirm the required 0.6m cover of uncontaminated soil has been placed, by excavating trial pits to 0.6m depth across these areas. Three trial pits are proposed. The trial pits will be photographed, to include a reference scale, and the photographs included within any report to enable the location on site to be identified.

4.5 If the existing made ground is removed from site to natural ground, then the surface will need to be inspected by an Engineer and sampled and tested (four locations) to confirm its contamination status. The area will be photographed, and all the details included within a Validation Letter Report. The disposal/transfer documents should be retained for inclusion in the Validation Report.

5.0 Laboratory Testing

5.1 For the subsoil and topsoil to be used in the clean soil cover system, the source will need to be confirmed, and the material tested for the attached suite of contaminants, to comply with the maximum screening values listed. The frequency of testing is given on the table below. Any samples already tested in the site investigation carried out to date can be considered part of the overall total required.

Material Type	**Number of Samples**
Topsoil or subsoil from greenfield / manufactured source	Minimum 3No. or 1 per 250m^3 (whichever is greater)
Topsoil or subsoil from brownfield / screened source.	Minimum 6No. or 1 per 100m^3 (whichever is greater)

5.2 When a potential source of soil is identified, the Client may provide ARP Geotechnical Ltd with supplier certificates, and we will comment on the apparent acceptability of the material. If no

certificates are available, the Client may wish us to sample the material at source prior to import, or sample an example load delivered to site, to minimise potential for any problems later. The test results will be available approximately one week, or slightly more, after the site visit.

5.3 Provided the results of the above are acceptable, there are two options for validation:-

A. Import a stockpile of material to site sufficient to complete the required areas and invite ARP to take sufficient further samples of the stockpile for testing to fully approve it as a source. The stockpile should be isolated from any other materials on the site (becoming a "Quarantined Stockpile"), fenced off to avoid any cross contamination, and must not be added to without further testing. The test results will be available approximately one week, or slightly more, after the site visit.

OR:

B. Import and place the material as and when required and invite ARP to sample the material when in place, during the inspection pits noted in Section 4. The samples will be issued to the laboratory for contamination testing to confirm acceptability. The test results will be available approximately one week, or slightly more, after the site visit. Our letter report will be available a day or two later. Therefore, Clients should allow for receiving the final letter report two weeks after the site visit.

5.4 Any cross contamination of materials should be avoided, and further testing carried out where any cross contamination is suspected to have occurred.

5.5 The results of all the laboratory analysis, excavation logs, plans, photographs, and import documents will form part of the Remediation Validation Report.

6.0 Timescales for Remediation and Validation

6.1 It is anticipated that the clean soil cover systems will be placed as construction of the dwelling is nearing completion (usually following removal of scaffolding) and not sooner. This is to ensure that the soils will not be subjected to trafficking or cross contamination by construction activities once placed.

6.2 As soon as the soils are in place, validation can take place via inspection pits, as per Section 4 above.

6.3 Soils in any landscaped areas can be placed as soon as those areas are safe from any further construction trafficking.

6.4 Imported soils can be imported at any time for future use as quarantined stockpiles, provided there is sufficient space for storage.

7.0 Unexpected Contamination

7.1 Any unexpected contamination uncovered during the works shall be inspected, sampled and analysed in laboratory for the suite of determinands appended to this Remediation Statement, and compared to the maximum concentration levels listed on the enclosure. Works on the affected

materials shall cease until the appraisal is complete and, if necessary, a revised Remediation Statement is to be prepared and approved by the Planning Authority before work is recommenced.

8.0 Protection of Workers and the Public During Development Works

8.1 Damping down of the contaminated made ground must be implemented during dry periods, and timely placement of the contaminated material below barriers.

8.2 Washing facilities and a clean mess room should be provided.

8.3 Site fencing will be provided to exclude access to members of the public, and contaminated material will be contained within the site boundary and placed below barriers as soon as possible.

8.4 Workers will be educated to use adequate hygiene and PPE.

8.5 Movement of contamination off site on vehicle wheels shall be minimised by cleaning of vehicle wheels and/or use of road sweeper, as required.

ARP GEOTECHNICAL LIMITED
IMPORTED SOIL CONTAMINANT SCREENING VALUES
RESIDENTIAL WITH HOME-GROWN PRODUCE

Determinand	S4UL (unless stated otherwise) (mg/kg)			C4SL (mg/kg)		
Arsenic	37			37		
Cadmium	11			22		
Chromium (trivalent) (MAFF)	400					
Chromium (hexavalent)	6			21		
Copper (MAFF)	80#					
Lead				200		
Inorganic Mercury	40			200		
Nickel (MAFF)	50#					
Selenium	250					
Zinc (MAFF)	200#					
Acidity (pH)	*Should be Greater Than 5			*Should be Greater Than 5		
	1% SOM	**2.5% SOM**	**6% SOM**	**1% SOM**	**2.5% SOM**	**6% SOM**
Naphthalene	2.3	5.6	13	15	36	85
Acenaphthylene	170	420	920			
Acenaphthene	210	510	1,100			
Fluorene	170	400	860			
Phenanthrene	95	220	440			
Anthracene	2,400	5,400	11,000			
Fluoranthene	280	560	890			
Pyrene	620	1,200	2,000			
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			5
Indeno(1,2,3-cd)pyrene	27	36	41			
Dibenzo(a,h)anthracene	0.24	0.28	0.30			
Benzo(g,h,I)perylene	320	340	350			
Phenols	120	200	380			
Total TPH	*Above 500, speciate and compare with values below:					
C5 to C6 Aliphatic	42	78	160			
C6 to C8 Aliphatic	100	230	530			
C8 to C10 Aliphatic	27	65	150			
C10 to C12 Aliphatic	130	330	760			
C12 to C16 Aliphatic	1100	2,400	4,300			
C16 to C35 Aliphatic	65,000	92,000	110,000			
C35 TO C44 Aliphatic	65,000	92,000	110,000			
C5 to C7 Aromatic (Benzene)	70	140	300			
C7 to C8 Aromatic (Toluene)	130	290	660			
C8 to C10 Aromatic	34	83	190			
C10 to C12 Aromatic	74	180	380			
C12 to C16 Aromatic	140	330	660			
C16 to C21 Aromatic	260	540	930			
C21 TO C35 Aromatic	1100	1,500	1,700			
C35 TO C44 Aromatic	1100	1,500	1,700			
Asbestos	*Should be None Detected			*Should be None Detected		

* In House Value/Approach S4UL = Suitable 4 Use Level, CIEH/LQM 2014 C4SL = Cat 4 Screening Level, DEFRA, 2014

Blank cell indicates no published value or in-house value. Some values presented are above saturation limits.

MAFF: Ministry of Agriculture, Fisheries and Food - "Code of Good Agricultural Practice for the Protection of Soil

#pH dependent. If exceeded, to be compared against appropriate MAFF value for the pH