

Environmental
Geotechnical
Specialists



PHASE 2

ENVIRONMENTAL REPORT

| | | | |
|--------------|-------------------------------------------------------|------------|------------|
| job number | C3096/22/E/4693 | date | 14/11/2022 |
| site address | 9 Miry Lane, Thongsbridge, Holmfirth HD9 7SA | | |
| written by | S. Alexander | checked by | S. Rogers |
| issued by | S. Alexander | | |

 Please consider the environment before printing this report.



< ENVIRONMENTAL > < GEOTECHNICAL >



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864

Contents

| | | Page |
|-------|-------------------------------------------------|------|
| 1. | Introduction | 2 |
| 2. | Limitations | 2 |
| 3. | Desk Study | 2 |
| 4. | Fieldworks | 2 |
| 4.1 | Trial Pits (Mechanical Plant) | 2 |
| 5. | Geology | 3 |
| 6. | Strata Conditions | 3 |
| 6.1 | General Strata | 4 |
| 6.2 | Groundwater | 4 |
| 7. | Laboratory Testing - Environmental | 4 |
| 8. | Discussion of Ground Conditions - Environmental | 4 |
| 8.1 | Discussion of Test Results | 4 |
| 8.1.1 | Soil Samples | 5 |
| 8.1.2 | Ground Gas Risk Assessment | 5 |
| 8.1.3 | Effect of Sulphates | 6 |
| 8.2 | Site Specific Risk Assessment | 6 |
| 8.2.1 | Approach | 6 |
| 8.2.2 | Conceptual Ground Model and Risk Assessment | 7 |
| 8.3 | Indicative Remediation Strategy | 10 |
| 8.3.1 | Remediation Objectives | 10 |
| 8.3.2 | Development Requirements | 10 |
| 8.3.3 | Outline Strategy | 10 |
| 8.4 | Fill Materials | 15 |
| 8.5 | Verification Report | 16 |
| 9. | Recommendations for Further Work | 17 |
| 10. | References | 19 |

Appendices

| | |
|----|-----------------------|
| 1. | Site Plan |
| 2. | Trial Pit Records |
| 3. | Laboratory Testing |
| 4. | Fill Screening Values |



Report on a Phase 2 Environmental Investigation

Location: 9 Miry Lane, Thongsbridge,
Holmfirth, HD9 7SA.

For: A H Construction

Report No. C3096/22/E/4693

Report date: November 2022

For and on behalf of **Rogers Geotechnical Services Ltd**

Scott Alexander BSc FGS
Geo-Environmental Engineer

Steve Rogers CEng CGeol MICE MCIHT FGS
Technical Consultant

Report Summary¹

| Item | Comments | Section |
|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Development | Construction of a new residential property with associated garden areas. | 1. |
| Geology | Superficial geology – None. Solid geology – Huddersfield White Rock and Millstone Grit Group. | 5. |
| Strata Conditions | Topsoil overlying made ground up to 1.50m, overlying soft clay. | 6.1 |
| Groundwater | None encountered during investigation. | 6.2 |
| Contamination | Lead contamination proven up to 0.80m in made ground. | 9.1.1 |
| Gas | RB17 pragmatic approach to ground gas adopted. TOC screening >4% requires <i>Characteristic Situation 3</i> . Further ground gas assessment recommended following earthworks phase. | 9.1.2 |
| Effect of Sulphates | DC-1. DS-1 AC-1. | 9.1.3 |

¹ This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that the land at 9 Miry Lane, Thongsbridge, Holmfirth, HD9 7SA is to be developed by the construction of a single residential property with associated garden areas. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils and to take into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Phase One Desk Study

A phase one desk study has been completed by EnviroSolution Ltd., Ref: CL101_V1 dated 29th March 2018. This report has been used during this investigation and should be referenced regarding the sites history and setting.

4. Fieldworks

The fieldworks were undertaken on the 21st October 2022 and included the following:

- Two Machine Excavated Trial Pits.

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 Trial Pits (Mechanical Plant)

A total of two trial pits were excavated in order to reveal the nature of the near surface soils using a mini-excavator. The soils were logged on site in general accordance with BS5930: 2015+A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 2. At regular intervals throughout the excavation of the pits, samples were taken for chemical testing. The test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the chemical laboratory.

Trial pits were excavated and reinstated by the client and inspected by the attending engineer. It should be noted that the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations. Furthermore, it must be realised that the infilled pits represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

| Strata Type | Strata Name ² | Previous Name ³ | Description ³ |
|---------------------|--------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Superficial Geology | N/A | N/A | Not indicated to underlie the site. |
| Solid Geology | Millstone Grit Group | - | Fine- to very coarse-grained feldspathic sandstones, interbedded with grey siltstones and mudstones, with subordinate marine shaly mudstone, claystone, coals and seatearths. |
| | Huddersfield White Rock | - | The Huddersfield White Rock is a medium- to coarse-grained, massive to flaggy, cross-bedded, micaceous sandstone. |

The geological maps indicate that alluvium deposits are present local to the River Holme adjacent to the north-west of the site. However, these are downhill of the site and unlikely to encroach onto the site.

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

| Depth m below ground level to underside of layer | Strata Type | Positions Encountered | Groundwater Strikes m below ground level |
|--------------------------------------------------------|---------------------------------------------------------------------|-----------------------|---------------------------------------------|
| 0.30 | TOPSOIL | ALL | None |
| 1.40 – 1.50 | MADE GROUND (Cohesive) | ALL | None |
| +1.70 – 1.80 | Soft light brown mottled red and grey sandy slightly gravelly CLAY. | ALL | None |

² Sources: British Geological Survey (NERC) Map Sheet 77; Huddersfield; Solid and Drift Edition, and Geology of Britain Viewer [online resource from www.bgs.ac.uk]

³ Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [online resource from www.bgs.ac.uk]

| | | | |
|-------|-------------------------------|------|------|
| 2.10m | Very soft black organic clay. | TP02 | None |
|-------|-------------------------------|------|------|

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

6.1 General Strata

In general, the borehole records indicate that beneath a 0.30m capping of topsoil was revealed overlying cohesive made ground up to 1.50m.

Beneath the made ground natural deposits comprising soft light brown clay and black carbonaceous mudstone recovered as clay were proven to pit termination. It is considered that this material is representative of the weathered fraction of the Huddersfield White Rock which is indicated to be present below the site and black organic clay to represent the Subcrenatum Marine Band shown at the base of the Huddersfield White Rock Member and Marsden Formation.

6.2 Groundwater

No groundwater strikes were observed during the site investigation. However, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Laboratory Testing - Environmental

A suite of testing was conducted on samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr(VI), Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN⁻ and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO₄²⁻.
- Asbestos.

This testing was undertaken by Eurofins Ltd and the results of all of the chemical testing are presented in Appendix 3 of this report.

8. Discussion of Ground Conditions - Environmental

8.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a new residential property with associated garden areas. Consequently, the site may be classified as residential with plant uptake.

8.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 2.5% and 8.1%. On this basis, it is considered that the screening values associated with 6% SOM should be adopted. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website⁴ and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 3. These results indicate the following:

Table 3: Summary of contaminated areas

| Location | Strata | Depth (m) | Contaminants found to be exceeding SSVs (Residential with plant uptake) |
|----------|-------------|-----------|-------------------------------------------------------------------------|
| TP01 | Topsoil | 0.1 – 0.2 | None |
| TP01 | Made ground | 0.6 – 0.8 | Lead |
| TP02 | Made ground | 0.4 – 0.6 | Lead |

Concentrations of chromium(VI), free cyanide, phenols (total) and total petroleum hydrocarbons and the majority of PAH determinants were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values, other than lead as listed in the above table. In addition, no asbestos was detected within the soils samples tested.

In addition to the above a sample from the organic clay recovered was subject to a Loss on Ignition test to determine the organic matter content of the sample. This returned a value of 3.0%.

8.1.2 Ground Gas Risk Assessment

The desk study provided by EnviroSolution has quantified the site as a low risk for ground gas where no significant ground gas source has been identified nearby during the desk study.

From the site investigation works samples of made ground were selected for organic matter content (OMC) testing and Total Organic Carbon (TOC) testing to determine the potential risk from ground gas production from the made ground proven on site. Furthermore a sample of organic clay material, thought to represent the Subcrenatum marine fossil band was also undertaken for Loss on Ignition testing to determine its organic matter content.

The organic matter content testing of the made ground was returned between 2.5% and 8.4% however upon screening for Total Organic Carbon, which could produce bulk hazardous ground gases such as carbon dioxide and methane, were found to be between 1.4% and 4.7%. Furthermore, the sample of organic clay returned an organic matter content of 3.6%.

Based on the maximum Total Organic Carbon level of 4.70% and the thickness of made ground encountered being up to 1.50m, utilising CL:AIRE RB17, November 2021, Pragmatic Approach to

⁴ <http://www.atrisksoil.co.uk/pages/general/subscribers.asp>

Ground Gas Monitoring, Table 1 that *Characteristic Situation Level 3* may be adopted for the proposed development of the site based on the TOC and thickness of made ground shown from historical maps to have been deposited around 1970.

Instead of the above, the client may wish to undertake ground gas monitoring which would involve the installation of ground gas monitoring pipes and carrying out six visits over a three-month period. Such investigation may allow a revision of the risk assessment based on the findings of the intrusive works to date which may provide a more economically viable solution to the site.

Should further investigation works be required the ground gas assessment should be revised.

The finalised designs for ground gas protection measures required shall be provided in a phase three remediation statement report.

8.1.3 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2⁵, which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-1 requirements. Assuming mobile groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-1 due to natural topography which may allow for mobilisation of water.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1⁶, which can be found in Part D, *Specifying concrete for general cast-in-situ use*, of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-1 is required.

8.2 Site Specific Risk Assessment

8.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency⁷ advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.⁸ This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is

⁵ Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*

⁶ Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*

⁷ R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.

⁸ The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.⁹

8.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 7. Sources of contamination include the following:

On-site – Made Ground (Lead).

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

- | | |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| N/A - | A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required. |
| Low - | A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence. |
| Moderate - | The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary |
| High - | The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary. |

The results of the risk assessment are presented in Table 4.

⁹ See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 4: Conceptual Site Model and Site Specific Risk Assessment [Contamination: Lead]

| Conceptual Site Model | | | Site Specific Risk Assessment | |
|-------------------------------------------------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pathways | Receptor | Linkage Present? | Risk Rating | Notes |
| Direct contact/dermal absorption/soil ingestion | Operative | Yes – lead contamination found to be present within the made ground at the site and contact with soil likely during works. | High | Lead contamination found to be present within the made ground at the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. |
| | End User | Yes – lead contamination found to be present within the made ground at the site. Site to be developed into a single residential property with garden areas. | High | |
| | Neighbours | Yes – lead contamination found to be present within the made ground at the site. Residential and commercial area surrounds the site. | High | |
| Inhalation of Dust/Vapours | Operative | Yes – dust may be derived from contaminated soils. However, lead contamination is not considered likely to represent a significant vapour risk. | High (Dust) Low (Vapours) | Lead contamination found to be present within the made ground at the site. Some precautionary measures such as damping of site during dry periods to prevent excessive dust generation. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways. |
| | End User | Yes – dust may be derived from contaminated soils. However, lead contamination is not considered likely to represent a significant vapour risk. | High (Dust) Low (Vapours) | |
| | Neighbours | Yes – contamination found to be present at the site and residential and commercial properties located within 250m radius of the site. Possible inhalation of dust during the works. | High (Dust) Low (Vapours) | |
| Ingestion of fruit/vegetables and/or waters | Operative | No – no edible plants or contained water sources in the area of the proposed new works. | N/A | Lead contamination found to be present within the made ground at the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.. |
| | End User | Yes – lead contamination found to be present within the made ground at the site. Site to be developed into a single residential property with garden areas | High | |
| | Neighbours | Yes – lead contamination found to be present within the made ground at the site. Residential and commercial area surrounds the site. | High | |

| | | | | |
|----------------------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Migration of hazardous gases via permeable strata or shallow mining activity | Operative | Yes – Made ground up to 1.50m Total Organic carbon maximum level of 4.7%. Made ground thought to be older than 20 years old. | High | RB17 Pragmatic Approach to Ground Gas Assessment. Table 1 indicates <i>Characteristic Situation Level 3</i> . Precautionary measures will be required during the construction in order to protect site operatives and the end users. Further works may be undertaken to further reduce risks from ground gases. |
| | End User | | | |
| | Neighbours | No – as no adjoining structures are present, it is considered that ground gasses will vent directly to atmosphere. | Low | |
| Spillage/loss/run off direct to receiving water | Controlled Waters | Yes – River Holme located 120m west of the site. River located distant from site, surface run-off unlikely to affect controlled water. | Low | Lead contamination found to be present within the made ground at the site. |
| Migration via permeable unsaturated strata | Controlled Waters | Yes – a secondary A aquifer is present beneath the site. High groundwater vulnerability due to sensitive aquifer located at or close to the surface. Natural deposits shown to be cohesive. Lead contamination may be in soluble state. | Moderate | Downward mobilisation unlikely due to lack of groundwater and cohesive deposits underlying site/ Remediation will be required to either remove the contamination or break pathways. |
| Run off via drainage/sewers etc | Controlled Waters | Yes – old services may be present on site. | Moderate | Old services to be removed or capped. |
| Direct contact with contaminated soils Uptake via root system | Plants | Yes – lead contamination found to be present within the made ground at the site. Site to be developed into a single residential property with garden areas. Lead contamination likely to pose a risk to vegetation through root uptake. | High | Lead contamination found to be present within the made ground at the site. |
| | | | High | Remediation will be required to either remove the contamination or break pathways. |
| Direct contact with contaminated soils Direct contact with contaminated groundwater | Building Materials | Yes – pH level precludes the use of copper pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-1. | Moderate (plastic services) | Please see section 8.3.3 for information on good building practice. |
| | | | Moderate (buried concrete) | |
| Exposure to Radon | Operative | Yes – The property is in an Intermediate probability radon area (1 to 3% of homes are estimated to be at or above the Action Level). | Low | The publication BR211 states that no protection measures are necessary. |
| | End User | | | |

8.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

8.3.1 Remediation Objectives

Based on the site specific risk assessment the object of the remediation is likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect the end user from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect neighbours from the inhalation and ingestion dust during the construction process.
- To protect the end user from the possible elevated levels of carbon dioxide.
- To protect end users and neighbours from the ingestion of contaminated fruit and vegetables.
- To protect plants from direct contact with contamination and prevent uptake via root system.
- To ensure that contamination cannot reach controlled waters via surface run-off or permeable strata.
- To ensure that contamination cannot enter the former services occupying the site which may return to controlled waters.
- To protect services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwater.

8.3.2 Development Requirements

It is understood that it is to be developed by the construction of a new residential property with associated garden areas. In view of the above a site specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

8.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

It is recommended that a staged approach be undertaken for this particular site with an initial site strip phase expected to reduce and level the site due to the existing slope. The reduced level dig will remove a significant portion of the made ground, followed by a post earthworks ground gas

risk assessment to fully quantify the residual risk from the remaining made ground anticipated to be present beneath the site.

The existing site levels are between 0.50m and 0.75m above finish levels therefore a reduced level dig will be required to bring the site to formation prior to commencing any construction works. During the initial site strip and reduced level dig it is anticipated that a large volume of the made ground encountered during the site investigation will be removed. As a result, the contaminated material encountered within the trial pits is also likely to be partially removed.

Given that the main bulk of ground gas risk arises from the thickness of made ground on the site. Once site levels have been reduced to formation, expected to be ca. 0.75m below the existing ground level, it is recommended that an intrusive ground gas risk assessment be undertaken to measure and fully quantify the risks from hazardous ground gases (carbon dioxide and methane) via monitoring standpipes.

It is understood that the site displays a gentle slope from the south towards the north. Thus, it is proposed to elevate the garden areas with a minimum of 500mm of topsoil. The elevated garden area is proposed to be supported by a stone retaining wall. This elevated garden area of screened imported material will in effect act as a clean cover system to garden areas and protect end users and vegetation on the site.

Given the natural material comprised-cohesive generally impermeable strata the risk from downward mobilisation into the underlying aquifer is low and is likely to be impeded by the cohesive strata.

As a reduced level dig is proposed, where contamination has been found within the made ground it may be necessary to ensure that materials to be removed off-site are appropriately classified via Waste Acceptance Criteria (WAC) testing to ensure this is suitably disposed and handled in landfill.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore, the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with contaminated soils and the potential hazards associated with materials containing lead.
- Site operatives at all levels should be made aware of the hazards of working in an area where accumulations of bulk ground gasses (carbon dioxide or methane) could occur.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Access to the site by the general public should be restricted until remediation has taken place.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition, dust masks must be provided to all site operatives for use in dry weather.
- In order for contaminated soils to be disposed of to an appropriate landfill, it may be necessary to carry out Waste Acceptance Criteria (WAC) testing in accordance with BS EN 12457.

- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.
- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-1 AC-1.

Gas Protection Measures

In order to assess the ground gas risk present the approach outlined within *CL:AIRE RB17, Pragmatic Approach to Ground Gas Risk Assessment* was followed to determine the risks from bulk gases beneath the site. Based on the flowchart presented and the limiting values for organic content presented Table 1, the site has been classified as *Characteristic Situation 3* based on the findings from chemical testing and visual inspection of trial pits.

In order to assess the protection measures required BS8485: 2015: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* has been employed. In accordance with Table 3, *Building types*, of the code, the development may be considered to conform to Type A. Therefore, on the basis of Table 4 *Gas protection score by CS and type of building*, the minimum gas protection score (points) is 4.5. The gas protection system should consist of at least two different elements. The elements work independently and collaboratively, and a single element should not be used because there would be no redundancy to allow for defects in the component.

In order to achieve this score the following shall be undertaken.

Table 5: Combination of protection elements (BS8485: 2015) for CS2

| Reference | Protection Element | Score |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Table 5 | <i>Precast suspended segmental sub-floor (i.e. beam and block).</i> | 0 |
| | <i>Cast insitu ground-bearing floor slab (with only nominal mesh reinforcement).</i> | 0.5 |
| | <i>Cast insitu monolithic reinforced ground bearing raft or reinforced cast insitu suspended floor slab with minimal penetrations.</i> | 1.0 or 1.5 ¹⁰ |
| Table 6 ¹¹ | <i>Passive sub-floor dispersal layer (Note 1):</i> | |
| | <i>Good Performance</i> <i>Very good performance</i> | 1.5 2.5 |
| Table 7 | <i>Gas resistant membrane complying with the requirements given in Table 7 (Note 2)</i> | 2 |
| Total Score | | Min: 4.5 Max: 6.0 |

Note 1:

Dispersal layers could include:

- Clear void.
- Polystyrene void former blanket.
- Geocomposite void former blanket.
- No-fines gravel layer with gas drains.
- No-fines gravel layer.

Note 2:

The gas resistant membrane shall meet the following criteria (from Table 7, BS 8485: 2015):

- Sufficiently impervious (methane gas transmission rate <40.0ml/day/m²/atm (average) BS ISO 15105-1 manometric method).
- Sufficiently durable and strong to remain serviceable for the anticipated life of the building, to withstand in-service stresses and installation process.
- Capable, after installation, of providing a complete barrier to the entry of the relevant gas.
- Verified in accordance with CIRIA C735: 2014: *Good practice on the testing and verification of protection systems of buildings against hazardous ground gasses.*
- Chemically resistant to degradation by other contamination that might be present.

It should be appreciated that if the membrane installed does not meet all the criteria above, then the score for the membrane is considered to be zero.

In addition to the above, the following points shall be considered.

- Technical drawings of the incorporation of the gas protection measures into the sub-structure will be provided by a suitably qualified engineer/architect and produced in accordance with the guidance given in BRE 414.

¹⁰ To achieve a score of 1.5, the raft or suspended slab should be well reinforced to control cracking and have minimal penetrations cast in.

¹¹ For details on the criteria for good and very good performance see Annex B of BS84845: 2015.

- The sequence of construction indicating when the gas protection system will be installed will be included with the remediation statement. Where possible the installation of membranes will take place as a unique activity on site and shall not take place until sub-structure construction is complete.
- During and following the installation of the membrane, all parties in attendance at the site shall be made aware that a gas protection system is to be employed within the construction. Such communications should include, but not be limited to, the CDM documentation for the site and site inductions.
- The installation of the membrane shall be carried out only by suitable personnel and the qualifications or experience/training will be included as part of the remediation statement. The suitability of personnel will be assessed in accordance with Annex 1 of CIRIA C735.
- The installation shall be in strict accordance with manufacturer specifications and recommendations, which shall also be included as part of the remediation statement.
- The membrane system employed will not be an ensemble (i.e. a system comprising a mixture of products from different manufacturers will not be employed).
- Membranes shall be supplied to site on a single wound roll, creased product will not be accepted or employed.
- Whilst membranes are exposed, signage will be provided to indicate the access to the installation area is prohibited unless authorised. Footwear will be checked prior to accessing the membrane surface to ensure no sharp objects are apparent, such as stones caught in treads. The use of sharp objects or hot-works around the exposed membrane will be strictly prohibited unless the risk of damaging the membrane has been fully assessed and mitigated.
- Non-conformance of manufacturer recommendations shall be discussed and agreed as acceptable, in writing, with a suitably qualified person from the manufacturer.

The above ground gas protection risk assessment and required protection measures should remain live until the final ground gas monitoring has been completed and the risk assessment updated accordingly following completion of monitoring and site earthworks.

Landscaped Areas

It is understood that it is proposed to include soft landscaped areas. In view of this and the potential lead contamination on site, it is considered that landscaped areas will require some remediation.

The lead contamination encountered on site is present within the cohesive made ground and is underlain by cohesive material. Furthermore, no groundwater was encountered during works. This combination is likely to inhibit downward migration of contamination to the underlying aquifer and is unlikely to pose a significant risk to controlled water or the aquifer beneath the site.

Given the thickness of made ground on site it is not economically viable to completely remove all of the made ground, instead the pathway to vegetation and end users' shall be severed via a clean cover system. Given the proposed reduce level dig and the topography of the surrounding area it is expected that the elevated gardens areas which are to be filled with clean imported topsoil and sub soil and supported via a stone retaining wall will in effect act as a clean cover system to receptors at the surface of the site.

This clean cover system shall be a minimum of 600mm thick from finish levels and would need to employ a capping layer of say 500mm of inert material, which will put the contaminated ground out of the end users' dig range. At the base of this layer, a granular capillary break of say 100mm of free draining granular soil should be placed in order to prevent mobile contamination rising upward. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

8.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3883 (2007)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG¹² documentation and may be used as a guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

| Fill Type | Frequency | Minimum Determinands |
|--------------------------------|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virgin Quarried Material | 1 or 2 depending on the type of stone (to confirm the inert nature of the material) | Standard metals/metalloids (As, Cd, Cr, Cr(VI), Cu, Hg, Ni, Pb, Se, Zn) |
| Crushed Hardcore, Stone, Brick | Minimum 1 per 1000m ³ | Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos |
| Greenfield/ Manufactured Soils | The greater of a minimum of 3 or 1 per 250m ³ | Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos |
| Brownfield/ Screened Soils | The greater of a minimum of 6 or 1 per 100m ³ | Standard metals/metalloids as above plus PAH (16 USEPA), TPH (CWG banded) and Asbestos Any additional analysis dependant on the history of the donor site. |

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

| Contaminant | Screening Value (Residential with Plant Uptake) (mg/kg) | | Reference |
|-------------|---------------------------------------------------------------|--------|-----------------------------|
| | 1% SOM | 6% SOM | |
| As | 37 | 37 | Atrisk ^{SOIL} SSVs |
| Cd | 22.1 | 22.1 | Atrisk ^{SOIL} SSVs |
| Cr(VI) | 3.62 | 3.63 | Atrisk ^{SOIL} SSVs |
| Cu | 4730 | 4790 | Atrisk ^{SOIL} SSVs |
| Hg | 8.81 | 15.8 | Atrisk ^{SOIL} SSVs |
| Ni | 136 | 136 | Atrisk ^{SOIL} SSVs |

¹² YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V3.3 Appendix 1a, October 2016.

| | | | |
|--------------|----------------------------|-------|-----------------------------|
| Pb | 200 | 200 | Atrisk ^{SOIL} SSVs |
| V | 136 | 138 | Atrisk ^{SOIL} SSVs |
| Zn | 20000 | 20300 | Atrisk ^{SOIL} SSVs |
| TPH CWG | See attached summary sheet | | Atrisk ^{SOIL} SSVs |
| PAH 16 USEPA | See attached summary sheet | | Atrisk ^{SOIL} SSVs |

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

8.5 Verification Report

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

This should be done in a sequence and verification be completed at the end of each phase.

In the first instance a verification report shall be submitted at the completion of the pre-construction and earthworks phase. This report shall include the following:

- The extents and volumes of materials removed from site.
- Reporting and completion of ground gas monitoring and a revised risk assessment for ground gas protection measures and if required finalised technical drawings showing ground gas protection measures.
- Finalised topographic profile for the site to determine if additional reduce level excavation will be required to provide a suitable clean cover system for the garden areas.
- Photographic evidence of the site at the end of the earthworks phase. Photographs should include visual site references or reference boards to prove the location and date taken.

Following completion of the earthworks, and mitigation and protection measures have been finalised, a second and final verification shall be undertaken during the construction phase. This verification shall include the following:

Verification of Landscaped Areas and Imported Fill

- The extents of any areas where additional made ground has been removed.
- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery

tickets where appropriate and the conditions by which the clean material has been stored and handled on site.

- Where possible the screening of imported fill shall be taken from source or immediately upon delivery to site to avoid costs for re-excavation.
- Photographic and logged evidence the clean material has been handled on site and placed in a sufficient thickness across the site. This should be validated via a series of hand excavated trial pits in the landscaped areas following placement. Given the small scale of the site this should comprise of two locations within the external landscaped areas. Photographs should include visual site references or reference boards to prove the location and date taken. A measurement reference should be visible in the photographs to substantiate the thickness of material placed.

Ground Gas Protection System

In order to assess the performance of the ground gas barrier, verification of the system will be carried out throughout the installation process and the following will be included in a report to be produced at the end of the construction process:

- The qualifications or relevant experience/training of the persons carrying out the installation.
- The independence of the person carrying out the verification, along with evidence of their qualifications or relevant experience/training.
- Details of the verification process including the dates of inspections and findings.
- Signed statements to confirm that protection measures were constructed as agreed. These statements shall also include confirmation that:
 - Membranes were free from tears and punctures, and installed in accordance within manufacturer guidelines.
 - Underfloor voids were clear and free from debris.
- Clear photographic evidence of the construction of membranes and/or underfloor voids, which should include key details such as air vents, membrane penetrations etc.
- Details of non-conformances and how they were rectified.
- A declaration that remedial objectives set out in the conceptual site model have been achieved.

The report detailed above should be produced by a suitably qualified engineer. The number of verification areas for the development should be confirmed with any statutory authorities for the site.

9. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Discussions with ground work contractors in relation to the requirement for testing of materials to be disposed off-site (Waste Acceptance Criteria) and the suitability of imported materials.
- Following reduce level dig, completion of additional ground gas risk assessment via boreholes and standpipe monitoring.
- Production of interim verification report and finalised remediation statement outlining the finalised soil risk assessment and contamination profile, and revised ground gas risk assessment with finalised ground gas protection measures if required in remediation statement report.

- Discussions with contractors in relation to the suitability of materials and installation methods for gas protection measures.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Produce a final validation report to demonstrate that the geo-environmental risks discussed in this report and the subsequent reassessment have been mitigated.

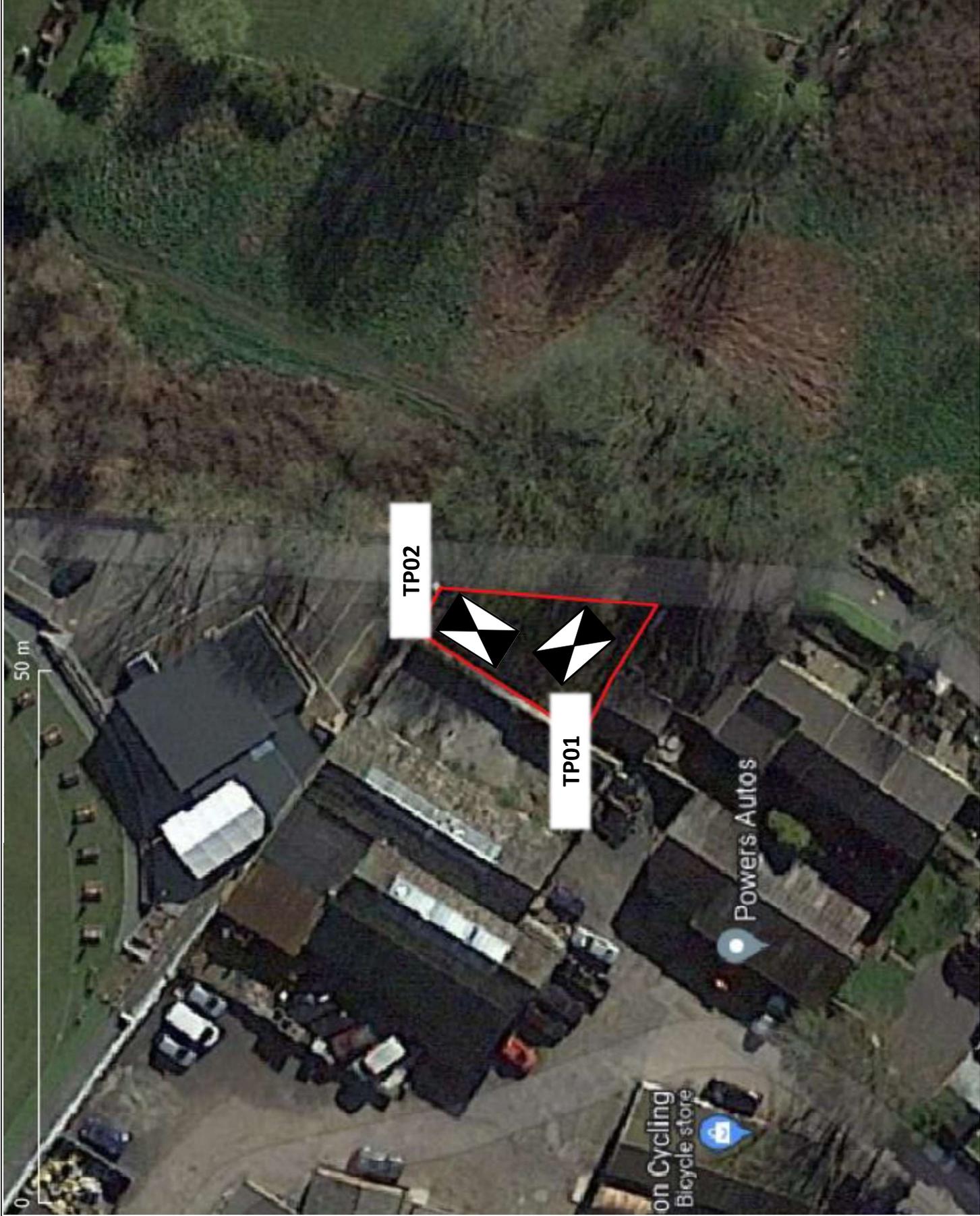
Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

10. References

- British Geological Survey (NERC) (2022), BGS, Keyworth.
 - Geology of Britain Viewer:
(http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)
 - Lexicon of Named Rock Units:
(<http://www.bgs.ac.uk/lexicon/>)
- British Standards Institution (1990) BS1377: *British standard methods of test for soils for civil engineering purposes*, B.S.I., London.
- British Standards Institution (2015) BS5930: *Code of practice for site investigations*, B.S.I., London.
- British Standards Institution (2011), BS 10175: *Investigation of potentially contaminated sites – Code of Practice*, British Standards Institute.
- British Standards Institution (2015) BS8485: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings*, B.S.I., London.
- British Standards Institution (2013), BS 8576 *Guidance on Investigations for Ground Gas – Permanent Gases and Volatile Organic Compounds*.
- British Standards Institution (2004) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil, incorporating corrigendum no.1 (2007)*, B.S.I., London.
- Building Research Establishment (BRE) Special Digest 1 (2005), Third Edition: *Concrete in aggressive ground*, BRE Press, Garston.
 - Part C: *Assessing the aggressive chemical environment*.
 - Part D: *Specifying concrete for general cast-in-situ use*.
- Card G, Wilson S, Mortimer S. *A Pragmatic Approach to Ground Gas Risk Assessment*. CL:AIRE Research Bulletin RB17 (2012), CL:AIRE, London, UK. ISSN 2047- 6450 (Online)
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.
- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.
- Wilson S, Oliver S, Mallet H, Hutchings H, Card G, *Assessing risks posed by ground gasses to buildings*, CIRIA Report C665.

Appendix 1

Site Plan



Notes:

W/S/CP091, positions approximated from site operative's notes.



Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe
Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:
A H Construction

Job Number:
C3096/22/E/4693

Project Details:
Miry Lane, Thongsbridge

Scale: Not to scale - reference only

Appendix 2

Trial Pit Records



Trial Pit Log

Trialpit No
TP01
Sheet 1 of 1

| | | | |
|---------------------------------------|-------------------------------|----------------------|----------------------------------|
| Project Name: Miry Lane, Thongsbridge | Project No. C3096/22/E/4693 | Co-ords: - Level: | Date 21/10/2022 |
| Location: Miry Lane, Thongsbridge | Dimensions (m): Depth 1.70 | | Scale 1:50 Logged SA/AA |
| Client: AH Construction | 2.4 | | |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|---------------------------------------------------------------------------------------------------------------------------------------------|
| | Depth | Type | Results | | | | |
| | 0.10 - 0.20 | ES | | 0.30 | | | TOPSOIL. (Brown, slightly sandy, gravelly CLAY with occasional plant roots) |
| | 0.60 - 0.80 | ES | | 1.40 | | | MADE GROUND. (Soft brown, sandy, gravelly CLAY. Gravel is angular to sub angular, fine to coarse of sandstone, brick, mortar. Rare plastic) |
| | | | | 1.70 | | | Soft light brown and gray, sandy, slightly gravelly CLAY. Gravel is fine to medium of sandstone. End of pit at 1.70 m |



Remarks: Arrive Site: 10:30 / Leave Site: 12:00 / Notes: 1. No groundwater encountered /

Stability: Stable





Trial Pit Log

Trialpit No
TP02
Sheet 1 of 1

| | | | |
|---------------------------------------|-------------------------------|----------------------|----------------------------------|
| Project Name: Miry Lane, Thongsbridge | Project No. C3096/22/E/4693 | Co-ords: - Level: | Date 21/10/2022 |
| Location: Miry Lane, Thongsbridge | Dimensions (m): Depth 2.10 | | Scale 1:50 Logged SA/AA |
| Client: AH Construction | | | |

| Water Strike | Samples and In Situ Testing | | | Depth (m) | Level (m) | Legend | Stratum Description |
|--------------|-----------------------------|------|---------|-----------|-----------|--------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Depth | Type | Results | | | | |
| | 0.40 - 0.60 | ES | | 0.30 | | | TOPSOIL. (Dark brownish grey sandy gravelly CLAY with moderate cobble content and common plant roots. Gravel is angular to sub rounded fine to coarse of brick, sandstone. Cobbles are angular brick and sandstone blocks. Rare plastic.) |
| | | | | 1.50 | | | MADE GROUND. (Soft brown, sandy, gravelly CLAY. Gravel is angular to sub angular, fine to coarse of sandstone, brick, mortar. Rare plastic. Brick wall starting from 0.90m in north east corner of the pit.) |
| | 1.80 | D | | 1.80 | | | Soft light brown, red and grey sandy slightly gravelly CLAY. Gravel is rounded to sub rounded fine to medium of red brown and grey sandstone. |
| | | | | 2.10 | | | Very soft black locally light brown slightly sandy organic CLAY. |
| | | | | | | | End of pit at 2.10 m |

Remarks: Arrive Site: 10:30 / Leave Site: 12:00 / Notes: 1. No groundwater encountered /

Stability: Stable



Appendix 3

Laboratory Testing

Environmental
Geotechnical
Specialists



< ENVIRONMENTAL > < GEOTECHNICAL >

LABORATORY REPORT

| | | | |
|----------------|------------------------------------------------------------------------|-------------|------------|
| job number | C/3096/22/E/4693 | date | 10/11/2022 |
| site address | 9 Miry Lane, Thongsbridge, Holmfirth, West Yorkshire, HD9 7SA | | |
| date scheduled | 21/10/2022 | date issued | 10/11/2022 |
| issued by | H J Letch | | |

 Please consider the environment before printing this report.



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



8948

Schedule of UKAS Accredited Laboratory Tests



| 1. CLASSIFICATION OF SOIL | BS 1377-2:1990 | BS EN 150 17892 | Accredited (A) | Unaccredited (U) |
|---------------------------------------------------|-----------------------|--------------------------------------|----------------|------------------|
| 1.1 Moisture / Water content determination | | | | |
| i. Oven drying | Pt 2 : 3.2 | Pt 1 : 2014 Pt 12 : 2018 : 5.3 / 5.5 | A | |
| ii. Saturation m/c of chalk | Pt 2 : 3.3 | | | U |
| 1.2 Index Properties | | | | |
| i. Liquid limit – cone penetrometer | Pt 2 : 4.3 | | A | |
| ii. Plastic limit | Pt 2 : 5.3 | | A | |
| iii. Shrinkage limit | Pt 2 : 6.3 | | | U |
| iv. Linear shrinkage | Pt 2 : 6.5 | | A | |
| 1.3 Particle Density | | | | |
| i. Gas jar | Pt 2 : 8.2 | | | U |
| ii. Large pycnometer | Pt 2 : 8.3 | | | U |
| iii. Small pycnometer | Pt 2 : 8.4 | Pt 3 : 2015 : 5.1 | | U |
| 1.4 Density Tests | | | | |
| i. Linear measurement | Pt 2 : 7.2 | Pt 2 : 2014 : 5.1 | A | |
| ii. Immersion in water | Pt 2 : 7.3 | Pt 2 : 2014 : 5.2 | | U |
| iii. Fluid / Water displacement | Pt 2 : 7.4 | Pt 2 : 2014 : 5.3 | | U |
| iv. Sand replacement | Pt 9 : 2.1, 2.2 | | | U |
| v. Core cutter | Pt 9 : 2.4 | | | U |
| 1.5 Particle Size Distribution | | | | |
| i. Dry Sieve | Pt 2 : 9.2 | Pt 4 : 2016 : 5.2 | A | |
| ii. Wet Sieve | Pt 2 : 9.3 | Pt 4 : 2016 : 5.2 | A | |
| iii. Sedimentation by pipette | Pt 2 : 9.4 | Pt 4 : 2016 : 5.3 / 5.4 | A | |
| iv. Sedimentation by hydrometer | Pt 2 : 9.5 | | | U |
| 2. CHEMICAL TESTS | | | | |
| ii. Mass loss on ignition | Pt 3 : 4 | | | U |
| 3. COMPACTION RELATED TESTS | | | | |
| 3.1 Dry density/moisture relationship | | | | |
| i. 2.5kg rammer – 1 litre mould | Pt 4 : 3 | | | U |
| - CBR mould | Pt 4 : 3 | | | U |
| ii. 4.5kg rammer – 1 litre mould | Pt 4 : 3 | | | U |
| - CBR mould | Pt 4 : 3 | | | U |
| 3.2 Moisture Condition Value | | | | |
| i. Single point test | Pt 4 : 5.4 | | | U |
| ii. MCV/moisture content relationship | Pt 4 : 5.5 | | | U |
| 3.3 California Bearing Ratio | | | | |
| i. Undisturbed sample | Pt 5 : 7 | | | U |
| ii. Recompacted sample | Pt 5 : 7 | | | U |
| iii. Soaked, inc measurement of swell | Pt 5 : 7 | | | U |
| 4. COMPRESSIBILITY OF SOIL | | | | |
| ii. Swelling pressure test | Pt 5 : 3 | | | U |
| 5. SHEAR STRENGTH OF SOIL | | | | |
| i. Hand shear vane | Makers instructions | | | U |
| ii. Shear box (100mm square sample) | BS 1377 : Pt 7 : 4 | | | U |
| iii. Triaxial – quick undrained | BS 1377 : Pt 7 : 8, 9 | | | U |
| 6. PERMEABILITY | | | | |
| i. Falling head | K. H. Head Vol 2 | | | U |
| ii. Constant head | BS 1377 : Pt 6 : 6 | | | U |
| iii Triaxial cell | BS 1377 : Pt 6 : 6 | | | U |
| 7. ROCK TESTS | | | | |
| 7.1 Classification Tests | | | | |
| i. Natural moisture content | - | | | U |
| ii. Saturated moisture content | - | | | U |
| iii. Natural density | - | | | U |
| iv. Porosity | - | | | U |
| 7.2 Strength Tests | | | | |
| i. Point load index | ISRM '85 | | | U |
| ii. Uniaxial compression test | ISRM '81 | | | U |

ENVIRONMENTAL & GEOTECHNICAL





< ENVIRONMENTAL > < GEOTECHNICAL >

GEOTECHNICAL TESTING RESULTS



Please consider the environment before printing this report.



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



< ENVIRONMENTAL > < GEOTECHNICAL >

Blank Page



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



< ENVIRONMENTAL > < GEOTECHNICAL >

Blank Page



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



< ENVIRONMENTAL > < GEOTECHNICAL >

ENVIRONMENTAL TESTING RESULTS



Please consider the environment before printing this report.



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



< ENVIRONMENTAL > < GEOTECHNICAL >

Blank Page



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864



Final Report

Report No.: 22-40823-1

Initial Date of Issue: 30-Oct-2022

Client: Rogers Geotechnical Services Ltd

Client Address: Offices 1&2, Barncliffe Business Park
Near Bank
Shelley
Huddersfield
West Yorkshire
HD8 8LU

Contact(s): Harry Letch

Project: 3069/22/E/4690 Miry Lane
Thongsbridge

Quotation No.: **Date Received:** 25-Oct-2022

Order No.: **Date Instructed:** 25-Oct-2022

No. of Samples: 3

Turnaround (Wkdays): 5 **Results Due:** 31-Oct-2022

Date Approved: 30-Oct-2022

Approved By:

Details: Stuart Henderson, Technical
Manager

Results - Soil

Project: 3069/22/E/4690 Miry Lane Thongsbridge

| Client: Rogers Geotechnical Services Ltd | Chemtest Job No.: | 22-40823 | 22-40823 | 22-40823 |
|------------------------------------------|----------------------|-------------|-------------|-------------|
| Quotation No.: | Chemtest Sample ID.: | 1531872 | 1531873 | 1531874 |
| Order No.: | Client Sample Ref.: | ES1 | ES2 | ES1 |
| | Client Sample ID.: | ES1 | ES2 | ES1 |
| | Sample Location: | TP01 | TP01 | TP02 |
| | Sample Type: | SOIL | SOIL | SOIL |
| | Top Depth (m): | 0.1 | 0.6 | 0.4 |
| | Bottom Depth (m): | 0.2 | 0.8 | 0.6 |
| | Date Sampled: | 21-Oct-2022 | 21-Oct-2022 | 21-Oct-2022 |
| | Asbestos Lab: | DURHAM | DURHAM | DURHAM |
| Determinand | Accred. | SOP | Units | LOD |
| Cadmium | M | 2455 | mg/kg | 0.10 |
| Chromium (Hexavalent) | N | 2490 | mg/kg | 0.50 |
| Copper | M | 2455 | mg/kg | 0.50 |
| Mercury | M | 2455 | mg/kg | 0.05 |
| Nickel | M | 2455 | mg/kg | 0.50 |
| Lead | M | 2455 | mg/kg | 0.50 |
| Zinc | M | 2455 | mg/kg | 0.50 |
| Vanadium | U | 2455 | mg/kg | 0.5 |
| Arsenic | M | 2455 | mg/kg | 0.5 |
| Selenium | M | 2455 | mg/kg | 0.25 |
| Cyanide (Free) | M | 2300 | mg/kg | 0.50 |
| Total Phenols | M | 2920 | mg/kg | 0.10 |
| Naphthalene | M | 2700 | mg/kg | 0.10 |
| Acenaphthylene | M | 2700 | mg/kg | 0.10 |
| Acenaphthene | M | 2700 | mg/kg | 0.10 |
| Fluorene | M | 2700 | mg/kg | 0.10 |
| Phenanthrene | M | 2700 | mg/kg | 0.10 |
| Anthracene | M | 2700 | mg/kg | 0.10 |
| Fluoranthene | M | 2700 | mg/kg | 0.10 |
| Pyrene | M | 2700 | mg/kg | 0.10 |
| Benzo[a]anthracene | M | 2700 | mg/kg | 0.10 |
| Chrysene | M | 2700 | mg/kg | 0.10 |
| Benzo[b]fluoranthene | M | 2700 | mg/kg | 0.10 |
| Benzo[k]fluoranthene | M | 2700 | mg/kg | 0.10 |
| Benzo[a]pyrene | M | 2700 | mg/kg | 0.10 |
| Indeno(1,2,3-c,d)Pyrene | M | 2700 | mg/kg | 0.10 |
| Dibenz(a,h)Anthracene | M | 2700 | mg/kg | 0.10 |
| Benzo[g,h,i]perylene | M | 2700 | mg/kg | 0.10 |
| Total Of 16 PAH's | M | 2700 | mg/kg | 2.0 |
| Aliphatic TPH >C5-C6 | N | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C6-C8 | N | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C8-C10 | M | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C10-C12 | M | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C12-C16 | M | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C16-C21 | M | 2680 | mg/kg | 1.0 |

Results - Soil

Project: 3069/22/E/4690 Miry Lane Thongsbridge

| Client: Rogers Geotechnical Services Ltd | Chemtest Job No.: | 22-40823 | 22-40823 | 22-40823 |
|------------------------------------------|----------------------|-------------|--------------|-------------|
| Quotation No.: | Chemtest Sample ID.: | 1531872 | 1531873 | 1531874 |
| Order No.: | Client Sample Ref.: | ES1 | ES2 | ES1 |
| | Client Sample ID.: | ES1 | ES2 | ES1 |
| | Sample Location: | TP01 | TP01 | TP02 |
| | Sample Type: | SOIL | SOIL | SOIL |
| | Top Depth (m): | 0.1 | 0.6 | 0.4 |
| | Bottom Depth (m): | 0.2 | 0.8 | 0.6 |
| | Date Sampled: | 21-Oct-2022 | 21-Oct-2022 | 21-Oct-2022 |
| | Asbestos Lab: | DURHAM | DURHAM | DURHAM |
| Determinand | Accred. | SOP | Units | LOD |
| Aliphatic TPH >C21-C35 | M | 2680 | mg/kg | 1.0 |
| Aliphatic TPH >C35-C44 | N | 2680 | mg/kg | 1.0 |
| Total Aliphatic Hydrocarbons | N | 2680 | mg/kg | 5.0 |
| Aromatic TPH >C5-C7 | N | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C7-C8 | N | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C8-C10 | M | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C10-C12 | U | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C12-C16 | U | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C16-C21 | N | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C21-C35 | M | 2680 | mg/kg | 1.0 |
| Aromatic TPH >C35-C44 | N | 2680 | mg/kg | 1.0 |
| Total Aromatic Hydrocarbons | N | 2680 | mg/kg | 5.0 |
| Total Petroleum Hydrocarbons | N | 2680 | mg/kg | 10.0 |
| pH | M | 2010 | | 4.0 |
| Sulphate (2:1 Water Soluble) as SO4 | M | 2120 | g/l | 0.010 |
| ACM Type | U | 2192 | | N/A |
| Asbestos Identification | U | 2192 | | N/A |
| Moisture | N | 2030 | % | 0.020 |
| Soil Colour | N | 2040 | | N/A |
| Other Material | N | 2040 | | N/A |
| Soil Texture | N | 2040 | | N/A |
| Sulphate (Total) | U | 2430 | % | 0.010 |
| Organic Matter | M | 2625 | % | 0.40 |
| Total Organic Carbon | M | 2625 | % | 0.20 |
| Benzene | M | 2760 | µg/kg | 1.0 |
| Toluene | M | 2760 | µg/kg | 1.0 |
| Ethylbenzene | M | 2760 | µg/kg | 1.0 |
| m & p-Xylene | M | 2760 | µg/kg | 1.0 |
| o-Xylene | M | 2760 | µg/kg | 1.0 |
| Methyl Tert-Butyl Ether | M | 2760 | µg/kg | 1.0 |

Test Methods

| SOP | Title | Parameters included | Method summary |
|------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2010 | pH Value of Soils | pH | 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 <37°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 |
| 2300 | Cyanides & Thiocyanate in Soils | Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate | Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser. |
| 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. |
| 2680 | TPH A/A Split | Aliphatics: >C5-C6, >C6-C8,>C8-C10, >C10-C12, >C12-C16, >C16-C21, >C21-C35, >C35- C44Aromatics: >C5-C7, >C7-C8, >C8- C10, >C10-C12, >C12-C16, >C16- C21, >C21- C35, >C35- C44 | Dichloromethane extraction / GCxGC FID detection |
| 2700 | Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID | 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-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds) |
| 2760 | Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS | Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule | Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds. |
| 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 |

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

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 TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°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

If you require extended retention of samples, please email your requirements to:

customerservices@chemtest.com



< ENVIRONMENTAL > < GEOTECHNICAL >

End of Report



Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
☎ 01484 604354 Company No. 5130864

Appendix 4

Fill Screening Values

| Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet | | | | | | | | | |
|-------------------------------------------------------------------------------|-----------------|-------------------------|------|----------------------------------|-------------|-------------------------------|-------------|-----|-----|
| Job Number | C3069/22/E/4690 | | | Sample Location | TP01 | TP01 | TP02 | KEY | KEY |
| | Job Name | Miry Lane, Thongsbridge | | | | | | | |
| Date | 02/11/2022 | | | Depth Top | 0.1 | 0.6 | 0.4 | | |
| Client | AH Construction | | | Depth Base | 0.2 | 0.8 | 0.6 | | |
| Determinand | Units | Ref | LOD | Residential With Plant Uptake 6% | | Atrisk 2015 (No Free Product) | Atrisk 2017 | KEY | KEY |
| | | | | Atrisk 2015 (No Free Product) | Atrisk 2017 | | | | |
| Cadmium | mg/kg | C | 0.10 | 22.1 | 0.55 | 0.17 | 0.10 | | |
| Chromium (Hexavalent) | mg/kg | B/C | 0.5 | 3.62 | < 0.50 | < 0.50 | < 0.50 | | |
| Copper | mg/kg | A+ | 0.50 | 4790 | 32 | 29 | 17 | | |
| Mercury | mg/kg | A/D | 0.10 | 15.8 | 0.53 | 1.8 | 1.1 | | |
| Nickel | mg/kg | A+ | 0.50 | 136 | 15 | 18 | 12 | | |
| Lead | mg/kg | C | 0.50 | 200 | 170 | 210 | 1900 | | |
| Zinc | mg/kg | A+ | 0.50 | 20300 | 170 | 67 | 51 | | |
| Vanadium | mg/kg | A+ | 5.0 | 138 | 25 | 21 | 18 | | |
| Arsenic | mg/kg | C | 1.0 | 37 | 20 | 33 | 18 | | |
| Selenium | mg/kg | A | 0.20 | 375 | 0.93 | 0.78 | 1.0 | | |
| Cyanide (Free) | mg/kg | A | 0.50 | 34 | < 0.50 | < 0.50 | < 0.50 | | |
| Total Phenols | mg/kg | A | 0.1 | 1200 | < 0.10 | < 0.10 | < 0.10 | | |
| Naphthalene | mg/kg | A+ | 0.10 | 12.2 | < 0.10 | < 0.10 | < 0.10 | | |
| Acenaphthylene | mg/kg | | 0.10 | | < 0.10 | < 0.10 | < 0.10 | | |
| Acenaphthene | mg/kg | A+ | 0.10 | 2760 | < 0.10 | < 0.10 | < 0.10 | | |
| Fluorene | mg/kg | A+ | 0.10 | 2610 | < 0.10 | < 0.10 | < 0.10 | | |
| Phenanthrene | mg/kg | | 0.10 | | < 0.10 | 0.49 | < 0.10 | | |
| Anthracene | mg/kg | A+ | 0.10 | 26200 | < 0.10 | 0.14 | < 0.10 | | |
| Fluoranthene | mg/kg | A+ | 0.10 | 2980 | 1.6 | 1.7 | 1.2 | | |
| Pyrene | mg/kg | A+ | 0.10 | 2120 | 1.7 | 1.7 | 1.5 | | |
| Benzofluoranthene | mg/kg | A | 0.10 | 8.54 | 0.89 | 0.72 | 0.68 | | |
| Chrysene | mg/kg | A | 0.10 | 927 | 0.42 | 0.93 | 0.63 | | |
| Benzobenzofluoranthene | mg/kg | A | 0.10 | 7.29 | < 0.10 | 1.2 | < 0.10 | | |
| Benzokjfluoranthene | mg/kg | A | 0.10 | 4.12 | < 0.10 | 0.53 | < 0.10 | | |
| Benzofluoranthene | mg/kg | B/C | 0.10 | 5 | < 0.10 | 0.94 | < 0.10 | | |
| Indeno(1,2,3-c,d)Pyrene | mg/kg | A* | 0.10 | 9.75 | < 0.10 | < 0.10 | < 0.10 | | |
| Dibenz(a,h)Anthracene | mg/kg | A | 0.10 | 4.95 | < 0.10 | < 0.10 | < 0.10 | | |
| Benzog(h,i)perylene | mg/kg | A | 0.10 | 103 | < 0.10 | < 0.10 | < 0.10 | | |
| Total Of 16 PAH's | mg/kg | | 2.0 | 4.6 | 8.4 | 4.0 | 4.0 | | |
| Aliphatic TPH >C6-C8 | mg/kg | A+ | 1.0 | 369 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C9-C10 | mg/kg | A+ | 1.0 | 768 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C11-C12 | mg/kg | A+ | 1.0 | 204 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C13-C14 | mg/kg | A+ | 1.0 | 297 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C15-C16 | mg/kg | A+ | 1.0 | 125 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C17-C21 | mg/kg | A+ | 1.0 | 210100 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C21-C35 | mg/kg | A+ | 1.0 | 210100 | < 1.0 | < 1.0 | < 1.0 | | |
| Aliphatic TPH >C35-C44 | mg/kg | | 1.0 | | < 1.0 | < 1.0 | < 1.0 | | |
| Total Aliphatic Hydrocarbons | mg/kg | | 5.0 | | < 5.0 | < 5.0 | < 5.0 | | |
| Aromatic TPH >C5-C7 | mg/kg | A+ | 1.0 | 0.871 | < 1.0 | < 1.0 | < 1.0 | | |

| Rogers Geotechnical Services Ltd: Soil Screening Value (SSV) Comparison Sheet | | | | | | | | | | | |
|-------------------------------------------------------------------------------|-------------------------|-----|-------|----------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------------|--------------------------|
| Job Number | C3069/22/E/4690 | | | | | | | | | | |
| Job Name | Miry Lane, Thongsbridge | | | | | | | | | | |
| Date | 02/11/2022 | | | | | | | | | | |
| Client | AH Construction | | | | | | | | | | |
| Determinand | Units | Ref | LOD | Sample Location | | | | | | KEY | |
| | | | | TP01 | TP01 | TP02 | | | | KEY | |
| | | | | Depth Top | 0.1 | 0.6 | 0.4 | | | | Exceeds SSV |
| | | | | Depth Base | 0.2 | 0.8 | 0.6 | | | | Exceeds 2017, Below 2015 |
| | | | | Residential With Plant Uptake 6% | | | | | | Below limit of detection (LOD) | |
| Aromatic TPH >C7-C8 | mg/kg | A+ | 1.0 | 780 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C8-C10 | mg/kg | A+ | 1.0 | 232 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C10-C12 | mg/kg | A+ | 1.0 | 468 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C12-C16 | mg/kg | A+ | 1.0 | 830 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C16-C21 | mg/kg | A+ | 1.0 | 1040 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C21-C35 | mg/kg | A+ | 1.0 | 1710 | 18 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Aromatic TPH >C35-C44 | mg/kg | | 1.0 | | < 1.0 | < 1.0 | < 1.0 | < 1.0 | < 1.0 | | |
| Total Aromatic Hydrocarbons | mg/kg | | 5.0 | | 18 | < 5.0 | < 5.0 | < 5.0 | < 5.0 | | |
| Total Petroleum Hydrocarbons | mg/kg | | 10.0 | | 18 | < 10 | < 10 | < 10 | < 10 | | |
| pH | | | N/A | | 7.4 | 8.2 | 7.9 | 7.9 | 7.9 | | |
| Sulphate (2:1 Water Soluble) as SO4 | g/l | | 0.010 | | < 0.010 | < 0.010 | 0.014 | 0.014 | 0.014 | | |
| ACM Type | | | N/A | | - | - | - | - | - | | |
| Asbestos Identification | % | | 0.001 | | No Asbestos Detected | | |
| Moisture | % | | 0.020 | | 11 | 9.2 | 8.5 | 8.5 | 8.5 | | |
| Soil Colour | | | N/A | | Brown | Brown | Brown | Brown | Brown | | |
| Other Material | | | N/A | | Stones and Clay | | |
| Soil Texture | | | N/A | | Clay | Clay | Clay | Clay | Clay | | |
| Sulphate (Total) | % | | 0.010 | | 0.077 | 0.037 | 0.14 | 0.14 | 0.14 | | |
| Organic Matter | % | | 0.40 | | 8.1 | 2.5 | 7.0 | 7.0 | 7.0 | | |
| Total Organic Carbon | % | | 0.20 | | 4.7 | 1.4 | 4.0 | 4.0 | 4.0 | | |

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Residential With Plant Uptake Landuse

| Tox Data Report No. | Compound | Residential with Homegrown Produce Landuse (mg/kg) | | | | Reference |
|----------------------------------------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------|-----------------|--------------|-----------------|-----------|
| | | SOM: 1% | | SOM: 6% | | |
| <i>Metals</i> | | | | | | |
| | | SOM: 1% | | SOM: 6% | | |
| 3 | Cadmium | 22.1 | | 22.1 | | C |
| 4 | Chromium VI | 3.62 | 20.5 | 3.62 | 20.5 | B/C |
| | Copper | 4730 | | 4790 | | A+ |
| 7 | Mercury | 8.81 | | 15.80 | | A/D |
| 8 | Nickel | 136 | | 136 | | A+ |
| | Lead | 200 | | 200 | | C |
| | Zinc | 20000 | | 20300 | | A+ |
| | Vanadium | 136 | | 138 | | A+ |
| <i>Semi and Non Metals</i> | | | | | | |
| 1 | Arsenic | 37 | | 37 | | C |
| 10 | Selenium | 375 | | 375 | | A |
| | Free Cyanide | 34 | | 34 | | A |
| 9 | Phenols (total) | 267 | | 1200 | | A |
| <i>Poly Aromatic Hydrocarbons</i> | | | | | | |
| | | Free product | No free product | Free product | No free product | |
| 20 | Napthalene | 0.829 | | 12.2 | | A+ |
| | Acenaphthene | 157 | 608 | 2760 | | A+ |
| | Fluorene | 735 | | 2610 | | A+ |
| | Anthracene | 10200 | | 26200 | | A+ |
| | Fluoranthene | 983 | | 2980 | | A+ |
| | Pyrene | 668 | | 2120 | | A+ |
| | Benzo(a)anthracene | 1.71 | 4.52 | 8.54 | | A |
| 2 | Chrysene | 0.44 | 585 | 2.64 | 927 | A |
| 2 | Benzo(b)fluoranthene | 1.22 | 7.72 | 7.29 | 9.86 | A |
| 2 | Benzo(k)fluoranthene | 0.686 | 84.4 | 4.12 | 100 | A |
| 2 | Benzo(a)pyrene | 1.51 | 4.95 | 0.998 | 5 | B/C |
| 2 | Dibenzo(a,h)anthracene | 0.00393 | 0.838 | 2.05 | 4.95 | A* |
| 2 | Indeno(1,2,3-cd)pyrene | 0.0614 | 7.31 | 0.368 | 9.75 | A |
| 2 | Benzo(g,h,i)perylene | 0.0187 | 96.2 | 0.112 | 103 | A |
| <i>Petroleum Hydrocarbons</i> | | | | | | |
| | Aliphatic C5-C6 | 42.7 | | 369 | | A+ |
| | Aliphatic C6-C8 | 99.3 | | 768 | 1240 | A+ |
| | Aliphatic C8-C10 | 13.9 | | 204 | | A+ |
| | Aliphatic C10-C12 | 49.9 | 81.7 | 297 | 1180 | A+ |
| | Aliphatic C12-C16 | 20.9 | 385 | 125 | 4130 | A+ |
| | Aliphatic C16-C21 | 210000 | | 210100 | | A+ |
| | Aliphatic C21-C35 | 210000 | | 210100 | | A+ |
| | Aromatic C5-C7 (Benzene) | 0.137 | | 0.871 | | A+ |
| | Aromatic C7-C8 (Toluene) | 113 | | 780 | | A+ |
| | Aromatic C8-C10 | 20.5 | | 232 | | A+ |
| | Aromatic C10-C12 | 70 | | 468 | | A+ |
| | Aromatic C12-C16 | 155 | 165 | 830 | | A+ |
| | Aromatic C16-C21 | 319 | | 1040 | | A+ |
| | Aromatic C21-C35 | 1120 | | 1710 | | A+ |
| A+ = Values update June 2017. | | | | | | |
| A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound. | | | | | | |
| B = Health Criterion Values (available from toxicological reviews published in the C4SL project methodology report). | | | | | | |
| C = Category 4 Screening Levels (C4SLs). | | | | | | |
| D = SSV provided is for Methyl Mercury. | | | | | | |