DOCUMENT VERIFICATION

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

CONTRACT NO. E13431/1

GEO-ENVIRONMENTAL APPRAISAL OF A SITE AT 119 HUDDERSFIELD ROAD, MIRFIELD

Prepared by
DTS Raeburn Limited

Client:	Morbaine Limited	
Report Issue No.	1	
Report Status:	**FINAL**	
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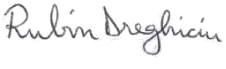
	R.O.N. Dreghiciu MSc FGS Geo-environmental Engineer	
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Generic List of Acronyms and Abbreviations

µg/kg	micrograms per kilogram
µg/l	micrograms per litre
ACEC	aggressive chemical environment for concrete
ACM	asbestos containing material
AOD	above Ordnance datum
bgl	below ground level
BGS	British Geological Survey
BH	borehole
BTEX	benzene, toluene, ethylbenzene and xylene compounds
CBR	California bearing ratio
CH_4	methane
CIRIA	Construction Industry Research and Information Association
CLR	Contaminated Land Report
CO	carbon monoxide
CO_2	carbon dioxide
COMAH	control of major accident hazards
CPT	cone penetration test
CSM	conceptual site model
DEFRA	Department of Environment, Food and Rural Affairs
DoE	Department of Environment (now part of DEFRA)
DP	dynamic probe
DPSH	dynamic probe super heavy
DQRA	detailed quantitative risk assessment
DS	design sulphate class
DWS	drinking water standard
EA	Environment Agency
EHO	Environmental Health Officer
EQS	environmental quality standard
FRA	flood risk assessment
GAC	generic assessment criteria
GPR	ground penetrating radar
GPS	global positioning systems
GQRA	generic quantitative risk assessment
GW-TV	groundwater threshold value
ha	hectare
H_2S	hydrogen sulphide
HPA	Health Protection Agency (now PHE)
HSE	Health and Safety Executive
IPPC	Integrated Pollution Prevention and Control
LAPPC	Local Authority Pollution Prevention and Control
LNR	Local Nature Reserve
mb	millibar
MAGIC	Multi Agency Geographical Information for the Countryside
MCERTS	Monitoring Certification Scheme
mg/kg	milligrams per kilogram
mg/l	milligrams per litre
NIEA	Northern Ireland Environment Agency
NGR	National Grid Reference
O_2	oxygen
OS	Ordnance Survey
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
PFS	petrol filling station
PID	photo ionisation detector
PHE	Public Health England
PPE	personal protective equipment
PRA	preliminary risk assessment
SAC	Special Area of Conservation
S4UL	Suitable For Use Level
SEPA	Scottish Environment Protection Agency
SGV	soil guideline value
SOM	soil organic matter
SPA	Special Protection Area
SPT	standard penetration test
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SVOCs	semi-volatile organic compounds
TOC	total organic carbon
TP	trial pit
TPH	total petroleum hydrocarbons
TPO	Tree Preservation Order
UKAS	United Kingdom Accreditation Service
UXO	unexploded ordnance
UST	underground storage tank
VOCs	volatile organic compounds
WAC	Waste Acceptance Criteria
WFD	Water Framework Directive
WHO	World Health Organisation
WS	window sampling borehole

GEO-ENVIRONMENTAL APPRAISAL OF A SITE AT 119 HUDDERSFIELD ROAD, MIRFIELD

Executive Summary

Objectives	To carry out a ground contamination and geotechnical appraisal for the proposed development of a new retail food store with associated external hardstandings and limited landscaped areas. The investigation was undertaken following a review of a report previously prepared for the site by Waterco Limited (the 'Waterco Report') supplemented by a site reconnaissance by DTS, and the preparation of an initial conceptual site model (CSM) by DTS on the basis of the review.
Site Description	The site covers about 0.8 hectares and is used primarily for the external sales and storage of caravans. A building, which is utilised as a retail shop, workshop and offices and two adjoining portacabin structures are located in the south-eastern part of the site. At the site's south-western boundary, a steeply-sloping vegetated embankment slopes downwards by about 4m towards the River Calder.
Proposed Development	The proposed development will comprise a retail food store in the western section and car parking in the central and eastern sections. New retaining walls are also proposed at along two sections of the site's south-western boundary.
Site History	Quarrying is indicated to have commenced in the north-eastern part of the site by 1890, and to have expanded to cover almost the whole of the site by the late 1950s. The quarry is indicated to have been backfilled with unknown materials by the early 1970s, with the existing buildings established in the south-eastern corner of the site by the early 1980s. In the surrounding area, the land adjacent the site to the south-east has historically been occupied by a malthouse, above-ground tanks and a petrol filling station (PFS), whilst the land to the north-west has historically been occupied by railway sidings and light industrial units. Additional railway sidings were also present at about 100m south of the site (on the southern bank of the River Calder) during the late 19th and early 20th centuries.
Geology	British Geological Survey (BGS) mapping data indicates the southern and western sections of the site to be underlain by superficial alluvium. The northern and eastern sections are indicated to be underlain by bedrock geology of the 'Clifton Rock' (part of the Pennine Lower Coal Measures) which also continues beneath the alluvium in the southern and western parts of the site. Trial pit and borehole records from the surrounding area, obtained from the BGS database indicate a general increase in the depth to bedrock from about north to south in the site locality. However, there are no borehole records from within the site boundary to identify the nature or thickness of any quarry backfill materials.
Mineral Extraction	The site lies outside a Coal Authority-defined 'Development High Risk Area' and a site-specific Consultant's Coal Mining Report indicates a low risk to the proposed development from former coal mining activity.
Hydrology	The closest surface water feature to the site is the River Calder located adjacent the south-western boundary.
Hydrogeology	Both the superficial alluvium and Lower Coal Measures bedrock geology are classified as 'Secondary A' aquifers.
Major Ecological Receptors	No such receptors have been identified within a 1km radius of the site.
Flood Risk	The site lies within 'Flood Zone 1' (the lowest risk classification with respect to fluvial flooding).
Initial CSM	The initial CSM identified that ground contamination had the potential to be present beneath the site as a result of historical uses of the site and surrounding area, and to present a potential risk to the proposed development, human health and controlled waters.
Scope of Ground	Comprised five cable percussion boreholes and five window sampling boreholes, with

Investigation	associated soil and groundwater sampling, in situ and laboratory testing and gas and groundwater monitoring.
Ground Conditions	Made ground, including both loose granular and soft cohesive soils with fragments of materials including sandstone, quartz, brick, concrete, tile, glass, ash and clinker was proved to depths of between 3.5m and 6.2m below ground level (bgl). The made ground appears to have been end-tipped, without compaction to any form of engineering specification. The underlying natural soils comprised alluvium, consisting primarily of medium dense sandy cobbly gravel with varying layers or lenses of loose to medium dense clayey sand and predominantly firm sandy clay. Weak sandstone, siltstone or mudstone (suspected to represent weathered Coal Measures bedrock) was encountered at depths of between 8.00 and 11.0m bgl (41.42m and 37.53mAOD) in three of the boreholes.
Groundwater	Groundwater strikes were encountered within granular alluvial soil horizons at depths varying between 6.5m and 9.3m bgl during the fieldwork. Subsequent groundwater monitoring during February and March 2021 indicated a laterally continuous Groundwater Table within the alluvium beneath the site, which is probably controlled by the adjacent River Calder. A separate locally perched accumulation of groundwater within the made ground beneath the northern and central parts of the site is also indicated.
Ground Contamination Appraisal	The levels of ground contamination detected in the tested soil and groundwater samples are considered to present a sufficiently low risk to the proposed development, subject to the following mitigation measures: - Placement of a minimum 500mm thickness of suitably clean cover material above any areas of proposed landscaping. Alternatively, further soil sampling and testing in proposed landscaped areas may enable the extent of clean cover material required to be reduced - Any new underground services should be placed in a corridor of clean fill material - Procedures should be identified for dealing with unforeseen contamination in the event that this becomes apparent during construction.
Ground Gas	On the basis of soil gas monitoring carried out during February and March 2021, it is recommended that gas protection appropriate to a 'Characteristic Situation' Classification CS-2 as defined by CIRIA (2007) be incorporated into the proposed structures. Gas protection beneath the majority of the retail store should afford a minimum point score of 1.5, as defined by BS8485:2015+A1,2019, but this should be increased to 2.5 beneath small rooms within the main structures.
Off-site Disposal of Soils	Three samples of made ground contained arsenic, TPH and TOC at concentrations sufficiently high to place the affected soils into the hazardous waste classification for off-site disposal. The test results indicate that the remainder of the made ground tested could be classified as non-hazardous waste, but further testing may be necessary to enable segregation of the hazardous and non-hazardous waste materials. The natural soils could be classified as inert waste for disposal. This advice is given for guidance only and is subject to the Landfill Operator's certification.
Geotechnical Assessment	**Foundations:** The existing made ground is not considered suitable for the placement of pad or strip foundations. A raft foundation is also not considered feasible. The proposed store could be founded on either driven or continuous flight auger (CFA) piles, and estimated design bearing resistances are included in Section 11.0. The values given should be used for general guidance only and advice on the pile type and design should be obtained from specialist piling contractors for their proprietary piling systems. The floor slab of the new store should be suspended. **Retaining Walls:** Retaining walls are proposed at the site's south western boundary which is approximately 5m higher than river level. Soil parameters for the design of the walls are provided in the report. It is recommended that free-draining granular fill is placed behind the new retaining walls and that suitable drainage is provided. **New pavement:** The existing hardstanding together with any unsuitable materials should be removed and the formation prepared by proof-rolling. A design CBR value of less than 2% is considered appropriate for the existing ground conditions. However, this

	should be confirmed through a scheme of *in situ* CBR testing undertaken following the finalisation of the proposed site levels.
Buried Concrete	Should conform to Design Sulphate Class DS-2 and ACEC Class AC-4 of Special Digest 1 (3rd Edition, BRE, 2005).
Limitations	The limitations of this report are detailed in Section 12.0.

1.0 INTRODUCTION

DTS RAEBURN Limited (DTS) were commissioned by Morbaine Limited to undertake a ground contamination and geotechnical appraisal of a site located at 119 Huddersfield Road, Mirfield. It is understood that the site, which is currently occupied by a caravan dealership is to be redeveloped into a food retail store and car park. The proposed development will also include the construction of new retaining walls at the site's south-western boundary with the River Calder.

The appraisal has been undertaken based on the following works:

- Review of the historical uses of the site and surrounding area, and geological and environmental sensitivity data contained in a report previously prepared for the site by Waterco, titled *'Huddersfield Road, Mirfield: Phase 1 Geotechnical and Geo-environmental Desk Study',* dated April 2019 (Ref: w8013-190429-Phase 1 Desk Study). This will be referred to hereafter as the 'Waterco Report'

- Where appropriate, the review was supplemented by reference to current published geological and environmental sensitivity data, and by a site reconnaissance undertaken by DTS in January 2021

- Preparation of an initial Conceptual Site Model (CSM) based on the findings and conclusions of this review

- Intrusive ground investigation, sampling, laboratory testing and ground gas monitoring to enable a quantitative assessment of the risk to the proposed development from ground contamination, and to provide geotechnical recommendations for the design of structural foundations, pavements and retaining walls

The scope of the intrusive investigation included cable percussion boreholes and window-sampling boreholes, with associated sampling and *in situ* and laboratory testing. The investigation also included the installation of gas and groundwater monitoring standpipes to identify the presence and proportions of methane, carbon dioxide, oxygen, hydrogen sulphide and carbon monoxide within the ground gas and the extent of groundwater beneath the site.

This report presents the findings of the ground contamination and geotechnical appraisal together with recommendations for the development proposals.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Details

Address	119 Huddersfield Road, Mirfield, WF14 9DA **(Figures 1 & 2)**
National Grid Reference (NGR)	419840, 420000
Site Area	Approximately 0.8 hectares
Current Use	Caravan Dealership

2.2 Site Description

Hereafter within this report 'the site' refers to the area within the boundary indicated in Figure 3. This comprises a roughly rectangular parcel of land that is accessed from Huddersfield Road to the north-east.

A two-storey building is located in the south-eastern section of the site, and is utilised as a shop, office and covered servicing area for touring caravans. The building is adjoined to the west by two portacabins that serve as offices, and to the east by a gas bottle storage area which is sited on a raised concrete base. In the far south-eastern corner of the site is a caged storage area which at the time of the DTS site reconnaissance in January 2021, contained vehicle wheels and vehicle cleaning products. No evidence of fuel storage or other potentially contaminative activities was observed.

The remainder of the site is used for the external storage and sale of caravans. The majority of the site is surfaced by tarmac hardstanding, but it also includes a limited area of compact gravel and a raised planted area adjacent the north-western and north-eastern boundaries respectively. Site observations suggest that the ground level across the site slopes gently downwards from approximately east to west.

2.3 Surrounding Area

The site is bounded to the north-east by the A644 Huddersfield Road, beyond which lie residential dwellings. A car and van sales, servicing and repair workshop is located adjacent the site to the south-east, whilst industrial units are located adjacent the site to the north-west. At the time of the DTS site reconnaissance, occupants of these units were noted to include a metal coupling works, a manufacturer of curtain and stair rods and a manufacturer of automatic doors.

At the site's south-western boundary, an embankment slopes steeply downwards by about 4m towards the River Calder, which flows from north-west to south-east. The embankment was note to be interspersed with numerous mature deciduous trees. The site's southern boundary is lined with a ring mesh fence which prevented access onto the river bank, however, no clear evidence of instability of the embankment was noted from within the site boundary.

2.4 Ecology/Invasive & Injurious Plant Species

Detailed ecological and agricultural surveys were outside the scope of this report, but no infestations of Japanese Knotweed or other invasive or injurious species were observed within or immediately adjacent the site at the time of the present investigation. However, it should be noted that Japanese Knotweed commonly grows on river banks, and also that the present investigation was undertaken outside of the growing season. It would therefore be prudent to undertake a specialist inspection of the river bank during the spring or summer months to provide verification in this regard.

2.5 Proposed Development

It is understood that the site is to be redeveloped into a food retail store and associated car park. The store building is to be located at the western end of the site, with car parking in the central and eastern sections. The development will also necessitate the construction of new retaining walls along two sections of the site's south-western boundary. A plan illustrating the proposed development is included as Figure 4.

3.0 REVIEW OF SITE HISTORY AND GEO-ENVIRONMENTAL SETTING

3.1 Site History

Historical maps included in the Waterco Report indicate that the site was mostly undeveloped in the late 19th century, with the exception of small buildings along its eastern boundary. However, quarrying had commenced in the north-eastern part of the site by 1890. By 1933 the quarry had

expanded to cover approximately the north-eastern half of the site, and by 1958 it had expanded further to occupy almost the whole site except for the south-western corner.

Subsequent maps indicate that the quarry had been backfilled by the early 1970s. By 1983, several small buildings had been established at approximately the locations of the existing building and adjacent porta-cabins on the site. No significant changes are indicated within the site in maps dated between 1989 and the present day.

Notable historical land uses in the surrounding area have included the following:

- A malthouse (associated with brewing) was located adjacent the site to the east during the late 19th and early to mid-20th centuries. By 1958 this had been demolished and several above-ground tanks constructed within the site. By the late 1980s the land had been redeveloped into a garage and petrol filling station (PFS), which remained until at least 2000. It is not known whether the former tanks and associated infrastructure were decommissioned prior to the establishment of the existing vehicle sales, servicing and repair workshop

- The land adjacent the site to the north-west was developed from Greenfield into railway sidings in approximately the 1920s. The sidings were associated with a woollen mill located at about 150m west of the site. The sidings had been removed by the late 1950s, and the existing industrial units were constructed in approximately the mid-1990s

- The land between about 100m and 150m to the south of the site, on the southern bank of the River Calder was occupied by railway sidings and an associated engine shed and a turntable between the late 19th century and the late 1950s/early 1960s. The sidings had been removed by the early 1970s and no subsequent development is indicated to have taken place in this area. Additional woollen mills and malt kilns were also located on the southern bank of the river during the late 19th and early to mid-20th centuries.

- Maps dated between 1893 and 1958 indicate the presence of additional, relatively small quarries at distances of about 90m and 200m to the north-west of the site. It is not known how these were subsequently backfilled.

The possibility of ground contamination having been caused at the site as a result of the previous uses of the site and surrounding area is discussed further in an initial Conceptual Site Model (CSM) which is presented in Section 5.0 of this report.

3.2 Topography

A topographical survey drawing of the site prepared by Ellam Surveys Limited, dated March 2019 and included in the Waterco Report indicates that the ground level across the site slopes gently downwards from approximately east to west, between about 51m and 48m Above Ordnance Datum (AOD).

3.3 Geology

3.3.1 Geological Mapping Data

Enclosure A to this report contains a site-specific 'GeoIndex' report produced by British Geological Survey (BGS). This indicates the southern and western sections of the site to be underlain by Superficial Alluvium of *Quaternary* age. This is reported to consist of detrital materials deposited by running water and potentially including mixtures of clay, silt, sand and gravel. The northern and eastern sections are indicated to be directly underlain by the *Carboniferous* Clifton Rock, which also continues beneath the alluvium in the southern and western parts of the site. The Clifton Rock forms part of the Pennine Lower Coal Measures and is reported to consist predominantly of fine-grained sandstone with a thin coal seam.

A geological fault, orientated approximately north-east to south-west is indicated within the bedrock strata close to the north-western boundary of the site. The downthrow of the fault is shown to be towards the north-west (i.e. away from the site). The fault is not considered to be of any geotechnical consequence with respect to the proposed development.

3.3.2 BGS Borehole Records

Enclosure B contains the records of three trial pit records and one borehole record (BGS Ref: SE12SE566, SE12SE567, SE11SE569 and SE11NE574) which have been obtained from the BGS database and are reported to have been drilled at about 20-40m north and 130m south-west of the site respectively.

Two of the trial pits, excavated at between about 20m and 40m north of the site are reported to have terminated in highly weathered siltstone at depths of between 1.6m and 1.9m below ground level (bgl). The third trial pit, located at about 30m north of the site terminated at 1.6m bgl in firm to stiff clay, which may also represent completely weathered Coal Measures strata.

The borehole, which is reported to have been drilled at about 130m south-west of the site is reported to have encountered superficial gravel between ground level and 9.15m depth. This overlay Coal Measures bedrock, consisting predominantly of sandstone to the termination depth of the borehole at 28.5m bgl.

The ground elevation, relative to OD is not recorded on any of the BGS records consulted and it is therefore not possible to make a detailed assessment of the ground conditions encountered in these exploratory holes relative to the subject site. However, in general terms the records indicate a general increase in the depth to bedrock from approximately north to south in the site locality.

It is also noted that the BGS database does not contain the records of any trial pits or boreholes previously completed within the site boundary. Therefore, there is no information to indicate the nature or thickness of materials used to backfill the former quarry located within the site.

3.4 Hydrology

The closest surface water feature to the site is the River Calder located adjacent the southern boundary of the site and flowing towards the south-east.

3.5 Hydrogeology

Hydrogeological maps included in the Waterco Report indicate that both the superficial alluvium and the Pennine Lower Coal measures bedrock geology are classified as 'Secondary A' Aquifers.

'Secondary A' Aquifers are defined by the Environment Agency as 'permeable layers capable of supporting water supplies at a local level rather than strategic level, and in some cases forming an important source of base flow to rivers'.

The site does not lie within a Source Protection Zone (SPZ) and there are no recorded licensed groundwater abstractions within a 2km radius of the site.

3.6 Major Ecological Receptors

Site sensitivity maps included in the Waterco Report indicate that there are no major ecological receptors[1] within a 1km radius of the site.

3.7 Flood Risk

Environment Agency flood risk mapping data (consulted February 2021) indicates the site to lie within 'Flood Zone 1'. This corresponds to the lowest risk classification with respect to fluvial flooding.

4.0 MINERAL EXTRACTION

Interactive mapping data published by the Coal Authority (consulted March 2020) indicates that the site lies within a defined 'Coal Mining Reporting Area', but outside a defined 'Development High Risk Area'. A site-specific Consultant's Coal Mining Report was therefore obtained from the Coal Authority and is included as Enclosure C.

Table 4.1 presents a summary of the information contained in the Coal Mining Consultant's Report for the site and identifies any associated risks to the proposed development.

Table 4.1 Summary of findings of Consultant's Coal Mining Report

Past Underground Mining	None recorded
Probable coal workings at shallow depth	None recorded.
Recorded Mine entries	None within 100m of site boundary
Outcrops	None recorded.
Faults, fissures or breaklines	
Spine roadways at shallow depth	None recorded.
Current or former open-cast workings	None recorded within 500m of site boundary.
Coal mining subsidence	None recorded within 50m of site boundary since 31st October 1994.
Mine gas emissions	None recorded within 500m of site boundary.
Other coal mining related hazards	None recorded.
Future underground mining	None recorded.

Based on the above information it is considered that subsidence due to underground or open-cast coal mining is unlikely to affect the proposed development.

[1] As listed in Table A of Annex 3, DEFRA Circular 01/2006: Environmental Protection Act 1990: Part 2A – Contaminated Land, September 2006.

The historical maps indicate the presence of two relatively small quarries at distances of about 90m and 200m north-west of the site, most likely for sandstone extraction. Subsequent maps indicate that quarrying at both locations has since ceased, and it is considered unlikely that the former quarries could present a risk of ground instability at the subject site.

The potential for settlement of the materials used to backfill the former quarry located within the site has however been considered, and was assessed further as part of the ground investigation works described later in this report.

5.0 INITIAL CONCEPTUAL SITE MODEL

A qualitative risk assessment of the site was undertaken based on the findings of the information summarised in Sections 3.0 and 4.0 above, in order to facilitate the development of an initial CSM. This was based on a risk-based approach and incorporated the accepted source–pathway–receptor linkage approach ('pollutant linkage') outlined in Part IIa of the Environmental Protection Act 1990. This approach also follows the risk assessment framework included in Land Contamination Risk Management (LCRM) (Environment Agency, 2020) in which three essential elements to any risk are considered:

- A **source** – a contaminant or pollutant that is in, on or under the land and has the potential to cause harm or pollution;
- A **receptor** – in simple terms, something that may be adversely affected by a contaminant
- A **pathway** – a route or means by which a receptor can be exposed to, or affected by, a contaminant.

A risk is created only where the above three elements are linked together, and must first be established for a contaminated land hazard to exist and before any other secondary considerations are given to the effects and the need/requirement for remediation.

Table 5.1 summarises the potential contaminants, receptors and pathways identified. Contaminants arising from the current and historical uses of both the site and surrounding area have been considered. The contaminants have been separated according to whether they are likely to have originated from on-site or off-site sources. The potential contaminants arising from the identified sources have been determined from the relevant DoE Industry Profiles (where available) and are included in the Table.

Table 5.1 Initial CSM

Potential sources (*associated contaminants*)
On-site sources: • Materials used to backfill the former quarry located within the site (contaminants dependant on the nature and source of the backfill materials but could potentially include: *metals/metalloids, petroleum hydrocarbons, PAH compounds, acidity/alkalinity (low/high pH), sulphates, asbestos, ground gas*) • Demolition of historical buildings (*metals* (associated with pipework and paint constituents), *asbestos*)
Off-site sources: • Former railway sidings located adjacent site to west. Current use of this area for metal working and commercial door manufacture (*metals/metalloids, petroleum hydrocarbons, PAH compounds, acidilty/alkalinity (low/high pH), asbestos, glycols*) • Former PFS adjacent site to east (currently occupied by a vehicle sales, servicing and repair workshop (*petroleum hydrocarbons, volatile organic compounds (VOC), sulphates, acidity/alkalinity (low/high*

pH), asbestos) • Backfilling of former quarries located at about 90m and 200m north-west of site (could include: *metals/metalloids, petroleum hydrocarbons, PAH compounds, acidity/alkalinity (low/high pH), sulphates, asbestos, ground gas*) • Former railway sidings, turntable and engine shed located at about 100m south of site (*petroleum hydrocarbons, asbestos, metals/metalloids, glycols, acidity/alkalinity (low/high pH)*. However, the DOE Industry Profile for railway land notes that the distribution of these contaminants is typically confined to the running lines. It is noted that the primary responsibility for ground contamination occurring at the site from off-site sources would lie with the respective site owners/occupiers.
Potential receptors
• Humans: Construction and future maintenance workers, future site users, off-site residents • Development end use: Proposed buildings, hardstandings, services/utilities and limited peripheral landscaping • Controlled waters: - 'Secondary A' aquifer status of underlying alluvium and Coal Measures bedrock geology - River Calder located adjacent south-western boundary of the site
Potential pathways
• Humans: Ingestion, skin contact, inhalation of dust and indoor and outdoor air. These pathways are likely to be largely mitigated post-development due to the proposed coverage by buildings and hardstanding, but may remain potentially active in landscaped areas and with respect to ground gas) • Development end use: Contact with buried concrete and services/utilities • Controlled waters - Groundwater: leachate migration into pore water from soil contamination, free product flow (if present), dilution and dispersion into groundwater - Surface water: hydrogeological flow within groundwater to River Calder, surface water run-off

The CSM summarises the identified potential sources of ground contamination, potential exposure/migratory pathways, and potential receptors, and indicates that it is possible for ground contamination to be encountered beneath the site as a result of previous uses of the site, as well as current and historical uses of the surrounding area. Pathway linkages may be completed with respect to human health, the proposed development end use and controlled water receptors. It is noted however that controlled waters also have the potential to be affected by contamination from off-site sources, and that this may mean that contamination of either groundwater or surface water, if encountered, cannot conclusively be attributed to a specific source(s).

A ground investigation was therefore undertaken at the site, with the objectives of identifying the nature of the underlying quarry backfill materials and enabling a quantitative assessment of the levels of ground contamination (including ground gas) beneath the site and the associated risk to the relevant receptors. Additional objectives included the provision of geotechnical data for the design of foundations, pavements and retaining walls for the proposed development. Details of the ground investigation works undertaken are presented in Section 6.0 below.

6.0 DETAILS OF GROUND INVESTIGATION

The ground investigation was undertaken between 25th January and 8th February 2021, and comprised five cable percussion boreholes (CP1 – CP5) and five window sampling boreholes (WS1-WS5). The locations of the exploratory holes are shown on Figure 3.

The investigation was designed to provide information required for both the ground contamination and geotechnical aspects of the appraisal (as described below) whilst minimising interference with the continued operation of the site at the time of the fieldwork.

Ground contamination objectives

The boreholes were positioned to enable non-targeted investigation and sampling across the site, including the former quarry backfill materials. Seven of the boreholes were fitted with standpipe installations on completion, targeting either the quarry backfill or the underlying natural soils, to enable measurement of the ground gas concentrations and groundwater levels, and enable the recovery of groundwater samples for laboratory analysis.

The continued operational nature of the site at the time of the investigation necessitated the scope of the intrusive works to be limited to a total of ten boreholes. This is slightly less than the thirteen sampling points which would be recommended by BS10175:2011+A2,2017 for a typical non-targeted sampling density across a site area of 0.8 hectares. However, taking account of the findings of the sampling and laboratory testing undertaken, which has indicated the nature of the made ground to be largely consistent across the site, this is considered unlikely to have a significant effect on the conclusions of this report.

Geotechnical objectives

Cable percussion boreholes CP1-CP4 were positioned at approximately the four corners of the proposed retail store building, to provide geotechnical data for the design of foundations for this structure. Boreholes CP4 and CP5 were also located close to the proposed retaining walls in the southern part of the site.

The following subsections describe the investigation in additional detail. Figure 3 indicates the positions of the exploratory holes

6.1 Underground Utilities Clearance

Non-intrusive electromagnetic and ground penetrating radar (GPR) techniques were employed identify the presence or otherwise of underground services in the vicinity of the borehole locations, and minimise the risk of damage to buried utilities. An additional scan using a Cable Avoidance Tool (CAT) was also carried out by the DTS Raeburn Engineer.

6.2 Exploratory Hole Information

Cable Percussion Boreholes

Boreholes CP1-CP5 were drilled to refusal at depths of between 8.6m and 15.5m bgl using standard, 150mm-diameter cable percussion boring equipment.

Clean drilling techniques were employed at the site and included casing through the made ground in each borehole to avoid the potential for any cross-contamination between strata. Due attention was maintained to determine whether groundwater was encountered within the strata penetrated. Standard Penetration Tests (SPTs), as described in BS EN ISO 22476-3:2005+A1:2011, were also carried out during drilling to allow an assessment of the in-situ density or stiffness of the ground.

Window Sampling Boreholes

Boreholes WS1-WS5 were drilled by window sampling drilling techniques to depths of 5.0m bgl. SPTs, as described in BS EN ISO 22476-3:2005+A1:2011, were carried out at 1m intervals during drilling.

Gas and groundwater monitoring installations

On completion, soil gas and groundwater monitoring installations were fitted into Boreholes CP1-CP5 and WS1-WS3. The installations comprised 63mm HDPE tubes, topped with gas control valves, which were perforated along differing lengths to target either the made ground or the underlying groundwater-bearing natural soils as identified on the respective borehole records. The response zones were surrounded with clean pea gravel whilst the upper section of each installation comprised a bentonite seal, which was overlain by concrete securing a protective cover fitted flush with the surrounding ground surface. A second bentonite seal was also included beneath the base of each installation that did not continue to the termination depth of the borehole.

Those boreholes not fitted with standpipe installations were backfilled with materials arising, sealed with bentonite and reinstated with tarmacadam at the ground surface.

Falling Head Permeability Tests

One falling head permeability test was performed in Borehole CP5 (6.0-8.0m bgl). The test was performed in the naturally occurring alluvium and conducted over a 30-minute period. The results are included as Appendix 2.

Tests could not be conducted in the alluvium at the other borehole locations due to the depths at which groundwater was struck during drilling. The overlying made ground was noted to contain various anthropogenic materials including brick, concrete and clinker, in addition to mixed granular and cohesive soils. Attempting permeability tests in such stratum is not considered appropriate due to the potential risk of mobilising contamination from the soils into the underlying groundwater, in addition to the material being geotechnically unsuitable for the construction of soakaway drainage.

6.3 Soil Sampling

Samples were recovered from the window-sampling boreholes in new clean 1m-length plastic liners, which were opened and sub-sampled by the DTS Engineer. The guidelines in BS10175:2011+A2, 2017 '*Investigation of potentially contaminated sites - Code of practice*' were followed during recovery of samples for chemical analysis. During sampling all reasonable effort was maintained to prevent potential cross-contamination or general failure of the sampling strategy. All samples were collected in new, clean bags or jars as appropriate using a stainless-steel trowel, which was cleaned prior to the collection of each sample. The samples recovered for chemical analysis were temporarily stored in cool boxes with freeze packs, and dispatched to the laboratory under complete chain of custody documentation.

The DTS Site Engineer also collected samples from the cable percussion boreholes for chemical analysis using the above procedures. Additional geotechnical samples from the cable percussion boreholes were collected by the drilling crew in new clean bags or containers using appropriately cleaned tools.

6.4 Groundwater and Gas Monitoring

The depth to groundwater and the concentrations of methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), hydrogen sulphide (H_2S) and carbon monoxide (CO) were recorded on four occasions during February and March 2021 from the standpipe installations fitted to boreholes CP1-CP5 and WS1-WS3. The barometric pressures and gas flow rates were also recorded.

6.5 Groundwater Sampling

Groundwater samples were recovered from the installations fitted to Boreholes CP1-CP5 on 16th March 2021 using dedicated disposable bailers and following development of the installation by purging with at least three times the borehole volume of water. The water samples were taken in

glass bottles and vials and stored in cool boxes with freeze packs in order to maintain low temperatures during transfer to the laboratory.

A second round of groundwater sampling was undertaken from Boreholes CP2-CP5 on 9th March 2021 using the same methodology.

6.6 Records of Fieldwork

Detailed records of the boreholes have been produced in accordance with BS5930:2015 and are included as Appendix 1. Details of the samples and SPT results are given on the respective logs.

Permeability tests results from the falling head tests conducted in Boreholes CP2 and CP3 are included as Appendix 2.

The ground gas and groundwater monitoring results are included in Table A, which immediately follows the report text.

7.0 LABORATORY TESTING

7.1 Soil Contamination Testing

Table 7.1 lists the contamination tests performed on soil samples during the present investigation, together with a summary of the purpose of each test.

Table 7.1 Soil contamination tests

Row	Test	No. of tests	Purpose
1	Suite of determinants comprising arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, cyanide, phenol, speciated PAH[1] and speciated TPH[2]	17	Included testing of samples of made ground and natural soils for the main contaminants of concern identified by the initial CSM, and also took account of observations made during inspection/logging of the samples (including any noted hydrocarbon odours).
2	Asbestos Screen	11	Tests performed on one sample of made ground in which suspected asbestos-containing materials (ACM) were identified during the fieldwork, and a further ten non-targeted samples of made ground from surrounding locations and depths
3	Asbestos quantification by Phase Contrast Optical Microscopy	1	Tests performed on samples in which asbestos fibres were positively identified by the screening tests
4	Total organic carbon (TOC) and Loss On Ignition (LOI)	4	To facilitate an initial assessment of the off-site disposal classification of surplus soils.
5	Waste Acceptance Criteria (WAC) leachate analysis[3]	4	
6	pH and water-soluble sulphate	24	Assessed in conjunction with total (acid soluble) sulphate and total sulphur (performed as part of the suite detailed in Row 2 above) to determine the required design classification for buried concrete

[1] PAH were speciated into the USEPA-16 'priority pollutants'.

[2] TPH were speciated into aliphatic and aromatic fractions in the carbon chain lengths C_5-C_6, C_6-C_8, C_8-C_{10}, C_{10}-C_{12}, C_{12}-C_{16}, C_{16}-C_{21} and C_{21}-C_{35}, and also included BTEX compounds (benzene, toluene, ethylbenzene and xylene)
[3] The leachate tests were performed in accordance with British Standard BS EN12457-3. The tests comprised the suite necessary to assess whether any of the test soils could be classified as inert waste for disposal purposes.

7.2 Groundwater sampling

Groundwater samples from BH1-5 were subjected to analysis for the determinants specified in Rows 1 and 5 of Table 7.1.

7.3 Geotechnical Testing

Seven Particle Size Distribution tests (PSDs) also performed on samples of the natural granular soils recovered from Boreholes CP1-CP5 in order to determine the relative proportions of sand, gravel and clay-silt.

7.4 Results of Laboratory Tests

The contamination and geotechnical laboratory tests were performed by Terra Tek Limited to UKAS and MCERTS accreditation where applicable. The results of the soil contamination tests, groundwater contamination tests and geotechnical tests are presented as Appendices 3, 4 and 5 respectively.

8.0 GROUND CONDITIONS

8.1 Ground Level

The site slopes gently downwards from about 51m Above Ordnance Datum (m AOD) at the site's eastern boundary to about 48m at the site's south-western boundary. A vegetated bank adjacent the south-western boundary slopes steeply downwards towards the River Calder beyond.

8.2 Succession of Strata

Beneath tarmacadam surface cover, the general success of strata encountered in the exploratory holes can be summarised as the following:

- MADE GROUND: Encountered in all boreholes and including loose granular and soft cohesive soils with sand, gravel and cobble sized fragments of sandstone, quartz, brick concrete, tile, glass and clinker, and varying quantities of ash. Proved to depths of between 3.8m (44.35m AOD) and 6.2m bgl (43.22m AOD). The nature of the made ground encountered suggests that it has most likely been end-tipped, without compaction to any form of engineering specification.

- SUPERFICIAL ALLUVIUM: Consisting primarily of medium dense sandy cobbly gravel, with varying layers or lenses of loose to medium dense clayey sand and predominantly firm sandy clay

- PENNINE LOWER COAL MEASURES: Encountered as weak sandstone in Borehole CP5, and weak mudstone/siltstone at Boreholes CP1 and CP2 at depths of between 8.00m and 11.00m bgl (41.42m and 37.53mAOD). Boreholes CP3 and CP4 terminated due to refusal at depths of 15.50m and 12.50m bgl (32.70m and 35.65mAOD) respectively, but it was not clear whether this represented bedrock or dense superficial gravel and cobbles.

8.3 Groundwater

Groundwater strikes were recorded within granular alluvial soil horizons during drilling of the cable percussion boreholes, at depths varying between 6.5m and 9.3m bgl. No groundwater strikes were recorded within the made ground. However, small quantities of water were necessarily added during the drilling process, which may have masked any slow seepages.

Subsequent monitoring of the groundwater levels within standpipe installations targeting the natural superficial soils (Boreholes CP1, CP3, CP4 and CP5) showed the groundwater levels to be approximately constant at about 43mAOD (equating to between approximately 5.9m and 6.4m bgl). Probably the groundwater level within the superficial soils is controlled by the River Calder located adjacent the site to the south-west, and is likely to flow in a direction parallel to the river (i.e. approximately towards the south-east).

The standpipe installations targeting the made ground in Boreholes CP2 and WS2 showed standing groundwater levels at approximately 44mAOD (equating to about 4.5m bgl) for most of the monitoring period, although it was noted that the groundwater level at CP2 had fallen to 42.6mAOD on the final visit made on 9th March. It is noted from the borehole log that the made ground at CP2 below 2m depth contained a high clay content, which may indicate the presence of a locally perched accumulation of groundwater within the made ground beneath the central part of the site. A further line of evidence for this supposition is that the installation fitted to Borehole WS1, which extended to 4.5m bgl (43.75mAOD) remained dry throughout the monitoring period.

8.4 Evidence of Contamination

Small clumps of brown fibrous material suspected to be Asbestos Containing Material (ACM) was observed in the made ground recovered from Borehole CP1 between 2.0m and 4.0m bgl. No visual or olfactory evidence of ground contamination was apparent in any of the other exploratory holes.

9.0 GROUND CONTAMINATION APPRAISAL

9.1 Assessment Methodology

The ground contamination appraisal has been undertaken based on a risk-based approach and incorporating the accepted 'pollutant linkage' outlined in Part IIa of the Environmental Protection Act 1990.

The detailed appraisal of the soil and groundwater contamination at the site has followed the tiered procedure adopted in LCRM and repeated below:

- Development of a Conceptual Site Model (CSM) summarising the identified pollutant linkages at the site (Preliminary Risk Assessment)
- Selection of appropriate generic screening criteria and comparisons to the measured contaminant concentrations (Generic Quantitative Risk Assessment)
- Derivation of site-specific values where the determinants exceed the generic screening criteria (Detailed Quantitative Risk Assessment) as appropriate.

9.2 Preliminary Risk Assessment

The present investigation has confirmed the site to be underlain by made ground to between 3.8m to 6.3m bgl. The made ground included loose granular and soft cohesive soils, and contained fragments of various anthropogenic materials including sandstone, quartz, brick concrete, tile, glass, clinker and ash. However, the made ground appeared broadly visually similar between borehole

positions and with the exception of suspected ACM in one borehole between 2m and 4m depth, no visual or olfactory evidence of ground contamination was noted during the fieldwork.

The made ground is underlain by superficial alluvium, which contains predominantly granular soils and which extends to between approximately 8m (41.4mAOD) and at least 15.5m (32.7mAOD), generally increasing in thickness from about north-east to south-west across the site. Groundwater monitoring indicates the presence of a laterally continuous Groundwater Table within the alluvium (most likely controlled by the adjacent River Calder) and an apparently separate perched groundwater accumulation within the made ground in the vicinity of Boreholes CP2 and WS2.

The investigation included contamination laboratory testing of the made ground, natural soils and groundwater to facilitate a quantitative assessment of the risk to the receptors identified in the initial CSM.

9.3 Quantitative Risk Assessment

For the various receptors identified in the CSM, appropriate screening criteria relevant to the potential 'pollutant linkages' were selected. These are summarised below:

9.3.1 Receptor: Short-term human health (construction workers)

The main exposure pathways to construction workers are skin contact and inhalation of both indoor and outdoor air. The risks of exposure via these pathways are short-term and should be mitigated by taking account of the relevant Health and Safety Executive (HSE) Guidance on Workplace Exposure Limits (EH40/2005, 4th Edition 2020). A Health and Safety Hazard Assessment for the construction works should be undertaken as stipulated under the Construction Design and Management (CDM) Regulations 2015, with due regard to the contamination laboratory test results included in Appendices 3 and 4.

The soil contamination test results (Appendix 3) indicate the presence locally elevated concentrations of arsenic and PAHs within the made ground (Borehole WS01, 0.1-0.4m and CP1 2.0-3.0m, CP5 2.0-3.0m bgl). These are most likely contained within ash and clinker materials present within the made ground, and are therefore likely to also occur at elevated concentrations elsewhere beneath the site.

The made ground between 2m and 4m bgl in Borehole CP1, which were noted to contain fragments of ACM during sampling, were confirmed by laboratory tests to contain loose chrysotile and amosite asbestos fibres from a degraded asbestos insulation board. The concentration of asbestos was subsequently quantified at 1.505% relative to the surrounding soil mass. Laboratory testing of a further ten samples of made ground from across the site did not identify any asbestos fibres, suggesting that asbestos is not widespread in the made ground beneath the site. However, attention is drawn to the possibility of encountering ACM within the made ground at other locations and depths.

In general, for most encounters with exposure to contaminated soils, site personal protective equipment (PPE) consisting of overalls, gloves and suitable protective footwear and headgear is considered appropriate. As asbestos is carcinogenic by inhalation, it is recommended that all works be undertaken in adequately ventilated areas. Respiratory PPE should be provided if man entry to any confined spaces/excavations is required. Further advice on PPE and confined space working is given in HSE Publication HS(G)66 (1991) 'Protection of Workers and the General Public During Development of Contaminated Land'.

The Control of Asbestos Regulations 2012 includes a requirement for site workers to prevent or reduce to the lowest level reasonably practicable the spread of asbestos across the site, and for air monitoring by measurement of asbestos present in the air in circumstances where asbestos-containing materials have the potential to be disturbed. These procedures should be adhered to on site.

9.3.2 Receptor: Long-term human health (site end users) and proposed development end use

The risk to long-term human health (site end users) has been assessed using a combination of appropriate generic assessment criteria for a proposed commercial/industrial development, as described in Science Report SC050021/SR3 (EA, 2009). This is considered appropriate for the understood proposed development of the site.

The results of laboratory analysis of recovered soil samples from the current investigation have been compared directly to GAC selected from the sources below (listed in order of preference). The maximum concentration of each determinant is presented in Table 9.1 together with the adopted assessment criteria.

1. Category 4 Screening Levels (C4SL) published by DEFRA (2014)
2. CLEA Model SGVs, published by the EA (March – June 2009)
3. Suitable for Use Levels (S4ULs) published by Land Quality Management Limited (LQM) and the Chartered Institute of Environmental Health (CIEH) (2015)
4. Specifically with respect to cyanide, GAC have been derived by DTS Raeburn using the CLEA UK (v1.071) Model 2015. The derivation of these GAC has taken account of the relevant TOX data and published literature information regarding chemical properties. The standard parameters for a commercial development end use and a UK sandy loam soil have been assumed.

Where necessary a soil organic matter (SOM) concentration of 2.5% has been assumed. This is considered to be suitably conservative taking account of the results of site-specific laboratory tests for TOC.

Table 9.1 Assessment of soil contamination test results

Determinant	Number of Samples	mg/kg		Source of Criteria	Number and location of exceedances *Maximum exceedance*
		Maximum Value	Assessment Criteria		
Arsenic	17	**1,221.7**	640	1	***WS1, 0.1-0.4m*** **Also at CP1, 2.0-3.0m (1142.6mg/kg)**
Cadmium	17	1.72	410	1	-
chromium (total)	17	355	8,600	3	-
Copper	17	127	68,000	3	-
Lead	17	268	2,300	1	-
Selenium	17	2.3	13,000	2	-
mercury (inorganic)	17	2.02	3,600	2	-
Nickel	17	103	1,800	3	-
Zinc	17	312	730,000	3	-
Boron	17	2.1	240,000	3	-
Phenol [1]	17	5.8	1,500	3	-
total cyanide [2]	17	11.0	16,000	4	-
PAH					
Acenapthene [3]	17	3.29	141	3	-

Determinant	Number of Samples	mg/kg		Source of Criteria	Number and location of exceedances *Maximum exceedance*
		Maximum Value	Assessment Criteria		
Acenaphthylene [3]	17	2.17	212	3	-
anthracene	17	26.05	540,000	3	-
benzo(a)anthracene	17	59.84	170	3	-
benzo(a)pyrene	17	**61.10**	35	3	***CP5, 0.3-1.0m***
benzo(b)fluoranthene	17	**49.81**	44	3	***CP5, 0.3-1.0m***
benzo(g,h,i)perylene	17	34.40	4,000	3	-
benzo(k)fluoranthene	17	34.71	1,200	3	-
Chrysene	17	48.69	350	3	-
dibenzo(a,h)anthracene	17	**8.11**	3.6	3	***CP5. 0.3-1.0m***
Fluoranthene	17	116.74	23,000	3	-
Fluorine [3]	17	3.56	68,000	3	-
indeno(1,2,3-cd)pyrene	17	29.42	510	3	-
Naphthalene [3]	17	3.09	183	3	-
Phenanthrene	17	38.89	22,000	3	-
Pyrene	17	101.19	54,000	3	-
TPH & BTEX					
aliphatic C_5-C_6 [3]	17	<0.01	558	3	-
aliphatic C_6-C_8 [3]	17	<0.01	322	3	-
aliphatic C_8-C_{10} [3]	17	<1	190	3	-
aliphatic C_{10}-C_{12} [3]	17	3	118	3	-
aliphatic C_{12}-C_{16} [3]	17	49	59	3	-
aliphatic C_{16}-C_{35}	17	771	1,600,000	3	-
aliphatic C_{35}-C_{40}	17	59	1,600,000	3	-
aromatic EC_5-EC_7 [3]	17	<0.01	2,260	3	-
aromatic EC_7-EC_8 [3]	17	<0.01	1,920	3	-
aromatic EC_8-EC_{10} [3]	17	<0.01	1,500	3	-
aromatic EC_{10}-EC_{12} [3]	17	8	899	3	-
aromatic EC_{12}-EC_{16} [3]	17	27	37,000	3	-
aromatic EC_{16}-EC_{21}	17	234	28,000	3	-
aromatic EC_{21}-EC_{35}	17	1,110	28,000	3	-
aromatic EC_{35}-EC_{44}	17	56	28,000	3	-
Benzene	17	<0.005	27	1	-
Toluene [3]	17	<0.005	1,920	3	-
Ethylbenzene [3]	17	<0.005	1,220	3	-
m&p-xylene	17	<0.01	1,200	3	-
o-xylene	17	<0.005	478	3	-

[1] Based on a threshold protective of direct skin contact with phenol (most conservative)

[2] Calculated using TOX data for inorganic cyanide (R&D Publication TOX5, DEFRA and EA, 2002)

[3] SGV/GAC capped at the lower of the vapour or aqueous saturation limits in soil

Table 9.1 indicates that the maximum detected concentrations of all of the tested determinants were below the respective GAC with the exception of arsenic (in 2/17 samples tested) and the PAH compounds benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene (in 1/17 samples tested). All of the exceedances were detected in samples of made ground, with no elevated concentrations apparent in the underlying natural superficial deposits.

The CLEA model indicates that for all of these determinants, the primary routes of exposure to humans within a commercial land-use are ingestion of soil or indoor dust and/or dermal contact.

The inhalation pathway contributes less than 1% of total exposure. On this basis, it is considered that the test soils could be retained beneath buildings and external hardstanding areas without presenting an unacceptable risk to long-term human health. However, mitigation measures will be necessary for any areas of soft landscaping. Further discussions and recommendations in this regard are included in 9.5 below.

Asbestos

As discussed in Section 9.3.1 above, loose chrysotile and amosite asbestos fibres were identified in one sample of made ground (of eleven tested) and was subsequently quantified at a concentration of 1.505% relative to the surrounding soil mass.

Asbestos in soils presents a risk to human health only if fibres are able to be released into the air and subsequently inhaled. This is generally unlikely to be the case given that the ACM encountered were present at over 2m depth beneath the site. However, it is recommended that any surplus soil arisings generated from the proposed development (including the construction of foundations) are not retained within the uppermost 0.5m of soils beneath landscaping areas. It is also recommended that any new underground services are placed within a corridor of clean fill material, in order that future maintenance operatives do not come into contact with soils impacted by asbestos and other contaminants. This issue is discussed further in Section 9.5 below. The presence of localised ACM within the made ground should also be recorded in the Health and Safety file for the site.

9.3.3 Receptor: Controlled Waters

Neither the soil contamination test results (reviewed in Section 9.2.3 above) nor site observations indicate the presence of widespread contamination in soils beneath the site. However, the investigation has confirmed the presence of a laterally continuous Groundwater Table within the alluvium beneath the site, and thus indicated a potentially active pollutant linkage with respect to controlled waters. A quantitative assessment has therefore been undertaken in this regard by means of laboratory testing of groundwater samples recovered from the standpipe installations fitted to Boreholes CP1-CP5 on 16th February 2021.

Table 9.2 summarises the results of the laboratory analyses and compares the maximum detected concentrations of the tested determinants to GAC selected from the following sources (listed in order of preference), as specified in the Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015:

1. Environmental Quality Standards (EQS) for individual substances in inland surface water.
2. Groundwater Threshold Values (GW-TV) for drinking water protected areas

Table 9.2 Assessment of groundwater contamination test results (16th February 2021)

Determinant	Number of Samples	µg/l		Location of Exceedance(s) *Maximum exceedance*
		Maximum Value	GAC (source)	
arsenic	5	6.1	7.5 (2)	-
cadmium	5	**0.80**	0.25 (1)	***CP1***
chromium (total)	5	3.21	4.7 (1)	-
copper	5	5.28	28 (1)	-
lead	5	<0.01	1.2 (1)	-
mercury (inorganic)	5	<0.05	0.75 (1)	-
selenium	5	**10.7**	10 (1)	***CP1***
nickel	5	**79.7**	15 (2)	***CP1*. Also at CP5 (15.4 µg/l)**
zinc	5	19.3	50 (1)	-

Determinant	Number of Samples	µg/l		Location of Exceedance(s) *Maximum exceedance*
		Maximum Value	GAC (source)	
phenol	5	<0.50	7.7 (1)	-
cyanide	5	0.02	1 (1)	-
boron	5	0.25	750 (2)	-
PAH				
naphthalene	5	<0.01	2.0 (1)	-
anthracene	5	<0.01	0.1 (1)	-
fluoranthene	5	**0.29**	0.0063 (1)	***CP2***
benzo(a)pyrene	5	**0.232**	0.00017 (1)	***CP2*. Also at CP5 (0.011µg/l)**
benzo(b)fluoranthene	5	**<0.289**	0.075 (2)	***CP2*. Also at CP5 (0.0132µg/l)**
TPH				
aliphatic C_5-C_6	5	<10		-
aliphatic C_6-C_8	5	<10		-
aliphatic C_8-C_{10}	5	<10		-
aliphatic C_{10}-C_{12}	5	<10		-
aliphatic C_{12}-C_{16}	5	<10		-
aliphatic C_{16}-C_{21}	5	<10		-
aliphatic C_{21}-C_{35}	5	<10		-
aromatic EC_5-EC_7	5	<10	10[1]	-
aromatic EC_7-EC_8	5	<10		-
aromatic EC_8-EC_{10}	5	<10		-
aromatic EC_{10}-EC_{12}	5	<10		-
aromatic EC_{12}-EC_{16}	5	<10		-
aromatic EC_{16}-EC_{21}	5	<10		-
aromatic EC_{21}-EC_{35}	5	<10		-
aromatic EC_{35}-EC_{44}	5	<10		-
benzene	5	<1	0.75 (1)	-
toluene	5	<1	74 (2)	-
ethylbenzene	5	<1	10[1]	-
m&p-xylene	5	<2	10[1]	-
o-xylene	5	<1	10[1]	-
MTBE	5	<1	10[1]	-

[1] in the absence of published assessment criteria for these determinants, a notional screening value of 10µg/l has been adopted.

Table 9.2 shows that the maximum detected concentrations of the majority of the tested determinants were below the respective GAC. However, elevated concentrations of dissolved metals (cadmium, nickel and selenium) were detected in the groundwater sample recovered from Borehole CP1, whilst concentrations of the PAH compounds fluoranthene, benzo(a)pyrene and benzo(b)fluoranthene in excess of the GAC were detected in the groundwater sample at Borehole CP2.

A repeat round of groundwater sampling was therefore undertaken on 9th March 2021 in order to further assess whether the distribution of these results was consistent over a longer timer period, or whether the results were indicative of a 'snapshot' of dissolved contaminants being transported in mobile groundwater beneath the site. Unfortunately, it was not possible to recover a second groundwater sample from Borehole CP1 due to the cover of the installation having been damaged during ongoing site activities. However, an assessment of the results of analysis of the groundwater samples from Boreholes CP2 to CP5 (included in Appendix 4) indicated the following:

- The concentrations of PAH compounds detected in groundwater at CP2 on the second visit remained broadly consistent with those detected on the first visit, as summarised in Table 9.3 below:

Table 9.3 PAH concentrations detected in groundwater at CP2 (16th February versus 9th March 2021)

PAH compound	µg/l	
	Concentration at CP2 (16.02.21)	Concentration at CP2 (09.03.21)
naphthalene	<0.01	<0.01
anthracene	<0.01	0.016
fluoranthene	**0.29**	**0.31**
benzo(a)pyrene	**0.232**	**0.189**
benzo(b)fluoranthene	**<0.289**	**0.214**

- Concentrations of all PAH compounds were below test detection limits in the groundwater sample recovered from Borehole CP5 on 9th March 2021

- No exceedances of the GAC for the other tested determinants were exceeded in any of the boreholes. This indicates that the elevated concentrations of dissolved metals detected in groundwater at CP1 on 16th February have not migrated in groundwater towards the River Calder, and also provides assurance that the elevated arsenic concentrations detected in the made ground at Boreholes CP1 and WS1 have not leached into the underlying groundwater at unacceptable concentrations.

A further discussion of the exceedances of dissolved cadmium, nickel, selenium and PAH compounds in groundwater, taking account of the above observations is as follows:

- The laboratory test data has indicated that the distribution of dissolved metals in groundwater is localised to the vicinity of Borehole CP1. The investigation has indicated that the groundwater within the alluvial soils beneath the site is controlled by the River Calder, and therefore probably flows from approximately north-west to south-east across the site. This suggests that Borehole CP1, which was positioned in approximately the north-western corner of the site, is at an up-gradient location and that the test results may therefore indicate influence from an off-site source

- The test results for both rounds of groundwater sampling show that exceedances of the GAC for PAH compounds were detected only at Borehole CP2. The installation fitted to CP2 targeted made ground that had a relatively high clay content. The test results are therefore consistent with the groundwater at CP2 representing a locally perched accumulation within the made ground. These observations, together with the evidently lower concentrations of PAH (generally below test detection limits) in the remaining groundwater samples suggest that the localised elevated PAH concentrations in the vicinity of CP2 do not present an unacceptable risk to the Groundwater Table within the underlying alluvium, or the adjacent River Calder.

On the basis of the foregoing, it is considered that ground contamination beneath the site presents a sufficiently low risk to controlled waters. However, in accordance with normal practice for the development of Brownfield sites, procedures should be identified for dealing with unforeseen

contamination in the event that this becomes apparent during development. It is also recommended that infiltration drainage is not constructed within the made ground, in order to reduce the risk of mobilisation of any contaminants from soils into groundwater as a result of water infiltration. Further recommendations in this regard are included in Section 9.5 below.

9.4 Ground Gas

Table 9.4 summarises the soil gas monitoring results recorded on four occasions in February and March 2021. The full results are included in Table A which immediately follows the report text.

Table 9.4 Summary of soil gas monitoring data

Number of monitoring visits:	4	**Dates of monitoring visits:**			16/02/2021, 26/02/2021, 02/03/2021, 09/03/2021		
	Pressure (mb)	**CH_4 (%)**	**CO_2 (%)**	**CO (ppm)**	**H_2S (ppm)**	**O_2 (%)**	**Flow (l/hr)**
Maximum concentration	1033	0.1	7.2	7	0	21.7	3.3
Minimum concentration	1004*	0.0	0.2	0	0	11.5	-2.7

* undertaken during a period of low and rapidly falling atmospheric pressure.

Elevated gas flow rates of 3.3, 2.3 and 1.2litres/hour were measured in Boreholes CP05 and CP03 on three occasions however, the flow rates were observed to steadily decrease over a period of 5 minutes. The measured gas flow rates are therefore indicative of localised trapped gas within the borehole headspace, which is unlikely to be representative of long-term steady state conditions. However, in keeping with a precautionary approach a worst case scenario gas flow rate of 3.3litres/hour has been assumed.

The assessment framework presented in CIRIA Report C665 (2007) recommends that the requirement for soil gas protection to new buildings should be determined based on a 'gas screening value (GSV)', calculated by multiplication of the maximum methane (CH_4) or carbon dioxide (CO_2) concentrations (whichever is the higher) by the corresponding gas flow rate. Based on the data summarised above the calculated GSV is 0.2376 litres/hour which falls under 'Characteristic Situation' Classification CS-2. This classification is also consistent with the ground conditions encountered beneath the site, which include up to 6m of made ground with a relatively low organic content, as well as being suitably conservative for circumstances where CO_2 is measured at concentrations in excess of 5% by volume (even if the corresponding gas flow rates are lower).

British Standard BS8485:2015+A1,2019 introduces a point score system to achieve the required gas protection, taking account of both the CS classification and the proposed building type (classified as Type A – Type D in order of decreasing sensitivity). BS8485 advises that large industrial buildings can be classified as 'Type D' structures (least sensitive) with the proviso that small rooms within these buildings are classified separately. On this basis, it is recommended that the proposed retail store buildings be fitted with gas protection affording a minimum point score of 1.5 as defined by BS8485. However, any smaller rooms including, but not limited to offices, store rooms and toilets should be classified as 'Type C' and increased protection, affording a minimum point score of 2.5 fitted accordingly.

The above guidance does not take account of carbon monoxide (CO) in providing its recommendations. There are no published authoritative assessment criteria for CO concentrations measured in boreholes, but EH40/2005 (4th Edition) includes a long-term Workplace Exposure Limit of 20ppm, measured in indoor air over an 8-hour time-weighted average. This threshold was not exceeded in any of the standpipe installations during the monitoring period. On this basis, no additional protection measures to the proposed buildings are considered necessary with respect to CO.

9.5 Effect of Ground Contamination on Proposed Development

The levels of ground contamination detected in the existing made ground has been found to contain arsenic and PAH compounds at concentrations in excess of the respective GAC for a commercial development.

The levels of contamination detected in the tested soils and groundwater beneath the site are considered suitable for retention beneath the proposed development without presenting an unacceptable risk to human health, the proposed development end use and controlled waters, subject to implementation of the following mitigation measures:

- Placement of a minimum 500mm-thickness of suitably clean 'capping' material above any areas of proposed landscaping, in order to mitigate the risk of exposure by future site users to localised elevated concentrations of arsenic, PAH and asbestos in soil. Alternatively, given that the investigation has indicated that the distribution of these contaminants is not widespread, consideration could be given to undertaking further sampling and testing beneath the proposed landscaped areas which may enable a reduction in the extent of 'capping' material required

- Placement of buried services in a corridor of clean fill material, to mitigate the risk of exposure by future maintenance workers to contamination in soils

- No form of infiltration drainage should be constructed within the made ground

- Provision of ground gas protection affording a minimum point score of 1.5 for the sales floor and warehouse areas of the proposed building, or 2.5 for any smaller rooms (in accordance with BS8485:2015+A1,2019)

- Identification of procedures for dealing with unforeseen contamination, in the event that this is encountered during development. Specifically, if unforeseen contamination is encountered or suspected, works in the affected area should cease and the affected materials inspected, sampled and tested as necessary by a suitably qualified environmental specialist. If the results of the inspection and testing show that remediation is necessary, proposals should be communicated to the Local Planning Authority prior to implementation.

9.6 Off-site Disposal of Surplus Soils

The off-site disposal of all surplus soils from the site is subject to the tip operator's certification and should be determined by reference to the soil contamination test results included in Appendix 3. The comments below are offered only for general guidance.

The concentrations of arsenic, TPH, asbestos and TOC detected in the made ground from Boreholes WS1 (0.1-0.4m bgl), CP1 (2.00-3.00m bgl) and CP5 (0.3-1.00m bgl) are sufficiently high to place the affected soils into the hazardous waste classification for off-site disposal.

The remaining samples of made ground could be classified for off-site disposal as non-hazardous waste provided that the hazardous and non-hazardous waste materials could be segregated. However, such segregation is unlikely to be possible on the basis of site observations, and further testing of surplus made ground may therefore be necessary prior to disposal.

The results indicate that the natural soils could be classified for off-site disposal as inert waste under the Landfill (England and Wales) (Amendment) Regulations 2004 provided that they were segregated from the made ground prior to disposal. This should be possible from site observations.

10.0 ENGINEERING PROPERTIES OF STRATA

10.1 *In situ* Standard Penetration Tests

Standard Penetration Tests (SPTs) were performed at regular depth intervals during drilling of the boreholes. Each test result is expressed as an N-value, which is the blow-count from a calibrated drop hammer needed to cause a standard penetrometer to advance 300mm into the ground.

The SPT N-values are given on the respective borehole logs and have been plotted against depth below existing ground level on Figure 5. Some of the high SPT N-values obtained appeared to have been influenced by large gravel or cobbles and have been corrected.

The plot shows that in the top 5m the soils (which consist predominantly of made ground) are mostly soft or loose, while from about 7m bgl the natural soils are firm or medium dense. Mudstone/siltstone and sandstone rock was encountered in Boreholes CP2 at 11m bgl and CP5 at 8m bgl, and SPT N-values of 50 or greater were recorded in these materials.

10.2 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were undertaken on seven samples of the natural granular soils. The results of the tests and the corresponding engineering classification of the soils are summarized in Table 10.1.

Table 10.1 Particle Size Distribution test results

Location and Depth (m)	Soil Type	Fraction size range (mm)			
		cobbles 200-60	**gravel** 60-2	**sand** 2-0.06	**silt+clay** ≤0.06
CP1; 7.0-8.0	Clayey/silty, very sandy, slightly cobbly GRAVEL	4.1	46.9	30.3	18.7
CP1; 9.5-11.0	Clayey/silty, sandy GRAVEL	0.0	73.5	11.8	14.7
CP2; 7.0-8.0	Clayey/silty, sandy, cobbly GRAVEL	13.2	59.8	15.3	11.7
CP2; 10.0-11.0	Slightly clayey/silty, slightly sandy, slightly cobbly GRAVEL	1.0	90.8	4.4	3.8
CP3; 5.0-6.0	Very clayey/silty, slightly gravelly SAND	0.0	0.7	65.5	33.8
CP4; 4.0-5.0	Very clayey/silty, slightly gravelly, slightly cobbly SAND	0.6	4.3	60.2	34.9
CP4; 8.0-9.0	Slightly clayey/silty, sandy, cobbly GRAVEL	6.6	77.2	14.4	1.8

11.0 GEOTECHNICAL ASSESSMENT

11.1 Proposed development

It is understood that the proposed development will comprise a retail food store in the western section, car parking in the central and eastern section together with a new retaining wall at the south-western boundary of the site

11.2 Foundations

At the location of the proposed retail store there is about 5m of made ground which comprises both cohesive and granular materials of low strength/density. Conventional shallow pad or strip foundations bearing in the made ground are not considered feasible. Unacceptable levels of settlement are also expected from a raft foundation. The new store could however be supported on piled foundations.

The use of either driven piles or continuous flight auger (CFA) piles would be feasible. For general guidance purposes, Table 11.1(a) gives the estimated design bearing resistance of a single vertical driven concrete jointed pile of square cross-section l x l and length L, whilst Table 11.1(b) gives the estimated design bearing resistance of a single CFA pile of diameter d and length L. The length L in both tables relates to ground level as it existed at the time of the present investigation.

Table 11.1(a) Estimated design bearing resistance of a single driven concrete jointed pile of square cross-section *l* x *l* and length *L*

pile length *L* (m bgl)	estimated design bearing resistance (kN)				
	0.25x0.25m	0.3x0.3m	0.35x0.35m	0.4x0.4m	0.45x0.45m
11	195	265	345	430	530
13	315	425	550	690	845

Driven piles should be spaced at a distance $s \geq P$, where P represents the perimeter of the larger of two adjacent piles.

Table 11.1(b) Estimated design bearing resistance of a single CFA pile of diameter *d* and length *L*

pile length *L* (m bgl)	estimated design bearing resistance (kN)				
	d=0.3m	d=0.35m	d=0.4m	d=0.45m	d=0.5m
11	210	270	335	405	485
13	340	435	535	650	775

CFA piles should be spaced at a minimum distance $s \geq 3d$, where d represents the diameter of the larger of two adjacent piles.

At some locations (such as in the vicinity of Borehole CP2), some of the piles may reach the engineering rockhead at about 11m bgl, and these piles may achieve higher bearing resistances.

Attention is drawn to the reported presence of cobbles, both within the made ground and natural soils which may cause difficulties with regard to pile installation.

Eurocode 7 recommends that pile bearing resistance should be determined from loading tests, and that calculations should be regarded only as preliminary estimates.

It is recommended that advice on the pile type and design should be obtained from specialist piling contractors for their proprietary piling systems.

Floor Slab

The use of ground-bearing floor slab is expected to result in unacceptable total and differential settlement due to the poor strength and compressibility of the made ground. It is recommended that the floor slab is suspended.

11.3 Retaining Walls

Figure 4 indicates that two retaining walls are to be constructed adjacent to the south-western boundary of the site. The retained height of these walls is not known, however, from visual inspection it is estimated that the ground levels at the base of the embankment near the river was approximately 5m lower than the site level at the south-west section, at the time of the investigation.

Boreholes CP3-CP5 and WS3 were positioned in the vicinity of the proposed retaining walls. On the basis of the soil materials encountered and SPT N-values, the following soil parameters could be used for retaining wall design:

- Effective angle of internal shearing resistance $\varphi'_k \approx 26.5^\circ$
- Effective cohesion *c'* should be taken as zero
- Soil weight density $\gamma_k \approx 20 kN/m^3$
- Groundwater levels are indicated to lie at about 5m bgl (about 43.0m AOD).

It is recommended that free-draining granular fill with a characteristic effective angle of shearing resistance of at least $(\varphi'_k) \approx 30^\circ$ is placed behind the retaining walls and that suitable drainage is provided in order to avoid the build-up of pore water pressure in the retained material.

11.4 New Pavements

Existing hardstanding should be removed and the formation level proof-rolled. Any soft, loose, organic or otherwise unfavourable materials should be excavated and replaced by suitably compacted hardcore. A design CBR value of less than 2% is considered appropriate for the existing ground conditions. However, this should be confirmed through a scheme of *in situ* CBR testing undertaken following the finalisation of the proposed site levels. New pavement should be flexible.

11.5 Drainage

The construction of soakaways in the made ground beneath the site should be avoided due to the increased risk of mobilising contaminants (specifically arsenic, TPH and PAH compounds) which have been shown to be present. The placement of soakaways in made ground is not generally recommended in any case due to the inherent variability of such material.

The falling head permeability test (Appendix 2) and groundwater monitoring data (Table A) show that the underlying naturally alluvium is highly saturated. On this basis, it is considered that soakaway drainage will not be viable for the proposed development.

11.6 Buried Concrete

Measurements of the soluble sulphate content of sixteen soil and five groundwater samples indicate a 'characteristic' value of 500mg/l. This falls into Design Sulphate Class DS-2. The soil and groundwater pH values, together with the presence of a laterally continuous groundwater table beneath the site indicate an Aggressive Chemical Environment for Concrete (ACEC) Class of AC-2.

12.0 LIMITATIONS AND USE OF THIS REPORT

IMPORTANT: This section should be read before reliance is placed on any of the opinions, advice, recommendations and conclusions contained in this report.

a) This report has been prepared at the request of Morbaine Limited ('the Client') pursuant to their appointment of DTS Raeburn Limited in connection with the investigation;

b) Except for Morbaine Limited, no duty is undertaken or warranty or representation made to any party in respect of the opinions, advice, recommendations or conclusions contained in this report;

c) All work carried out in preparing this report has used, and is based upon DTS Raeburn's professional knowledge and understanding of the current (February 2021) relevant standards, codes, technology and legislation. Changes in the above may cause the opinion, advice, recommendations or conclusions set out in this report to become inappropriate or incorrect. However, in giving its opinions, advice, conclusions and recommendations, DTS Raeburn have considered pending changes to environmental legislation and regulations of which they are currently aware. Following delivery of this report, DTS Raeburn will have no obligation to advise the Clients of any such changes or of their repercussions. It may therefore be necessary to review the opinions, advice, recommendations and conclusions of this report following future changes to legislation;

d) Some of the information referenced and included in the report has been provided by third parties and whilst DTS Raeburn has no reason to doubt the accuracy, these items have not been verified. DTS Raeburn accepts no responsibility for errors within third party materials referenced and presented in this report;

e) DTS Raeburn acknowledge that they are being retained, in part, because of their knowledge and experience with respect to geotechnical and environmental matters. DTS Raeburn will consider and analyse all information provided in the context of their knowledge and experience and all other relevant information known to DTS Raeburn. To the extent that the information provided to DTS Raeburn is not inconsistent and/or incompatible therewith, DTS Raeburn shall be entitled to rely upon and assume, without independent verification, the accuracy and completeness of all such information and shall have no obligation to verify the accuracy and completeness of such information,

f) The opinions expressed in this report are based on the ground conditions revealed by investigation, together with an assessment of the site and of 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 only for guidance and no liability can be accepted for their accuracy;

g) The groundwater and ground gas conditions entered on the various records are those observed at the time of investigation and subsequent monitoring. Groundwater is subject to seasonal variation or changes in local drainage conditions. Ground gas levels may vary depending on variations in weather conditions particularly barometric pressure. Rates of decomposition / degradation of organic matter in the underlying soils can also affect the generation of ground gases.

h) The content of this report represents the professional opinion of experienced geotechnical and environmental specialists/consultants. DTS Raeburn does not provide associated legal advice and appropriate legal advice should be sought if required.

i) The lack of evidence of the presence of hazardous materials, voids or obstructive features at the subject property does not guarantee the absence of such materials, rather it indicates only that none were found as a result of the services provided.

DTS RAEBURN Ltd

E13431/1 – March 2021

References

- BGS Online Geological Data
  http://www.bgs.ac.uk/opengeoscience/home.html
- British Standards Institution
  BS 10175:2011 + A2:2017
  Investigation of Potentially Contaminated Sites: Code of Practice
- Environment Agency
  Model procedures for the management of land contamination (CLR11)
  2004
- British Standards Institution
  BS 5930:2015
  Code of Practice for Ground Investigations
- Health and Safety Executive
  Protection of Workers and the General Public During Development of Contaminated Land
  HSE Publication HS(G)66
  1991
- CL:AIRE and CIEH
  Guidance on Comparing Soil Contamination Data with a Critical Concentration
  2008
- Environment Agency Contaminated Land Assessment (CLEA) UK Model (Version 1.06)
  Science Reports SC050021/SR2, SR3, arsenic, cadmium, mercury, selenium, nickel, phenol, benzene, toluene, ethylbenzene and xylene SGVs
  2009
- Nathanial, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanial, J.F.
  The LQM/CIEH S4ULs for Human Health Risk Assessment. Land Quality Press, Nottingham (as amended)
  2015
- Department for Environment, Food and Rural Affairs and the Environment Agency
  R&D Publication SGV 6 (lead)
  R&D Publications TOX 5 (inorganic cyanide) and TOX 6 (lead)
  2002
- Health and Safety Executive
  Workplace Exposure Limits 3rd edition
  HSE Publication EH40/2005
  2018
- BRE
  Concrete in Aggressive Ground
  Special Digest 1 (3rd Edition)
  2005
- The Landfill (England and Wales) (Amendment) Regulations 2004
  Statutory Instrument 2004 No 1375
- Environment Agency
  WM3 - Guidance on the classification and assessment of waste
  2015
- British Standards Institution
  BS EN 12457-3:2002
  Characterisation of waste
- British Standards Institution
  BS EN 1997-1:2004+A1:2013
  Geotechnical design – general rules
- British Standards Institution
  BS EN 1997-2:2007
  Geotechnical design – ground investigation and testing
- British Standards Institution
  UK National Annexes to BS EN 1997-1:2004+A1:2013 & BS EN 1997-2:2007
- British Standards Institution
  BS EN ISO 14688-1:2002+A1:2013
  Geotechnical investigation and testing – Identification and classification of soil – Part 1: Identification and description
- British Standards Institution
  BS EN ISO 14688-2:2002+A1:2013
  Geotechnical investigation and testing – Identification and classification of soil – Part 2: Principles for a classification
- British Standards Institution
  BS EN ISO 22476-2:2005+A1:2011
  Geotechnical investigation and testing. Field testing. Dynamic probing
- British Standards Institution
  BS EN ISO 22476-3:2005+A1:2011
  Geotechnical investigation and testing. Field testing. Standard penetration test

TABLE A - GAS AND GROUNDWATER MONITORING RESULTS

Project: E13431/1 – Mirfield

Date: 16/02/21
Atmospheric Pressure: 1004 mb (falling)
Weather: Overcast, dry

Borehole	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Flow Rate (l/hr)		Gas Concentration (by volume)									
					CH_4 (%)		CO_2 (%)		O_2 (%)		H_2S (ppm)		CO (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady
Calibration	-	-	-	-	0.0	0.0	0.0	0.0	21.6	21.6	0	0	0	0
CP01	5.84	42.82	0.0	0.0	0.0	0.0	1.0	1.0	20.8	20.8	0	0	7	6
CP02	4.48	44.05	0.0	0.0	0.0	0.0	0.7	0.7	20.3	20.3	0	0	0	0
CP03	5.12	43.08	0.0	0.0	0.0	0.0	2.3	2.1	17.6	17.6	0	0	4	3
CP04	5.02	43.13	0.1	0.0	0.0	0.0	0.2	0.2	21.6	21.6	0	0	0	0
CP05	6.22	43.2	2.3	0.0	0.0	0.0	1.3	1.3	19.6	19.6	0	0	6	6
WS01	DRY	DRY	0.0	0.0	0.0	0.0	0.6	0.6	21.7	21.7	0	0	0	0
WS02	4.10	44.28	0.0	0.0	0.0	0.0	0.3	0.3	21.6	21.6	0	0	0	0
WS03	4.43	44.08	0.0	0.0	0.0	0.0	6.1	6.1	11.9	11.9	0	0	0	0

Date: 26/02/2021
Atmospheric Pressure: 1030mb (steady)
Weather: Overcast, dry

Borehole	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Flow Rate (l/hr)		Gas Concentration (by volume)									
					CH_4 (%)		CO_2 (%)		O_2 (%)		H_2S (ppm)		CO (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady
Calibration	-	-	-	-	0.0	0.0	0.0	0.0	20.4	20.4	0	0	0	0
CP01	6.07	42.59	0.0	0.0	0.0	0.0	0.5	0.5	20.6	20.6	0	0	0	0
CP02	4.56	43.97	0.0	0.0	0.0	0.0	0.5	0.5	20.2	20.2	0	0	0	0
CP03	5.24	42.96	0.0	0.0	0.0	0.0	1.5	1.5	18.2	18.2	0	0	0	0
CP04	5.13	43.02	0.0	0.0	0.0	0.0	0.8	0.8	18.3	18.3	0	0	0	0
CP05	6.32	43.1	0.0	0.0	0.0	0.0	0.4	0.4	20.8	20.8	0	0	0	0
WS01	Unable to locate beneath caravans													
WS02	4.11	44.27	0.0	0.0	0.0	0.0	0.4	0.4	20.3	20.3	0	0	0	0
WS03	4.45	44.06	0.0	0.0	0.0	0.0	7.2	7.2	12.6	12.6	0	0	0	0

Date: 02/03/2021
Atmospheric Pressure: 1033mb (steady)
Weather: Overcast, dry

Borehole	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Flow Rate (l/hr)		Gas Concentration (by volume)									
					CH_4 (%)		CO_2 (%)		O_2 (%)		H_2S (ppm)		CO (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady
Calibration	-	-	-	-	0.0	0.0	0.0	0.0	21.4	21.4	0	0	0	0
CP01	6.11	42.55	0.0	0.0	0.0	0.0	1.0	1.0	20.4	20.4	0	0	3	3
CP02	4.59	43.94	0.0	0.0	0.0	0.0	0.6	0.6	20.2	20.2	0	0	0	0
CP03	5.33	42.87	1.2*	0.1	0.0	0.0	3.8	3.8	14.2	14.2	0	0	1	0
CP04	5.24	42.91	-2.7	-2.7	0.0	0.0	0.7	0.7	19.2	19.2	0	0	1	1
CP05	6.15	43.27	0.0	0.0	0.0	0.0	0.6	0.6	20.6	20.6	0	0	0	0
WS01	DRY	-	0.0	0.0	0.0	0.0	0.8	0.8	21.5	21.5	0	0	0	0
WS02	Unable to locate beneath caravans													
WS03	4.63	43.88	0.0	0.0	0.0	0.0	6.8	6.7	14.1	14.1	0	0	0	0

*flow rate observed to steadily decrease over period of 5 minutes.

Date: 09/03/2021
Atmospheric Pressure: 1013mb (steady)
Weather: Overcast, Rain Showers

Borehole	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Flow Rate (l/hr)		Gas Concentration (by volume)									
					CH_4 (%)		CO_2 (%)		O_2 (%)		H_2S (ppm)		CO (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady
Calibration	-	-	-	-	0.0	0.0	0.0	0.0	20.9	20.9	0	0	0	0
CP01	Borehole installation inaccessible due to damaged cover													
CP02	4.66	43.87	-0.1	-0.1	0.1	0.1	0.7	0.7	19.4	19.5	0	0	0	0
CP03	4.74	42.46	-0.3	-0.2	0.0	0.0	4.3	4.3	11.5	11.7	0	0	1	0
CP04	5.65	42.50	-0.1	0.0	0.1	0.1	1.0	0.9	17.6	17.7	0	0	1	0
CP05	6.42	43.00	3.3	0.2*	0.1	0.1	1.5	1.5	18.7	18.8	0	0	0	0
WS01	DRY	-	-0.3	-0.2	0.0	0.0	0.8	0.8	19.8	19.9	0	0	0	0
WS02	4.20	44.18	0.0	-0.1	0.0	0.0	0.4	0.4	20.4	20.4	0	0	0	0
WS03	4.74	43.77	0.1	0.1	0.1	0.0	6.8	6.8	13.3	13.5	0	0	0	0

*flow rate observed to steadily decrease over period of 5 minutes. Minimum value recorded shown.

Date: 03/11/2023
Atmospheric Pressure: 974mb (steady)
Weather: Overcast, Rain Showers

Borehole	Groundwater Level (m bgl)	Groundwater Level (m AOD)	Flow Rate (l/hr)		Gas Concentration (by volume)									
					CH_4 (%)		CO_2 (%)		O_2 (%)		H_2S (ppm)		CO (ppm)	
			Peak	Steady	Peak	Steady	Peak	Steady	Min.	Steady	Peak	Steady	Peak	Steady
Calibration	-	-	-	-	0.1	0.1	0.1	0.1	21.6	21.6	0	0	0	0
CP01	Borehole installation inaccessible due to damaged cover													
CP02	4.02	44.51	0.0	0.0	0.1	0.1	1.3	1.3	20.1	20.1	0	0	1	0
CP03	Unable to locate – demolition rubble													
CP04	4.72	43.43	0.0	0.0	0.1	0.1	1.0	1.0	20.4	20.4	0	0	0	0
CP05	Unable to locate – demolition rubble													
WS01	DRY	-	0.0	0.0	0.5	0.3	1.7	1.7	19.9	19.9	0	0	0	0
WS02	4.15	44.23	0.0	0.0	0.1	0.1	1.1	1.1	20.3	20.3	0	0	0	0
WS03	Unable to locate – demolition rubble													

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FIGURE 1

Site Location Plan
NOT TO SCALE

E13431/1: Huddersfield Road, Mirfield
Prepared for: Morbaine Limited

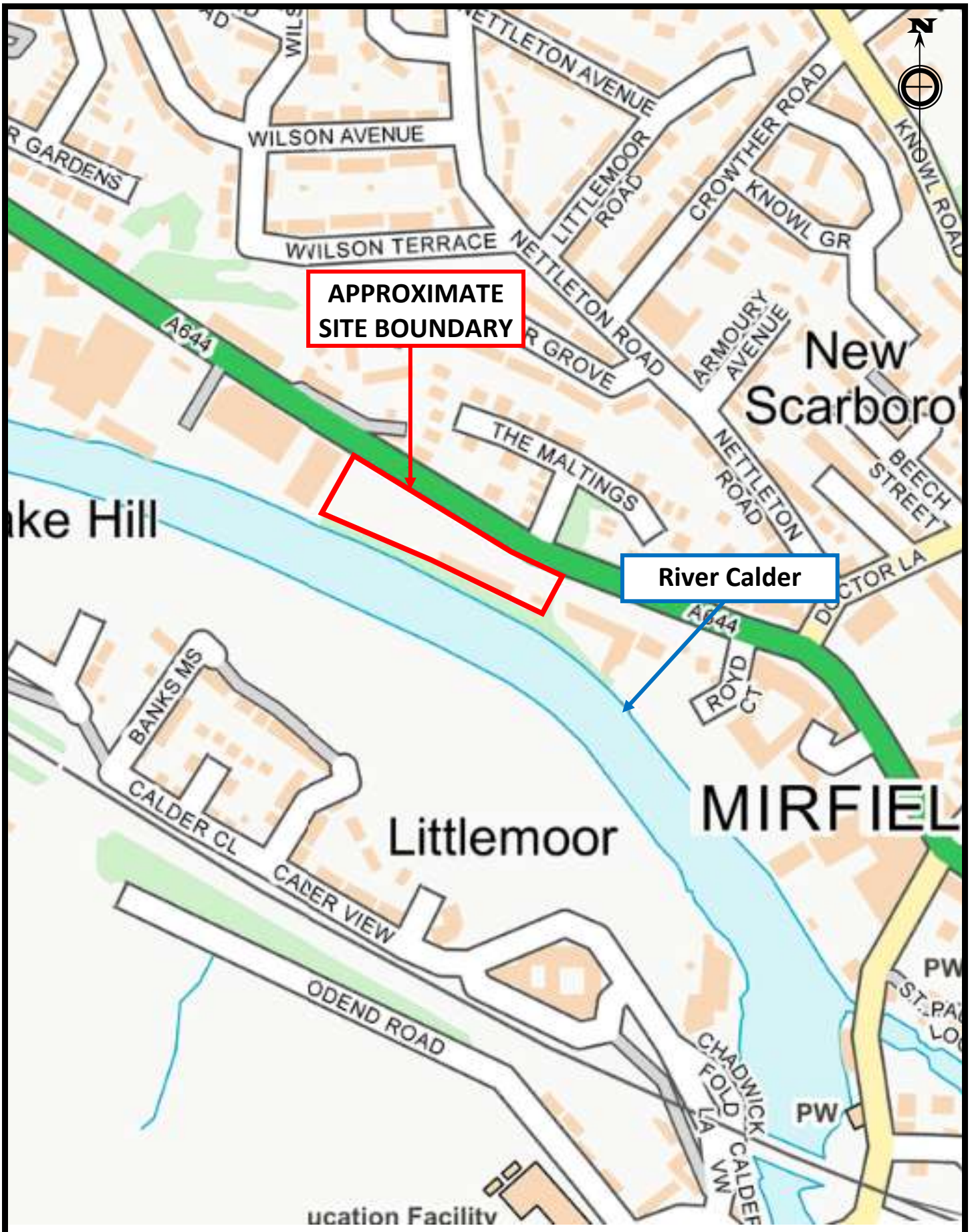

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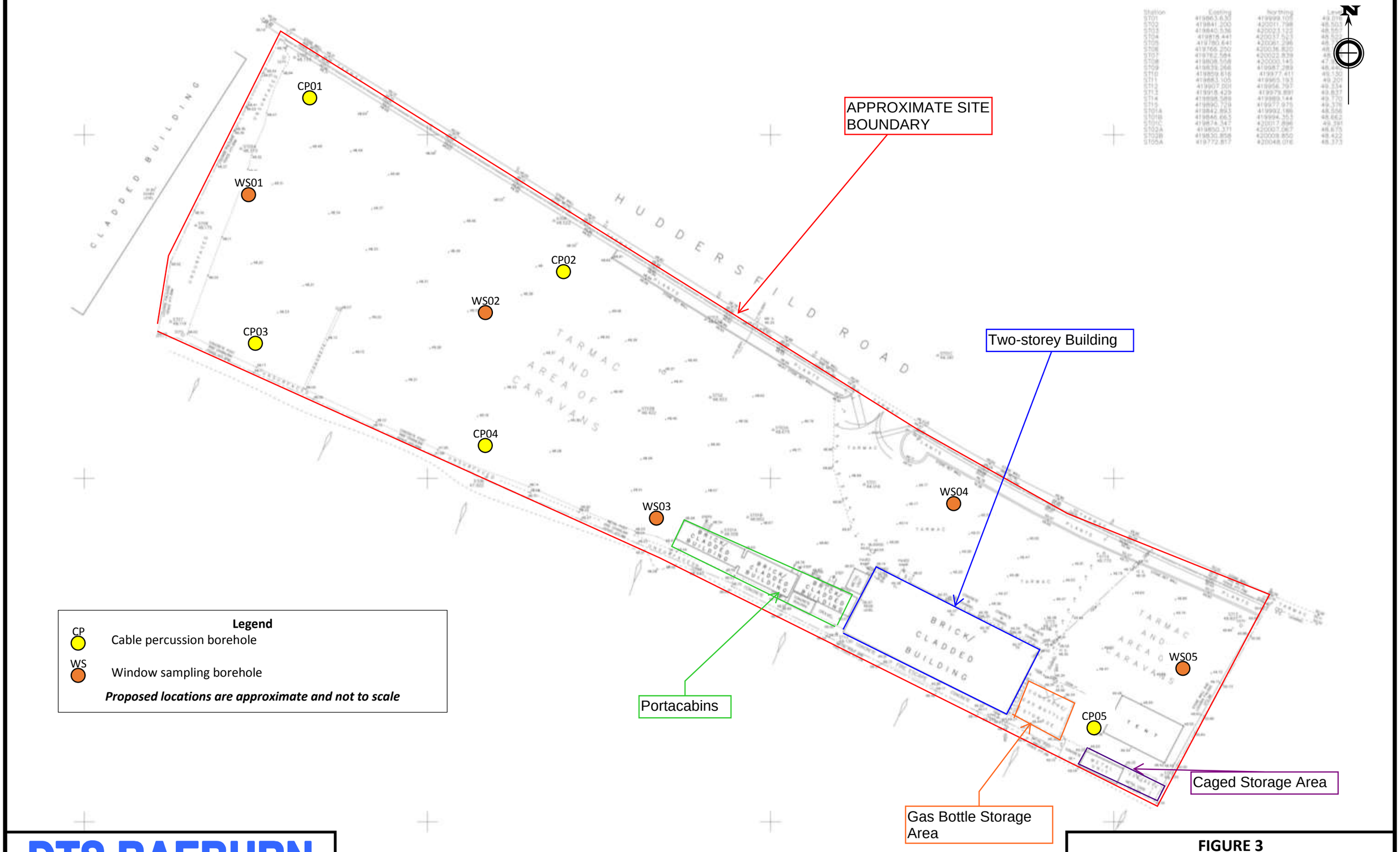
FIGURE 2

Street Plan
NOT TO SCALE

E13431/1: Huddersfield Road, Mirfield
Prepared for: Morbaine Limited



Legend

CP — Cable percussion borehole

WS — Window sampling borehole

Proposed locations are approximate and not to scale

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FIGURE 3

Exploratory Hole Location Plan
Scale 1:500 @ A3

E13431/1 – Huddersfield Road, Mirfield
Prepared for: Morbaine Limited

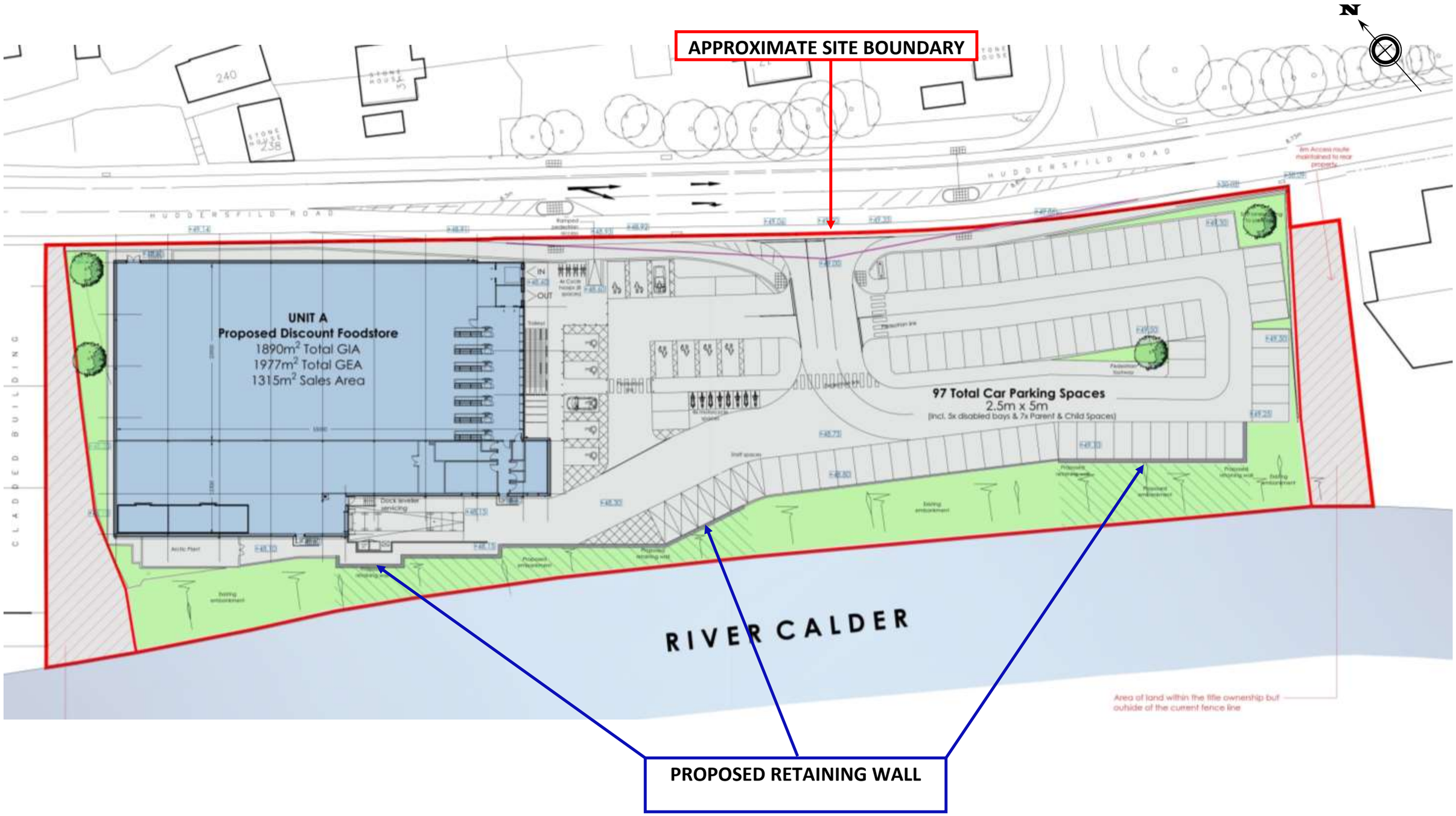

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FIGURE 4

Site plan indicating proposed development
1:500 @ A3

E13431/1: Huddersfield Road, Mirfield
Prepared for: Morbaine Limited

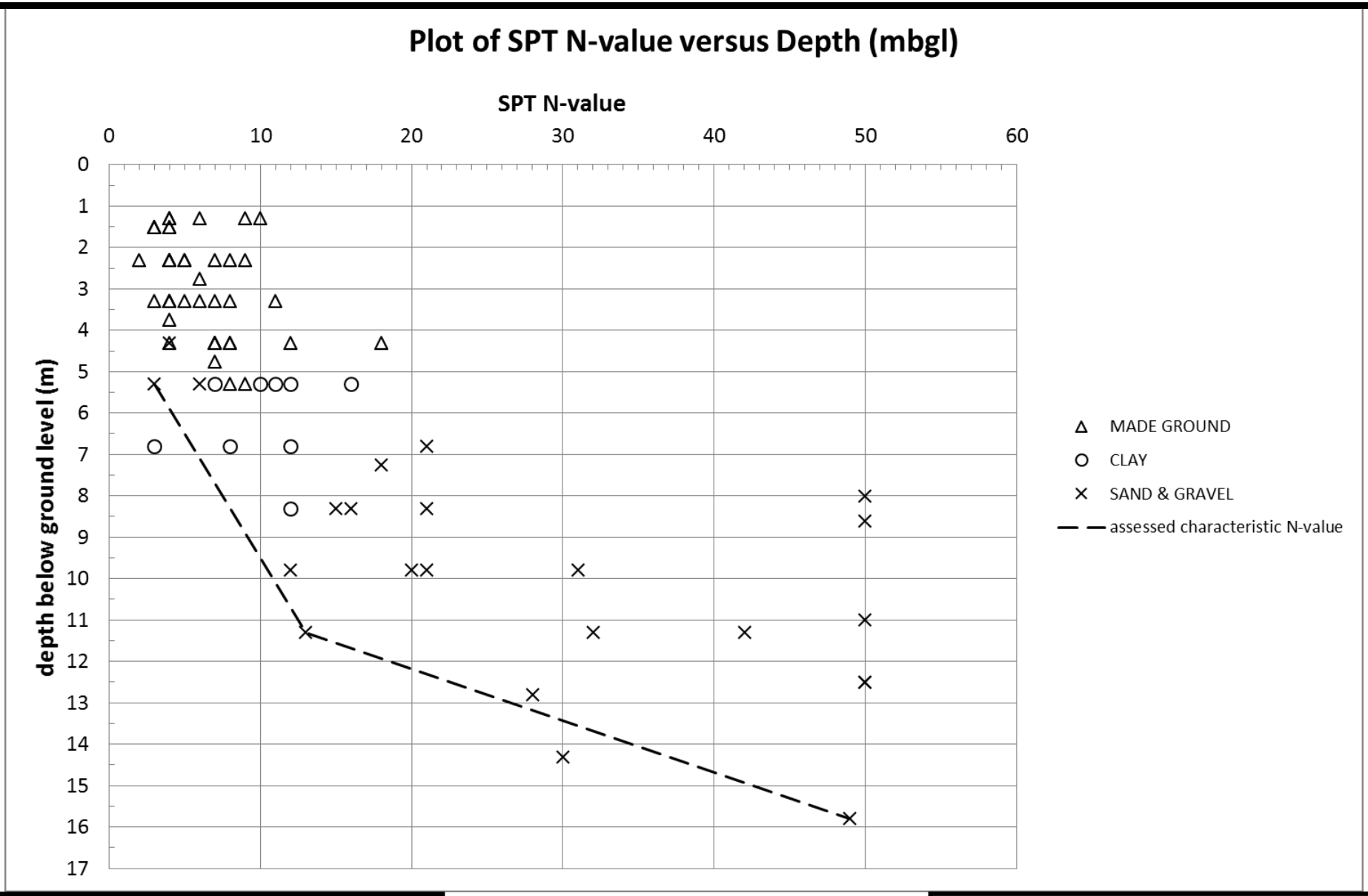

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FIGURE 5

Plot of SPT N-values versus Depth (m bgl)

E13431/1: Huddersfield Road, Mirfield
Prepared for: Morbaine Limited

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ENCLOSURE A

BGS GeoIndex Report
(4 pages)

Bedrock Geology

British Geological Survey

Map Key

Bedrock geology 1:50,000 scale

- PENNINE LOWER COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - MUDSTONE, SILTSTONE AND SANDSTONE
- BIRSTALL ROCK - SANDSTONE
- PENNINE MIDDLE COAL MEASURES FORMATION - SANDSTONE

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 3

Method Mechanical Excavator (Ford 550)

Date 23rd June, 1981

1992
2005

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
	0.15	FILL (loose coated chippings)				
	0.60	FILL (loose brown sandy clayey silt with some fine to coarse angular gravel-sized fragments of brick and masonry rubble with roots and rootlets)				
	1.90	Medium dense yellowish brown slightly sandy very silty fine to coarse angular and subangular gravel-sized fragments of siltstone (COMPLETELY WEATHERED LCM SILTSTONE)	B1	1.30-1.40	m PL LL CBR R	12 20 32 >8
	2.00	Completely to highly weathered brown sandy SILTSTONE (LOWER COAL MEASURES)				
		END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. A continuous partial collapse of the walls of the trial pit occurred to a depth of 0.60m. Thereafter the walls stood vertically.

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 4

Method Mechanical Excavator

Date 23rd June, 1981

1994
2003

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
	0.50	FILL (loose sandy clayey silt with some fine to coarse angular and subangular gravel-sized fragments of brick and masonry rubble)				
		Firm to stiff yellowish brown and light grey slightly sandy silty CLAY with some fine to coarse angular and subangular gravel-sized fragments of siltstone	B1	1.00-1.10	m	17
					PL	19
		Becomes slightly sandy clayey silt with some gravel with depth (RESIDUAL SOIL)			LL	33
					CBR R	6
		Below 1.90m; silt and gravel				
	2.10	END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. The walls of the trial pit stood vertically throughout excavation.

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 6

Method Mechanical Excavator (Ford 580)

Date 23rd June, 1981

1991
2002

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
		Black sandy silty TOPSOIL				
	0.30					
		Firm to stiff yellowish brown and light grey silty CLAY with some fine to coarse angular and subangular gravel-sized fragments of siltstone	B1	0.80-0.90	m	19
		Becomes clayey silt with gravel with depth. (RESIDUAL SOIL)			PL	24
					LL	50
					CBR R	6
	1.60					
		Completely to highly weathered light grey and brown sandy SILTSTONE (LOWER COAL MEASURES)				
	2.00					
		END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. The walls of the trial pit stood vertically throughout excavation.

YORKSHIRE WATER AUTHORITY – **Survey of Existing Boreholes** SE 11

I.C.S. Ref. No ..... N.G.R. SE 197 199

Licence No.

OWNERS NAME .....

ADDRESS ROYAL OAK HOTEL

DACRE BANKS

App No

Authorised Abstraction

g.p.h.
g.p.d.
m.g.a.

DOMESTIC ONLY

STRATA DETAILS	Thick'ss	Depth
GRAVEL	30 9.15	30 9.15
COARSE GRAVEL ROCK	40 12.20	70 21.34
SOFT SANDY ROCK	2 0.61	72 21.95
HARD STRONG	23 7.01	95 28.96

Dia. .....

Depth 95' 28.96 m
5" to 40' 4" to 82'

Lining .....

Well sinker HYMAS

Date .....

R.W.L. 20

P.W.L. .....

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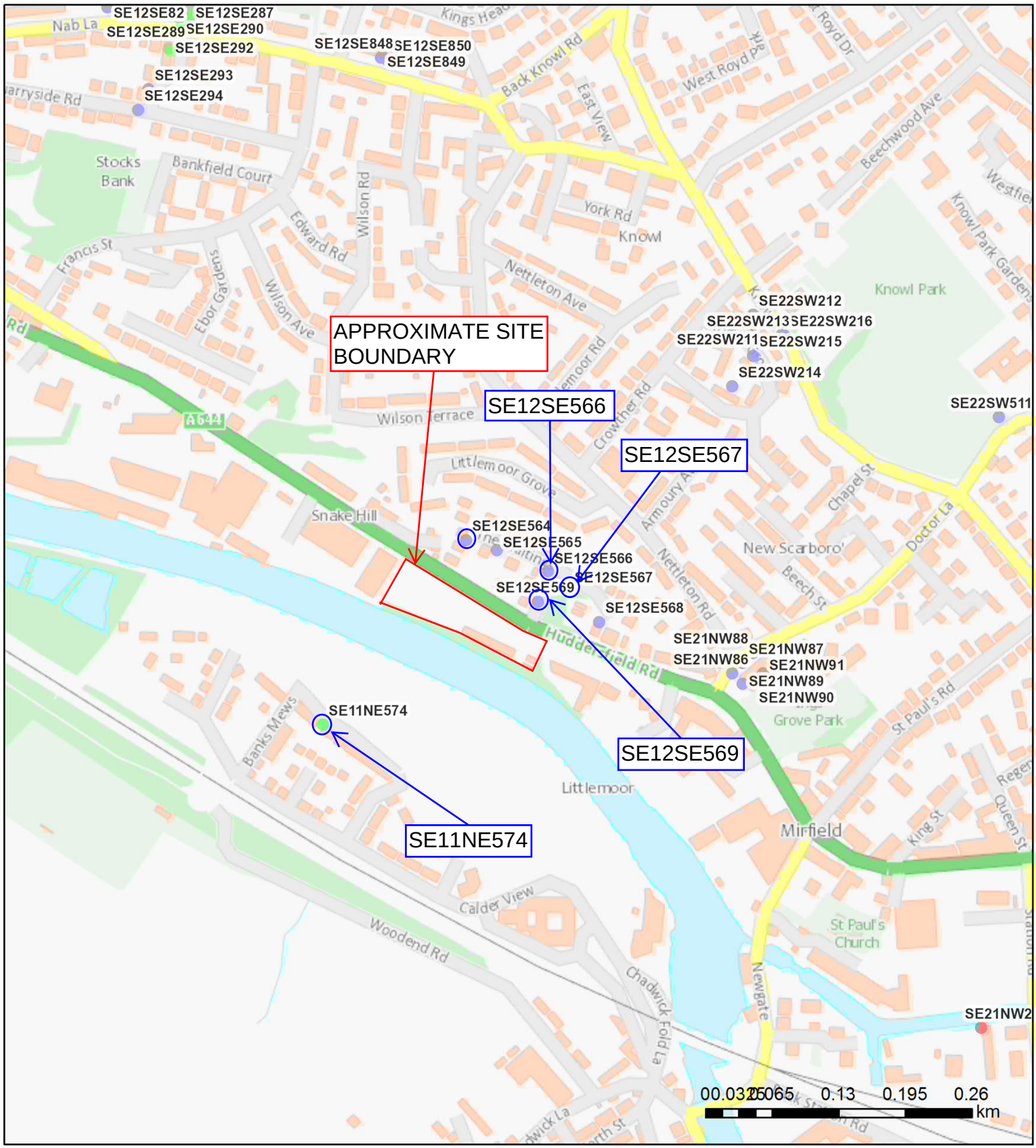
ENCLOSURE B

BGS Borehole and Trial Pit Records
(6 pages)

BGS Exploratory Holes

British Geological Survey



Map Key

Borehole records

- **Unknown Length**
- **Confidential**
- **0 - 10m**
- **10 - 30m**
- **30m+**

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 3

Method Mechanical Excavator (Ford 550)

Date 23rd June, 1981

1992
2005

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
	0.15	FILL (loose coated chippings)				
	0.60	FILL (loose brown sandy clayey silt with some fine to coarse angular gravel-sized fragments of brick and masonry rubble with roots and rootlets)				
	1.90	Medium dense yellowish brown slightly sandy very silty fine to coarse angular and subangular gravel-sized fragments of siltstone (COMPLETELY WEATHERED LCM SILTSTONE)	B1	1.30-1.40	m PL LL CBR R	12 20 32 >8
	2.00	Completely to highly weathered brown sandy SILTSTONE (LOWER COAL MEASURES)				
		END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. A continuous partial collapse of the walls of the trial pit occurred to a depth of 0.60m. Thereafter the walls stood vertically.

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 4

Method Mechanical Excavator

Date 23rd June, 1981

1994
2003

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
	0.50	FILL (loose sandy clayey silt with some fine to coarse angular and subangular gravel-sized fragments of brick and masonry rubble)				
		Firm to stiff yellowish brown and light grey slightly sandy silty CLAY with some fine to coarse angular and subangular gravel-sized fragments of siltstone	B1	1.00-1.10	m	17
					PL	19
		Becomes slightly sandy clayey silt with some gravel with depth (RESIDUAL SOIL)			LL	33
					CBR R	6
		Below 1.90m; silt and gravel				
	2.10	END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. The walls of the trial pit stood vertically throughout excavation.

LOCATION: MIRFIELD, LITTLEMOOR HOUSE

TRIAL PIT 6

Method Mechanical Excavator (Ford 580)

Date 23rd June, 1981

1991
2002

Casing -

Sheet 1 of 1

R.L. m A.O.D.	DEPTH m	SOIL DESCRIPTION	SAMPLING No.	SAMPLING Depth	TEST	RESULT
	G.L.					
		Black sandy silty TOPSOIL				
	0.30					
		Firm to stiff yellowish brown and light grey silty CLAY with some fine to coarse angular and subangular gravel-sized fragments of siltstone	B1	0.80-0.90	m	19
		Becomes clayey silt with gravel with depth. (RESIDUAL SOIL)			PL	24
					LL	50
					CBR R	6
	1.60					
		Completely to highly weathered light grey and brown sandy SILTSTONE (LOWER COAL MEASURES)				
	2.00					
		END OF TRIAL PIT				

Remarks

1. Groundwater was not encountered.
2. The walls of the trial pit stood vertically throughout excavation.

YORKSHIRE WATER AUTHORITY – **Survey of Existing Boreholes** SE 11

I.C.S. Ref. No ..... N.G.R. SE 197 199

Licence No.

OWNERS NAME .....

ADDRESS ROYAL OAK HOTEL

DACRE BANKS

App No

Authorised Abstraction

g.p.h.
g.p.d.
m.g.a.

DOMESTIC ONLY

STRATA DETAILS	Thick'ss	Depth
GRAVEL	30. 9.15	30. 9.15
COARSE GRAVEL ROCK	40. 12.30	70. 21.45
SOFT SANDY ROCK	2. 0.61	72. 21.95
HARD STONE	23. 7.01	95. 28.96

Dia. .....

Depth 95' 28.96 m
5" to 40' 4" to 82'

Lining .....

Well sinker HYMAS

Date .....

R.W.L. 20

P.W.L. .....

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

ENCLOSURE C

Coal Mining Consultants Report
(10 pages)

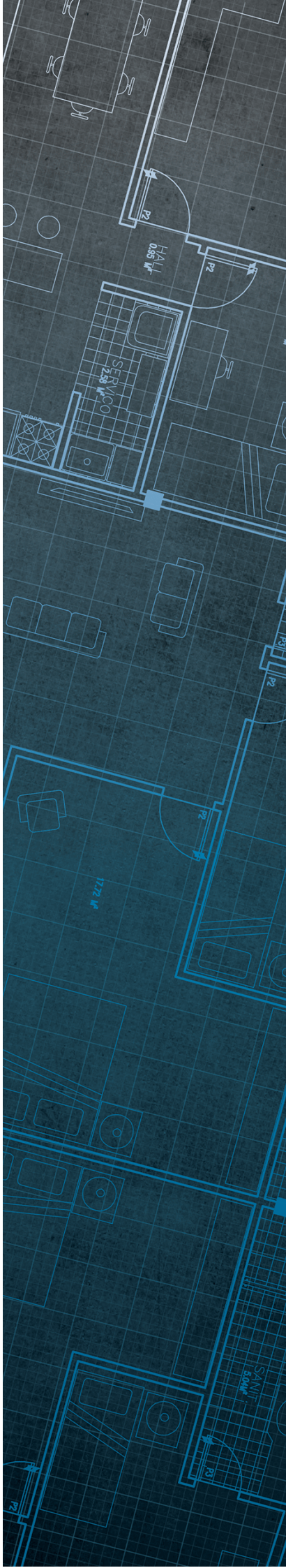
The Coal Authority

Consultants

Coal Mining Report

Kenmore Caravans
119 Huddersfield Road
Mirfield
Kirklees
WF14 9DA

Date of enquiry:	**18 January 2021**
Date enquiry received:	**18 January 2021**
Issue date:	**18 January 2021**
Our reference:	**51002354732001**
Your reference:	**E13431-1_31495**



Consultants
Coal Mining Report

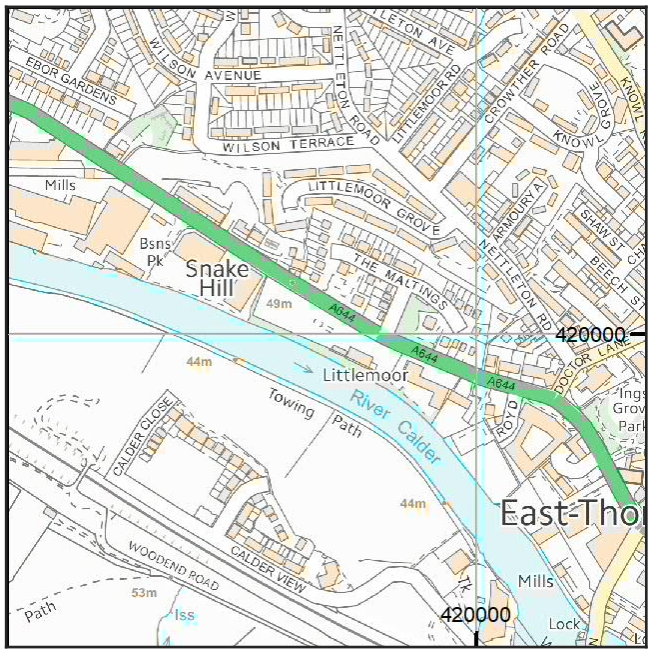
This report is based on and limited to the records held by the Coal Authority at the time the report was produced.

Client name

DTS Raeburn

Enquiry address

Kenmore Caravans
119 Huddersfield Road
Mirfield
Kirklees
WF14 9DA



Approximate position of property

How to contact us

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Mansfield
Nottinghamshire
NG18 4RG

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@coalauthority
/company/the-coal-authority
/thecoalauthority
/thecoalauthority

Section 1 – Mining activity and geology

Past underground mining
No past mining recorded.

Probable unrecorded shallow workings
None.

Spine roadways at shallow depth
No spine roadway recorded at shallow depth.

Mine entries
None recorded within 100 metres of the enquiry boundary.

Abandoned mine plan catalogue numbers
The following abandoned mine plan catalogue numbers intersect with some, or all, of the enquiry boundary:

LF23		

Please contact us on 0345 762 6848 to determine the exact abandoned mine plans you require based on your needs.

Outcrops
No outcrops recorded.

Geological faults, fissures and breaklines
Please refer to the 'Summary of findings' map (on separate sheet) for details of any geological faults, fissures or breaklines either within or intersecting the enquiry boundary.

Faults under or close to the property recorded.

Opencast mines
None recorded within 500 metres of the enquiry boundary.

Coal Authority managed tips
None recorded within 500 metres of the enquiry boundary.

Section 2 – Investigative or remedial activity

Please refer to the 'Summary of findings' map (on separate sheet) for details of any activity within the area of the site boundary.

Site investigations
None recorded within 50 metres of the enquiry boundary.

Remediated sites
None recorded within 50 metres of the enquiry boundary.

Coal mining subsidence
The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994.

There is no current Stop Notice delaying the start of remedial works or repairs to the property.

The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

Mine gas
None recorded within 500 metres of the enquiry boundary.

Mine water treatment schemes
None recorded within 500 metres of the enquiry boundary.

Section 3 – Licensing and future mining activity

Future underground mining
None recorded.

Coal mining licensing
None recorded within 200 metres of the enquiry boundary.

Court orders
None recorded.

Section 46 notices
No notices have been given, under section 46 of the Coal Mining Subsidence Act 1991, stating that the land is at risk of subsidence.

Withdrawal of support notices
The property is not in an area where a notice to withdraw support has been given.

The property is not in an area where a notice has been given under section 41 of the Coal Industry Act 1994, cancelling the entitlement to withdraw support.

Payments to owners of former copyhold land
The property is not in an area where a relevant notice has been published under the Coal Industry Act 1975/Coal Industry Act 1994.

Section 4 – Further information

Based on the responses in this report, no further information has been highlighted.

Section 5 – Data definitions

The datasets used in this report have limitations and assumptions within their results. For more guidance on the data and the results specific to the enquiry boundary, please **call us on 0345 762 6848** or **email us at groundstability@coal.gov.uk.**

Past underground coal mining

Details of all recorded underground mining relative to the enquiry boundary. Only past underground workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination, will be included.

Probable unrecorded shallow workings

Areas where the Coal Authority believes there to be unrecorded coal workings that exist at or close to the surface (less than 30 metres deep).

Spine roadways at shallow depth

Connecting roadways either, working to working, or, surface to working, both in-seam and cross measures that exist at or close to the surface (less than 30 metres deep), either within or within 10 metres of the enquiry boundary.

Mine entries

Details of any shaft or adit either within, or within 100 metres of the enquiry boundary including approximate location, brief treatment details where known, the mineral worked from the mine entry and conveyance details where the mine entry has previously been sold by the Authority or its predecessors British Coal or the National Coal Board.

Abandoned mine plan catalogue numbers

Plan numbers extracted from the abandoned mines catalogue containing details of coal and other mineral abandonment plans deposited via the Mines Inspectorate in accordance with the Coal Mines Regulation Act and Metalliferous Mines Regulation Act 1872. A maximum of 9 plan extents that intersect with the enquiry boundary will be included. This does not infer that the workings and/or mine entries shown on the abandonment plan will be relevant to the site/property boundary.

Outcrops

Details of seam outcrops will be included where the enquiry boundary intersects with a conjectured or actual seam outcrop location (derived by either the British Geological Survey or the Coal Authority) or intersects with a defined 50 metres buffer on the coal (dip) side of the outcrop. An indication of whether the Coal Authority believes the seam to be of sufficient thickness and/or quality to have been worked will also be included.

Geological faults, fissures and breaklines

Geological disturbances or fractures in the bedrock. Surface fault lines (British Geological Survey derived data) and fissures and breaklines (Coal Authority derived data) intersecting with the enquiry boundary will be included. In some circumstances faults, fissures or breaklines have been known to contribute to surface subsidence damage as a consequence of underground coal mining.

Opencast mines
Opencast coal sites from which coal has been removed in the past by opencast (surface) methods and where the enquiry boundary is within 500 metres of either the licence area, site boundary, excavation area (high wall) or coaling area.

Coal Authority managed tips
Locations of disused colliery tip sites owned and managed by the Coal Authority, located within 500 metres of the enquiry boundary.

Site investigations
Details of site investigations within 50 metres of the enquiry boundary where the Coal Authority has received information relating to coal mining risk investigation and/or remediation by third parties.

Remediated sites
Sites where the Coal Authority has undertaken remedial works either within or within 50 metres of the enquiry boundary following report of a hazard relating to coal mining under the Coal Authority's Emergency Surface Hazard Call Out procedures.

Coal mining subsidence
Details of alleged coal mining subsidence claims made since 31 October 1994 either within or within 50 metres of the enquiry boundary. Where the claim relates to the enquiry boundary confirmation of whether the claim was accepted, rejected or whether liability is still being determined will be given. Where the claim has been discharged, whether this was by repair, payment of compensation or a combination of both, the value of the claim, where known, will also be given.

Details of any current 'Stop Notice' deferring remedial works or repairs affecting the property/site, and if so the date of the notice.

Details of any request made to execute preventative works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. If yes, whether any person withheld consent or failed to comply with any request to execute preventative works.

Mine gas
Reports of alleged mine gas emissions received by the Coal Authority, either within or within 500 metres of the enquiry boundary that subsequently required investigation and action by the Coal Authority to mitigate the effects of the mine gas emission.

Mine water treatment schemes
Locations where the Coal Authority has constructed or operates assets that remove pollutants from mine water prior to the treated mine water being discharged into the receiving water body.

These schemes are part of the UK's strategy to meet the requirements of the Water Framework Directive. Schemes fall into 2 basic categories: Remedial – mitigating the impact of existing pollution or Preventative – preventing a future pollution incident.

Mine water treatment schemes generally consist of one or more primary settlement lagoons and one or more reed beds for secondary treatment. A small number are more specialised process treatment plants.

Future underground mining
Details of all planned underground mining relative to the enquiry boundary. Only those future workings where the enquiry boundary is within 0.7 times the depth of the workings (zone of likely physical influence) allowing for seam inclination will be included.

Coal mining licensing
Details of all licenses issued by the Coal Authority either within or within 200 metres of the enquiry boundary in relation to the under taking of surface coal mining, underground coal mining or underground coal gasification.

Court orders
Orders in respect of the working of coal under the Mines (Working Facilities and Support) Acts of 1923 and 1966 or any statutory modification or amendment thereof.

Section 46 notices
Notice of proposals relating to underground coal mining operations that have been given under section 46 of the Coal Mining Subsidence Act 1991.

Withdrawal of support notices
Published notices of entitlement to withdraw support and the date of the notice. Details of any revocation notice withdrawing the entitlement to withdraw support given under Section 41 of the Coal Industry Act 1994.

Payment to owners of former copyhold land
Relevant notices which may affect the property and any subsequent notice of retained interests in coal and coal mines, acceptance or rejection notices and whether any compensation has been paid to a claimant.

The Coal Authority

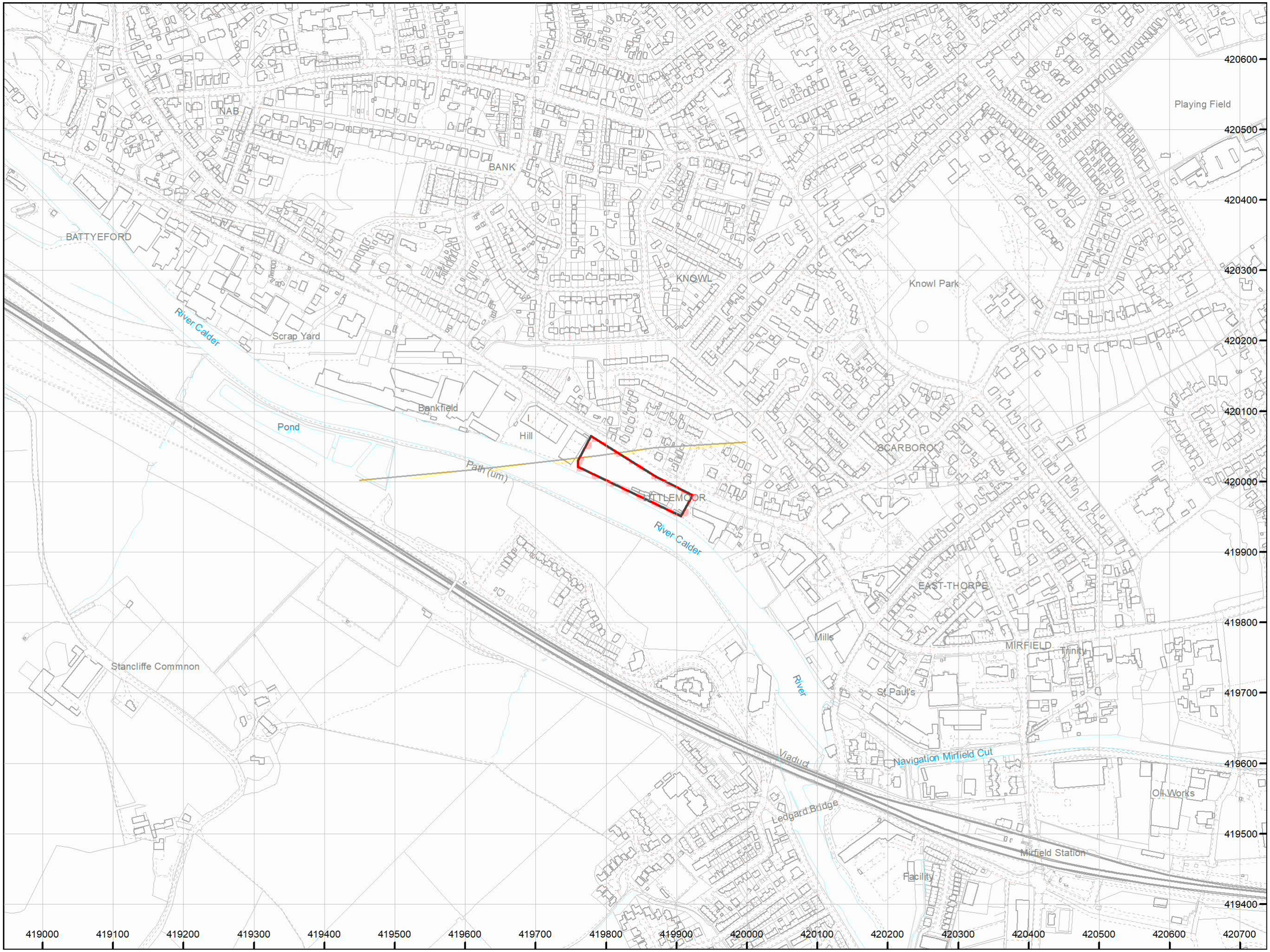
Summary of findings

The map highlights any specific surface or subsurface features within or near to the boundary of the site.

Key

Approximate position of the enquiry boundary shown

Geological faults



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GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

APPENDIX 1

Exploratory Hole Records
(14 pages)

DTS RAEBURN GEOTECHNICAL & ENVIRONMENTAL ENGINEERING			Moor Lane, Witton, Birmingham, B6 7HG +44 (0) 121 3445885 enquiries@dts-raeburn.co.uk www.dts-raeburn.co.uk		Borehole No. CP01 Sheet 1 of 2
Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419783E - 420055N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.66m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021 - 26/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.20 - 0.60 0.24 - 1.00	ES B		0.10	48.56		TARMAC. MADE GROUND: Soft dark brown slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone, brick and concrete. Rare fragments of metal and occasional sub-rounded sandstone cobbles.
		1.00 1.00 - 2.00 1.20	D B SPT	N=3 (1,1/1,1,1,0)				
		2.00 - 3.00 2.00 - 3.00 2.45	B ES SPT	N=6 (2,3/1,1,1,3)	2.00	46.66		MADE GROUND: Loose dark brown and black slightly clayey sandy ashy angular to sub-rounded fine to coarse GRAVEL of sandstone, quartz, brick, quartz and clinker. Occasional sub-angular cobbles of brick, sandstone and clinker. Clumps of brown fibrous material.
		3.00 3.00 - 4.00 3.45	D B SPT	N=4 (1,1/1,1,1,1)				
		4.00 4.00 - 5.00 4.45 4.60 - 5.00	D ES SPT B	N=7 (1,2/1,1,2,3)	4.00	44.66		MADE GROUND: Soft brown mottled black locally stained purple, slightly sandy slightly gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone and mudstone. Occasional sub-angular sandstone cobbles.
		5.00 5.00 - 5.45 5.30 - 6.00 5.30 - 6.00 5.60	D U B ES D	Ublow=57	5.30	43.36		Soft to firm light brown sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of sandstone. Rare sub-angular sandstone cobbles. (ALLUVIUM).
		6.00 6.00 - 7.00 6.95 7.00 - 8.00	D B SPT B	N=27 (7,5/6,4,4,13)	6.00	42.66		Medium dense orangish brown clayey silty very sandy slightly cobbly angular to sub-rounded fine to coarse GRAVEL of sandstone with occasional sub-rounded fine to medium gravel and of quartz. (ALLUVIUM). 7.00-8.00 - becoming less clayey
		8.00 8.00 - 8.45 8.30 - 9.00 9.00	SPT D B D	N=12 (1,2/2,2,4,4)	8.00	40.66		Firm becoming stiff grey slightly sandy gravelly silty CLAY. Gravel is angular to sub-angular fine to coarse of mudstone and sandstone. (HIGHLY WEATHERED PENNINE LOWER COAL MEASURES FORMATION). 9.00-9.50 - becoming very gravelly
		9.50 9.50 - 11.00 9.50 - 9.95	SPT B D	N=24 (2,4/4,4,6,10)	9.50	39.16		Medium dense grey clayey silty sandy sub-angular fine to coarse GRAVEL of mudstone and sandstone. (HIGHLY WEATHERED PENNINE LOWER COAL MEASURES

Continued on next sheet

Remarks	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 7.5m bgl and 9.3m bgl rising to 6.3m bgl after 20 minutes. Borehole terminated at 11m bgl due to practical drilling refusal.	**Final**

DTS RAEBURN GEOTECHNICAL & ENVIRONMENTAL ENGINEERING			Moor Lane, Witton, Birmingham, B6 7HG +44 (0) 121 3445885 enquiries@dts-raeburn.co.uk www.dts-raeburn.co.uk		Borehole No. CP01 Sheet 2 of 2
Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419783E - 420055N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.66m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021 - 26/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
								FORMATION).
		11.00	SPT	N=50 (10,12/50 for 230mm)	11.00	37.66		End of borehole at 11.00m bgl
		11.00 - 11.38	D					

Remarks	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 7.5m bgl and 9.3m bgl rising to 6.3m bgl after 20 minutes. Borehole terminated at 11m bgl due to practical drilling refusal.	**Final**

DTS RAEBURN

GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

Moor Lane, Witton, Birmingham, B6 7HG
+44 (0) 121 3445885
enquiries@dts-raeburn.co.uk
www.dts-raeburn.co.uk

Borehole No. CP02 Sheet 1 of 2

Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419821E - 420031N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.53m AOD	Scale: 1:50
Client:	Morbaine		Dates:	27/02/2021 - 28/02/2029	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		0.20 - 0.60	ES		0.01	48.52		TARMAC.
		0.40 - 1.00	B					MADE GROUND: Loose dark brown and black slightly clayey sandy ashy angular to rounded fine to coarse GRAVEL of quartz, sandstone, brick and concrete. Frequent whole bricks and sub-angular sandstone cobbles and occasional coarse gravel of clinker.
		1.00	D					
		1.00 - 2.00	B					
		1.20	SPT	N=4 (5,1/1,1,1,1)				
		2.00	D		2.00	46.53		MADE GROUND: Loose orangish brown and black sandy slightly clayey angular to sub-rounded fine to coarse GRAVEL of sandstone and occasional fragments of red brick.
		2.00	SPT	N=5 (1,1/1,1,2,1)				
		2.00 - 3.00	B					
		2.00 - 3.00	ES					
		3.00	D					
		3.00	SPT	N=4 (2,0/1,1,1,1)				
		3.00 - 4.00	B					
		4.00	D		4.00	44.53		MADE GROUND: Soft to firm dark brown slightly sandy gravelly silty CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone, mudstone and brick fragments. Occasional sub-angular cobbles of red brick and sandstone. Rare fragments of coal.
		4.00	SPT	N=7 (1,1/1,1,2,3)				
		4.00 - 5.00	B					
		4.00 - 5.00	ES					
		5.00	D		5.00	43.53		Firm light brown mottled grey sandy gravelly silty CLAY. Gravel is angular to sub-rounded fine to coarse of sandstone. Rare sub-angular sandstone cobbles. (ALLUVIUM).
		5.00	SPT	N=7 (2,2/1,2,2,2)				
		5.00 - 6.00	B					
		5.30 - 6.00	ES					
		6.00	D					
		6.00 - 7.00	B					
		6.50	SPT	N=16 (3,2/3,3,3,7)				
		7.00 - 8.00	B		7.00	41.53		Medium dense clayey silty sandy cobbly angular to sub-rounded fine to coarse GRAVEL of sandstone. Sand is fine to coarse. (ALLUVIUM).
		8.00	SPT	N=15 (8,6/4,4,2,5)	8.00	40.53		Medium dense light brown slightly sandy slightly clayey silty angular to sub-rounded fine to coarse GRAVEL of sandstone. Sand is fine to coarse. Occasional cobbles of sandstone. (ALLUVIUM).
		8.00 - 8.45	D					
		8.00 - 9.00	B					
		9.00	D					
		9.00 - 10.00	B					
		9.50	SPT	N=21 (8,4/4,4,6,7)				
		9.50 - 9.95	D					
		10.00 - 11.00	B					

Continued on next sheet

Remarks

Hand dug inspection pit to 1.2m bgl. Groundwater strike at 7m bgl rising to 5.7m bgl after 20 minutes. Falling head test carried out at 2-4m bgl. Chiselling between 9.5-11m bgl. Borehole terminated at 12.5m bgl due to practical drilling refusal.

Final

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419821E - 420031N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.53m AOD	Scale: 1:50
Client:	Morbaine		Dates:	27/02/2021 - 28/02/2029	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		11.00 11.00 - 11.45 11.00 - 12.50	SPT D B	N=42 (7,9/10,12,10,10)	11.00	37.53		Extremely weak grey with orangish brown staining interbedded MUDSTONE and SILTSTONE. Recovered as clayey angular to sub-angular fine to coarse cobbly gravel and cobbles. (WEATHERED PENNINE LOWER COAL MEASURES).
		12.00 12.00 - 12.50	D B		12.00	36.53		Very weak grey locally stained orange MUDSTONE. Recovered as: angular to sub-angular fine to coarse gravel and cobbles. (PENNINE LOWER COAL MEASURES FORMATION).
		12.50 12.50 - 12.80	SPT D	N=50 (8,14/50 for 170mm)	12.50	36.03		End of borehole at 12.50m bgl

Remarks	
	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 7m bgl rising to 5.7m bgl after 20 minutes. Falling head test carried out at 2-4m bgl. Chiselling between 9.5-11m bgl. Borehole terminated at 12.5m bgl due to practical drilling refusal.

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419778E - 420020N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.20m AOD	Scale: 1:50
Client:	Morbaine		Dates:	26/02/2021 - 27/02/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description	
		Depth (m bgl)	Type	Results					
		0.13 - 1.00 0.20 - 1.00	B ES		0.07	48.13		TARMAC. MADE GROUND: Soft brown slightly sandy gravelly CLAY. Gravel is angular to rounded fine to coarse of quartz, sandstone, brick and concrete. Occasional angular cobble size fragments of sandstone, brick and concrete.	
		1.00 1.00 - 2.00 1.20	D B SPT	N=4 (1,1/0,2,1,1)					1
		2.00 2.00 - 2.45 2.00 - 3.00	SPT D B	N=5 (1,1/1,1,1,2)					2
		3.00 3.00 - 3.45 3.00 - 4.00	SPT D B	N=5 (11,5/2,1,1,1)					3
		4.00 4.00 - 5.00	SPT B	N=4 (0,1/1,1,1,1)					4
		5.00 5.00 - 5.45 5.00 - 6.00 5.00 - 6.00	SPT D B ES	N=6 (0,1/1,2,1,2)	5.00	43.20		Loose light brown slightly gravelly very clayey silty fine to coarse SAND. Gravel is sub-angular to sub-rounded fine to coarse of quartz. (ALLUVIUM)	5
		6.00 6.00 - 7.00	D B		6.00	42.20		Soft to firm brown sandy silty gravelly CLAY. Gravel is angular to sub-rounded fine to medium of quartz. Sand is fine to coarse. (ALLUVIUM).	6
		6.50 6.50 - 6.95	SPT D	N=8 (0,0/0,0,4,4)					
					7.00	41.20		Medium dense becoming dense light brown sandy sub-angular to rounded fine to coarse cobbly GRAVEL of quartz, sandstone and chert. Cobbles are sub-rounded of quartz. Sand is fine to coarse. (ALLUVIUM).	7
		8.00 8.00 8.00 - 9.00	D SPT B	N=16 (4,11/6,3,3,4)				8.00-10.00 - Becoming very sandy	8
		9.00 9.00 - 10.00	D B						9
		9.50	SPT	N=12 (5,3/4,3,2,3)					
		10.00	D					Continued on next sheet	10

Remarks	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 6.8m bgl rising to 5.5m bgl after 20 minutes. Borehole terminated at 15.5m bgl.	**Final**

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419778E - 420020N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.20m AOD	Scale: 1:50
Client:	Morbaine		Dates:	26/02/2021 - 27/02/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		10.00 - 11.00	B					10.00-11.00 - Becoming very cobbly
		11.00	SPT	N=13 (1,1/2,4,4,3)				
		12.00	D					12.00-15.00 - Becoming grey
		12.00 - 13.00	B					
		12.50	SPT	N=30 (5,6/7,7,6,10)				
		13.00	D					
		13.00 - 14.00	B					
		14.00	D					
		14.00	SPT	N=35 (7,8/11,8,10,6)				
		14.00 - 15.00	B					
		15.00	D					
		15.50	SPT	N=49 (25 for 145mm/17,14,7,11)	15.50	32.70		End of borehole at 15.50m bgl

Remarks	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 6.8m bgl rising to 5.5m bgl after 20 minutes. Borehole terminated at 15.5m bgl.	**Final**

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419808E - 420006N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.15m AOD	Scale: 1:50
Client:	Morbaine		Dates:	10/02/2029	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.20 - 1.00 0.20 - 1.00	B ES		0.08	48.07		TARMAC. MADE GROUND: Very loose grey brown sandy angular to sub-rounded fine to coarse GRAVEL of quartz, sandstone, limestone, brick and concrete fragments. Occasional angular cobbles of red brick.
		1.00 1.00 - 2.00 1.20	D B SPT	N=3 (1,2/1,1,0,1)				
		2.00 2.00 2.00 - 3.00	D SPT B	N=7 (1,2/1,1,1,4)	2.00	46.15		MADE GROUND: Soft to firm dark brown slightly sandy gravelly silty CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone, brick and concrete. Frequent angular cobbles of brick and sandstone. Rare fragments of wire.
		3.00 3.00 3.00 - 4.00	D SPT B	N=11 (1,1/2,3,3,3)				
		4.00 4.00 4.00 - 5.00 4.00 - 5.00	D SPT B ES	N=4 (0,1/1,1,1,1)	3.80	44.35		Very loose dark brown slightly gravelly slightly cobbly very clayey silty medium to coarse SAND. Gravel is sub-angular to sub-rounded fine to medium of sandstone. (ALLUVIUM).
		5.00 5.00 5.00 - 6.00	D SPT B	N=3 (0,0/0,1,1,1)				
		6.00 6.00 - 7.00 6.50 6.50 - 6.95 7.00 - 8.00	D B SPT D B	N=21 (1,2/5,4,6,6)	6.00	42.15		Medium dense becoming dense brown slightly clayey silty sandy cobbly sub-angular to rounded fine to coarse GRAVEL of quartz and chert. Cobbles are sub-rounded of quartz. (ALLUVIUM).
		8.00 8.00 8.00 - 9.00	D SPT B	N=21 (6,5/4,5,5,7)				
		9.00 9.00 - 10.00 9.50	D B SPT	N=31 (7,5/6,9,8,8)				
		10.00	D					Continued on next sheet

Remarks	Hand dug inspection pit to 1.2m bgl. Groundwater strike at 6.5m bgl rising to 5.2m bgl after 20 minutes. Borehole terminated at 12.5m bgl due to practical drilling refusal.	**Final**

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419808E - 420006N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.15m AOD	Scale: 1:50
Client:	Morbaine		Dates:	10/02/2029	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		10.00 - 11.00	B					10.00-11.00 - Becoming slightly silty
		11.00	D		11.00	37.15		
		11.00	SPT	N=32 (7,7/7,8,7,10)				Dense brown sandy cobbly sub-rounded to rounded fine to coarse GRAVEL of quartz. Sand is medium to coarse. Cobbles are sub-rounded of quartz. (ALLUVIUM).
		11.00 - 12.00	B					
		12.00	D					12.00-12.50 - becoming very sandy
		12.00 - 12.50	B					
		12.50	SPT	N=50 (25 for 80mm/50 for 145mm)	12.50	35.65		End of borehole at 12.50m bgl

Remarks

Hand dug inspection pit to 1.2m bgl. Groundwater strike at 6.5m bgl rising to 5.2m bgl after 20 minutes. Borehole terminated at 12.5m bgl due to practical drilling refusal.

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Borehole No. CP05 Sheet 1 of 1

Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419899E - 419964N	Hole Type: CP
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	49.42m AOD	Scale: 1:50
Client:	Morbaine		Dates:	03/02/2021 - 04/02/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
					0.00	49.42		TARMAC.
		0.14 - 1.00 0.30 - 1.00	B ES		0.14	49.28		MADE GROUND: Very loose black sandy ashy angular to sub-rounded fine to coarse GRAVEL of quartz, sandstone, brick, clinker and coal. Occasional clasts of brown and grey clay.
		1.00 1.00 - 2.00 1.20	D B SPT	N=3 (1,1/0,1,1,1)				
					1.70	47.72		MADE GROUND: Soft to firm orangish brown mottled grey and black, slightly sandy gravely silty CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone, brick, concrete, tile and clinker. Occasional sub-angular cobbles of brick and sandstone. 1-2cm Pockets of black carbonaceous material.
		2.00 2.00 2.00 - 3.00 2.00 - 3.00	D SPT B ES	N=4 (0,1/1,1,1,1)				
		3.00 3.00 - 3.45 3.00 - 4.00	SPT D B	N=4 (0,1/1,1,1,1)				
		4.00 4.00 - 4.45 4.00 - 5.00	SPT D B	N=7 (1,1/1,2,2,2)				
		5.00 5.00 - 5.45 5.00 - 6.00	SPT D B	N=9 (1,3/3,2,2,2)				
		6.00 6.00 - 7.00 6.00 - 7.00	D B ES					
		6.50	SPT	N=3 (0,0/0,1,1,1)	6.20	43.22		Very soft grey mottled orangish brown slightly gravelly silty CLAY. Gravel is sub-angular to sub-rounded fine to coarse of sandstone and quartz. (ALLUVIUM).
		7.00 - 8.00	B					
		8.00	SPT	N=50 (25,25/50 for 220mm)	8.00	41.42		Weak grey and orange SANDSTONE. Recovered as angular to sub-angular medium to coarse cobbly gravel. (CLIFTON ROCK?)
		8.00 - 8.25 8.00 - 8.60	D B					
		8.60 8.60	D SPT	N=50 (5,5/50 for 220mm)	8.60	40.82		End of borehole at 8.60m bgl

Remarks

Hand dug inspection pit to 1.2m bgl. No Groundwater encountered during drilling, groundwater standing at 5.9m after 12 hours. Falling head test carried out at 6.2-8.0m bgl. Chiselling from 8-8.6m bgl. Borehole terminated at 8.6m bgl due to practical drilling refusal.

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Borehole No. **WS01**

Sheet 1 of 1

Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419773E - 420038N	Hole Type: WLS
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.24m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing: Depth (m bgl)	Type	Results	Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		0.10 - 0.40	ES		0.05	48.19		TARMAC MADE GROUND: Loose light brown sandy slightly clayey slightly ashy angular to rounded fine to coarse GRAVEL of brick, concrete, quartz, clinker, tile, glass and sandstone. Frequent sub-angular cobbles of sandstone and occasional clasts of brown clay.
		1.00	SPT	N=4 (1,1/1,1,1,1)				
		1.20 - 1.40	D					
		2.00	SPT	N=8 (1,1/2,2,2,2)				
		2.00 - 2.20	D					
		2.80 - 3.00	D					2.80-3.20 - Band of light brown sandy silty clay.
		3.00	SPT	N=6 (3,2/2,2,1,1)				
		3.50 - 3.80	D					
		4.00	SPT	N=7 (2,2/2,2,2,1)				
		4.50 - 4.70	ES		4.50	43.74		Firm brown slightly sandy silty CLAY. Sand is fine to medium. (ALLUVIUM?).
		5.00	SPT	N=11 (2,2/2,3,3,3)	5.00	43.24		End of borehole at 5.00m bgl

Remarks: No groundwater encountered during drilling.

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419801E - 420031N	Hole Type: WLS
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.38m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.10 - 0.20	ES		0.05	48.33		TARMAC
		0.25 - 0.40	ES		0.25	48.13		MADE GROUND: Cream and red sub-angular to sub-rounded fine to coarse GRAVEL of limestone and brick. (SUB-BASE).
		1.00	SPT	N=11 (1,1/2,2,1,6)				MADE GROUND: Very loose to loose dark brown locally yellow brown slightly clayey slightly sandy angular to sub-rounded fine to coarse GRAVEL of brick, concrete, quartz, sandstone, glass and tile. Occasional sub-rounded cobbles of brick and concrete.
		1.20	D					
		1.20 - 1.60	D					
		2.00	SPT	N=4 (1,1/1,1,1,1)				
		2.00 - 2.20	D					
		3.00	SPT	N=3 (0,0/0,1,1,1)				3.00-4.00 - 10% recovery
		4.00	SPT	N=18 (9,9/13,3,1,1)				
		4.00 - 4.20	D					
		4.60 - 5.00	ES		4.60	43.78		Firm brown slightly sandy silty CLAY. Rare fine gravel of quartz. Sand is fine to coarse. (ALLUVIUM?).
		5.00	SPT	N=12 (2,2/3,3,3,3)	5.00	43.38		End of borehole at 5.00m bgl

Remarks	Final
No groundwater encountered during drilling.	

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419835E - 419994N	Hole Type: WLS
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	48.51m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.20 - 0.40	ES		0.08 0.15	48.43 48.36		TARMAC. MADE GROUND: Cream and red sub-angular to sub-rounded fine to coarse GRAVEL of limestone and brick. (SUB-BASE).
		1.00 1.20 - 1.50	SPT D	N=6 (2,2/2,1,1,2)				MADE GROUND: Loose dark brown slightly ashy slightly clayey gravelly SAND. Gravel is angular to rounded fine to coarse of quartz, brick, clinker, sandstone, concrete and glass. Occasional small rootlets and sub-rounded cobbles of sandstone. 0.30-0.50 - becoming very clayey.
		2.00 2.00 - 2.70	SPT D	N=9 (2,2/1,3,3,2)				2.00-3.00 - 50% recovery.
		3.00 3.20 - 3.50	SPT D	N=8 (2,2/2,2,2,2)				
		4.00 4.00 - 5.00	SPT D	N=12 (4,4/4,3,3,2)				4.00-5.00 - 15% recovery
		5.00	SPT	N=8 (1,1/2,2,2,2)	5.00	43.51		End of borehole at 5.00m bgl

Remarks	No groundwater encountered during drilling.	**Final**

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Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419876E - 419998N	Hole Type: WLS
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	49.27m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.20 - 0.40	ES		0.10	49.17		TARMAC. MADE GROUND: Loose dark brown locally yellow brown slightly clayey slightly sandy angular to sub-rounded fine to coarse GRAVEL of brick, concrete, quartz, sandstone, glass and tile. Occasional sub-rounded cobbles of brick and concrete.
		1.00	SPT	N=10 (3,3/3,2,3,2)				
		1.00 - 1.10	D					
		1.80 - 2.00	D					
		2.00	SPT	N=2 (1,0/0,0,1,1)				
		2.60 - 2.80	ES		2.50	46.77		MADE GROUND: Soft to firm light brown mottled orange and grey slightly gravelly sandy CLAY. Gravel is angular to sub-angular fine to coarse of sandstone. Occasional fragments of brick and tile.
		3.00	SPT	N=7 (1,1/1,2,2,2)				
		3.50 - 3.80	D					
		4.00	SPT	N=8 (2,2/2,2,2,2)				
		4.70 - 5.00	ES		4.70	44.57		Firm light orangish brown mottled grey slightly sandy slightly gravelly CLAY. Gravel is sub-angular to sub-rounded fine to coarse of sandstone. (ALLUVIUM?).
		5.00	SPT	N=16 (14,10/4,4,4,4)	5.00	44.27		End of borehole at 5.00m bgl

Remarks: No groundwater encountered during drilling.

Final

DTS RAEBURN GEOTECHNICAL & ENVIRONMENTAL ENGINEERING			Moor Lane, Witton, Birmingham, B6 7HG +44 (0) 121 3445885 enquiries@dts-raeburn.co.uk www.dts-raeburn.co.uk		Borehole No. WS05 Sheet 1 of 1
Project Name:	Mirfield	Project No. E13431/1	Co-ords:	419907E - 419973N	Hole Type: WLS
Location:	Kenmore Caravans, Huddersfield Road, Mirfield, WF14 9DA		Level:	49.65m AOD	Scale: 1:50
Client:	Morbaine		Dates:	25/01/2021	Logged by: TDB

Well	Water Strikes	Samples and In Situ Testing			Depth (m bgl)	Level (m AOD)	Legend	Stratum Description
		Depth (m bgl)	Type	Results				
		0.10 - 0.30	ES		0.05	49.60		TARMAC. MADE GROUND: Loose black sandy ashy GRAVEL of coal quartz. Rare fragments of clinker.
		1.00	SPT	N=4 (1,1/1,1,1,1)				
		1.20 - 1.40	D		1.20	48.45		MADE GROUND: Soft light brown sandy gravelly CLAY. Gravel is angular to rounded fine to coarse of quartz, brick, concrete, coal and sandstone.
		2.00	SPT	N=4 (1,1/1,1,1,1)				
		2.20 - 2.40	D		2.20	47.45		MADE GROUND: Soft to firm light brown slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of quartz, sandstone and brick. Occasional sub-angular gravel of clinker and coal.
		3.00	SPT	N=4 (1,1/1,1,1,1)				
		3.00 - 3.20	D					
		4.00	SPT	N=8 (2,2/2,2,2,2)				
		4.00 - 4.20	D					
		4.70 - 5.00	ES		4.70	44.95		Firm light brown mottled grey and orange slightly sandy gravelly CLAY. Gravel is angular to sub-rounded fine to coarse of sandstone. (ALLUVIUM?)
		5.00	SPT	N=10 (2,3/3,3,2,2)	5.00	44.65		End of borehole at 5.00m bgl

Remarks

No groundwater encountered during drilling.

Final

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

APPENDIX 2

Falling Head Infiltration Test Results
(1 page)

Huddersfield Road, Mirfield

Falling Head Test

03/02/2021

CP5 6-8.0m bgl Casing at 6.0m bgl	
m bgl	**mins**
0.66	0
0.66	1
1.00	2
1.69	3
2.04	4
2.34	5
2.64	6
2.89	7
3.06	8
3.28	9
3.44	10
3.60	11
3.67	12
3.84	13
3.91	14
4.05	15
4.09	16
4.16	17
4.31	18
4.31	19
4.34	20
4.40	21
4.44	22
4.50	23
4.64	24
4.64	25
4.64	26
4.64	27
4.64	28
4.64	29
4.64	30

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

APPENDIX 3

Soil Contamination Laboratory Test Results
(34 pages)

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

DTS Raeburn Limited
Moor Lane
Witton
Birmingham
B6 7HG

For the attention of Tom Dentith-Barnard

Report No: B25564
Issue No 01

LABORATORY TEST REPORT

Project Name	**MIRFIELD**		
Project Number	**B25564**	Date samples received	26/01/2021
Your Ref	E13431/1	Date written instructions received	26/01/2021
Purchase Order	31536/E13431/1	Date testing commenced	26/01/2021

Please find enclosed the results as summarised below

Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	13	Client Specified Suites - Soil	See report
2	11	PAHs (speciated) - Soil	Yes
3	11	TPHCWG - Soil	Yes
4	11	VPHCWG/BTEX - Soil	Yes
5	9	Asbestos Screen	Yes
6	3	WAC Leachate Suite - Soil	See report

Remarks :

Issued by : Stephen Langman Date of Issue : 15/02/2021

Approved Signatories : S. Langman 15/02/2021

S Langman (Laboratory Coordinator), D Bowen (Production Manager)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw
our report if we have not received cleared funds in accordance with our standard terms and conditions
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website www.terratek.co.uk/contact-us

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Terra Tek Ltd is registered in Scotland No. 121594
Offices in Airdrie, Birmingham, Belfast and Aston Clinton
Head Office : 62 Rochsolloch Road, Airdrie, ML6 9BG

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron (water soluble)	Hexavalent Chromium	Phenol	Total Cyanide	Free Cyanide	Sulphate (acid soluble as SO4)	Sulphate (water soluble in 2:1 extract) as SO4	Sulphide	Total Sulphur	Loss on Ignition	Total organic carbon
Hole	Depth m	Sample Ref	Sample Type		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	g/l	mg/kg	%	%	%
WS01	0.10-0.40		ET	759201	1,221.7	1.14	31	155	<0.10	0.8	82	42	227	0.7	<0.3	<0.3	5.8	<0.1	0.23	0.06	<10	0.13	6.1	3.9
WS01	4.50-4.70		ET	759204	31.0	0.73	30	28	<0.10	1.4	26	35	92	1.3	<0.3	<0.3	0.3	<0.1	0.11	0.24	16	0.04	~	~
WS02	0.25-0.40		ET	759207	82.4	1.72	30	194	0.51	0.8	127	40	230	0.7	<0.3	<0.3	0.5	<0.1	0.12	0.03	68	0.08	~	~
WS02	4.60-5.00		ET	759210	32.7	0.67	34	41	<0.10	1.0	35	43	105	1.4	<0.3	<0.3	0.2	<0.1	0.09	0.07	<10	0.04	6.9	2.5
WS03	0.20-0.40		ET	759213	116.8	0.90	355	189	0.77	0.9	112	49	232	0.5	<0.3	11.0	0.1	<0.1	0.15	0.02	270	0.11	~	~
WS04	0.20-0.40		ET	759216	30.6	0.96	89	74	<0.10	2.3	60	35	312	0.6	<0.3	<0.3	<0.1	<0.1	0.28	0.31	1,800	0.32	~	~
WS04	2.60-2.80		ET	759233	21.9	0.70	35	59	<0.10	1.1	38	51	95	0.8	<0.3	0.5	0.1	<0.1	0.31	1.16	160	0.13	5.7	2.9
WS05	1.20-1.40		ET	759219	27.3	0.66	21	268	0.44	1.5	72	42	91	0.8	<0.3	<0.3	<0.1	<0.1	0.13	0.05	410	0.10	~	~
WS05	2.20-2.40		ET	759222	76.4	0.84	33	198	2.02	0.8	95	52	100	1.8	<0.3	0.6	<0.1	<0.1	0.13	0.03	590	0.10	~	~
WS04	4.70-5.00		ET	759226	8.3	0.96	68	19	<0.10	0.8	28	103	152	0.6	<0.3	<0.3	<0.1	<0.1	0.06	0.14	<10	0.02	~	~
Limits of Detection					0.5	0.10	1	1	0.10	0.5	1	1	0.5	1.0	0.3	0.3	0.1	0.1	0.01	0.01	10	0.01	0.1	0.1
Terra Tek Analysis Method					TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP032	TP040	S/C	S/C	S/C	TP171	TP169	S/C	TP129	TP042	TP174
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	M	M	M	M	U	U	M	M	M	M	M	N	M	M	N

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																								
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Arsenic mg/kg	Cadmium mg/kg	Chromium mg/kg	Lead mg/kg	Mercury mg/kg	Selenium mg/kg	Copper mg/kg	Nickel mg/kg	Zinc mg/kg	Boron (water soluble) mg/kg	Hexavalent Chromium mg/kg	Phenol mg/kg	Total Cyanide mg/kg	Free Cyanide mg/kg	Sulphate (acid soluble as SO4) %	Sulphate (water soluble in 2:1 extract) as SO4 g/l	Sulphide mg/kg	Total Sulphur %	Loss on Ignition %	Total organic carbon %
WS05	4.70-5.00		ET	759228	4.6	0.67	33	11	<0.10	0.9	11	49	89	2.1	<0.3	<0.3	<0.1	<0.1	0.04	0.02	<10	0.01	~	~
WS01	1.20-1.40		ET	759203	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.45	0.78	~	0.18	~	~
WS02	2.00-2.20		ET	759209	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.20	0.06	~	0.12	~	~
Limits of Detection					0.5	0.10	1	1	0.10	0.5	1	1	0.5	1.0	0.3	0.3	0.1	0.1	0.01	0.01	10	0.01	0.1	0.1
Terra Tek Analysis Method					TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP032	TP040	S/C	S/C	S/C	TP171	TP169	S/C	TP129	TP042	TP174
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	M	M	M	M	U	U	M	M	M	M	M	N	M	M	N

Originator	Checked & Approved
DAB	S. Langman 15/02/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	pH
Hole	Depth m	Sample Ref	Sample Type		
WS01	0.10-0.40		ET	759201	8.4
WS01	4.50-4.70		ET	759204	7.7
WS02	0.25-0.40		ET	759207	8.6
WS02	4.60-5.00		ET	759210	7.3
WS03	0.20-0.40		ET	759213	8.3
WS04	0.20-0.40		ET	759216	8.5
WS04	2.60-2.80		ET	759233	7.7
WS05	1.20-1.40		ET	759219	8.4
WS05	2.20-2.40		ET	759222	8.5
WS04	4.70-5.00		ET	759226	7.7
Limits of Detection				~	
Terra Tek Analysis Method				TP019	
Accreditation M=Mcerts U=UKAS N=No accreditation				M	

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	pH																		
Hole	Depth m	Sample Ref	Sample Type																				
WS05	4.70-5.00		ET	759228	7.9																		
WS01	1.20-1.40		ET	759203	7.9																		
WS02	2.00-2.20		ET	759209	8.5																		
Limits of Detection					~																		
Terra Tek Analysis Method					TP019																		
Accreditation M=Mcerts U=UKAS N=No accreditation					M																		

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	Benzo (a) anthracene mg/kg	Chrysene mg/kg	Benzo (b) fluoranthene mg/kg	Benzo (k) fluoranthene mg/kg	Benzo (a) pyrene mg/kg	Indeno (1,2,3 - cd) pyrene mg/kg	Dibenzo (ah) anthracene mg/kg	Benzo (ghi) perylene mg/kg	Total PAHs (USEPA 16) mg/kg			
Hole	Depth m	Sample Ref	Sample Type																					
WS01	0.10-0.40		ET	759201	1.37	0.16	2.19	2.45	20.28	7.96	23.71	20.41	9.44	9.42	9.86	5.49	9.72	4.37	1.22	5.28	133.3			
WS01	4.50-4.70		ET	759204	<0.05	<0.05	0.13	0.06	0.28	0.13	0.15	0.14	0.14	0.12	0.06	0.06	0.05	<0.10	<0.10	<0.10	1.3			
WS02	0.25-0.40		ET	759207	0.18	<0.05	0.15	0.14	1.35	1.05	2.45	2.21	1.09	1.31	1.19	0.80	0.78	0.47	0.15	0.58	13.9			
WS02	4.60-5.00		ET	759210	<0.05	<0.05	<0.10	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<1.3			
WS03	0.20-0.40		ET	759213	3.02	0.22	1.39	1.43	15.03	5.77	30.08	26.81	13.75	13.67	15.71	8.24	14.12	6.69	1.83	7.72	165.5			
WS04	0.20-0.40		ET	759216	1.08	0.46	1.05	0.87	12.50	5.74	37.92	35.70	20.08	18.13	20.16	13.43	24.43	13.35	3.58	15.82	224.3			
WS04	2.60-2.80		ET	759233	<0.05	<0.05	<0.10	<0.05	0.20	0.11	0.63	0.65	0.39	0.45	0.41	0.29	0.26	0.22	<0.10	0.24	3.9			
WS05	1.20-1.40		ET	759219	0.48	0.16	0.52	0.48	4.92	1.99	8.65	7.49	3.94	4.38	4.07	2.32	4.26	1.94	0.58	2.32	48.5			
WS05	2.20-2.40		ET	759222	0.45	0.77	0.18	1.61	8.16	4.44	7.33	6.11	4.36	3.85	1.74	2.15	2.38	0.96	0.38	0.91	45.8			
WS04	4.70-5.00		ET	759226	<0.05	<0.05	<0.10	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<1.3			
Limits of Detection					0.05	0.05	0.10	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.10	0.10	0.10	1.3			
Terra Tek Analysis Method					TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045			
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M			

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

POLYAROMATIC HYDROCARBONS (USEPA 16) - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																								
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Naphthalene mg/kg	Acenaphthylene mg/kg	Acenaphthene mg/kg	Fluorene mg/kg	Phenanthrene mg/kg	Anthracene mg/kg	Fluoranthene mg/kg	Pyrene mg/kg	Benzo (a) anthracene mg/kg	Chrysene mg/kg	Benzo (b) fluoranthene mg/kg	Benzo (k) fluoranthene mg/kg	Benzo (a) pyrene mg/kg	Indeno (1,2,3 - cd) pyrene mg/kg	Dibenzo (ah) anthracene mg/kg	Benzo (ghi) perylene mg/kg	Total PAHs (USEPA 16) mg/kg			
WS05	4.70-5.00		ET	759228	<0.05	<0.05	<0.10	<0.05	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.05	<0.05	<0.05	<0.10	<0.10	<0.10	<1.3			
Limits of Detection					0.05	0.05	0.10	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.10	0.10	0.10	1.3			
Terra Tek Analysis Method					TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045			
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M			

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

POLYAROMATIC HYDROCARBONS (USEPA 16) - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C8-C10) mg/kg	TPH (Aliphatics >C10-C12) mg/kg	TPH (Aliphatics >C12-C16) mg/kg	TPH (Aliphatics >C16-C21) mg/kg	TPH (Aliphatics >C21-C35) mg/kg	TPH (Aliphatics >C35-C40) mg/kg	TPH (Aromatics >C10-C12) mg/kg	TPH (Aromatics >C12-C16) mg/kg	TPH (Aromatics >C16-C21) mg/kg	TPH (Aromatics >C21-C35) mg/kg	TPH (Aromatics >C35-C40) mg/kg									**Sample received in appropriate container**
Hole	Depth m	Sample Ref	Sample Type																					
WS01	0.10-0.40		V	759202	<1	<1	<1	5	65	15	2	13	67	284	36									**Yes**
WS01	4.50-4.70		V	759205	<1	<1	1	3	21	11	<1	3	3	4	<1									**Yes**
WS02	0.25-0.40		V	759208	<1	<1	1	2	35	7	<1	2	9	47	14									**Yes**
WS02	4.60-5.00		V	759211	<1	<1	<1	1	<1	3	<1	1	3	1	1									**Yes**
WS03	0.20-0.40		V	759214	<1	<1	2	6	100	<1	8	27	108	398	20									**Yes**
WS04	0.20-0.40		V	759217	<1	1	9	19	165	34	1	10	97	646	50									**Yes**
WS04	2.60-2.80		V	759234	<1	<1	<1	1	<1	<1	<1	1	2	<1	<1									**Yes**
WS05	1.20-1.40		V	759220	<1	<1	1	2	<1	4	1	5	21	63	<1									**Yes**
WS05	2.20-2.40		V	759223	<1	<1	<1	1	<1	<1	1	6	35	99	<1									**Yes**
WS04	4.70-5.00		V	759227	<1	<1	<1	1	<1	3	1	2	2	<1	<1									**Yes**
Limits of Detection					1	1	1	1	1	1	1	1	1	1	1									
Terra Tek Analysis Method					TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126									
Accreditation U=UKAS N=No accreditation					U	U	U	U	U	U	U	U	U	U	U									

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

TPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 3

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C8-C10) mg/kg	TPH (Aliphatics >C10-C12) mg/kg	TPH (Aliphatics >C12-C16) mg/kg	TPH (Aliphatics >C16-C21) mg/kg	TPH (Aliphatics >C21-C35) mg/kg	TPH (Aliphatics >C35-C40) mg/kg	TPH (Aromatics >C10-C12) mg/kg	TPH (Aromatics >C12-C16) mg/kg	TPH (Aromatics >C16-C21) mg/kg	TPH (Aromatics >C21-C35) mg/kg	TPH (Aromatics >C35-C40) mg/kg									**Sample received in appropriate container**
Hole	Depth m	Sample Ref	Sample Type																					
WS05	4.70-5.00		V	759229	<1	<1	<1	<1	<1	<1	1	2	2	<1	<1									**Yes**
Limits of Detection					1	1	1	1	1	1	1	1	1	1	1									
Terra Tek Analysis Method					TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126									
Accreditation U=UKAS N=No accreditation					U	U	U	U	U	U	U	U	U	U	U									

Originator	Checked & Approved
DAB	15/02/2021

TPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 3

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C5-C6) µg/kg	TPH (Aliphatics C6-C8) µg/kg	TPH (Aromatics C6-C7) µg/kg	TPH (Aromatics C7-C8) µg/kg	TPH (Aromatics C8-C10) µg/kg	Benzene µg/kg	Ethylbenzene µg/kg	m & p - Xylene µg/kg	o - Xylene µg/kg	Toluene µg/kg	MTBE µg/kg									**Sample received in appropriate container**
Hole	Depth m	Sample Ref	Sample Type																					
WS01	0.10-0.40		V	759202	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS01	4.50-4.70		V	759205	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS02	0.25-0.40		V	759208	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS02	4.60-5.00		V	759211	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS03	0.20-0.40		V	759214	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS04	0.20-0.40		V	759217	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS04	2.60-2.80		V	759234	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS05	1.20-1.40		V	759220	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS05	2.20-2.40		V	759223	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
WS04	4.70-5.00		V	759227	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
Limits of Detection					10	10	10	10	10	5	5	10	5	5	5									
Terra Tek Analysis Method					TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M									
Accreditation U=UKAS N=No accreditation																								

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

VPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 4

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C5-C6) µg/kg	TPH (Aliphatics C6-C8) µg/kg	TPH (Aromatics C6-C7) µg/kg	TPH (Aromatics C7-C8) µg/kg	TPH (Aromatics C8-C10) µg/kg	Benzene µg/kg	Ethylbenzene µg/kg	m & p - Xylene µg/kg	o - Xylene µg/kg	Toluene µg/kg	MTBE µg/kg									**Sample received in appropriate container**
Hole	Depth m	Sample Ref	Sample Type																					
WS05	4.70-5.00		V	759229	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
Limits of Detection					10	10	10	10	10	5	5	10	5	5	5									
Terra Tek Analysis Method					TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M									
Accreditation U=UKAS N=No accreditation																								

Originator	Checked & Approved
DAB	15/02/2021

VPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 4

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Asbestos	Chrysotile (white asbestos)	Amosite (brown asbestos)	Crocidolite (blue asbestos)	Anthophyllite asbestos	Tremolite asbestos	Actinolite asbestos	Quantity of soil/material provided	Comments	Quantification Result (dry mass)	Analyst
Hole	Depth m	Sample Ref	Sample Type									g		%	
WS01	0.10-0.40		ET	759200	ND	~	~	~	~	~	~	780		~	MN
WS02	0.25-0.40		ET	759206	ND	~	~	~	~	~	~	815		~	MN
WS03	0.20-0.40		ET	759212	ND	~	~	~	~	~	~	851		~	MN
WS04	0.20-0.40		ET	759215	ND	~	~	~	~	~	~	1,150		~	MN
WS04	2.60-2.80		ET	759232	ND	~	~	~	~	~	~	908		~	MN
WS05	1.20-1.40		ET	759218	ND	~	~	~	~	~	~	1,091		~	MN
WS05	2.20-2.40		ET	759221	ND	~	~	~	~	~	~	975		~	MN
WS02	1.20-1.60		ET	759224	ND	~	~	~	~	~	~	~	Analysed as a Bulk sample, bitumenous product.	~	MN
WS02	1.20-1.60		ET	759225	ND	~	~	~	~	~	~	1,198		~	MN
Limits of Detection Terra Tek Analysis Method Accreditation M=Mcerts U=UKAS N=No accreditation												~ TP181 U		0.001 TP183 U	

Originator	Checked & Approved
MN	S. Langrish 15/02/2021

ASBESTOS IDENTIFICATION

Refer to Appendix S4 notes when interpreting asbestos results

KEY

ND - no asbestos detected

D - asbestos detected

Figure 5

Sheet 1 of 1

TERRA TEK
Site Investigation & Laboratory Services

Site MIRFIELD

Client

Engineer

Contract No E13431/1

All results expressed at L/S ratio 10:1

Sample Identification																						
Exploratory Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Lead mg/kg	Antimony mg/kg	Selenium mg/kg	Zinc mg/kg	Chloride mg/kg	Fluoride mg/kg	Sulphate mg/kg	Dissolved Solids mg/kg	Phenol mg/kg	Dissolved Organic Carbon mg/kg	
WS01	0.10-0.40		ET	759201	8.10	<0.01	<0.04	<0.1	<0.1	<0.005	0.08	<0.1	<0.2	<0.05	<0.05	<0.2	<40	4	287	814	<0.1	80	
WS02	4.60-5.00		ET	759210	0.08	0.09	<0.04	<0.1	<0.1	<0.005	0.15	<0.1	<0.2	<0.05	<0.05	<0.2	<40	<1	116	380	0.3	134	
WS04	2.60-2.80		ET	759233	0.05	0.12	<0.04	<0.1	<0.1	<0.005	0.09	<0.1	<0.2	<0.05	<0.05	<0.2	<40	4	1240	2256	<0.1	34	
WASTE ACCEPTANCE CRITERIA																						
Inert landfill					0.5	20	0.04	0.5	2	0.01	0.5	0.4	0.5	0.06	0.1	4	800	10	1000	4000	1	500	
Stable, non-reactive hazardous waste in non-hazardous landfill					2	100	1	10	50	0.2	10	10	10	0.7	0.5	50	15000	150	20000	60000	~	800	
Hazardous landfill					25	300	5	70	100	2	30	40	50	5	7	200	25000	500	50000	100000	~	1000	
Limits of Detection					0.05	0.01	0.04	0.1	0.1	0.005	0.01	0.1	0.2	0.05	0.05	0.2	40	1	100	50	0.1	10	
Terra Tek Analysis Method					TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP068	TP080	TP065	TP035	TP060	TP162	
Accreditation M=Mcerts U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U	

Originator	Checked & Approved
DAB	S. Langran 15/02/2021

NOTE

A WAC test will not identify whether a waste is hazardous or not. Waste must be classified using characterisation assessment and analysis in accordance with WM3 first. Then if a waste hierarchy assessment determines that landfill is the appropriate disposal option then chemical WAC testing must be undertaken for wastes destined for inert, stable non-reactive hazardous, or hazardous classes of landfill.

Figure 6

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Temperature on receipt °C	PRIMARY MATRIX	Secondary Matrix	Additional matrix	% Loss at 30C	% Retained 2mm
Exploratory Hole	Depth m	Sample Ref	Sample Type								
WS01	0.10-0.40		ET	759201	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		12.1	41.1
WS01	1.20-1.40		ET	759203	25/01/21	4.2	Clayey SAND	Fine to medium gravel		18.6	43.5
WS01	4.50-4.70		ET	759204	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		20.1	21
WS02	0.25-0.40		ET	759207	25/01/21	4.2	Clayey SAND	Fine to medium gravel		15.4	50.2
WS02	2.00-2.20		ET	759209	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		17.2	37.9
WS02	4.60-5.00		ET	759210	25/01/21	4.2	Silty CLAY	Fine to medium gravel		23.7	22.2
WS03	0.20-0.40		ET	759213	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		16	34.2
WS04	0.20-0.40		ET	759216	25/01/21	4.2	Clayey SAND	Fine to medium gravel		10.5	56.6
WS05	1.20-1.40		ET	759219	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		15.3	24.8
WS05	2.20-2.40		ET	759222	25/01/21	4.2	Sandy CLAY	Fine to medium gravel		14.9	38.7
WS04	4.70-5.00		ET	759226	25/01/21	4.2	Silty CLAY	Fine gravel		12.3	28.1
WS05	4.70-5.00		ET	759228	25/01/21	4.2	Silty CLAY	Fine gravel		14.6	30.8
WS04	2.60-2.80		ET	759233	25/01/21	4.1	Silty CLAY	Fine to medium gravel		18.9	19.5

Notes

Terra Tek are accredited for clay, sand and loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials such as gravel, are not accredited where they comprise the major component of the sample.

Results are expressed on a dry-weight basis (samples dried at <30^{o}C) except where stated. Samples for asbestos testing are dried at 85^{o}C.

With the exception of samples analysed for asbestos, the laboratory removes any material > 2mm prior to analysis. The quantity and nature of the material is shown as the secondary and additional matrix types in the above table.

Where a parameter cannot be determined in house it is our policy to use a UKAS/MCERTS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS/MCERTS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors List, which is subject to performance assessment, will be selected.

Originator	Checked & Approved	SAMPLE DESCRIPTIONS	Appendix S1
DAB	S. Langman 15/02/2021		Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
WS01	0.10-0.40		ET	759200	25/01/21							
WS01	0.10-0.40		ET	759201	25/01/21							
WS01	0.10-0.40		V	759202	25/01/21							
WS01	4.50-4.70		ET	759204	25/01/21							
WS01	4.50-4.70		V	759205	25/01/21							
WS02	0.25-0.40		ET	759206	25/01/21							
WS02	0.25-0.40		ET	759207	25/01/21							
WS02	0.25-0.40		V	759208	25/01/21							
WS02	4.60-5.00		ET	759210	25/01/21							
WS02	4.60-5.00		V	759211	25/01/21							
WS03	0.20-0.40		ET	759212	25/01/21							
WS03	0.20-0.40		ET	759213	25/01/21							
WS03	0.20-0.40		V	759214	25/01/21							
WS04	0.20-0.40		ET	759215	25/01/21							
WS04	0.20-0.40		ET	759216	25/01/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved
DAB	S. Langman 15/02/2021

DEVIATING SAMPLES - SOIL

Appendix S2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
WS04	0.20-0.40		V	759217	25/01/21							
WS04	2.60-2.80		ET	759232	25/01/21							
WS04	2.60-2.80		ET	759233	25/01/21							
WS04	2.60-2.80		V	759234	25/01/21							
WS05	1.20-1.40		ET	759218	25/01/21							
WS05	1.20-1.40		ET	759219	25/01/21							
WS05	1.20-1.40		V	759220	25/01/21							
WS05	2.20-2.40		ET	759221	25/01/21							
WS05	2.20-2.40		ET	759222	25/01/21							
WS05	2.20-2.40		V	759223	25/01/21							
WS02	1.20-1.60		ET	759224	25/01/21							
WS02	1.20-1.60		ET	759225	25/01/21							
WS04	4.70-5.00		ET	759226	25/01/21							
WS04	4.70-5.00		V	759227	25/01/21							
WS05	4.70-5.00		ET	759228	25/01/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved
DAB	S. Langrish 15/02/2021

DEVIATING SAMPLES - SOIL

Appendix S2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
WS05	4.70-5.00		V	759229	25/01/21							
WS01	1.20-1.40		ET	759203	25/01/21							
WS02	2.00-2.20		ET	759209	25/01/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved
DAB	S. Longmuir 15/02/2021

DEVIATING SAMPLES - SOIL

Appendix S2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
GP001	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Preparation of soil samples for chemical analysis	Yes	Yes	N/A
GP012	BS EN 12457-3: Characterisation of Waste - Compliance test for leaching of granular waste materials and sludges (two-stage batch test)	Preparation of soil samples for two-stage leachate test			Dry
TP019	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of pH in 2.5:1 water/soil extract using pH meter.	Yes	Yes	Dry
TP032	MAFF Book 427: The Analysis of Agricultural Materials: Method 8	Determination of water soluble boron by ICP-OES	Yes		Dry
TP040	APHA/AWWA, 19th edition: Method 3500Cr-D	Determination of hexavalent chromium by colorimetry.	Yes		Dry
TP041	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of organic matter by titrimetry.	Yes		Dry
TP042	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of loss on ignition at 50-440°C by gravimetry	Yes	Yes	Dry
TP045	GACHAMJA A.M. Chromatography and Analysis: 1992 9-11 (modified)	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS	Yes	Yes	Dry
TP046	MEWAM method: Phenols in water and Effluents: 4-aminoantipyrine method	Determination of monohydric phenols by steam distillation/colorimetry	Yes	Yes	Dry
TP047	MEWAM method: Cyanide in Waters etc	Determination of free cyanide by steam distillation/colorimetry	Yes		Dry
TP048	MEWAM method: Cyanide in Waters etc	Determination of total cyanide by steam distillation/colorimetry.	Yes	Yes	Dry
TP049	MEWAM method: Cyanide in Waters etc	Determination of complex cyanide by calculation	Yes		Dry
TP050	MEWAM method: Determination of Thiocyanate ,1985	Determination of thiocyanate by colorimetry	Yes	Yes	Dry
TP051	USEPA Method 9030B	Determination of acid soluble sulphides by steam distillation/colorimetry.	Yes	Yes	Wet
TP067	TNRCC Method 1005: 2001 (modified)	Determination of pentane/acetone extractable petroleum hydrocarbons (C8 - C40) by GC/FID	Yes	Yes	Wet
TP072	In-house documented method	Determination of ammoniacal nitrogen by colorimetry			Dry
TP074	In-house documented method	Determination of water soluble fluoride by ion selective electrode			Dry
TP098	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of acid soluble chloride by titrimetry			Dry
TP099	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP100	Wisconsin DNR Modified GRO method, Method for Determining Gasoline Range Organics	Determination of Volatile Petroleum Hydrocarbons/GRO.	Yes	Yes	Wet

Notes

1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample.
2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated.
3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request.
4. The laboratory records the date of analysis of each parameter. This information is available on request.
5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.

Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)	Appendix S3
N/A	N/A		Sheet 1 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
TP110	USEPA Methods 8082A & 3665A	Determination of Total & Speciated 7 PCB Congeners by GC/MS SIM	Yes	Yes	Wet
TP114	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of carbonate in soil (rapid titration method)			Dry
TP126	TNRCC Method 1006 (modified)	Extracted petroleum hydrocarbons from TP067 split into aromatic and aliphatic fractions. Analysed by GC/FID.	Yes		Wet
TP129	In-house documented method	Determination of total sulphur by ICP-OES spectroscopy	Yes	Yes	Dry
TP134	In-house documented method	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP135	USEPA Methods 8100 & 8270D. In-house method TP045	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS (with concentration stage)			Dry
TP137	BS7755: Section 3.9: 1995/ISO 11466:1995	Determination of acid extractable metals in soil by ICP-OES	Selected	Selected	Dry
TP145	USEPA Methods 3550C & 8270D	Determination of Semi-Volatile Organic Compounds by GC/MS	Yes	Yes	Wet
TP147	USEPA Methods 8082A & 3665A	Determination of total & speciated WHO 12 PCB Congeners by GC/MS SIM.			Wet
TP150	USEPA Methods 8081B & 8141B	Determination of pesticides and herbicides in soil by GC/MS SIM			Dry
TP152	USEPA Method 556	Determination of carbonyls by GC/MS.			Wet
TP154	USEPA Method 5021. Wisconsin DNR modified GRO method	Determination of volatiles in by GC/MS headspace	Yes	Selected	Wet
TP158	USEPA Method 1671	Determination of glycols by GC/FID DI			Wet
TP169	In-house documented method	Determination of water soluble sulphate in 2:1 water/soil extract by ICP-OES spectroscopy	Yes	Yes	Wet
TP171	In-house documented method	Determination of acid soluble sulphate by ICP-OES spectroscopy	Yes	Yes	Dry
TP174	In-house documented method	Determination of Total Organic Carbon in soils by high temperature combustion & NDIR detection	Yes		Dry
TP178	In-house documented method	Determination of water soluble nitrate by ion selective electrode			Dry
TP181	HSG 248 Asbestos: The Analysts Guide (Appendix 2)	Asbestos Identification in bulk materials	Yes	No	Dry
TP183	HSG 248 Asbestos: The Analysts Guide (Appendix 2) & Standing Committee of Analysts: The Quantification of Asbestos in Soil (2017)	Asbestos Identification & Quantification in soils	Yes	No	Dry
TP185	In-house documented method	Determination of loss on ignition at 150-440°C by gravimetry	No	No	Dry

Notes

1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample.
2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated.
3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request.
4. The laboratory records the date of analysis of each parameter. This information is available on request.
5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.

Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)	Appendix S3
N/A	N/A		Sheet 2 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES	Site MIRFIELD	Contract No **E13431/1**
	Client	
	Engineer	

NOTES - ASBESTOS TESTING

The Limit of Detection of the method is 0.001% dry mass of asbestos fibre of the dry weight of soil provided. Where the result of analysis is ND (Not Detected), this indicates that presence of asbestos is below this level.

The Limit of Quantitation of the test is 0.001% dry mass of asbestos fibre of dry weight of soil/material provided based on method validation where the size of sample provided is in excess of 600g.

Asbestos analysis is only undertaken at the Birmingham Laboratory only.

The uncertainty of measurement for the quantification of asbestos fibre in soil can be provided on request.

The identification of product type or the Asbestos Containing Material (ACM) within a soil sample is based on the opinion of the analyst based on the visual assessment and may not be accurate and is not covered by the scope of UKAS accreditation.

The analysis result pertains only to the sample provided and is not guaranteed to be representative in whole or part from where it was taken.

Information relating to the sampling site, ie hole depth and location, is provided by the client and Terra Tek do not accept any responsibilty for the accuracy of validity of this information.

Originator	Checked & Approved	NOTES - ASBESTOS TESTING	Appendix S4
MN	N/A		Sheet 1 of 1

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

DTS Raeburn Limited
Moor Lane
Witton
Birmingham
B6 7HG

For the attention of Tom Dentith-Barnard

Report No: B25564-2
Issue No 02

LABORATORY TEST REPORT

Project Name	**MIRFIELD**		
Project Number	**B25564-2**	Date samples received	12/02/2021
Your Ref	E13431/1	Date written instructions received	12/02/2021
Purchase Order	31536/E13431/1	Date testing commenced	12/02/2021

Please find enclosed the results as summarised below

Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	12	Client Specified Suites - Soil	See report
2	4	PAHs (speciated) - Soil	Yes
3	4	TPHCWG - Soil	Yes
4	4	VPHCWG/BTEX - Soil	Yes
5	3	Asbestos Screen/Quantification - Soil	Yes
6	1	WAC Leachate Suite - Soil	See report

Remarks :

Issued by : Stephen Langman Date of Issue : 01/03/2021

Approved Signatories : S. Langman 01/03/2021
S Langman (Laboratory Coordinator), D Bowen (Production Manager)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw
our report if we have not received cleared funds in accordance with our standard terms and conditions
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website www.terratek.co.uk/contact-us

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TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron (water soluble)	Phenol	Total Cyanide	Free Cyanide	Sulphate (acid soluble as SO4)	Sulphate (water soluble in 2:1 extract) as SO4	Sulphide	Total Sulphur	Total organic carbon	Loss on Ignition	pH
Hole	Depth m	Sample Ref	Sample Type		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	g/l	mg/kg	%	%	%	
CP01	2.00-3.00		ET	760958	1,142.6	4.00	98	275	0.69	<0.5	281	63	1,088	1.3	<0.3	6.4	<0.1	0.14	~	40	0.11	~	~	8.0
CP01	4.00-5.00		ET	760962	148.5	1.23	50	90	0.12	<0.5	47	60	224	1.0	<0.3	2.1	<0.1	0.06	0.11	32	0.03	~	~	7.7
CP01	5.30-6.00		ET	760964	17.2	1.01	37	30	<0.10	<0.5	22	48	109	0.6	<0.3	<0.1	<0.1	0.04	0.08	<10	0.02	~	~	7.4
CP05	0.30-1.00		ET	760973	23.7	1.17	51	142	0.30	<0.5	114	49	163	0.4	<0.3	<0.1	<0.1	0.09	0.06	160	0.18	9.4	8.7	7.9
CP01	3.00		ET	760960	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.07	~	~	~	~	8.0
CP01	9.50-9.95		ET	760966	~	~	~	~	~	~	~	~	~	~	~	~	~	0.03	0.06	~		~	~	7.0
CP02	6.00		ET	760967	~	~	~	~	~	~	~	~	~	~	~	~	~	0.04	0.08	~		~	~	7.1
CP02	11.00-11.45		ET	760968	~	~	~	~	~	~	~	~	~	~	~	~	~	0.03	0.06	~		~	~	7.3
CP03	9.00		ET	760969	~	~	~	~	~	~	~	~	~	~	~	~	~	~	<0.01	~	~	~	~	7.3
CP03	15.00		ET	760970	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.14	~	~	~	~	7.8
Limits of Detection					0.5	0.10	1	1	0.10	0.5	1	1	0.5	1.0	0.3	0.1	0.1	0.01	0.01	10	0.01	0.1	0.1	~
Terra Tek Analysis Method					TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP032	S/C	S/C	S/C	TP171	TP169	S/C	TP129	TP174	TP042	TP019
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	U	M	M	M	U	U	U	U	M	M	N	M	U	M	M

Originator	Checked & Approved
DAB	S. Langrish 01/03/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Copper	Nickel	Zinc	Boron (water soluble)	Phenol	Total Cyanide	Free Cyanide	Sulphate (acid soluble as SO4)	Sulphate (water soluble in 2:1 extract) as SO4	Sulphide	Total Sulphur	Total organic carbon	Loss on Ignition	pH
Hole	Depth m	Sample Ref	Sample Type		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	%	g/l	mg/kg	%	%	%	
CP04	5.00		ET	760971	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.05	~	~	~	~	7.2
CP04	12.00		ET	760972	~	~	~	~	~	~	~	~	~	~	~	~	~	~	0.05	~	~	~	~	8.2
Limits of Detection					0.5	0.10	1	1	0.10	0.5	1	1	0.5	1.0	0.3	0.1	0.1	0.01	0.01	10	0.01	0.1	0.1	~
Terra Tek Analysis Method					TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP137	TP032	S/C	S/C	S/C	TP171	TP169	S/C	TP129	TP174	TP042	TP019
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	U	M	M	M	U	U	U	U	M	M	N	M	U	M	M

Originator	Checked & Approved
DAB	01/03/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo (a) anthracene	Chrysene	Benzo (b) fluoranthene	Benzo (k) fluoranthene	Benzo (a) pyrene	Indeno (1,2,3 - cd) pyrene	Dibenzo (ah) anthracene	Benzo (ghi) perylene	Total PAHs (USEPA 16)			
Hole	Depth m	Sample Ref	Sample Type		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg			
CP01	2.00-3.00		ET	760958	5.50	2.17	3.29	7.92	30.70	16.15	37.81	33.31	18.85	17.25	14.19	10.39	17.09	6.70	2.36	8.17	231.9			
CP01	4.00-5.00		ET	760962	0.25	<0.05	0.12	0.14	1.05	0.80	1.89	1.68	0.87	1.03	0.69	0.60	0.56	0.31	0.12	0.40	10.5			
CP01	5.30-6.00		ET	760964	<0.05	<0.05	<0.10	<0.05	<0.10	<0.10	0.16	0.15	0.14	0.12	0.05	0.08	0.06	<0.10	<0.10	<0.10	<1.3			
CP05	0.30-1.00		ET	760973	3.09	0.68	2.77	3.56	38.89	26.05	116.74	101.19	59.84	48.69	49.81	34.71	61.10	29.42	8.11	34.40	619.0			
Limits of Detection					0.05	0.05	0.10	0.05	0.10	0.10	0.10	0.10	0.10	0.10	0.05	0.05	0.05	0.10	0.10	0.10	1.3			
Terra Tek Analysis Method					TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045	TP045			
Accreditation M=Mcerts U=UKAS N=No accreditation					M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M			

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POLYAROMATIC HYDROCARBONS (USEPA 16) - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 2

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification					TPH (Aliphatics C8-C10)	TPH (Aliphatics >C10-C12)	TPH (Aliphatics >C12-C16)	TPH (Aliphatics >C16-C21)	TPH (Aliphatics >C21-C35)	TPH (Aliphatics >C35-C40)	TPH (Aromatics >C10-C12)	TPH (Aromatics >C12-C16)	TPH (Aromatics >C16-C21)	TPH (Aromatics >C21-C35)	TPH (Aromatics >C35-C40)									
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg									**Sample received in appropriate container**
CP01	2.00-3.00		V	760959	<1	3	18	54	78	<1	2	5	48	209	6									**Yes**
CP01	4.00-5.00		V	760963	<1	<1	<1	2	<1	<1	4	2	4	4	<1									**Yes**
CP01	5.30-6.00		V	760965	<1	<1	<1	1	<1	<1	4	4	4	<1	<1									**Yes**
CP05	0.30-1.00		ET	760973	<1	2	49	191	580	59	3	11	234	1,110	56									**No**
Limits of Detection					1	1	1	1	1	1	1	1	1	1	1									
Terra Tek Analysis Method					TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126	TP126									
Accreditation U=UKAS N=No accreditation					U	U	U	U	U	U	U	U	U	U	U									

Originator	Checked & Approved
DAB	S. Langrish 01/03/2021

TPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 3

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C5-C6) µg/kg	TPH (Aliphatics C6-C8) µg/kg	TPH (Aromatics C6-C7) µg/kg	TPH (Aromatics C7-C8) µg/kg	TPH (Aromatics C8-C10) µg/kg	Benzene µg/kg	Ethylbenzene µg/kg	m & p - Xylene µg/kg	o - Xylene µg/kg	Toluene µg/kg	MTBE µg/kg									Sample received in appropriate container
Hole	Depth m	Sample Ref	Sample Type																					
CP01	2.00-3.00		V	760959	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
CP01	4.00-5.00		V	760963	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
CP01	5.30-6.00		V	760965	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**Yes**
CP05	0.30-1.00		ET	760973	<10	<10	<10	<10	<10	<5	<5	<10	<5	<5	<5									**No**
Limits of Detection					10	10	10	10	10	5	5	10	5	5	5									
Terra Tek Analysis Method					TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M	TP154 M									
Accreditation U=UKAS N=No accreditation																								

Originator	Checked & Approved
DAB	01/03/2021

VPHCWG - SOIL

KEY

* - deviating result (refer to Appendix S2 for details)

^ - result expressed on as-received basis

Figure 4

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Asbestos	Chrysotile (white asbestos)	Amosite (brown asbestos)	Crocidolite (blue asbestos)	Anthophyllite asbestos	Tremolite asbestos	Actinolite asbestos	Quantity of soil/material provided	Comments	Quantification Result (dry mass)	Analyst
Hole	Depth m	Sample Ref	Sample Type									g		%	
CP01	2.00-3.00		ET	760957	~	D	D	~	~	~	~	1,082	A degraded Asbestos insulation board, despersed within the soil matrix	1.505	MN
CP01	4.00-5.00		ET	760961	ND	~	~	~	~	~	~	~		~	MN
CP05	0.30-1.00		ET	760973	ND	~	~	~	~	~	~	~		~	MN
Limits of Detection Terra Tek Analysis Method Accreditation M=Mcerts U=UKAS N=No accreditation												~ TP181 U		0.001 TP183 U	

Originator	Checked & Approved
MN	S. Longmore 01/03/2021

ASBESTOS IDENTIFICATION

Refer to Appendix S4 notes when interpreting asbestos results

KEY

ND - no asbestos detected

D - asbestos detected

Figure 5

TERRA TEK
Site Investigation & Laboratory Services

Site MIRFIELD

Client

Engineer

Contract No E13431/1

All results expressed at L/S ratio 10:1

Sample Identification				Lab Sample ID	Arsenic mg/kg	Barium mg/kg	Cadmium mg/kg	Chromium mg/kg	Copper mg/kg	Mercury mg/kg	Molybdenum mg/kg	Nickel mg/kg	Lead mg/kg	Antimony mg/kg	Selenium mg/kg	Zinc mg/kg	Chloride mg/kg	Fluoride mg/kg	Sulphate mg/kg	Dissolved Solids mg/kg	Phenol mg/kg	Dissolved Organic Carbon mg/kg
Exploratory Hole	Depth m	Sample Ref	Sample Type																			
CP05	0.30-1.00		ET	760973	<0.05	0.22	<0.04	<0.1	<0.1	<0.005	0.05	<0.1	<0.2	<0.05	<0.05	<0.2	<40	13	<100	578	<0.1	34
WASTE ACCEPTANCE CRITERIA																						
Inert landfill					0.5	20	0.04	0.5	2	0.01	0.5	0.4	0.5	0.06	0.1	4	800	10	1000	4000	1	500
Stable, non-reactive hazardous waste in non-hazardous landfill					2	100	1	10	50	0.2	10	10	10	0.7	0.5	50	15000	150	20000	60000	~	800
Hazardous landfill					25	300	5	70	100	2	30	40	50	5	7	200	25000	500	50000	100000	~	1000
Limits of Detection					0.05	0.01	0.04	0.1	0.1	0.005	0.01	0.1	0.2	0.05	0.05	0.2	40	1	100	50	0.1	10
Terra Tek Analysis Method					TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP068	TP080	TP065	TP035	TP060	TP162
Accreditation M=Mcerts U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	U

Originator	Checked & Approved
DAB	S. Langrish 01/03/2021

NOTE

A WAC test will not identify whether a waste is hazardous or not. Waste must be classified using characterisation assessment and analysis in accordance with WM3 first. Then if a waste hierarchy assessment determines that landfill is the appropriate disposal option then chemical WAC testing must be undertaken for wastes destined for inert, stable non-reactive hazardous, or hazardous classes of landfill.

Figure 6

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No **E13431/1**

Sample Identification				Lab Sample ID	Date Sampled	Temperature on receipt °C	PRIMARY MATRIX	Secondary Matrix	Additional matrix	% Loss at 30C	% Retained 2mm
Exploratory Hole	Depth m	Sample Ref	Sample Type								
CP01	2.00-3.00		ET	760958	25/01/21	3..2	Sandy CLAY	Fine to medium gravel		13.2	54.2
CP01	3.00		ET	760960	25/01/21	3..2	Sandy CLAY	Fine to medium gravel		12.9	57.3
CP01	4.00-5.00		ET	760962	25/01/21	3..2	Sandy CLAY	Fine to medium gravel		15.8	45.6
CP01	5.30-6.00		ET	760964	25/01/21	3..2	Silty CLAY	Fine to medium gravel		15.7	23.1
CP01	9.50-9.95		ET	760966	25/01/21	3..2	Silty CLAY	Fine to medium gravel		10.5	52.7
CP02	6.00		ET	760967	27/01/21	3..2	Silty CLAY	Fine to medium gravel		24.1	29.4
CP02	11.00-11.45		ET	760968	27/01/21	3..2	Silty CLAY	Fine to medium gravel		15.5	47.4
CP03	9.00		ET	760969	26/01/21	3..2	Fine to medium GRAVEL w/some some			5.9	68.6
CP03	15.00		ET	760970	26/01/21	3..2	Fine to medium GRAVEL w/some some			13.6	62.2
CP04	5.00		ET	760971	01/02/21	3..2	Silty CLAY	Fine to medium gravel		19.8	31.5
CP04	12.00		ET	760972	01/02/21	3..2	Fine to medium GRAVEL w/some some			7.8	72.9
CP05	0.30-1.00		ET	760973	03/02/21	3..2	SAND	Fine to medium gravel		9.9	55

Notes

Terra Tek are accredited for clay, sand and loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials such as gravel, are not accredited where they comprise the major component of the sample.

Results are expressed on a dry-weight basis (samples dried at <30^{o}C) except where stated. Samples for asbestos testing are dried at 85^{o}C.

With the exception of samples analysed for asbestos, the laboratory removes any material > 2mm prior to analysis. The quantity and nature of the material is shown as the secondary and additional matrix types in the above table.

Where a parameter cannot be determined in house it is our policy to use a UKAS/MCERTS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS/MCERTS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors List, which is subject to performance assessment, will be selected.

Originator	Checked & Approved	**SAMPLE DESCRIPTIONS**	**Appendix S1**
DAB	S. Langman 01/03/2021		Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
CP01	2.00-3.00		ET	760957	25/01/21							
CP01	2.00-3.00		ET	760958	25/01/21							
CP01	2.00-3.00		V	760959	25/01/21							
CP01	4.00-5.00		ET	760961	25/01/21							
CP01	4.00-5.00		ET	760962	25/01/21							
CP01	4.00-5.00		V	760963	25/01/21							
CP01	5.30-6.00		ET	760964	25/01/21							
CP01	5.30-6.00		V	760965	25/01/21							
CP05	0.30-1.00		ET	760973	03/02/21							
CP01	3.00		ET	760960	25/01/21							
CP01	9.50-9.95		ET	760966	25/01/21							
CP02	6.00		ET	760967	27/01/21							
CP02	11.00-11.45		ET	760968	27/01/21							
CP03	9.00		ET	760969	26/01/21							
CP03	15.00		ET	760970	26/01/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved
DAB	S. Langmead 01/03/2021

DEVIATING SAMPLES - SOIL

Appendix S2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
CP04	5.00		ET	760971	01/02/21							
CP04	12.00		ET	760972	01/02/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved	DEVIATING SAMPLES - SOIL	Appendix S2
DAB	S. Langman 01/03/2021		Sheet 2 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
GP001	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Preparation of soil samples for chemical analysis	Yes	Yes	N/A
GP012	BS EN 12457-3: Characterisation of Waste - Compliance test for leaching of granular waste materials and sludges (two-stage batch test)	Preparation of soil samples for two-stage leachate test			Dry
TP019	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of pH in 2.5:1 water/soil extract using pH meter.	Yes	Yes	Dry
TP032	MAFF Book 427: The Analysis of Agricultural Materials: Method 8	Determination of water soluble boron by ICP-OES	Yes		Dry
TP040	APHA/AWWA, 19th edition: Method 3500Cr-D	Determination of hexavalent chromium by colorimetry.	Yes		Dry
TP041	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of organic matter by titrimetry.	Yes		Dry
TP042	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of loss on ignition at 50-440°C by gravimetry	Yes	Yes	Dry
TP045	GACHAMJA A.M. Chromatography and Analysis: 1992 9-11 (modified)	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS	Yes	Yes	Dry
TP046	MEWAM method: Phenols in water and Effluents: 4-aminoantipyrine method	Determination of monohydric phenols by steam distillation/colorimetry	Yes	Yes	Dry
TP047	MEWAM method: Cyanide in Waters etc	Determination of free cyanide by steam distillation/colorimetry	Yes		Dry
TP048	MEWAM method: Cyanide in Waters etc	Determination of total cyanide by steam distillation/colorimetry.	Yes	Yes	Dry
TP049	MEWAM method: Cyanide in Waters etc	Determination of complex cyanide by calculation	Yes		Dry
TP050	MEWAM method: Determination of Thiocyanate ,1985	Determination of thiocyanate by colorimetry	Yes	Yes	Dry
TP051	USEPA Method 9030B	Determination of acid soluble sulphides by steam distillation/colorimetry.	Yes	Yes	Wet
TP067	TNRCC Method 1005: 2001 (modified)	Determination of pentane/acetone extractable petroleum hydrocarbons (C8 - C40) by GC/FID	Yes	Yes	Wet
TP072	In-house documented method	Determination of ammoniacal nitrogen by colorimetry			Dry
TP074	In-house documented method	Determination of water soluble fluoride by ion selective electrode			Dry
TP098	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of acid soluble chloride by titrimetry			Dry
TP099	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP100	Wisconsin DNR Modified GRO method, Method for Determining Gasoline Range Organics	Determination of Volatile Petroleum Hydrocarbons/GRO.	Yes	Yes	Wet

Notes

1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample.
2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated.
3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request.
4. The laboratory records the date of analysis of each parameter. This information is available on request.
5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.

Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)	Appendix S3
N/A	N/A		Sheet 1 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	MCERTS Accredited	Wet/Dry Sample Tested
TP110	USEPA Methods 8082A & 3665A	Determination of Total & Speciated 7 PCB Congeners by GC/MS SIM	Yes	Yes	Wet
TP114	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of carbonate in soil (rapid titration method)			Dry
TP126	TNRCC Method 1006 (modified)	Extracted petroleum hydrocarbons from TP067 split into aromatic and aliphatic fractions. Analysed by GC/FID.	Yes		Wet
TP129	In-house documented method	Determination of total sulphur by ICP-OES spectroscopy	Yes	Yes	Dry
TP134	In-house documented method	Determination of water soluble chloride by titrimetry	Yes	Yes	Dry
TP135	USEPA Methods 8100 & 8270D. In-house method TP045	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS (with concentration stage)			Dry
TP137	BS7755: Section 3.9: 1995/ISO 11466:1995	Determination of acid extractable metals in soil by ICP-OES	Selected	Selected	Dry
TP145	USEPA Methods 3550C & 8270D	Determination of Semi-Volatile Organic Compounds by GC/MS	Yes	Yes	Wet
TP147	USEPA Methods 8082A & 3665A	Determination of total & speciated WHO 12 PCB Congeners by GC/MS SIM.			Wet
TP150	USEPA Methods 8081B & 8141B	Determination of pesticides and herbicides in soil by GC/MS SIM			Dry
TP152	USEPA Method 556	Determination of carbonyls by GC/MS.			Wet
TP154	USEPA Method 5021. Wisconsin DNR modified GRO method	Determination of volatiles in by GC/MS headspace	Yes	Selected	Wet
TP158	USEPA Method 1671	Determination of glycols by GC/FID DI			Wet
TP169	In-house documented method	Determination of water soluble sulphate in 2:1 water/soil extract by ICP-OES spectroscopy	Yes	Yes	Wet
TP171	In-house documented method	Determination of acid soluble sulphate by ICP-OES spectroscopy	Yes	Yes	Dry
TP174	In-house documented method	Determination of Total Organic Carbon in soils by high temperature combustion & NDIR detection	Yes		Dry
TP178	In-house documented method	Determination of water soluble nitrate by ion selective electrode			Dry
TP181	HSG 248 Asbestos: The Analysts Guide (Appendix 2)	Asbestos Identification in bulk materials	Yes	No	Dry
TP183	HSG 248 Asbestos: The Analysts Guide (Appendix 2) & Standing Committee of Analysts: The Quantification of Asbestos in Soil (2017)	Asbestos Identification & Quantification in soils	Yes	No	Dry
TP185	In-house documented method	Determination of loss on ignition at 150-440°C by gravimetry	No	No	Dry

Notes

1. Terra Tek (Birmingham) are MCERTS accredited for clay, sand & loam matrix types only, where they constitute the major component of the sample. Other coarse granular materials, ie gravel, are not accredited where they comprise the major component of the sample.
2. Results are expressed on a dry-weight basis (samples dried at <30°C) except where stated.
3. With the exception of samples analysed for asbestos, the laboratory removes any material >2mm prior to analysis. The quantity and nature of any material removed from samples is recorded and the information is available on request.
4. The laboratory records the date of analysis of each parameter. This information is available on request.
5. The test results pertain only to the samples provided and is not guaranteed to be representative of the parent material in whole or part from which the sample was taken. Sample location, site address, taken by and client reference are included where provided by the client, Terra Tek accepts no responsibility for the validity or accuracy of this information.

Originator	Checked & Approved	SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (SOIL)	Appendix S3
N/A	N/A		Sheet 2 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES	Site MIRFIELD	Contract No **E13431/1**
	Client	
	Engineer	

NOTES - ASBESTOS TESTING

The Limit of Detection of the method is 0.001% dry mass of asbestos fibre of the dry weight of soil provided. Where the result of analysis is ND (Not Detected), this indicates that presence of asbestos is below this level.

The Limit of Quantitation of the test is 0.001% dry mass of asbestos fibre of dry weight of soil/material provided based on method validation where the size of sample provided is in excess of 600g.

Asbestos analysis is only undertaken at the Birmingham Laboratory only.

The uncertainty of measurement for the quantification of asbestos fibre in soil can be provided on request.

The identification of product type or the Asbestos Containing Material (ACM) within a soil sample is based on the opinion of the analyst based on the visual assessment and may not be accurate and is not covered by the scope of UKAS accreditation.

The analysis result pertains only to the sample provided and is not guaranteed to be representative in whole or part from where it was taken.

Information relating to the sampling site, ie hole depth and location, is provided by the client and Terra Tek do not accept any responsibilty for the accuracy of validity of this information.

Originator	Checked & Approved	NOTES - ASBESTOS TESTING	Appendix S4
MN	N/A		Sheet 1 of 1

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

APPENDIX 4

Groundwater Contamination Laboratory Test Results
(16 pages)

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

DTS Raeburn Limited
Moor Lane
Witton
Birmingham
B6 7HG

For the attention of Tom Dentith-Barnard

Report No: B25564-3
Issue No 01

LABORATORY TEST REPORT

Project Name	**MIRFIELD**		
Project Number	**B25564-3**	Date samples received	15/02/2021
Your Ref	E13431/1	Date written instructions received	15/02/2021
Purchase Order	31587/E13431/1	Date testing commenced	15/02/2021

Please find enclosed the results as summarised below

Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	5	Client Specified Suite - Water	See report
2	5	PAHs (speciated) - Water	No
3	5	TPHCWG - Water	No
4	5	VPHCWG / BTEX - Water	Yes

Remarks :

Issued by : Stephen Langman Date of Issue : 25/02/2021

Approved Signatories : S. Langman 25/02/2021

S Langman (Laboratory Coordinator), D Bowen (Production Manager)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw
our report if we have not received cleared funds in accordance with our standard terms and conditions
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website www.terratek.co.uk/contact-us

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TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																							
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Arsenic µg/l	Cadmium µg/l	Chromium µg/l	Lead µg/l	Mercury µg/l	Selenium µg/l	Copper µg/l	Nickel µg/l	Zinc µg/l	Calcium mg/l	Boron mg/l	Phenol µg/l	Total Cyanide mg/l	Free Cyanide mg/l	Sulphate (as SO4) mg/l	Sulphide mg/l	Sulphur mg/l	Dissolved Organic Carbon mg/l	pH	
CP01	0.00-0.00		W1	761183	6.1	0.80	0.86	<0.01	<0.05	10.7	5.28	79.7	19.3	177	0.25	~	0.02	<0.05	376	<0.01	125.0	6	7.3	
CP02	0.00-0.00		W1	761186	5.4	<0.04	2.16	<0.01	<0.05	3.1	4.42	4.5	<0.3	85	0.14	~	<0.01	<0.05	150	<0.01	50.0	8	7.5	
CP03	0.00-0.00		W2	761189	5.9	0.19	1.72	<0.01	<0.05	0.6	3.65	5.3	3.2	91	0.12	<0.50	<0.01	<0.05	195	<0.01	65.0	6	7.3	
CP04	0.00-0.00		W1	761191	3.0	<0.04	1.34	<0.01	<0.05	<0.5	3.99	1.6	1.9	80	<0.05	~	<0.01	<0.05	91	<0.01	30.0	6	7.9	
CP05	0.00-0.00		W1	761194	4.3	<0.04	3.21	<0.01	<0.05	0.5	4.87	15.4	2.8	159	0.19	~	<0.01	<0.05	297	<0.01	99.0	14	7.3	
CP01	0.00-0.00		W2	761184	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
CP02	0.00-0.00		W2	761187	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
CP04	0.00-0.00		W2	761192	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
CP05	0.00-0.00		W2	761195	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
Limits of Detection					0.2	0.04	0.04	0.01	0.08	0.5	0.03	0.3	0.3	1	0.05	0.50	0.01	0.05	4	0.01	1	1	~	
Terra Tek Analysis Method					TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP117	TP054	TP113	TP062	TP061	TP170	TP066	TP170	TP162	TP020	
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	U	U	N	U	U	U	U	U	N	U	

Originator	Checked & Approved
DAB	S. Langrish 25/02/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 1

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																							
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Naphthalene ng/l	Acenaphthylene ng/l	Acenaphthene ng/l	Fluorene ng/l	Phenanthrene ng/l	Anthracene ng/l	Fluoranthene ng/l	Pyrene ng/l	Benzo (a) anthracene ng/l	Chrysene ng/l	Benzo (b) fluoranthene ng/l	Benzo (k) fluoranthene ng/l	Benzo (a) pyrene ng/l	Indeno (1,2,3 - cd) pyrene ng/l	Dibenzo (ah) anthracene ng/l	Benzo (ghi) perylene ng/l	Polynuclear Aromatic Hydrocarbons (total) ng/l			Sample received in appropriate container
CP01	0.00-0.00		W2	761184	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<160			Yes
CP02	0.00-0.00		W2	761187	<10	<10	<10	<10	<10	<10	290	314	131	139	289	79	232	134	<10	172	1,779			Yes
CP03	0.00-0.00		W2	761189	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<160			Yes
CP04	0.00-0.00		W2	761192	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<160			Yes
CP05	0.00-0.00		W2	761195	<10	<10	<10	<10	174	<10	213	171	54	42	132	<10	11	76	33	87	993			Yes
Limits of Detection					10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	160			
Terra Tek Analysis Method					TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112			
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			

Originator	Checked & Approved
DAB	S. Langrish 25/02/2021

POLYAROMATIC HYDROCARBONS (USEPA 16) - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C8-C10) µg/l	TPH (Aliphatics >C10-C12) µg/l	TPH (Aliphatics >C12-C16) µg/l	TPH (Aliphatics >C16-C21) µg/l	TPH (Aliphatics >C21-C35) µg/l	TPH (Aliphatics >C35-C40) µg/l	TPH (Aromatics >C10-C12) µg/l	TPH (Aromatics >C12-C16) µg/l	TPH (Aromatics >C16-C21) µg/l	TPH (Aromatics >C21-C35) µg/l	TPH (Aromatics >C35-C40) µg/l									**Sample received in appropriate container**
Hole	Depth m	Sample Ref	Sample Type																					
CP01	0.00-0.00		W2	761184	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP02	0.00-0.00		W2	761187	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP03	0.00-0.00		W2	761189	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP04	0.00-0.00		W2	761192	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP05	0.00-0.00		W2	761195	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
Limits of Detection					10	10	10	10	10	10	10	10	10	10	10									
Terra Tek Analysis Method					TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130									
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N									

Originator	Checked & Approved
DAB	S. Langrish 25/02/2021

TPHCWG - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 3

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																							
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	TPH (Aliphatics C5-C6) µg/l	TPH (Aliphatics C6-C8) µg/l	TPH (Aromatics C6-C7) µg/l	TPH (Aromatics C7-C8) µg/l	TPH (Aromatics C8-C10) µg/l	Benzene µg/l	Ethylbenzene µg/l	m & p - Xylene µg/l	o - Xylene µg/l	Toluene µg/l	MTBE µg/l									**Sample received in appropriate container**
CP01	0.00-0.00		V	761185	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP02	0.00-0.00		V	761188	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP03	0.00-0.00		V	761190	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP04	0.00-0.00		V	761193	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP05	0.00-0.00		V	761196	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
Limits of Detection					10	10	10	10	10	1	1	2	1	1	1									
Terra Tek Analysis Method					TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155									
Accreditation U=UKAS N=No accreditation					U	U	U	U	U	U	U	U	U	U	U									

Originator	Checked & Approved
DAB	S. Langrish 25/02/2021

VPHCWG - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 4

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
CP01	0.00-0.00		W1	761183	11/02/21							
CP01	0.00-0.00		W2	761184	11/02/21							
CP01	0.00-0.00		V	761185	11/02/21							
CP02	0.00-0.00		W1	761186	11/02/21							
CP02	0.00-0.00		W2	761187	11/02/21							
CP02	0.00-0.00		V	761188	11/02/21							
CP03	0.00-0.00		W2	761189	11/02/21							
CP03	0.00-0.00		V	761190	11/02/21							
CP04	0.00-0.00		W1	761191	11/02/21							
CP04	0.00-0.00		W2	761192	11/02/21							
CP04	0.00-0.00		V	761193	11/02/21							
CP05	0.00-0.00		W1	761194	11/02/21							
CP05	0.00-0.00		W2	761195	11/02/21							
CP05	0.00-0.00		V	761196	11/02/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved	DEVIATING SAMPLES - WATER	Appendix W1
TGH	S. Langrish 25/02/2021		Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	
TP020	APHA/AWWA, 19th edition	Determination of pH using pH meter	Yes	
TP035	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of dissolved solids by gravimetry	Yes	
TP054	MAFF Book 427: The Analysis of Agricultural Materials: Method 8	Determination of boron by ICP-OES	Yes	
TP057	APHA/AWWA, 19th edition: Method 3500Cr-D	Determination of hexavalent chromium by colorimetry	Yes	
TP060	MEWAM method: Phenols in water and Effluents: 4-aminoantipyrine method	Determination of monohydric phenols by steam distillation/colorimetry	Yes	
TP061	MEWAM method: Cyanide in Waters etc	Determination of free cyanide by colorimetry	Yes	
TP062	MEWAM method: Cyanide in Waters etc	Determination of total cyanide by steam distillation/colorimetry	Yes	
TP063	MEWAM method: Cyanide in Waters etc	Determination of complex cyanide by calculation	Yes	
TP064	MEWAM method: Determination of Thiocyanate ,1985	Determination of thiocyanate by colorimetry	Yes	
TP066	MEWAM method: Sulphide in Waters and Effluents, Tentative Methods: 1983	Determination of sulphides by colorimetry	Yes	
TP068	APHA/AWWA, 19th edition: Method 4500-Cl-D	Determination of chlorides by titrimetry	Yes	
TP078	APHA/AWWA, 18th edition: Method 4500C	Determination of ammoniacal nitrogen by colorimetry		
TP079	In-house documented method	Determination of anionic detergent (MBAS) by colorimetry		
TP080	APHA/AWWA, 19th edition: Method 4500-F-C	Determination of fluoride by ion selective electrode	Yes	
TP081	APHA/AWWA, 19th edition: Method 2540D	Determination of suspended solids by gravimetry	Yes	
TP102	APHA/AWWA, 19th edition: Method 6640B USEPA Method 610	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS	Yes	
TP103	Texas Natural Resource Conservation Commission Method 1005 & USEPA Method 3510C	Determination of Extractable Petroleum Hydrocarbons (>C8 - C40) by GC/FID		
TP108	APHA/AWWA, 19th edition: Method 2510B	Determination of electrical conductivity by electrode	Yes	
TP112	USEPA Method 8100	Determination of polyaromatic hydrocarbons extractable in dichloromethane/hexane, by GC/MS		
TP113	APHA/AWWA, 19th edition: Method 6410 USEPA Method 2870D	Determination of phenol by GC/MS		

Notes

1. The laboratory records the date of analysis of each parameter. This information is available on request.
2. Where a parameter cannot be determined in house it is our policy to use a UKAS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors list, which is subject to performance assessment, will be selected.

Originator	Checked & Approved	**SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (WATER)**	**Appendix W2**
N/A	N/A		Sheet 1 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	
TP117	APHA/AWWA, 19th edition: Method 2340B	Determination of hardness of water (calculation)	Yes	
TP118	APHA/AWWA, 19th edition: Method 2320B	Determination of total alkalinity by titration	Yes	
TP128	APHA/AWWA, 19th edition: Method 6410 USEPA Method 2870D	Determination of Semi-Volatile Organic Compounds by GC/MS	Yes	
TP130	Texas Natural Resource Conservation Commission Method 1005 & 1006	Determination of Extractable Petroleum Hydrocarbons (EPH-CWG C8-C40) by GC/FID		
TP132	APHA/AWWA, 19th edition: Method 4500-NO2-B	Determination of nitrite by colorimetry	Yes	
TP133	In-house documented method	Determination of chemical oxygen demand by colorimetry		
TP146	USEPA Methods 8082A & 3665A	Determination of Total & Speciated 7 PCB Congeners by GC/MS SIM		
TP149	USEPA Methods 8082A & 3665A	Determination of Total & Speciated WHO 12 PCB Congeners by GC/MS SIM		
TP155	USEPA method 5021. Wisconsin DNR modified GRO method	Determination of volatiles in water by GC/MS headspace	Yes	
TP156	APHA/AWWA, 19th edition: Method 3030B (filtration)	Determination of dissolved metals by ICP-MS	Selected	
TP159	USEPA Method 1671	Determination of glycols in water by GC/FID DI		
TP160	USEPA Method 556	Determination of formaldeyde in water by GC/MS		
TP162	USEPA Method 9060A	Determination of TOC/DOC in water by HT Combustion/NDIR		
TP170	In-house documented method	Determination of sulphate by ICP-OES spectroscopy	Yes	
TP179	In-house documented method	Determination of nitrate by ion selective electrode		
TP184	In-house documented method	Analysis of water by discrete analyser		

Notes

1. The laboratory records the date of analysis of each parameter. This information is available on request.
2. Where a parameter cannot be determined in house it is our policy to use a UKAS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors list, which is subject to performance assessment, will be selected.

Originator	Checked & Approved	**SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (WATER)**	**Appendix W2**
N/A	N/A		Sheet 2 of 2

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

DTS Raeburn Limited
Moor Lane
Witton
Birmingham
B6 7HG

For the attention of Tom Dentith-Barnard

Report No: B25564-4
Issue No 01

LABORATORY TEST REPORT

Project Name	**MIRFIELD**		
Project Number	**B25564-4**	Date samples received	15/03/2021
Your Ref	E13431/1	Date written instructions received	15/03/2021
Purchase Order	31689/E13431/1	Date testing commenced	15/03/2021

Please find enclosed the results as summarised below

Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1	4	Client Specified Suite - Water	See report
2	4	PAHs (speciated) - Water	No
3	4	TPHCWG - Water	No
4	4	VPHCWG/BTEX - Water	Yes

Remarks :

Issued by : Stephen Langman Date of Issue : 25/03/2021

Approved Signatories : S. Langman 25/03/2021
S Langman (Laboratory Coordinator), D Bowen (Production Manager)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw
our report if we have not received cleared funds in accordance with our standard terms and conditions
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website www.terratek.co.uk/contact-us

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Terra Tek Ltd is registered in Scotland No. 121594
Offices in Airdrie, Birmingham, Belfast and Aston Clinton
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TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																							
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Arsenic µg/l	Cadmium µg/l	Chromium µg/l	Lead µg/l	Mercury µg/l	Selenium µg/l	Copper µg/l	Nickel µg/l	Zinc µg/l	Calcium mg/l	Boron mg/l	Phenol µg/l	Total Cyanide mg/l	Free Cyanide mg/l	Sulphate (as SO4) mg/l	Sulphide mg/l	Sulphur mg/l	Dissolved Organic Carbon mg/l	pH	
CP02	0.00-0.00		W2	767124	2.8	<0.04	2.92	<0.01	<0.08	1.8	3.98	1.9	0.4	110	0.1	<0.50	0.03	<0.05	138	<0.01	46	9.8	7.2	
CP03	0.00-0.00		W1	767126	35.7	0.06	1.21	<0.01	<0.08	<0.5	1.80	4.1	0.3	135	0.1	~	0.03	<0.05	180	<0.01	60	7.7	6.7	
CP04	0.00-0.00		W1	767129	0.9	<0.04	0.81	<0.01	<0.08	<0.5	1.76	2.7	<0.3	113	0.1	~	0.03	<0.05	148	<0.01	49	6.7	7.0	
CP05	0.00-0.00		W1	767132	4.5	<0.04	1.36	<0.01	<0.08	<0.5	1.63	7.1	<0.3	154	0.2	~	0.03	<0.05	273	<0.01	91	19.6	6.9	
CP03	0.00-0.00		W2	767127	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
CP04	0.00-0.00		W2	767130	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
CP05	0.00-0.00		W2	767133	~	~	~	~	~	~	~	~	~	~	~	<0.50	~	~	~	~	~	~	~	
Limits of Detection					0.2	0.04	0.04	0.01	0.08	0.5	0.03	0.3	0.3	1	0.3	0.50	0.01	0.05	4	0.01	1	1	~	
Terra Tek Analysis Method					TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP156	TP117	TP054	TP113	TP062	TP061	TP170	TP066	TP170	TP162	TP020	
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	U	U	N	N	U	U	U	U	N	U	

Originator	Checked & Approved
DAB	S. Langrish 25/03/2021

RESULTS OF CHEMICAL CONTAMINATION TESTS - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 1

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification																							
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	Naphthalene ng/l	Acenaphthylene ng/l	Acenaphthene ng/l	Fluorene ng/l	Phenanthrene ng/l	Anthracene ng/l	Fluoranthene ng/l	Pyrene ng/l	Benzo (a) anthracene ng/l	Chrysene ng/l	Benzo (b) fluoranthene ng/l	Benzo (k) fluoranthene ng/l	Benzo (a) pyrene ng/l	Indeno (1,2,3 - cd) pyrene ng/l	Dibenzo (ah) anthracene ng/l	Benzo (ghi) perylene ng/l	Polynuclear Aromatic Hydrocarbons (total) ng/l			Sample received in appropriate container
CP02	0.00-0.00		W2	767124	<10	<10	<10	<10	49	16	310	301	171	102	214	127	189	135	<10	127	1,742			Yes
CP03	0.00-0.00		W2	767127	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<160			Yes
CP04	0.00-0.00		W2	767130	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<160			Yes
CP05	0.00-0.00		W2	767133	<10	<10	<10	<10	<10	<10	17	<10	14	<10	<10	<10	<10	<10	<10	<10	<160			Yes
Limits of Detection					10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	160			
Terra Tek Analysis Method					TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112	TP112			
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N			

Originator	Checked & Approved
DAB	S. Langrish 25/03/2021

POLYAROMATIC HYDROCARBONS (USEPA 16) - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification					TPH (Aliphatics C8-C10)	TPH (Aliphatics >C10-C12)	TPH (Aliphatics >C12-C16)	TPH (Aliphatics >C16-C21)	TPH (Aliphatics >C21-C35)	TPH (Aliphatics >C35-C40)	TPH (Aromatics >C10-C12)	TPH (Aromatics >C12-C16)	TPH (Aromatics >C16-C21)	TPH (Aromatics >C21-C35)	TPH (Aromatics >C35-C40)									
Hole	Depth m	Sample Ref	Sample Type	Lab Sample ID	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l									**Sample received in appropriate container**
CP02	0.00-0.00		W2	767124	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100									**Yes**
CP03	0.00-0.00		W2	767127	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP04	0.00-0.00		W2	767130	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
CP05	0.00-0.00		W2	767133	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10									**Yes**
Limits of Detection					10	10	10	10	10	10	10	10	10	10	10									
Terra Tek Analysis Method					TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130	TP130									
Accreditation U=UKAS N=No accreditation					N	N	N	N	N	N	N	N	N	N	N									

Originator	Checked & Approved
DAB	S. Langrish 25/03/2021

TPHCWG - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 3

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	TPH (Aliphatics C5-C6) µg/l	TPH (Aliphatics C6-C8) µg/l	TPH (Aromatics C6-C7) µg/l	TPH (Aromatics C7-C8) µg/l	TPH (Aromatics C8-C10) µg/l	Benzene µg/l	Ethylbenzene µg/l	m & p - Xylene µg/l	o - Xylene µg/l	Toluene µg/l	MTBE µg/l									Sample received in appropriate container
Hole	Depth m	Sample Ref	Sample Type																					
CP02	0.00-0.00		V	767125	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP03	0.00-0.00		V	767128	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP04	0.00-0.00		V	767131	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
CP05	0.00-0.00		V	767134	<10	<10	<10	<10	<10	<1	<1	<2	<1	<1	<1									**Yes**
Limits of Detection					10	10	10	10	10	1	1	2	1	1	1									
Terra Tek Analysis Method					TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155	TP155									
Accreditation U=UKAS N=No accreditation					U	U	U	U	U	U	U	U	U	U	U									

Originator	Checked & Approved
DAB	S. Langrish 25/03/2021

VPHCWG - WATER

KEY

* - deviating result (refer to Appendix W1 for details)

Figure 4

Sheet 1 of 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Sample Identification				Lab Sample ID	Date Sampled	Deviating conditions						Preservatives used
Exploratory Hole	Depth m	Sample Ref	Sample Type			Sampling date has not been provided	Exceeded maximium holding time for selected test(s)	Presence of headspace in sample vial	Poorly fitting cap or lid	Damaged container		
CP02	0.00-0.00		W2	767124	11/02/21							
CP02	0.00-0.00		V	767125	11/02/21							
CP03	0.00-0.00		W1	767126	11/02/21							
CP03	0.00-0.00		W2	767127	11/02/21							
CP03	0.00-0.00		V	767128	11/02/21							
CP04	0.00-0.00		W1	767129	11/02/21							
CP04	0.00-0.00		W2	767130	11/02/21							
CP04	0.00-0.00		V	767131	11/02/21							
CP05	0.00-0.00		W1	767132	11/02/21							
CP05	0.00-0.00		W2	767133	11/02/21							
CP05	0.00-0.00		V	767134	11/02/21							

NOTES
1 Results reported for samples classified as deviating may be compromised. Deviation types are shown as "X" or "Yes" in the table above.
2 The absence of "X" or "Yes" in the table above indicates no reported deviations.
3 Deviations due to use of incorrect sample container are shown on result tables.
4 Deviating results are indicated within result tables.

Originator	Checked & Approved
TGH	S. Langrish 25/03/2021

DEVIATING SAMPLES - WATER

Appendix W1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	
TP020	APHA/AWWA, 19th edition	Determination of pH using pH meter	Yes	
TP035	BS1377, Part 3, 1990: Soils for Civil Engineering Purposes.	Determination of dissolved solids by gravimetry	Yes	
TP054	MAFF Book 427: The Analysis of Agricultural Materials: Method 8	Determination of boron by ICP-OES	Yes	
TP057	APHA/AWWA, 19th edition: Method 3500Cr-D	Determination of hexavalent chromium by colorimetry	Yes	
TP060	MEWAM method: Phenols in water and Effluents: 4-aminoantipyrine method	Determination of monohydric phenols by steam distillation/colorimetry	Yes	
TP061	MEWAM method: Cyanide in Waters etc	Determination of free cyanide by colorimetry	Yes	
TP062	MEWAM method: Cyanide in Waters etc	Determination of total cyanide by steam distillation/colorimetry	Yes	
TP063	MEWAM method: Cyanide in Waters etc	Determination of complex cyanide by calculation	Yes	
TP064	MEWAM method: Determination of Thiocyanate ,1985	Determination of thiocyanate by colorimetry	Yes	
TP066	MEWAM method: Sulphide in Waters and Effluents, Tentative Methods: 1983	Determination of sulphides by colorimetry	Yes	
TP068	APHA/AWWA, 19th edition: Method 4500-Cl-D	Determination of chlorides by titrimetry	Yes	
TP078	APHA/AWWA, 18th edition: Method 4500C	Determination of ammoniacal nitrogen by colorimetry		
TP079	In-house documented method	Determination of anionic detergent (MBAS) by colorimetry		
TP080	APHA/AWWA, 19th edition: Method 4500-F-C	Determination of fluoride by ion selective electrode	Yes	
TP081	APHA/AWWA, 19th edition: Method 2540D	Determination of suspended solids by gravimetry	Yes	
TP102	APHA/AWWA, 19th edition: Method 6640B USEPA Method 610	Determination of polyaromatic hydrocarbons extractable in dichloromethane, by GC/MS	Yes	
TP103	Texas Natural Resource Conservation Commission Method 1005 & USEPA Method 3510C	Determination of Extractable Petroleum Hydrocarbons (>C8 - C40) by GC/FID		
TP108	APHA/AWWA, 19th edition: Method 2510B	Determination of electrical conductivity by electrode	Yes	
TP112	USEPA Method 8100	Determination of polyaromatic hydrocarbons extractable in dichloromethane/hexane, by GC/MS		
TP113	APHA/AWWA, 19th edition: Method 6410 USEPA Method 2870D	Determination of phenol by GC/MS		

Notes

1. The laboratory records the date of analysis of each parameter. This information is available on request.
2. Where a parameter cannot be determined in house it is our policy to use a UKAS accredited laboratory wherever possible. Terra Tek will assume responsibility for the quality of subcontracted tests and the performance of the subcontractor chosen. Where there is no known UKAS laboratory for a particular parameter, a laboratory listed within the Terra Tek Approved Subcontractors list, which is subject to performance assessment, will be selected.

Originator	Checked & Approved	**SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (WATER)**	**Appendix W2**
N/A	N/A		Sheet 1 of 2

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Method Code	Reference	Description of Method	ISO17025 Accredited	
TP117	APHA/AWWA, 19th edition: Method 2340B	Determination of hardness of water (calculation)	Yes	
TP118	APHA/AWWA, 19th edition: Method 2320B	Determination of total alkalinity by titration	Yes	
TP128	APHA/AWWA, 19th edition: Method 6410 USEPA Method 2870D	Determination of Semi-Volatile Organic Compounds by GC/MS	Yes	
TP130	Texas Natural Resource Conservation Commission Method 1005 & 1006	Determination of Extractable Petroleum Hydrocarbons (EPH-CWG C8-C40) by GC/FID		
TP132	APHA/AWWA, 19th edition: Method 4500-NO2-B	Determination of nitrite by colorimetry	Yes	
TP133	In-house documented method	Determination of chemical oxygen demand by colorimetry		
TP146	USEPA Methods 8082A & 3665A	Determination of Total & Speciated 7 PCB Congeners by GC/MS SIM		
TP149	USEPA Methods 8082A & 3665A	Determination of Total & Speciated WHO 12 PCB Congeners by GC/MS SIM		
TP155	USEPA method 5021. Wisconsin DNR modified GRO method	Determination of volatiles in water by GC/MS headspace	Yes	
TP156	APHA/AWWA, 19th edition: Method 3030B (filtration)	Determination of dissolved metals by ICP-MS	Selected	
TP159	USEPA Method 1671	Determination of glycols in water by GC/FID DI		
TP160	USEPA Method 556	Determination of formaldeyde in water by GC/MS		
TP162	USEPA Method 9060A	Determination of TOC/DOC in water by HT Combustion/NDIR		
TP170	In-house documented method	Determination of sulphate by ICP-OES spectroscopy	Yes	
TP179	In-house documented method	Determination of nitrate by ion selective electrode		
TP184	In-house documented method	Analysis of water by discrete analyser		

Notes

1. The laboratory records the date of analysis of each parameter. This information is available on request.
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Originator	Checked & Approved	**SUMMARY OF IN-HOUSE ANALYTICAL TEST METHODS (WATER)**	**Appendix W2**
N/A	N/A		Sheet 2 of 2

DTS RAEBURN
GEOTECHNICAL & ENVIRONMENTAL ENGINEERING

APPENDIX 5

Geotechnical Laboratory Test Results
(8 pages)

TERRA TEK
SITE INVESTIGATION & LABORATORY SERVICES

DTS Raeburn Limited
Moor Lane
Witton
Birmingham
B6 7HG

For the attention of Tom Dentith-Barnard

Report No: B25564-2
Issue No 01

LABORATORY TEST REPORT

Project Name	**MIRFIELD**		
Project Number	**B25564-2**	Date samples received	12/02/2021
Your Ref	E13431/1	Date written instructions received	12/02/2021
Purchase Order	31536/E13431/1	Date testing commenced	12/02/2021

Please find enclosed the results as summarised below

Figure / Table	Test Quantity	Description	ISO 17025 Accredited
1 - 7	7	Particle Size Distribution	Yes

Remarks :

Issued by : Stephen Langman Date of Issue : 19/02/2021

Approved Signatories : S. Langman 19/02/2021

S Langman (Laboratory Coordinator), D Bowen (Production Manager)

Key to symbols used in this report
S/C : Testing was sub-contracted

Unless we are notified to the contrary, samples will be disposed after a period of one month from this date.
The results reported relate to samples received in the laboratory only.
All results contained in this report are provisional unless signed by an approved signatory
This report should not be reproduced except in full without the written approval of the laboratory.
Under multisite accreditation the testing contained in this report may have been performed at another Terra Tek laboratory.
The enclosed results remain the property of Terra Tek Limited and we reserve the right to withdraw
our report if we have not received cleared funds in accordance with our standard terms and conditions
Only those results indicated in this report are UKAS accredited and any opinions or interpretations expressed are outside the scope of UKAS accreditation.
Feedback on the this report may be left via our website www.terratek.co.uk/contact-us

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING 0126
30 YEARS 1990-2020

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Head Office : 62 Rochsolloch Road, Airdrie, ML6 9BG

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Hole CP01
Sample Ref
Depth (m) 7.00-8.00
Sample Type B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	96
50.0 mm	96
37.5 mm	91
28.0 mm	81
20.0 mm	72
14.0 mm	64
10.0 mm	59
6.30 mm	54
5.00 mm	53
3.35 mm	51
2.00 mm	49
1.18 mm	47
630 µm	46
425 µm	45
300 µm	43
200 µm	36
150 µm	30
63 µm	19

Non Engineering Description

Brown fine to cobble sized GRAVEL with much clayey sand.

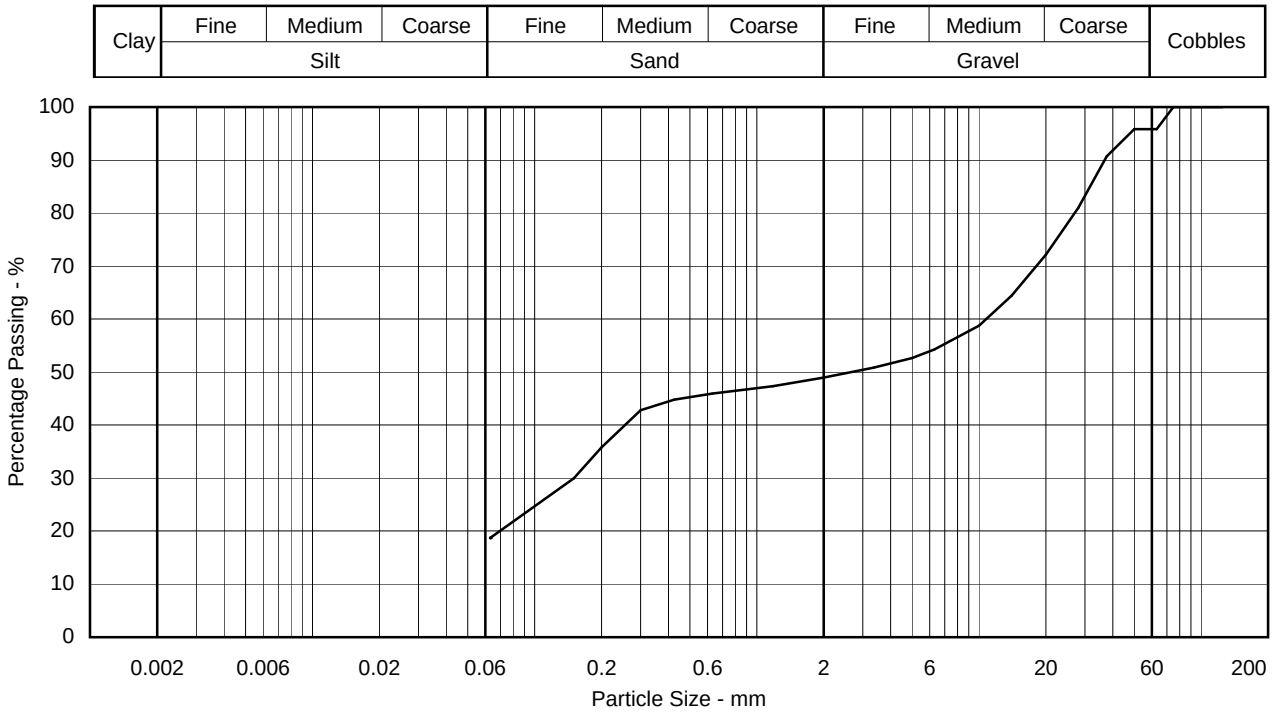
Sample Proportions - %

Cobbles	4.1
Gravel	46.9
Sand	30.3
Silt & Clay	18.7

Particle Diameter - mm

D100	75
D60	11
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes



Originator	Checked & Approved
IG/CR	S. Longmore 19/02/2021

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method

Figure 1

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Hole CP01
Sample Ref
Depth (m) 9.50-11.00
Sample Type B

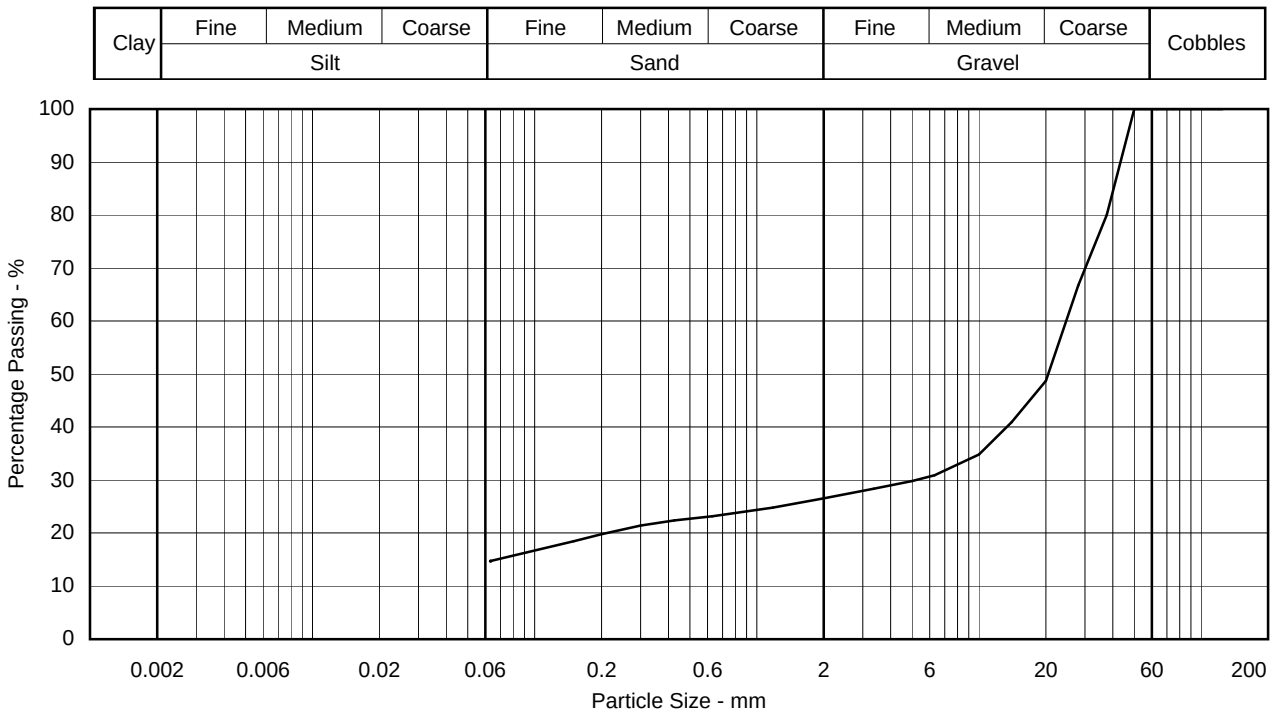
Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	80
28.0 mm	67
20.0 mm	49
14.0 mm	41
10.0 mm	35
6.30 mm	31
5.00 mm	30
3.35 mm	28
2.00 mm	27
1.18 mm	25
630 µm	23
425 µm	22
300 µm	21
200 µm	20
150 µm	18
63 µm	15

Non Engineering Description
Grey fine to coarse GRAVEL with much sandy clay.

Sample Proportions - %	
Cobbles	0.0
Gravel	73.5
Sand	11.8
Silt & Clay	14.7

Particle Diameter - mm	
D100	50
D60	25
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes
Sample does not comply with BS EN ISO 17892-4 minimum mass requirements



Originator	Checked & Approved
IG/CR	S. Longmore 19/02/2021

PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4 2016 Clause 5.2 - Sieving Method

Figure 2

Moor Lane, Witton, Birmingham, B6 7HG

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No **E13431/1**

Hole CP02
Sample Ref
Depth (m) 7.00-8.00
Sample Type B

Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	87
50.0 mm	87
37.5 mm	67
28.0 mm	54
20.0 mm	44
14.0 mm	39
10.0 mm	36
6.30 mm	32
5.00 mm	30
3.35 mm	29
2.00 mm	27
1.18 mm	26
630 µm	25
425 µm	24
300 µm	23
200 µm	20
150 µm	18
63 µm	12

Non Engineering Description

Brown fine to cobble sized GRAVEL with much clayey sand.

Sample Proportions - %

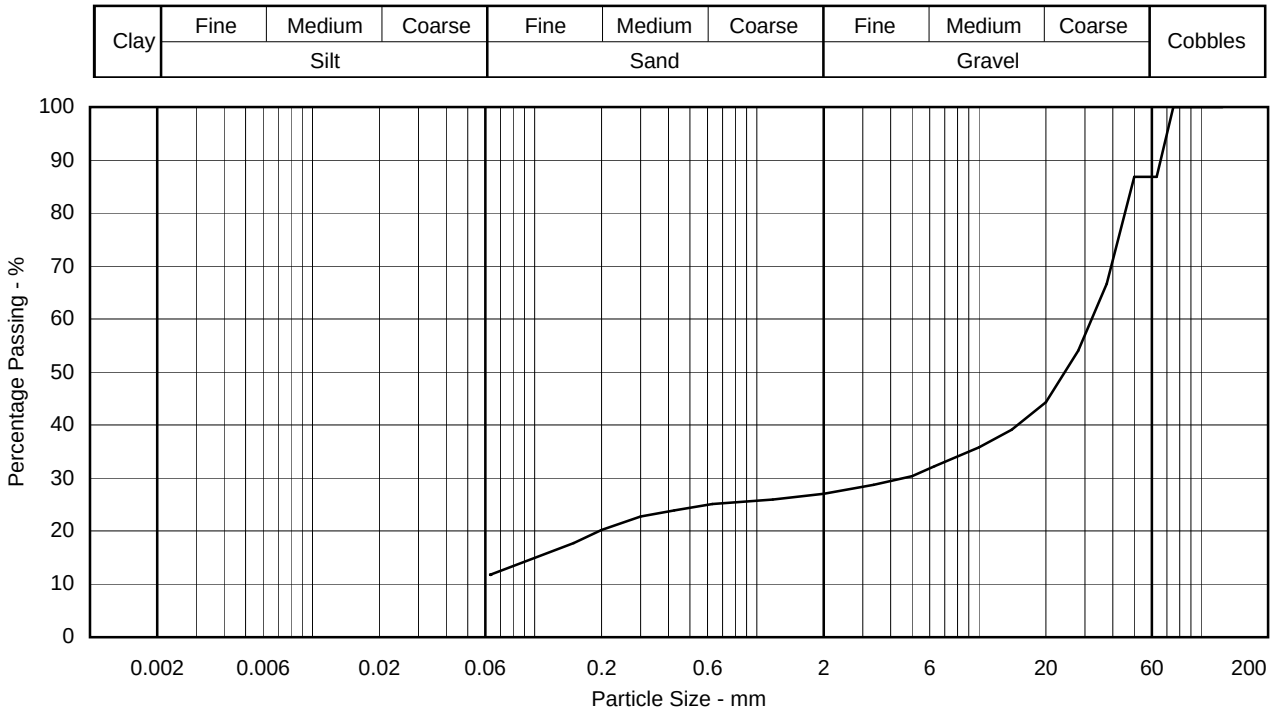
Cobbles	13.2
Gravel	59.8
Sand	15.3
Silt & Clay	11.7

Particle Diameter - mm

D100	75
D60	32
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes

Sample does not comply with BS EN ISO 17892-4 minimum mass requirements



Originator	Checked & Approved
IG/CR	S. Longmore 19/02/2021

PARTICLE SIZE DISTRIBUTION

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Figure 3

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No **E13431/1**

Hole CP02
Sample Ref
Depth (m) 10.00-11.00
Sample Type B

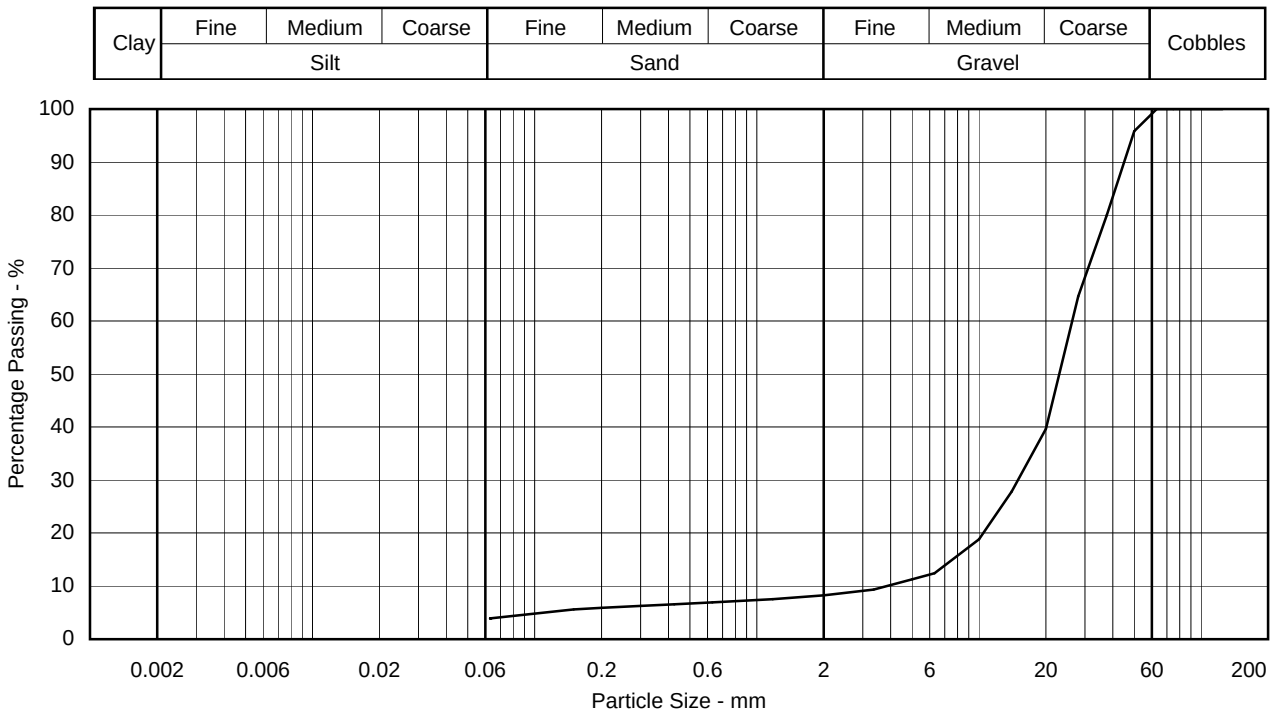
Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	96
37.5 mm	80
28.0 mm	65
20.0 mm	40
14.0 mm	28
10.0 mm	19
6.30 mm	12
5.00 mm	11
3.35 mm	9
2.00 mm	8
1.18 mm	7
630 µm	7
425 µm	7
300 µm	6
200 µm	6
150 µm	6
63 µm	4

Non Engineering Description
Brown fine to coarse GRAVEL with some slightly sandy clay.

Sample Proportions - %	
Cobbles	1.0
Gravel	90.8
Sand	4.4
Silt & Clay	3.8

Particle Diameter - mm	
D100	63
D60	26
D10	3.9
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	6.7

Notes
Sample does not comply with BS EN ISO 17892-4 minimum mass requirements



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IG/CR	S. Longmore 19/02/2021

PARTICLE SIZE DISTRIBUTION
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Figure 4

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TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No **E13431/1**

Hole CP03
Sample Ref
Depth (m) 5.00-6.00
Sample Type B

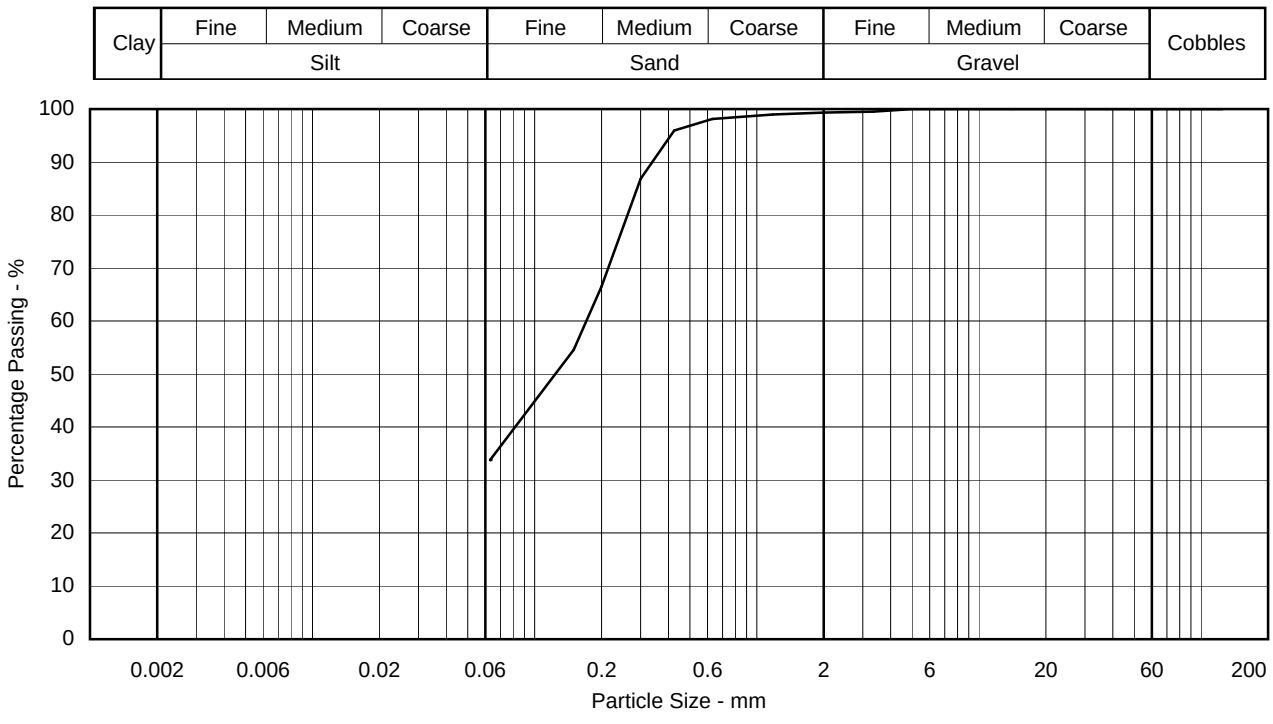
Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	100
37.5 mm	100
28.0 mm	100
20.0 mm	100
14.0 mm	100
10.0 mm	100
6.30 mm	100
5.00 mm	100
3.35 mm	100
2.00 mm	99
1.18 mm	99
630 µm	98
425 µm	96
300 µm	87
200 µm	67
150 µm	55
63 µm	34

Non Engineering Description
Brown clayey SAND.

Sample Proportions - %	
Cobbles	0.0
Gravel	0.7
Sand	65.5
Silt & Clay	33.8

Particle Diameter - mm	
D100	5.0
D60	0.17
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes



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CR	S. Longmore 19/02/2021

PARTICLE SIZE DISTRIBUTION
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Figure 5

TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Hole CP04
Sample Ref
Depth (m) 4.00-5.00
Sample Type B

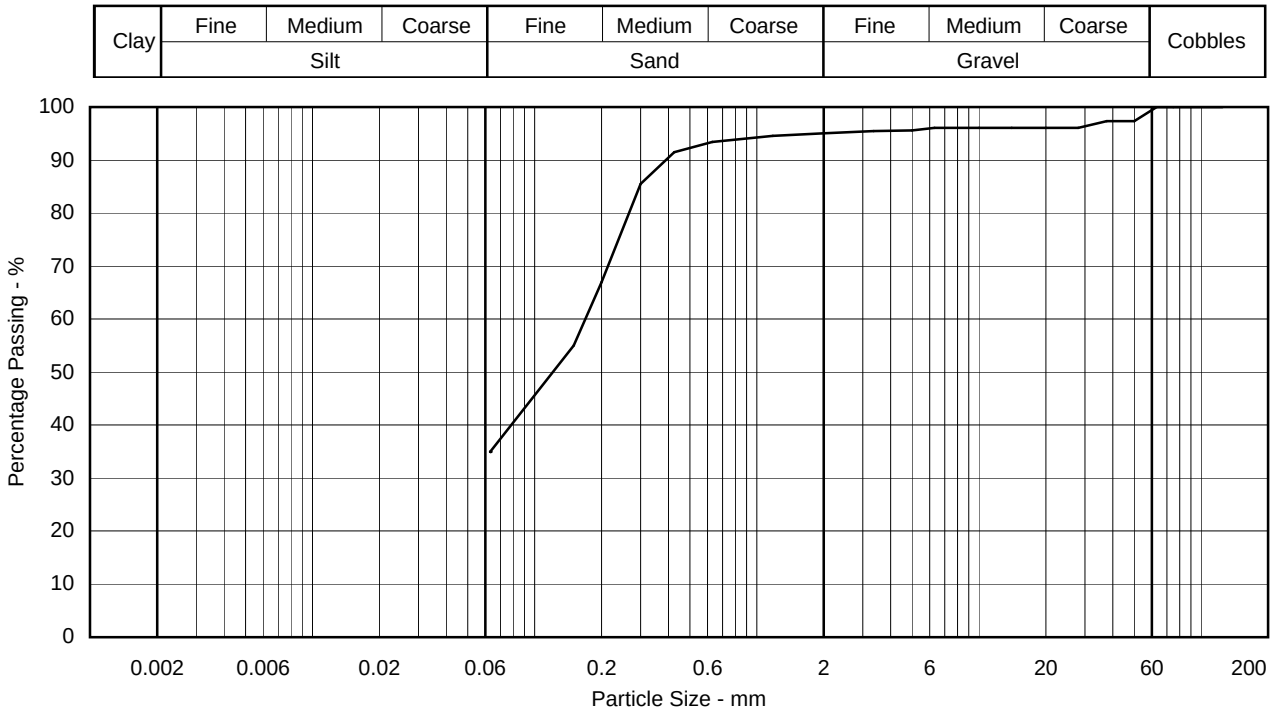
Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	100
63.0 mm	100
50.0 mm	97
37.5 mm	97
28.0 mm	96
20.0 mm	96
14.0 mm	96
10.0 mm	96
6.30 mm	96
5.00 mm	96
3.35 mm	95
2.00 mm	95
1.18 mm	95
630 µm	93
425 µm	91
300 µm	86
200 µm	67
150 µm	55
63 µm	35

Non Engineering Description
Brown clayey SAND with occasional gravel. Gravel is fine to coarse.

Sample Proportions - %	
Cobbles	0.6
Gravel	4.3
Sand	60.2
Silt & Clay	34.9

Particle Diameter - mm	
D100	63
D60	0.17
D10	
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	N/A

Notes



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PARTICLE SIZE DISTRIBUTION
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Figure 6

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TERRA TEK SITE INVESTIGATION AND LABORATORY SERVICES

Site MIRFIELD

Client

Engineer

Contract No E13431/1

Hole CP04
Sample Ref
Depth (m) 8.00-9.00
Sample Type B

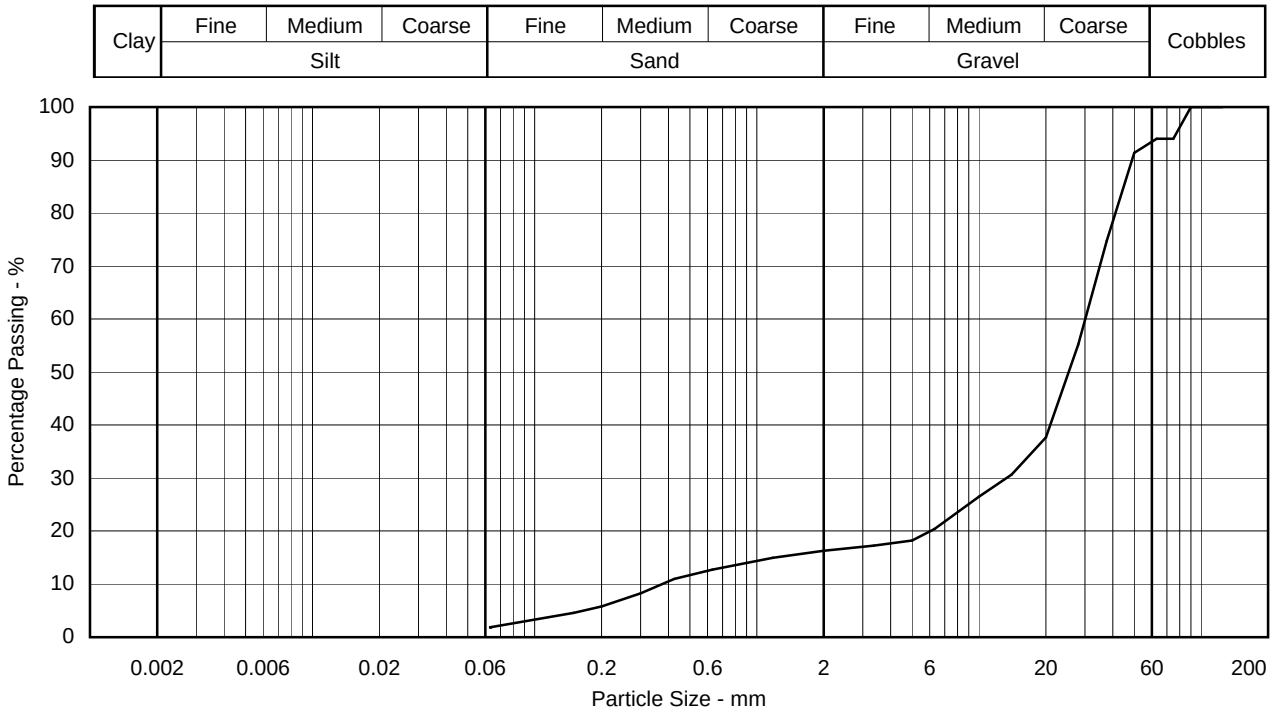
Particle Size	% Passing
125.0 mm	100
90.0 mm	100
75.0 mm	94
63.0 mm	94
50.0 mm	91
37.5 mm	75
28.0 mm	55
20.0 mm	38
14.0 mm	31
10.0 mm	26
6.30 mm	20
5.00 mm	18
3.35 mm	17
2.00 mm	16
1.18 mm	15
630 µm	13
425 µm	11
300 µm	8
200 µm	6
150 µm	5
63 µm	2

Non Engineering Description
Brown sandy fine to cobble sized GRAVEL.

Sample Proportions - %	
Cobbles	6.6
Gravel	77.2
Sand	14.4
Silt & Clay	1.8

Particle Diameter - mm	
D100	90
D60	30
D10	0.38
Uniformity Coefficient (SHW series 600, Table 6/1, footnote 5)	78.9

Notes



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PARTICLE SIZE DISTRIBUTION
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Figure 7