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Day Project Management Ltd
Studio 1, Lancaster Buildings
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For the attention of Chris Howard

Dear Chris,

Re: Ground Investigation at Fairfield General Hospital, Bury – Area Outside the Influence of the Suspected Mine Shaft

Introduction

GRM Development Solutions Ltd (GRM) have been instructed by Day Project Management Ltd (Client) to undertake a ground investigation at Fairfield General Hospital, Bury. The works reported within this Letter Report detail the findings of the ground investigation the principal aim of which was to determine the risk posed to end users from potential soil contamination and to confirm the local ground gas regime.

The investigation was conducted outside of the potential collapse zone of a mine shaft recorded on historical mining data, and conducted at the Client's request ahead of searching for the mine shaft itself. The works conducted to search for the mine shaft will be reported under separate cover.

This letter report should be read in conjunction with the following previous reports:

- GRM Ground Investigation (ref: GRM/P10147/LetRep.1, dated November 2022).
- GRM Ground Investigation at Fairfield Hospital, Bury (ref. GRM/P10351/LR01, dated 17th August 2023).

GRM Standard Limitations of Reporting are provided in Appendix A of this report.

Site Description

The site is located within the grounds of Fairfield General Hospital, approximately 2.75km to the east of Bury town centre. The site comprises a combination of tarmac/adam/asphalt access road, and grassed landscaped areas to the east of the Accident and Emergency Department / Ambulance arrivals zone. A Site Location and Boundary Plan is presented in Appendix B.



Land Appraisal | Environmental | Geotechnical | Design | Mining | Inspections

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Proposed Development

The Client proposes to construct an extension to the existing hospital buildings over the investigation area.

Background

Previous works by GRM have identified a potential risk to the proposed development from a recorded mine shaft (ref. 383411-014) situated within the proposed extension area. The shaft is noted to have been discovered in 1995 and is recorded to have been sunk for the purposes of coal mining; however, the Coal Authority (CA) have no knowledge of what treatment, if any, was afforded the shaft. Accordingly, future works are planned to locate the shaft and determine whether it has been treated and capped.

The works reported within this letter focus on the area beyond the departure of the potential shaft and seek to confirm the risk to end users from soil contamination and ground gas.

Ground Investigation

The ground investigation fieldwork was conducted on the 4th of October 2023 and comprised of two hand excavated sample pits (HDP101 and HDP102) and seven windowless sample boreholes (WS101 and WS107) undertaken to determine general ground conditions, obtain soils samples for chemical analysis and emplace monitoring wells to characterise the local ground gas / groundwater regime.

The hand excavated pits were designed to investigate the foundation depths of existing buildings in the south of the investigation area and terminated at depths of 1.2m and 1.3m below existing ground level (begl) having proven the depth of the existing foundations. The window sample boreholes terminated at depths of between 1.0m and 5.0m begl generally on rock, with the exception of WS104 and WS105, which were advanced to c.5m begl.

The Exploratory Hole Location Plan and Exploratory Hole Logs are presented in Appendix C and Appendix D.

The following ground conditions were encountered during the investigation fieldwork:

- Re-laid Topsoil.
- Made ground.
- Glacial Till
- Woodhead Hill Rock.

Re-laid Topsoil

Re-laid topsoil was observed in all of the window sample boreholes and comprised slightly gravelly, silty, sandy, CLAY / silty SAND with gravel of brick, quartzite and sandstone and was observed to a maximum depth of 0.4m begl.

Re-laid topsoil was not encountered in the two hand-excavated pits, which encountered made ground from surface.

Made Ground

Beneath the re-laid topsoil (with the exception of the hand-dug pits) made ground was observed to depths of between 0.7m and 1.5m begl within five of the seven window sample holes (exceptions were WS101 and WS106) as either:

- Sandy, gravelly CLAY with gravel of brick, concrete, quartzite and sandstone.
- Slightly sandy, clayey GRAVEL with gravel of brick, concrete, quartzite and sandstone.

Cohesive made ground was observed only within WS102 and WS107 (maximum depth 1.0m begl), whilst granular made ground was observed in WS102-WS105 and WS106.

The made ground materials have been observed to comprise generally of natural soils with minor amounts of anthropogenic material and are likely to have been generated by on-site construction activities.

Standard Penetration Test (SPT) 'N' values of between 2 and 14 were recorded in the granular strata indicating the stratum was very loose to medium dense. SPTs were not conducted in the cohesive made ground due to its shallow occurrence.

Glacial Till

Glacial Till was encountered in WS104 and WS105 at depths of between 1.4m – 3.7m and 1.2m – 3.5m begl respectively as slightly gravelly, silty, sandy CLAY with gravel including sandstone and quartzite.

SPT 'N' values of 0 and 4 were recorded at 2m depth and between 5 and 8 at 3m depth. Utilising the empirical relationship formulated by Stroud (1974) where undrained shear strength is related to SPT N-values and a factor based on plasticity, these strata are of very low to low strength.

Woodhead Hill Rock

Strata representative of the weathered Woodhead Hill Rock was observed as sandy, slightly gravelly, silty, sandy CLAY to depths of between 1.0m (WS101) and 4.90m+ begl (WS105). In WS104 the strata comprised gravelly SAND with gravel comprising mudstone and coal to the base of the borehole at 5.0m begl.

Rockhead is inferred at depths of between 1.0m and 2.5m in the window sample holes due to refusal (SPT blows 50+).

A summary of the SPT 'N' values is presented in the table below:

Test Depth (m)	SPT 'N' Values between:
1.0	5 and 29 (cohesive) 50 (rock)
2.0	34 (cohesive) 50 (rock)
4.0	12 (granular) 19 (cohesive)
4.9-5.0	30 (cohesive) 11 (granular)

Utilising the empirical relationship formulated by Stroud (1974) where undrained shear strength is related to SPT N-values and a factor based on plasticity, these strata are variable between 1.0m and

2.0m depth, low to medium strength at 3.0m depth and high strength below 4.0m depth. The local granular strata were at least medium dense.

Rockhead was noted to increase in depth to the south and east and was shallow (1.0m-2.0m) in the area of the proposed extension. The base of the Woodhead Hill Rock was not proven.

Groundwater

Groundwater seepages were observed in the following exploratory holes:

Exploratory Hole	Depth (m)	Stratum
WS102	0.20-1.5	Made ground
WS103	0.30-0.80	Made ground
WS104	3.7-4.0	Woodhead Hill Rock (sand)
WS105	0.40-0.90	Made ground

Groundwater occurrences in the made ground are considered to represent minor perched volumes, whilst that within the granular horizon of the Woodhead Hill Rock is likely to be representative of the true groundwater table.

Contamination

Five samples (two of re-laid topsoil and three of made ground) were submitted for chemical laboratory analysis (metals, speciated PAH and an asbestos screen).

Human Health

The results of the chemical analysis have been compared against the Tier 1 Thresholds for an industrial / commercial end use. A copy of the thresholds is presented in Appendix E.

None of the contaminants tested for have concentrations in excess of the relevant threshold.

Asbestos was not identified in the samples tested.

Based on the chemical laboratory results the risk to end users is assessed as negligible and remediation is not required.

A copy of the chemical laboratory results is presented in Appendix F.

Controlled Waters

No significant source of contamination has been identified. In the absence of an identified source and as the site will be covered by hardstanding, the risk to controlled waters is considered to be negligible and remediation is not required.

Ground Gas

The following potential sources of ground gas were anticipated from past works on the wider hospital site:

- Made ground associated with the sites past development.
- Mine workings associated with the wider areas mining legacy.

To investigate the gasing potential of the strata in the current area three 35mm groundwater / gas monitoring standpipes were installed into the window sample boreholes (WS101-WS103). The response zones of the installation in WS101 and WS103 targeted the natural strata and that within WS102 the made ground.

To date one monitoring visit has been undertaken (979mb). No elevated concentrations of methane and no flow has been recorded, with a maximum carbon dioxide concentration of 1.4%v/v.

Made ground

Based on the maximum concentrations of ground gas recorded and a calculated GSV of 0.0014l/hr a designation of Characteristic Situation 1 is considered appropriate at this stage.

Natural strata

Based on the maximum concentrations of ground gas recorded and a calculated GSV of 0.0002l/hr a designation of Characteristic Situation 1 is considered appropriate at this stage.

Additional gas data is required to complete the monitoring program. A gas addendum letter will be issued upon completion of the monitoring program confirming the assessment. It is recommended that the assessment is approved by the local EHO.

A copy of the gas monitoring data is presented in Appendix G.

Buried Concrete

Based on the recorded water-soluble sulphate and pH levels in the soils below the site and assuming a worst case of mobile groundwater conditions, in accordance with requirements of BRE Special Digest 1 (2005), 'Concrete in Aggressive Ground', the Design Sulphate Class for buried concrete at the site should be assumed as DS-1 and the ACEC Class as AC-1 GEN 1 for unreinforced concrete and RC 35 for reinforced concrete).

Summary

The ground investigation has proven a maximum thickness of made ground (including re-laid topsoil) of 1.5m within the proposed development area and that the concentration of contaminants within the shallow soils pose no significant risk to end users or controlled waters. Concentrations of ground gas recorded to date are consistent with those from earlier phases of investigation and show no significant risk to end users. Existing structures in the southern site area had proven foundation depths of between 1.2m and 1.3m bgl and were made on the weathered Woodhead Hill Rock.

The findings are the recent works are generally consistent with earlier phases of investigation and so the previous geotechnical recommendations do not require revision. Further recommendations will be made following the completion of the proposed mine shaft investigation.

Further works are proposed to investigate to confirm the presence and location of the recorded shaft and, if found, to determine its level of treatment. Until these further works are completed it is recommended that no construction should take place in the area of the mineshaft. Additionally, consideration should be given to restricting access to the area until the shaft is located and treated. Negotiation with the Coal Authority will be necessary to discuss capping requirements given the proximity of the shaft to the existing building, which may render full capping works impractical.

We trust this is suitable for your current requirements, should you require any further information or would like any clarification of the points raised above please do not hesitate to contact us.

Yours Sincerely,
for GRM Development Solutions Ltd

Prepared by

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Acting Principal Geologist

Approved by

Geoff Beckett
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Appendices

Appendix A	-	GRM Standard Limitations
Appendix B	-	Site Location & Boundary Plan
Appendix C	-	Exploratory Hole Location Plan
Appendix D	-	Exploratory Hole Logs
Appendix E	-	Tier 1 Thresholds
Appendix F	-	Chemical Test Results
Appendix G	-	Gas Monitoring Results



A P P E N D I X A

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GENERAL APPRAISAL COMMENTS

i INFORMATION SOURCES

Where available the following sources have been used for the identification and assessment of potential ground hazards:

- Relevant British Standards
- British Geological Survey (BGS) Geology Map Scale 1:10,000 for local area
- British Geological Survey (BGS) Geology Map Scale 1:50,000/1:63,320
- BGS Memoir
- BGS Borehole Records: <https://mapapps2.bgs.ac.uk/geoindex/home.html>
- BGS online viewer: <https://geologyviewer.bgs.ac.uk>
- Magic Groundwater Vulnerability Maps
- Historical Ordnance Survey (OS) Maps
- Environmental Data Report
- Environment Agency Website: <http://www.environment-agency.gov.uk/>
- Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites, UKWIR, 2010.
- Coal Authority Records / Coal Mining Report
- DEFRA/Environment Agency Contaminated Land publications and DoE Industry Profiles
- BRE Guide BR211 (2023), 'Radon: Guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment projects)'
- UK HSA Radon Maps: <https://www.ukradon.org/information/ukmaps>
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015 +A1: 2019, 'Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'
- Other technical references used throughout this document are detailed in the text.

ii CONTAMINANTS OF CONCERN

The DoE Industry Profiles are normally used to assess likely contaminants from past land use and potential nearby industrial sources. For land uses where no profile is available, likely contaminants of concern are selected by GRM based on past experience of similar sites, a general screening suite of contaminants covered by CLEA and common contaminants from the Industry Profiles.

- | | | |
|------------|-------------------|--|
| · Arsenic | · Copper | · Water soluble sulphate |
| · Cadmium | · Nickel | · PAH (polycyclic aromatic hydrocarbons) |
| · Chromium | · Zinc | |
| · Lead | · Phenols | |
| · Mercury | · cyanide (total) | |
| · Selenium | · pH | |

Asbestos and PCBs are listed in the vast majority of profiles. PCBs are listed as the profiles expect electricity substations and switch boxes on all industrial sites. There is the potential for asbestos containing material to be mixed up with made ground, following any demolition works.

iii CONCEPTUAL MODEL METHODOLOGY

The consideration of contamination is based upon the principles of risk assessment, using the 'source-pathway-receptor' model in order to establish the presence, or potential presence, of a pollutant linkage.

To create a risk, contamination must have the potential to cause harm to susceptible targets or receptors such as humans, the water environment or the built environment. The potential for harm to occur requires three conditions to be satisfied to form a pollutant linkage:

- The presence of substances that may cause harm (SOURCE).
- The presence of a target which may be harmed (RECEPTOR).
- The existence of a plausible migration route between the source and the receptor (PATHWAY).

In the absence of a plausible pollutant linkage there is no risk. Where a potential linkage is identified in order for it not to pose a risk to the identified receptor it must be broken.

iv INTRUSIVE INVESTIGATION SAMPLING METHODOLOGY

The ground investigation (including fieldwork, sampling, monitoring and laboratory analyses) has been designed to identify and assess potential ground related problems and to allow cost effective solutions to be advised. It has been planned on the basis of the desk study, site inspection and the proposed development layout (where available). All fieldwork and soil descriptions were carried out in general accordance with relevant British Standards.

The exploratory holes have been positioned and advanced to depths to determine the general ground/groundwater/gas conditions below the site. A general grid pattern has been adopted, where possible, to provide sufficient information based on the current proposed layout scheme. Some holes have been targeted at particular hazards identified in the Phase I assessment. The resultant exploratory hole density is considered to be commensurate with the complexity of the site conditions and detail of information required for this phase of the investigation.

v GROUND GAS RISK ASSESSMENT METHODOLOGY

Gas monitoring programmes undertaken by GRM are designed to broadly comply with the recommendations outlined in CIRIA Report C665 'Assessing risks posed by hazardous ground gas to buildings' (2007) and BS8576 'Guidance on Investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs) (2013).

To assess the risks posed by ground gases such as radon, carbon dioxide and methane, the relevant current guidance has been used. For radon the site has been assessed following the guidelines in 'Radon: guidance on protective measures for new dwellings (including supplementary advice for extensions, conversions and refurbishment projects) (BR211: 2023)'. For methane and carbon dioxide the primary guidance document used to determine if protection measures are required is *BS8485:2015 Code of practice for the design of protective measures from methane and carbon dioxide ground gases for new buildings*. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Flow Rate (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors such as gas concentrations.

Where flow is not recorded during the monitoring a default flow rate of 0.1l/hr will be used in the assessment to produce a positive result.

vi HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Guidance contained in the Environment Agency's CLEA Reports has been used to assess the risks posed to human health.

For residential developments that include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land with plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered including the consumption of home-grown vegetables.

For residential developments that do not include domestic gardens the default Tier 1 Assessment Criteria (TAC) for 'residential land without plant uptake' are used, i.e. a female with a start age class of one and an end age class of six. All pathways are considered except the consumption of home-grown vegetables. For commercial/industrial developments the default Tier 1 Assessment Criteria (TAC) for 'commercial/industrial' are used, i.e. a female with a start age class of sixteen and an end age class of eighteen. All pathways are considered except the consumption of home-grown vegetables.

The TAC used by GRM include Category 4 Screening Levels (C4SLs) published by DEFRA, values calculated by GRM using the CLEA v1.071 risk assessment, and values and Suitable for Use Levels (S4UL) developed by LQM/CIEH. The TAC used in the assessment are selected based on the lowest site specific SOM values returned as part of the chemical analysis.

Where soil chemical analysis results are found to exceed the TAC, Site-Specific Risk Assessments may be undertaken using the CLEA v1.071 risk assessment software using the age classes and pathways described above.

vii RISK TO SITE WORKERS – GENERAL COMMENTS

The risks to site workers are similar to those posed to site end users, although likely to be less severe due to the site workers' shorter exposure to the identified contamination. However, site workers (particularly groundworkers) are more likely to come into direct contact with contaminated soils due to the nature of their work. On this basis ground and construction workers should be provided with basic Personal Protective Equipment based on the site's general health and safety risk assessment, but including as a minimum safety footwear, gloves and overalls.

A site specific risk assessment should be carried out for all hazards identified within the ground investigation in accordance with current health and safety legislation. This assessment should identify any measures required to further reduce risks i.e. providing further Personal Protective Equipment, welfare facilities and if necessary preventing access to certain areas.

Demolition and dismantling of existing structures on the site must be carried out to a safe and acceptable standard, in accordance with current UK guidance and best practice. Whilst not ground related, asbestos and hazardous substances surveys should be conducted prior to any demolition.

Any unusual colours, odours and suspicious ground should be reported immediately to site management and then GRM.

Whilst this appraisal has considered the long-term effects of contamination, GRM can also help during the formulation of Health and Safety documentation, if required.

viii CONTROLLED WATERS RISK ASSESSMENT METHODOLOGY

Where the desk study and fieldwork do not reveal a potential source of contamination no leachate or groundwater testing will be performed. Where a potential source is identified the testing will comprise leachate testing on the material considered most likely to pose a risk, groundwater testing will be undertaken if water is present at shallow depth.

The UK Drinking Water Standards (UKDWS) or Environmental Quality Standards (EQS) are usually adopted for comparison with the leachate/groundwater test results. When the most sensitive receptor is considered to be the aquifer (groundwater) UKDWS will be adopted as the Initial Tier 1 screening values.

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Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

The 'screening levels' adopted for the assessment of risk to construction materials are taken from the following documents:

- UK Water Industry Research (UKWIR) Contamination thresholds for sub-surface water pipes, for the protection of buried pipes.
- Building Research Establishment (BRE) Special Digest SD1 (2005), 'Concrete in Aggressive Ground', for the protection of buried concrete.

x WASTE DISPOSAL, SITE WASTE MANAGEMENT PLANS AND MATERIAL MANAGEMENT PLANS

Under current Waste Management Regulations, waste soil materials produced from the site will require characterisation to enable it to be disposed of correctly.

The chemical analysis results included in this report should be provided to the relevant landfill operators to establish the characterisation of the waste, confirm its suitability for landfill disposal and provide estimated costings. If material is classified as hazardous, then the site will need to be registered with the Environment Agency prior to the movement of the waste. Depending on the receiving landfill's current permit, further chemical analysis, incorporating Waste Acceptance Criteria (WAC) leachate analysis, may be required.

All materials removed from the site will be classified as 'waste' and therefore must be removed by a suitably licensed carrier of waste. This applies whether or not the waste is contaminated. All waste removed to landfill will attract Landfill Tax.

The developer/builder is likely to be classed as the waste producer and therefore, has a duty of care to ensure that all waste is disposed of appropriately. This includes ensuring the waste carrier is licensed and disposes of the waste to a suitably licensed landfill site. They are also required to keep a paper trail from 'cradle to grave' including copies of the waste disposal tickets.

Efficient materials management on site is recommended as it can lead to significant cost savings when compared to the traditional side casting or single stockpile of arisings. GRM can assist in the production of Material Management Plans under the CL:AIRE Definition of Waste: Code of Practice. The DoWCoP enables:

- The direct transfer and re-use of clean naturally occurring soil materials between sites, and
- The re-use of both contaminated and uncontaminated materials on their site of origin and between sites within defined Cluster projects.

GRM can also undertake the role of Qualified Person and submit the DoW CoP project Declaration.

Likewise making the site as volume neutral as possible will reduce the costs of development. Whilst not a statutory requirement, Site Waste Management Plans allow better waste management practices, help to reduce the amount of waste produced and identify best environmental disposal options. Implementing a Site Waste Management Plan (SWMP) can reduce costs (increasing business profits) and maximise resource efficiency.

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

Where finished floor levels of proposed structures have not been provided by the Client, then for the purposes of initial assessment, GRM will assume that finished levels will not vary appreciably from the existing ground levels. If the depths of any underground engineering works (i.e. sewers, pumping stations etc.) are unknown they will not be taken in to account in the assessment and it will be assumed that any such works will not compromise foundation or ground stability.

Should the development proposals or finished levels be different from these assumptions then the comments/recommendations in the Geotechnical Assessment may require revising.

It should be noted that the results of window sampling and/or cable percussive boreholes may not give a true indication of a soils actual engineering properties (i.e. stability, mass structure etc). GRM consider that that prior to development trial pitting should be undertaken to confirm the recommendations in the Geotechnical Assessment.

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

Near surface soils have the potential to be disturbed by weathering and site traffic. Precautions should always be taken to avoid this, as excessive disturbance may leads to more onerous floor slab designs, road cap thickness and increased amounts of off-site disposal etc.

Near surface soils may need treatment or reinforcing to allow safe movement of construction plant and labour. An assessment by the contractor should be undertaken once the type of machinery/plant needed to complete the development is known.

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

Excavation instability (over-break) can result in damage to existing services or structures (e.g. foundations, roads or boundary walls/fences) both on and off-site, as well as increased foundation concrete costs. In order to minimise this, all excavations deeper than 1.2m deep (or any excavation within 1.5m of any existing structure or service) should be supported. Full support should be provided to the full depth of all near vertically sided excavations in made ground, soft and very soft clays and granular soils. A reduction to intermediate support should be acceptable within firm and stiffer natural clays.

Wherever possible, man entry into excavations should be prevented; however, where this is not possible, entry to, and time spent in, excavations should be kept to a minimum.

The build program should be tailored to reflect the impact that deep excavations through potentially unstable strata can have on adjacent properties, so that they are not undermined.

All excavations on site should be in accordance with HSE guidelines and stability should be practically maintained at all times. Reference should be made to HSE construction information sheet No. 8 (Revision 1) 'Safety in Excavations'.

Care should be taken to ensure that falls from excavation faces do not adversely affect the integrity of foundation concrete.

If contaminated water enters excavations it should be removed and transported to an appropriate treatment facility by a suitably licensed carrier before construction begins.

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

Where practicable, existing buried construction should be fully removed; however, if this is not practicable all new foundations should be carried down to fully penetrate it and it should be broken well away from all new structures.

There may be existing structures and/or infrastructure in close proximity to the proposed development. New build foundations may be constructed next to pavements with existing underground services beneath them, or excavations may be required near existing footings associated with adjacent properties. These potential hazards need to be taken into consideration when designing foundations and the groundworker needs to be made aware of their potential impact during the redevelopment works. Foundations close to existing underground services or buildings may require alternative foundation techniques (such as piling) to protect the integrity of these structures.

The contractor for the works should carry them out in such a fashion so as to not cause excessive overbreak, concrete usage or undermine existing buildings/roads/ services that are to be retained.

xv **GEOTECHNICAL ASSESSMENT – SOAKAWAYS**

Soakaway testing in trial pits by GRM is broadly carried out in accordance with BRE DG 365 (2016). The testing comprises the excavation of a test pit to a suitable depth, and the placement of water into the pit. The level of water present is then monitored over time. For borehole installations, the permeability testing (falling head/rising head) is undertaken in accordance with BS5930.

If it is decided to proceed with the use of soakaway drainage, then the following general points should be noted:

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.
- Interceptors are likely to be required for soakaways for highway drainage. The adopting authority for the highways should be consulted at the earliest opportunity regarding the use of soakaways for highways drainage.
- Consideration of site levels and slopes should be taken into account during the design.
- The construction of all soakaways should be in accordance with the current building regulations.
- Soakaways should not be placed within 5m of a proposed building.
- Placement of soakaways needs to be considered so as to avoid ponding of water down slope.
- The base of a soakaway should not be below the highest recorded water level.
- The Environment Agency prefer 1m of dry soil to be present between the base of a soakaway and the water table to provide attenuation for contamination.

xvi **GEOTECHNICAL ASSESSMENT – FOUNDATIONS**

If soft or hard spots are encountered during foundation excavation then they should be replaced with suitably compacted material or the footings deepened to suitable strata, to avoid differential settlement.

If strata of differing bearing character (e.g. sand and clay) are encountered at foundation levels within the excavations for a single plot then the excavation depths should be altered as appropriate to ensure the foundations rest on a single stratum, or strata that will not induce differential settlement. Where this is impractical then GRM should be contacted to assess a reinforced concrete detail or an alternative foundation solution (e.g. piles or vibro-replacement).

NOTES ON LIMITATIONS

General

GRM Development Solutions Limited has prepared this report solely for the use of the Client and those parties with whom a warranty agreement had been executed, or with whom an assignment had been agreed. Should any third party wish to use or rely upon the contents of the report, written approval must be sought from GRM Development Solutions Limited; a charge may be levied against such approval.

GRM Development Solutions Limited accepts no responsibility or liability for:

- a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and
- b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources (including the Client), together with (where appropriate) a brief walk over inspection of the site and meetings and discussions with relevant authorities and other interested parties. The opinions given in this report have been dictated by the finite data on which they are based and are relevant only to the purpose for which the report was commissioned. The information reviewed should not be considered exhaustive and has been accepted in good faith as providing true and representative data pertaining to site conditions. Should additional information become available which may affect the opinions expressed in this report, GRM Development Solutions Limited reserves the right to review such information and as considered necessary and appropriate to modify the opinions accordingly. It should be noted that any risks identified in a Phase 1 report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site.

Phase II Environmental Audits (Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, ground and groundwater conditions to allow a reasonable risk assessment to be made. The objectives of the investigation have been limited to establishing the risks associated with potential human targets, building materials, and controlled waters.

The amount of exploratory work and chemical testing undertaken has necessarily been restricted by the short timescale available, and the locations of exploratory holes have been restricted to the areas unoccupied by the building(s) on the site and by buried services. A more comprehensive investigation may be required if the site is to be redeveloped as, in addition to risk assessment, a number of important engineering and environmental issues need to be resolved.

For these reasons if costs have been included in relation to site remediation these must be considered as provisional only and must, in any event, be confirmed by a commercial adviser.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. Whilst exploratory testing is intended to gain an accurate representation of the site, the very nature of sampling and testing is such that it cannot ensure that all localised conditions are detected.

The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.

Phase II Geo-environmental Investigations (Combined Geotechnical and Contamination Investigations)

The investigation of the site has been carried out to provide sufficient information concerning the type and degree of contamination, geotechnical characteristics, and ground and groundwater conditions to provide a reasonable assessment of the environment risks together with engineering and development implications. If costs have been included in relation to site development a commercial adviser must confirm these.

The exploratory holes undertaken, which investigate only a small volume of the ground in relation to the size of the site, can only provide a general indication of site conditions. The opinions provided and recommendations given in this report are based on the ground conditions apparent at the site for each of the exploratory holes. There may be exceptional ground conditions elsewhere on the site which have not been disclosed by this investigation and which have therefore not been taken into account in this report.

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects. The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.



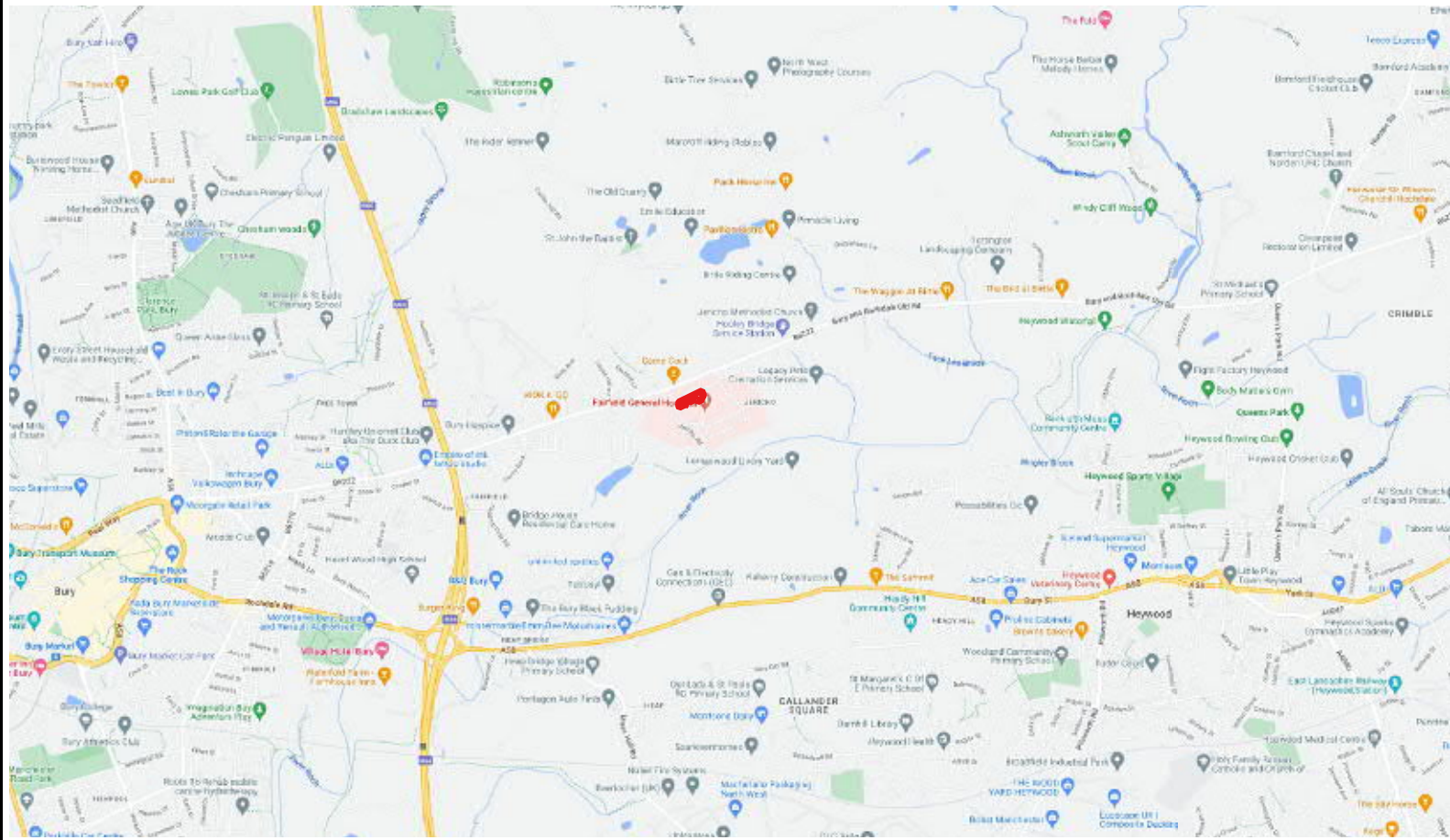
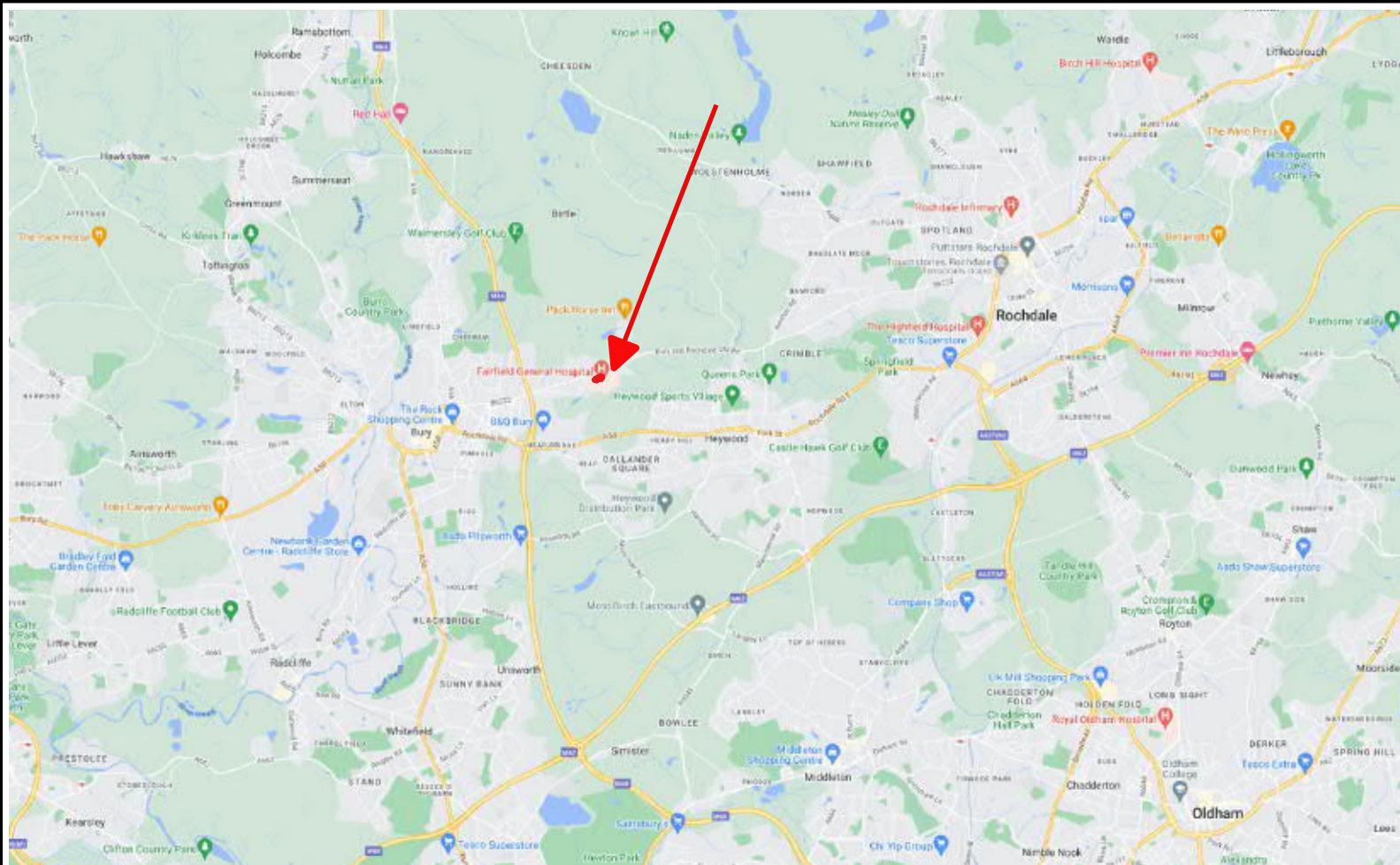
The risk assessment and opinions provided take in to consideration, inter alia, currently available guidance relating to acceptable contamination concentrations; no liability can be accepted for the retrospective effects of any future changes or amendments to these values.



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NOTES:

CLIENT:

DAY PROJECT MANAGEMENT

PROJECT:

FAIRFIELD GENERAL HOSPITAL

TITLE:

SITE LOCATION PLAN FOR CONTRACTORS

PROJECT No:

P10351

DATE:

07/2023

DESIGN/DRAWN:

AM

DRAWING NUMBER:

-

ISSUE:

-

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NOTES: Notes	CLIENT: DAY PROJECT MANAGEMENT	PROJECT No: P10351	DATE: 10/2023	DESIGN/DRAWN: AM	 GRM Development Solutions Ltd Tel: 01283 551 249 mail@grm-uk.comwww.grm-uk.com
	PROJECT: FAIRFIELD GENERAL HOSPITAL - Phase 2	DRAWING NUMBER: Prelim	ISSUE: Prelim		
	TITLE: EXPLORATORY HOLE LOCATION PLAN	© GRM Development Solutions Ltd © Crown Copyright. AL 100014100			



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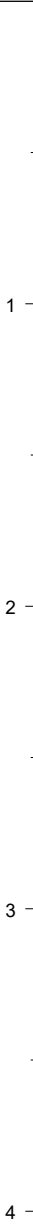
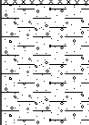
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No HDP101 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	

Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
▼	0.50	ES					Medium dense, light brown, slightly sandy, clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular concrete, brick, sandstone and quartzite. MADE GROUND	
			0.60				Soft, greyish-brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, concrete, quartzite and sandstone. Locally a clayey sand. MADE GROUND	
			0.90				Stiff, brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded sandstone. WEATHERED WOODHEAD HILL ROCK	1
			1.20				Wet at 1.00m. End of Pit at 1.200m	
								2
								3
								4

Date Excavated: 04/10/2023		Groundwater Observations:	
Date Backfilled: 04/10/2023		Water at 1.00m.	
Shoring: None.			
Stability: Stable during excavation.			
Plant Used: Spoons.		Reason for termination of Trial Pit:	
Logged by: AM		Base of foundation encountered.	
General Remarks:			

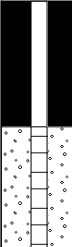
Relative density is approximate and determined by observation only.		Version: DRAFT		Scale: 1:25	
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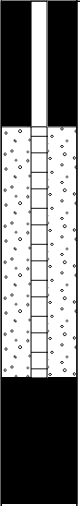
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Trial Pit Log			Trial Pit No HDP102 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	

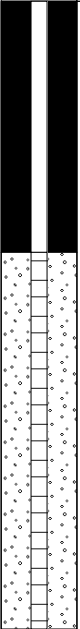
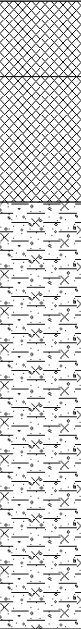
Water Strike	Samples & In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.50	ES		0.30		 Medium dense, light brown, slightly sandy, clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular concrete, brick, sandstone and quartzite. MADE GROUND		
			0.60		 Soft, greyish-brown, sandy CLAY. Sand is fine to coarse. Locally a clayey sand. MADE GROUND			
			0.90		 Soft, greyish-brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, concrete, quartzite and sandstone. Locally a clayey sand. MADE GROUND			
			1.30		 Stiff, brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded sandstone. WEATHERED WOODHEAD HILL ROCK			
						End of Pit at 1.300m		

Date Excavated: 04/10/2023		Groundwater Observations:	
Date Backfilled: 04/10/2023		No groundwater encountered.	
Shoring: None.			
Stability: Stable during excavation.			
Plant Used: Spoons.		Reason for termination of Trial Pit:	
Logged by: AM		Base of foundation encountered.	
General Remarks:			

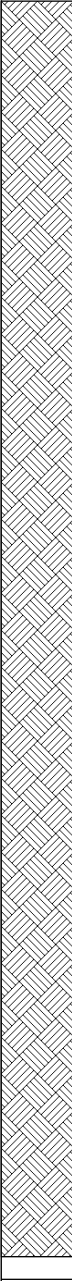
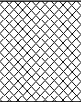
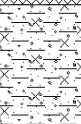
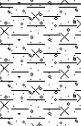
Relative density is approximate and determined by observation only.		Version: DRAFT		Scale: 1:25	
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		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS101 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description
		Depth	Type	SPT Result				
		0.10 - 0.20	ES		0.30			Dark greyish-brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded quartzite, sandstone and rare brick. Abundant rootlets. RELAID TOPSOIL
		0.80 - 0.90	D					Stiff to very stiff, very high strength, brown and yellowish-brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular sandstone. Occasional sand pockets.
		1.00	C	N=50 (2,2/50 for 235mm)	1.00			WEATHERED WOODHEAD HILL ROCK End of Borehole at 1.000m
								1
								2
								3
								4
								5
Crew: Dynamic Sampling UK Ltd				Logger: AM		Weather: Overcast.		
Equipment: Tracked Window Sampling Rig								
Reason for termination of borehole: SPT refusal at 1.00m.								
Groundwater Remarks: No groundwater encountered.								
General Remarks:								
Hole Started: 04/10/2023		Hole Complete: 04/10/2023		Version: FINAL		Scale: 1:31		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS102 Sheet 1 of 1		
Site Name: Fairfield General Hospital							Ground Level (mAOD)		
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N		
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	SPT Result					
					0.20			Dark brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded quartzite, sandstone and brick. Abundant rootlets. RELAID TOPSOIL	
		0.50 - 0.60	ES					Soft, greyish-brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, concrete, quartzite and sandstone. Locally a clayey sand. Recovered damp. MADE GROUND	1
		1.00	C	N=14 (1,0/0,7,4,3)	1.00				
		1.20 - 1.30	ES			1.50		Medium dense, light brown, slightly sandy, clayey GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular concrete, brick, sandstone and quartzite. Recovered damp. MADE GROUND	
		1.90 - 2.00	D					Stiff to very stiff, very high strength, brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded sandstone. WEATHERED WOODHEAD HILL ROCK	2
		2.00	C	N=50 (2,2/50 for 295mm)	2.00			End of Borehole at 2.000m	
									3
									4
									5
Crew: Dynamic Sampling UK Ltd				Logger: AM			Weather: Overcast.		
Equipment: Tracked Window Sampling Rig									
Reason for termination of borehole: SPT refusal at 2.00m.									
Groundwater Remarks: Recovered damp between 0.20m and 1.50m. Standing water at 1.50m upon completion of borehole.									
General Remarks:									
Hole Started: 04/10/2023		Hole Complete: 04/10/2023			Version: FINAL		Scale: 1:31		

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS103 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description
		Depth	Type	SPT Result				
		0.50 - 0.60	ES		0.30			Dark brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded quartzite and brick. Abundant rootlets. RELAI D TOPSOIL Loose to medium dense, greyish-brown, slightly clayey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular sandstone, concrete and brick. Recovered damp. MADE GROUND Soft, low strength becoming stiff to very stiff, very high strength, brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded sandstone. WEATHERED WOODHEAD HILL ROCK
		1.00	C	N=5 (2,3/2,1,1,1)	0.80			
		1.50 - 1.60	D					
		2.00	C	N=34 (3,8/8,8,8,10)				
		2.40 - 2.50	D		2.50			
2.50	C	50 (25 for 105mm/50 for 290mm)						
End of Borehole at 2.500m								
Crew: Dynamic Sampling UK Ltd				Logger: AM		Weather: Overcast.		
Equipment: Tracked Window Sampling Rig								
Reason for termination of borehole: SPT and sampler refusal at 2.50m.								
Groundwater Remarks: Recovered damp between 0.30m and 0.80m.								
General Remarks:								
Hole Started: 05/10/2023		Hole Complete: 05/10/2023		Version: FINAL		Scale: 1:31		

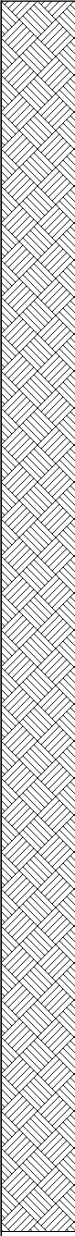
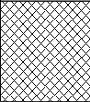
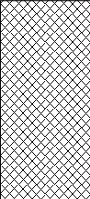
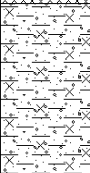
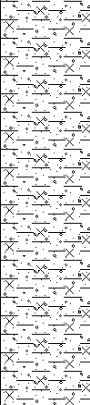
		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS104 Sheet 1 of 1		
Site Name: Fairfield General Hospital							Ground Level (mAOD)		
Client: DAY Project Management Ltd					GRM Project Ref: P10351			Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	SPT Result					
		0.10 - 0.20	ES		0.40		Dark brown, slightly gravelly, silty SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded brick and quartzite. Abundant rootlets. RELAIID TOPSOIL	1	
		0.60 - 0.70	ES				Very loose to loose, light grey, yellowish-brown and reddish-brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, concrete and rare clinker. MADE GROUND		
		1.00	C	N=2 (1,1/0,0,1,1)	1.40		Soft, low strength, orangish-brown and light grey, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded quartzite and sandstone. GLACIAL TILL	2	
		1.50 - 1.60	D						
		2.00	C	N=4 (1,0/1,1,1,1)	2.60		Soft, low strength, brown mottled grey, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded sandstone, mudstone and coal. GLACIAL TILL	3	
		2.60 - 2.70	D						
		3.00	C	N=5 (1,1/1,1,1,2)	3.70		Medium dense, dark brown and dark grey, gravelly SAND. Sand is fine to coarse. Gravel is fine to medium, subangular mudstone and coal. Recovered damp between 3.70m and 4.00m. Recovered wet from 4.00m. WEATHERED WOODHEAD HILL ROCK <i>Becoming silty from 4.00m.</i>	4	
		3.70 - 3.80	D						
		4.00	C	N=12 (2,2/2,2,4,4)	5.00			5	
4.50 - 4.60	D								
		5.00	C	N=11 (2,2/2,2,3,4)			End of Borehole at 5.000m		

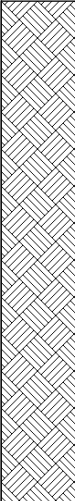
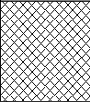
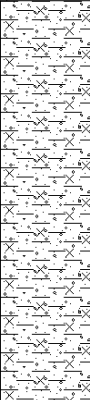
Crew: Dynamic Sampling UK Ltd	Logger: AM	Weather: Overcast.
Equipment: Tracked Window Sampling Rig		
Reason for termination of borehole: Target depth reached.		
Groundwater Remarks: Recovered damp between 3.70m and 4.00m. Recovered wet from 4.00m.		
General Remarks:		

Hole Started: 04/10/2023	Hole Complete: 04/10/2023	Version: FINAL	Scale: 1:31
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		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS105 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	SPT Result					
		0.50 - 0.60	ES		0.40			Dark brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, quartzite and coal. Abundant rootlets. RELAID TOPSOIL	1
		1.00	C	N=4 (1,1/1,1,1,1)				Very loose to loose, dark grey and reddish-brown, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular brick, concrete, coal and clinker. Recovered damp. MADE GROUND	
		1.30 - 1.40	D		1.20			Very soft to soft, very low to low strength, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular sandstone, coal and mudstone. GLACIAL TILL	
		2.00	C	N=0 (0,0/0,0,0,0)				Becoming mottled dark grey from 1.90m.	2
		2.30 - 2.40	D						
		3.00	C	N=8 (0,2/1,2,2,3)					3
		3.60 - 3.70	D		3.50				
		4.00	C	N=19 (3,5/6,5,4,4)				Stiff to very stiff, high to very high strength, dark brown and dark grey, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to coarse. Gravel is fine to medium, subangular to subrounded sandstone. WEATHERED WOODHEAD HILL ROCK	4
4.45	C	N=23 (4,4/5,6,6,6)							
		4.90	C	N=30 (7,8/7,7,8,8)	4.90			End of Borehole at 4.900m	5

Crew: Dynamic Sampling UK Ltd		Logger: AM		Weather: Overcast.	
Equipment: Tracked Window Sampling Rig					
Reason for termination of borehole: Target depth reached.					
Groundwater Remarks: Recovered damp between 0.40m and 0.90m.					
General Remarks: Hole collapse up to 2.00m when at 4.00m begl, continuous CPT from 4.00m to 4.90m.					
Hole Started: 04/10/2023		Hole Complete: 04/10/2023		Version: FINAL	
				Scale: 1:31	

		GRM Development Solutions Ltd Laurus House, First Avenue, Centrum 100, Burton-on-Trent, DE14 2WH Tel (HQ): 01283 551249 Email: info@grm-uk.com		Windowless Sample Borehole			Borehole No WS106 Sheet 1 of 1	
Site Name: Fairfield General Hospital							Ground Level (mAOD)	
Client: DAY Project Management Ltd					GRM Project Ref: P10351		Coordinates E N	
Installation/ Backfill	Water Strike	Samples/Tests			Depth (m)	Level (m)	Legend	Stratum Description
		Depth	Type	SPT Result				
		0.10 - 0.20	ES	N=29 (3,5/7,7,7,8)	0.40		Dark brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded quartzite and rare brick and sandstone. Abundant rootlets. RELAID TOPSOIL	
		0.80 - 0.90	D					
		1.00	C					
		1.50 - 1.60	D	N=50 (7,8/50 for 270mm)	2.00		Stiff to very stiff, high to very high strength, locally friable, brown and yellowish-brown, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular sandstone. WEATHERED WOODHEAD HILL ROCK	
2.00	C							
							End of Borehole at 2.000m	
Crew: Dynamic Sampling UK Ltd			Logger: AM			Weather: Overcast.		
Equipment: Tracked Window Sampling Rig								
Reason for termination of borehole: SPT refusal at 2.00m.								
Groundwater Remarks: No groundwater encountered.								
General Remarks:								
Hole Started: 04/10/2023		Hole Complete: 04/10/2023		Version: FINAL		Scale: 1:31		



A P P E N D I X E

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	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Commercial Industrial		
CONTAMINANT	1%	2.50%	6%
^a Arsenic	640	640	640
^a Cadmium	410	410	410
^b Chromium III	8600	8600	8600
^a Chromium VI	49	49	49
^a Lead	2330	2330	2330
^{b/c} Mercury	1100	1100	1100
^b Selenium	12000	12000	12000
^b Nickel	980	980	980
^b Phenols	760	1500	3200
^b Copper	68000	68000	68000
^b Zinc	730000	730000	730000
^d Cyanide	280	280	280
^b Benzene	27	47	90
^b Toluene	56000	110000	180000
^b Ethylbenzene	5700	13000	27000
^b <i>o</i> - xylene	6600	15000	33000
^b <i>m</i> - xylene	6200	14000	31000
^b <i>p</i> - xylene	5900	14000	30000
Non Genotoxic PAHs			
^b Acenaphthene	84000	97000	100000
^b Acenaphthylene	83000	97000	100000
^b Anthracene	520000	540000	540000
^b Fluoranthene	23000	23000	23000
^b Fluorene	63000	68400	70800
^b Napthalene	190	460	1100
^b Phenanthrene	22000	22000	23000
^b Pyrene	54000	54000	54000
Genotoxic PAHs			
^{a/e} Benzo(a)pyrene	76	76	76
ALIPHATIC HYDROCARBONS			
^b C5-C6	3200	5900	12000
^b C6-C8	7800	17000	40000
^b C8-C10	2000	4800	11000
^b C10-C12	9700	23000	47000
^b C12-C16	59000	82000	90000
^b C16-35	1600000	1700000	1800000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	26000	46000	86000
^b C7-8 (toluene)	56000	110000	180000
^b C8-C10	3500	8100	17000
^b C10-C12	16000	28000	34000
^b C12-C16	36000	37000	38000
^b C16-C21	28000	28000	28000
^b C21-C35			

Notes

- a C4SL - SP1010 (2014) - Benzene and Benzo(a)pyrene values for 1% and 2.5% SOM have been calculated using default C4SL parameters in CLEA v1.07
 - b LQM/CIEH S4UL values (2015).
 - c S4UL for inorganic Hg used.
 - d Atkins ATRISKsoil Value
- Benzo(a)pyrene is a surrogate marker for the 8 genotoxic PAHs (Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(ghi)perylene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Ideno(1,2,3-cd)pyrene)
- GRM TAC 11-2016**



A P P E N D I X F

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Analytical Test Report: L23/05909/GRM - 23-38032

Your Project Reference:	P10351 Fairfield General Hospital		
Your Order Number:	P10351	Samples Received / Instructed:	06/10/2023 / 06/10/2023
Report Issue Number:	1	Sample Tested:	06/10 to 17/10/2023
Samples Analysed:	9 soil samples	Report issued:	17/10/2023

Signed

James Gane
Analytical Services Manager
CTS Group

Notes:**General**

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report with the exception of the asbestos test portion which is held for 6 months unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Stone Content was determined in accordance with CTS method statement MS - CL - Sample Prep and refers to the percentage of stones retained on a 10mm BS test sieve.

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Asbestos

Please note: Where further analysis is required samples identified as containing asbestos are screened and tested on an as received basis. No correction is made for moisture content and these results are not covered by our accreditation

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

Date of Issue: 10.10.2023

Issued by: J. Gane

Issue No: 4

Rev No: 4

L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Analytical Test Results - Solid

Lab Reference			318969	318970	318971	318972	318973
Client Sample ID			-	-	-	-	-
Client Sample Location			WS101	WS102	WS103	WS104	WS106
Client Sample Type			ES	ES	ES	ES	ES
Client Sample Number			-	-	-	-	-
Depth - Top (m)			0.10	0.50	0.50	0.60	0.10
Depth - Bottom (m)			0.20	0.60	0.60	0.70	0.20
Date of Sampling			04/10/2023	04/10/2023	04/10/2023	04/10/2023	04/10/2023
Time of Sampling			-	-	-	-	-
Sample Matrix			Clay	Clay	Sand	Sand	Clay
Determinant	Units	Accreditation					
Arsenic	(mg/kg)	MCERTS	23	< 10	< 10	< 10	23
Cadmium	(mg/kg)	MCERTS	2.2	1.6	1.4	1.1	2.1
Chromium (Total)	(mg/kg)	UKAS	25	15	13	12	24
Copper	(mg/kg)	MCERTS	110	32	13	45	88
Lead	(mg/kg)	MCERTS	150	31	16	78	170
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	< 2.5	< 2.5
Nickel	(mg/kg)	MCERTS	31	26	26	18	30
Selenium	(mg/kg)	u	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
Zinc	(mg/kg)	MCERTS	180	76	60	81	180
Total Phenols	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cyanide (Total)	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Chromium (Hexavalent)	(mg/kg)	u	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
pH	pH Units	MCERTS	7.7	8.8	8.9	11.8	8.3
Sulphate (Water soluble as SO ₄)	(mg/l)	u	16	< 10	24	190	< 10
Acenaphthene	(mg/kg)	MCERTS	0.19	< 0.02	< 0.02	< 0.02	0.10
Acenaphthylene	(mg/kg)	UKAS	0.14	< 0.02	< 0.02	< 0.02	0.05
Anthracene	(mg/kg)	UKAS	0.57	0.04	< 0.02	< 0.02	0.19
Benzo (a) anthracene	(mg/kg)	MCERTS	1.8	0.15	< 0.02	0.08	0.75
Benzo (a) pyrene	(mg/kg)	MCERTS	1.6	0.14	< 0.02	0.07	0.80
Benzo (b) fluoranthene	(mg/kg)	MCERTS	2.1	0.18	< 0.02	0.08	1.1
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.93	0.09	< 0.02	0.06	0.53
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.74	0.06	< 0.02	0.03	0.38
Chrysene	(mg/kg)	MCERTS	1.8	0.17	< 0.02	0.09	0.84
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	0.22	< 0.02	< 0.02	< 0.02	0.09
Fluoranthene	(mg/kg)	MCERTS	3.5	0.28	< 0.02	0.18	1.4
Fluorene	(mg/kg)	MCERTS	0.19	< 0.02	< 0.02	< 0.02	0.09
Indeno (1, 2, 3,-cd) pyrene	(mg/kg)	MCERTS	1.1	0.10	< 0.02	0.05	0.58
Naphthalene	(mg/kg)	MCERTS	0.08	< 0.02	< 0.02	< 0.02	0.10
Phenanthrene	(mg/kg)	MCERTS	2.2	0.15	0.04	0.09	0.81
Pyrene	(mg/kg)	MCERTS	3.3	0.28	< 0.02	0.17	1.3
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	20	1.7	0.36	1.0	9.0
SOM (via TOC)	(%)	UKAS	7.8	< 1.7	< 1.7	5.8	6.7
Asbestos	-	UKAS	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected



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L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Analytical Test Results - Chemical Analysis

Lab Reference			318974	318975	318976	318977
Client Sample ID			-	-	-	-
Client Sample Location			WS101	WS102	WS103	WS106
Client Sample Type			ES	ES	ES	ES
Client Sample Number			-	-	-	-
Depth - Top (m)			0.80	1.20	1.50	0.80
Depth - Bottom (m)			0.90	1.30	1.60	0.90
Date of Sampling			04/10/2023	04/10/2023	04/10/2023	04/10/2023
Time of Sampling			-	-	-	-
Sample Matrix			Clay	Sand	Clay	Clay
Determinant	Units	Accreditation				
Water soluble sulphate (as SO ₄)	(mg/l)	u	41	120	15	18
pH Value	pH Units	MCERTS	7.1	11.6	8.6	7.0

L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Analytical Test Results - TPH CWG

Lab Reference			318969	318970	318971	318972	318973
Client Sample ID			-	-	-	-	-
Client Sample Location			WS101	WS102	WS103	WS104	WS106
Client Sample Type			ES	ES	ES	ES	ES
Client Sample Number			-	-	-	-	-
Depth - Top (m)			0.10	0.50	0.50	0.60	0.10
Depth - Bottom (m)			0.20	0.60	0.60	0.70	0.20
Date of Sampling			04/10/2023	04/10/2023	04/10/2023	04/10/2023	04/10/2023
Time of Sampling			-	-	-	-	-
Sample Matrix			Clay	Clay	Sand	Sand	Clay
Determinant	Units	Accreditation					
Aliphatics							
>C ₅ to C ₆ [HS_MS_1D_AI]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
>C ₆ to C ₈ [HS_MS_1D_AI]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
>C ₈ to C ₁₀ [HS_MS_1D_AI]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
>C ₁₀ to C ₁₂ [EH_CU_1D_AI]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₁₂ to C ₁₆ [EH_CU_1D_AI]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₁₆ to C ₂₁ [EH_CU_1D_AI]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₂₁ to C ₃₅ [EH_CU_1D_AI]	(mg/kg)	u	< 20	< 20	< 20	< 20	< 20
Aromatics							
>C ₅ to C ₇ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C ₇ to C ₈ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
>C ₈ to C ₁₀ [HS_MS_1D_AR]	(mg/kg)	MCERTS	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
>C ₁₀ to C ₁₂ [EH_CU_1D_AR]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₁₂ to C ₁₆ [EH_CU_1D_AR]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₁₆ to C ₂₁ [EH_CU_1D_AR]	(mg/kg)	u	< 10	< 10	< 10	< 10	< 10
>C ₂₁ to C ₃₅ [EH_CU_1D_AR]	(mg/kg)	u	37	< 20	< 20	23	31
>C ₅ to C ₄₀ [EH_CU+HS_1D_Total]	(mg/kg)	u	< 50	< 50	< 50	< 50	< 50

L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Sample Descriptions

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
318969	-	WS101	ES	-	Dark brown slightly sandy slightly gravelly silty clay with rare rootlets	28	22	43
318970	-	WS102	ES	-	Brown slightly sandy slightly gravelly silty clay	11	37	71
318971	-	WS103	ES	-	Light grey clayey gravelly silty sand	6.8	59	56
318972	-	WS104	ES	-	Made Ground- light grey very gravelly coarse sand with frequent concrete brick fragments	7.4	65	17
318973	-	WS106	ES	-	Dark greyish brown sandy slightly gravelly silty clay with occasional rootlets	24	2.4	91
318974	-	WS101	ES	-	Brown slightly sandy slightly gravelly silty clay	-	-	100
318975	-	WS102	ES	-	Brownish grey very gravelly clayey silty sand	-	-	45
318976	-	WS103	ES	-	Brown slightly sandy silty clay	-	-	91
318977	-	WS106	ES	-	Brown slightly sandy slightly gravelly silty clay	-	-	100



L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
318969	-	WS101	ES	-	VPH/BTEX - Sample taken from container with headspace.
318970	-	WS102	ES	-	VPH/BTEX - Sample taken from container with headspace.
318971	-	WS103	ES	-	VPH/BTEX - Sample taken from container with headspace.
318972	-	WS104	ES	-	VPH/BTEX - Sample taken from container with headspace.
318973	-	WS106	ES	-	VPH/BTEX - Sample taken from container with headspace.
318974	-	WS101	ES	-	
318975	-	WS102	ES	-	
318976	-	WS103	ES	-	
318977	-	WS106	ES	-	

L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1 Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
EPHS	MS - CL - EPH in Soil	As received	Passing 10mm test sieve	Determination of Extractable Petroleum Hydrocarbons in soils via GC-MS
PAHASRDS	MS - CL - PAH (As Received)	As received	Passing 10mm test sieve	Determination of Polyaromatic hydrocarbons in soil via GC-MS
CWGS	MS - CL - VPH & MS - CL - EPH	As received	Passing 10mm test sieve	Determination of TPH CWG (Volatile Petroleum Hydrocarbons and Extractable Petroleum Hydrocarbons) in soils via Headspace-GC-MS and GC-MS respectively
TOCS	MS - CL - TOC Eltra	Air Dried	Passing 10mm test sieve	Determination of Total Organic Carbon in soils
VPHS	MS - CL - VPH	As received	Passing 10mm test sieve	Determination of VPH in soils via Headspace-GC-MS
SKALARCNS	MS - CL - Cyanide by Skalar	As received	Passing 10mm test sieve	Determination of cyanide (total / free / complex) in soil using a Skalar segmented flow analyser
SKALARHCS	MS - CL - Hexavalent Chromium by Skalar	As received	Passing 10mm test sieve	Determination of hexavalent chromium in soil using Skalar segmented flow analyser
ICPMETS	MS - CL - ICP Metals	Air dried	Passing 10mm test sieve	Determination of metals in soils via ICP
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SKALARPHS	MS - CL - Phenols by Skalar	As received	Passing 10mm test sieve	Determination of total phenols in soil using Skalar segmented flow analyser
ASB	MS - AS - Asbestos	-	-	Fibre identification is in accordance with in house documented methods which are based on the procedure documented in the HSE Document HSG 248 "Asbestos: The analysts guide for sampling, analysis and clearance procedures"
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis

L23/05909/GRM - 23-38032

Project Reference - P10351 Fairfield General Hospital

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
318969	-	WS101	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	C
318969	-	WS101	ES	-	MS - CL - ICP Metals	C
318969	-	WS101	ES	-	MS - CL - TOC Eltra	C
318969	-	WS101	ES	-	MS - CL - pH in Soils	C
318970	-	WS102	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	C
318970	-	WS102	ES	-	MS - CL - ICP Metals	C
318970	-	WS102	ES	-	MS - CL - TOC Eltra	C
318970	-	WS102	ES	-	MS - CL - pH in Soils	C
318971	-	WS103	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	C
318971	-	WS103	ES	-	MS - CL - ICP Metals	C
318971	-	WS103	ES	-	MS - CL - TOC Eltra	C
318971	-	WS103	ES	-	MS - CL - pH in Soils	C
318972	-	WS104	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	C
318972	-	WS104	ES	-	MS - CL - ICP Metals	C
318972	-	WS104	ES	-	MS - CL - TOC Eltra	C
318972	-	WS104	ES	-	MS - CL - pH in Soils	C
318973	-	WS106	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	C
318973	-	WS106	ES	-	MS - CL - ICP Metals	C
318973	-	WS106	ES	-	MS - CL - TOC Eltra	C
318973	-	WS106	ES	-	MS - CL - pH in Soils	C
318974	-	WS101	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	CT
318974	-	WS101	ES	-	MS - CL - pH in Soils	CT
318975	-	WS102	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	CT
318975	-	WS102	ES	-	MS - CL - pH in Soils	CT
318976	-	WS103	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	CT
318976	-	WS103	ES	-	MS - CL - pH in Soils	CT
318977	-	WS106	ES	-	MS - CL - Anions by Aquakem (2:1Extract)	CT
318977	-	WS106	ES	-	MS - CL - pH in Soils	CT



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Project Reference - P10351 Fairfield General Hospital

HWOL TPH Acronym Index

Acronym	Description
HS	Headspace Analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
Total	Aliphatics and Aromatics
AL	Aliphatics Only
AR	Aromatics Only
2D	GC-GC - Double Coil Gas Chromatography
#1	EH_Total but with humics mathmatically subtracted
#2	EH_Total but with fatty acids mathmatically subtracted
_	Operator - underscore to separate acronyms (except for +)
+	Operator to indicate cumlative e.g. EH+HS_Total or EH_CU+HS_Total
MS	Mass Spectrometry



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In-Situ Gas Monitoring Results

Project Name	Fairfield General Hospital (FGH) ED
Project Number	10351
Client	DAY Project Management Ltd
Date	25/10/2023
Weather	Cloudy
Atmospheric Pressure (mb)	979
Pressure Trend	Rising
Equipment	Gas Data GFM436
Operator	James Wardle

Ground Gas													
Well ID	Response Zone			Methane		CO2		Oxygen		Gas Flow		PID Reading	
	mbegl			%v/v		%v/v		%v/v		l/h		ppm	
ID	Top	Base	Strata	Peak	Steady	Peak	Steady	Low	Steady	Peak	Steady	Peak	Steady
WS01	1.0	2.0	NS										
WS02	0.8	1.0	NS										
WS101	0.5	1.0	NS	0.0	0.0	1.4	1.4	19.8	19.8	0.0	0.0	Not Recorded	
WS102	0.5	1.5	MG	0.0	0.0	0.1	0.1	20.5	20.5	0.0	0.0	Not Recorded	
WS103	1.5	2.5	NS	0.0	0.0	0.2	0.2	20.1	20.1	0.0	0.0	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
Not Detected	1.1
1.4	1.6
Not Detected	3.4

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L. = 5% Flammable Gas)		
N.D.	Not Detected	a	Methane => 1% v/v
N.R.	Not Recorded	b	Carbon Dioxide => 5% v/v
PID	Photo-Ionising Detector	MG	Made Ground
%	By volume	NS	Natural Strata

Ground Material Key

MG	Made Ground
NS	Natural Strata