



GRM Development Solutions Ltd
Laurus House
First Avenue
Centrum 100
Burton upon Trent
Staffordshire
DE14 2WH

Tel: 01283 551 249
Web: www.grm-uk.com

Our Ref: GRM/P10197/LR.02

Date: 27th March 2023

Peter Bryan
1 Dale Street
Liverpool
LE 2ET

For the attention of Peter Bryan,

Dear Peter,

RE: Supplemental Ground Investigation at Christie Extension, The Christie, Wilmslow Road, Manchester

GRM Development Solutions Ltd (GRM) have been instructed by The Alan Johnston Partnership (Client's Agent) on behalf of The Christie NHS Foundation Trust (Client) to undertake a supplementary geotechnical investigation at the above site. This letter reports the findings of the most recent ground investigation conducted for the proposed hospital building extension footprint at The Christie, Manchester.

GRM Limitation of Reporting are presented in Appendix A.

GRM produced a short form Phase I Desk Study for the proposed development site (report ref: GRM/P10197/DS.1RevA), dated December 2022. Previous reports relating to the redevelopment of the Paterson Building and CCU located to the immediate east of the site, have been reviewed and relevant information has been used in the assessment.

- ARUP, "Geotechnical and Geoenvironmental Desk Study", dated August 2018 (ref: 263083-00).
- CC Geotechnical Ltd (CCG), "Ground Investigation Report", dated April 2019 (ref: CCG-C-18-10614).
- CCU, "FBC Report – Structural Design", dated 6th May 2005.
- GRM, "Ground Investigation at Christie Extension, The Christie, Wilmslow Road, Manchester", , dated February 2023, (ref: GRM/P10197/LR.01 Rev.A).

The Client proposes a four-storey extension to the existing Critical Care Unit (CCU). The proposed extension will contain a new stair / lift core that will connect to the existing CCU. A Proposed Development Plan is presented in Appendix B.



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Site Setting

The site is located within the southern area of the Christie NHS Foundation Trust hospital complex, Manchester. The national Grid Reference (NGR) for the approximate centre of the site is SJ 848 924. The site currently comprises an IHP compound, with cabins and storage facilities recorded across the southern area.

The Site Location and Boundary Plans are presented in Appendix C.

Previous GRM Ground Investigation (February 2023)

GRM undertook a recent ground investigation during February 2023, which included the progression of three exploratory holes. However, due to presence and extent of services in hand-dug pits, all boreholes were terminated at shallow depth and the extents of the made ground was not proven and additionally, geotechnical testing was unable to be undertaken to aid foundation design.

Due to the utilities present within the site boundary, it was recommended that a single rotary borehole was undertaken in the adjacent access road (to avoid surrounding utilities) in order to better characterise the underlying ground conditions at depth and to collect samples for geotechnical testing.

The location of the hand-dug pit and rotary borehole was pre-selected and agreed upon with the Client and NHS Trust before attending site.

GRM Ground Investigation (March 2023)

GRM visited site on the 25th February 2023 to progress a single hand-dug service clearance pit to 1.2m below existing ground level (begl) within an agreed location prior to the drilling of a single rotary borehole. No services were recorded within the pit. Once the pit was complete, it was backfilled with Type 1 MOT material and re-surfaced with cold lay macadam.

GRM returned to site between the 3rd and 4th March 2023 to advance a single rotary borehole (BH01) to a maximum depth of 15.0m begl over the backfilled service pit. The Exploratory Hole Location Plan and Logs are presented in Appendix D and Appendix E respectively.

Proven Ground

The following ground conditions were encountered during the recent GRM investigation fieldwork:

- Made Ground
- Glacial Till
- Weathered Chester Formation
- Chester Formation (Solid Geology)

Made Ground

Made ground was encountered to a depth of 0.6m begl, with various types of made ground observed:

- Black macadam hardstanding recorded to a depth of 0.05m begl.
- Dense, light grey sandy gravel of angular quartzite (sub-base) recorded to 0.4m begl.

- Firm, dark brown mottled grey, slightly gravelly, sandy clay with gravels of quartzite recorded to 0.6m begl.

Glacial Till

This strata was recorded beneath the made ground to a depth of 3.1m begl and comprised firm, reddish brown mottled grey, slightly gravelly, slightly sandy to sandy clay with gravels of mudstone and sandstone.

Standard Penetration Test N-values were recorded as 4 at 1.2m depth (conducted at base of hand-dug pit) and 11 at 2.2m 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 are indicative of low strength soils at 1m depth and medium strength soils at 2m depth.

Chester Formation

This strata was observed to underlie the Glacial Till at a depth of 3.1m begl where a SPT refusal (N=50+) indicated rock quality strata was present and rotary coring commenced.

However, up to 7m begl the rock was extremely weak as the strata was recovered as medium dense becoming very dense, reddish brown, silty fine to medium sand with occasional weakly cemented sandstone gravel lithorelicts present and poor recovery noted.

SPT tests were undertaken at a depth of 5.5m begl and 7.0m begl in lieu of recoverable rock core samples, both recorded refusal (N=50+).

From 7m rock was recovered as extremely weak becoming very weak with depth, partially to highly weathered, pre-dominantly fine to coarse grained thinly to very thinly bedded sandstone.

From 7.0m to 10.5m begl recovery ranged between 35% and 61% of the total core run (1.0m to 1.5m lengths), beneath which recovery increased to between 81% and 100% from 10.5m to 15.0m begl.

Groundwater

It was not possible to accurately determine groundwater strikes from the rotary borehole due to water flush added during drilling. The borehole was recorded as dry to a depth of 10.5m begl at the beginning of the second day of drilling. Upon completion of the borehole, standing water was recorded at a depth of 8.9m begl.

Geotechnical Laboratory Testing

Geotechnical rock and soil testing has been undertaken as part of this ground investigation and included the following:

- Two samples of Glacial Till underwent PI and Water Soluble Sulphate Testing.
- One sample of Chester Formation was submitted for Unconfined Compressive Strength (UCS) testing.
- Eighteen samples of Chester Formation underwent axial Point Load (PL) testing.

Geotechnical tests were selected to provide the parameters necessary for the budgetary design of piled foundations.

Geotechnical Testing and Assessment

Geotechnical testing has been carried out both on site and in the laboratory; the results of this testing are provided on the logs in Appendix E, and in Appendix F. These results are summarised in the tables below:

The results of the in-situ SPT testing are presented below:

Test Parameter		Range of Results		
SPT 'N' values	Depth (m)	Glacial Till	Weathered Chester Formation	Chester Formation
	1.2	4	-	-
	2.2	11	-	-
	3.2	-	28	-
	4.2	-	50*	-
	5.5	-	50*	-
	7.0	-	-	50
	9.5	-	-	50
	10.5	-	-	50

* inferred rock quality strata.

The results of the point load and UCS test are included in the table below:

Exploratory Location	Depth (m)	Testing Orientation for PL	Corrected Point Load Is (50) (MN/m ²)	Unconfined Compressive Strength (UCS) (MN/m ²)
BH01	7.56 - 7.61	Axial	0.066	0.792*
BH01	8.32 - 8.40	Axial	0.032	0.384*
BH01	8.45 - 8.50	Axial	0.094	1.128*
BH01	9.16 - 9.19	Axial	0.019	0.228*
BH01	10.04 - 10.11	Axial	0.034	0.408*
BH01	10.13 - 10.19	Axial	0.057	0.684*
BH01	11.45 - 11.55	Axial	0.100	1.200*
BH01	11.58 - 11.67	Axial	0.047	0.564*
BH01	11.68 - 11.80	Axial	0.143	1.716*
BH01	11.82 - 11.87	Axial	0.101	1.212*
BH01	11.92 - 12.00	Axial	0.142	1.704*
BH01	12.00 - 12.12	Axial	0.129	1.548*
BH01	12.26 - 12.35	Axial	0.126	1.512*
BH01	12.66 - 12.84	Axial	-	10.700
BH01	12.86 - 13.02	Axial	0.179	2.148*
BH01	13.37 - 13.48	Axial	0.122	1.464*

Exploratory Location	Depth (m)	Testing Orientation for PL	Corrected Point Load Is (50) (MN/m ²)	Unconfined Compressive Strength (UCS) (MN/m ²)
BH01	13.82 - 14.00	Axial	0.051	0.612*
BH01	14.16 - 14.25	Axial	0.059	0.708*
BH01	14.79 - 14.89	Axial	0.150	1.800*

*= Approximate UCS from corrected PL.

Whilst laboratory Unconfined Compression Strength (UCS) tests were also scheduled alongside the Point Loads, only one test could be completed due to limited recovery, core dimensions and fractures within the cores. Where point loads have been completed, the approximate UCS strength shown in the table has been derived using a conservative ratio of 12 from the point load to UCS. This conversion ratio is in line with information provided in BGS Engineering Geology of British rocks and soils: Mudstones of the Mercia Mudstone Group and Tomlinson, 2001 'Foundation Design and Construction'. However, this ratio is considered to be conservative and a potentially more appropriate conversion ratio of 17.4 for sandstone has been suggested by Vallejo et al (1989).

The laboratory results generally suggest the rock strata is generally extremely weak (<1.0MN/m²) to very weak to a depth of 11.5m begl, below this the rock is on average very weak.

The results of the Plasticity Index are presented below:

Parameter	Characteristic Value	Volume Change Potential
Plasticity Index	13% to 18%	Low (Glacial Till)

Buried Concrete

Based on the recorded water soluble sulphate and pH levels in the soils below the site and assuming 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.

The results of the water soluble sulphate and pH testing of are presented in Appendix F.

Conclusion

The geotechnical test results should be provided to the piling contractor for detailed foundation design.

A testing regime and objectives of the works will need agreeing with regulatory and warranting bodies prior to works. The pile design will need to be justified to the warranting bodies and the justification should be included within the piling contract.

A working platform will be required for any piling plant. It is recommended that the design of the working platform is carried out as soon as possible. The working platform certificate requires signing by the Principal Contractor for the site. An allowance for this, and responsibility for the design of the platform (estimated at 600mm thick if constructed without reinforcement), should be made in tender packages and site programmes.

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

Yours sincerely,
for GRM Development Solutions Ltd



Andrew Lamont BSc (Hons)
FGS
(Engineering Geologist)



Charlotte Mortimer BSc
(Hons) MEnvSc
(Senior Environmental Scientist)



Richard Upton MSc CEnv
(Director)

Enclosed:

- | | | |
|------------|---|---|
| Appendix A | - | General Appraisal Comments and Standard Limitations |
| Appendix B | - | Proposed Development Plan |
| Appendix C | - | Site Location and Boundary Plan |
| Appendix D | - | Exploratory Hole Location Plan |
| Appendix E | - | Exploratory Hole Logs |
| Appendix F | - | Geotechnical Testing 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
- BGS online viewer: <http://www.bgs.ac.uk/data/mapViewers/home.html>
- Environment Agency 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 (2015), 'Radon: Guidance on protective measures for new buildings'
- HPA-RPD-033 (2007), 'Indicative Atlas of Radon in England and Wales'
- PHE-CRCE-032 (PHE, 2017), Radon in Homes in England: 2016 Data Report
- CIRIA C665 'Assessing risks posed by hazardous ground gases to buildings'
- BS8485:2015, '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 (BR211: 2015)'. 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

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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. Where the most sensitive receptor is a surface water feature the EQS values will be used as Initial Tier 1 Screening values.

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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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P01	CLS	First Issue - For Information Only	24.10.22
Rev	By	Description	Date



The Cruck Barn, Duxbury Park, Chorley, Lancashire. PR7 4AT
t: 01257 260070 f: 01257 260071

Client Name:
The Christie NHS Foundation Trust

Site Name:
The Christie, Wilmslow Road, Manchester

Project Name:
TIF Wards

Drawing Title:
Proposed Ground Floor GA Plan

Project No: 8283-002	Sheet Size: A2	Scale: 1 : 100	
Drawn by: MJC	Checked by: CLS	Approved by: NW	Revision: P01
Suitability: Initial Stage WIP			Status: S0

Drawing Number:
Project Code / Orig / Vol / Level / Type / Disc / System-Number
CHRCW-GDA-V4-00-DR-A-1001



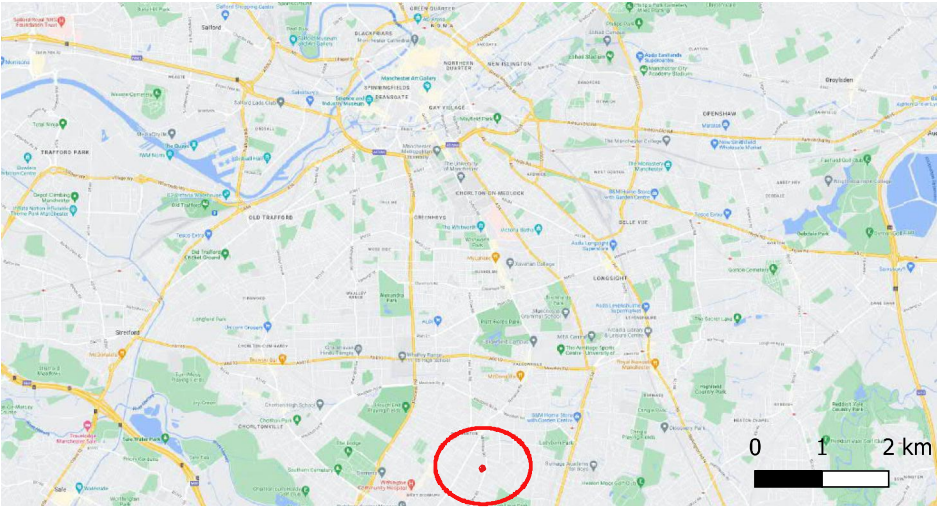
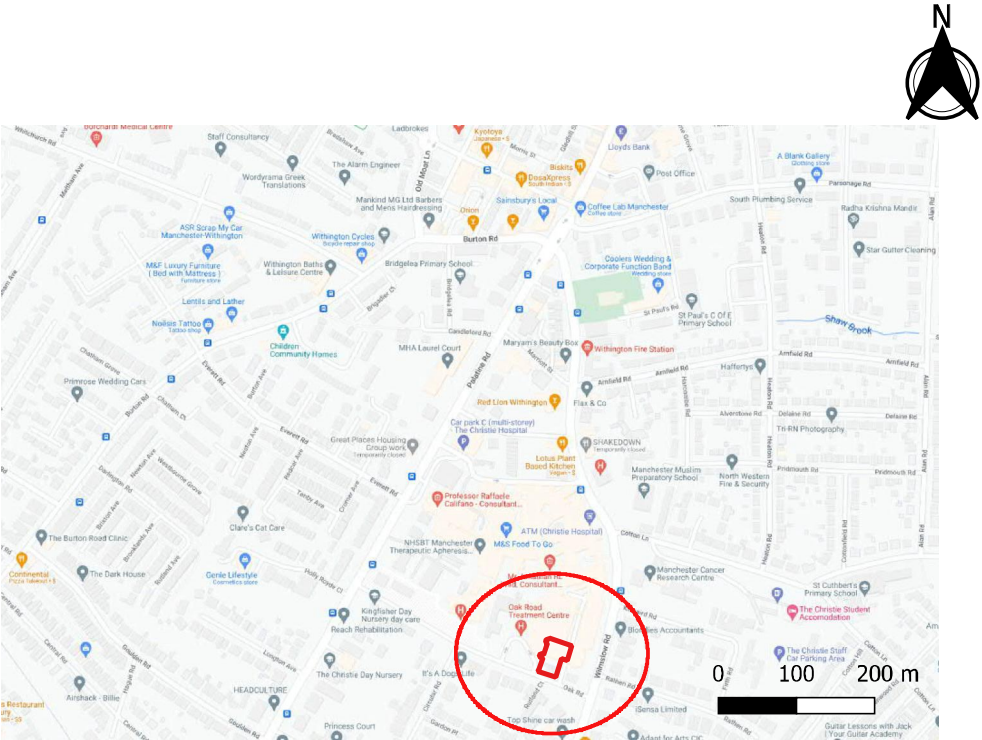
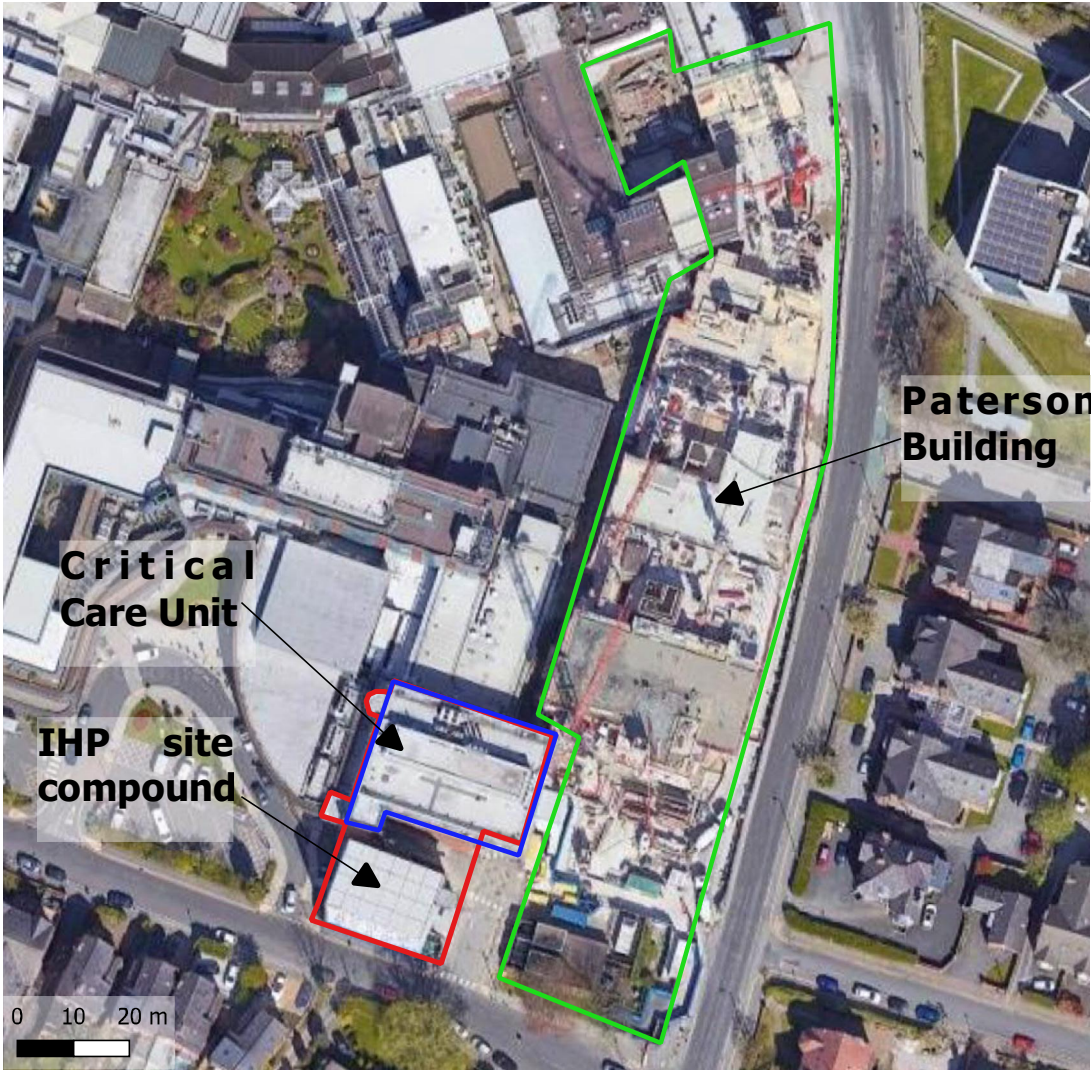
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Legend

- Site Boundary
- Hospital Buildings
- Critical Care Unit
- Paterson Building



NOTES:

CLIENT: THE HRISTIE NHS FOUNDATION TRUST /O AJP

PROJECT: HRISTIE EXTENSION, THE HRISTIE, WILMSLOW ROAD, MANCHESTER

TITLE: SITE LOCATION AND BOUNDARY PLAN

PROJECT No: P10197

DATE: DE 2022

DESIGNED/DRAWN: SS

DRAWING NUMBER: 01

ISSUE: FINAL

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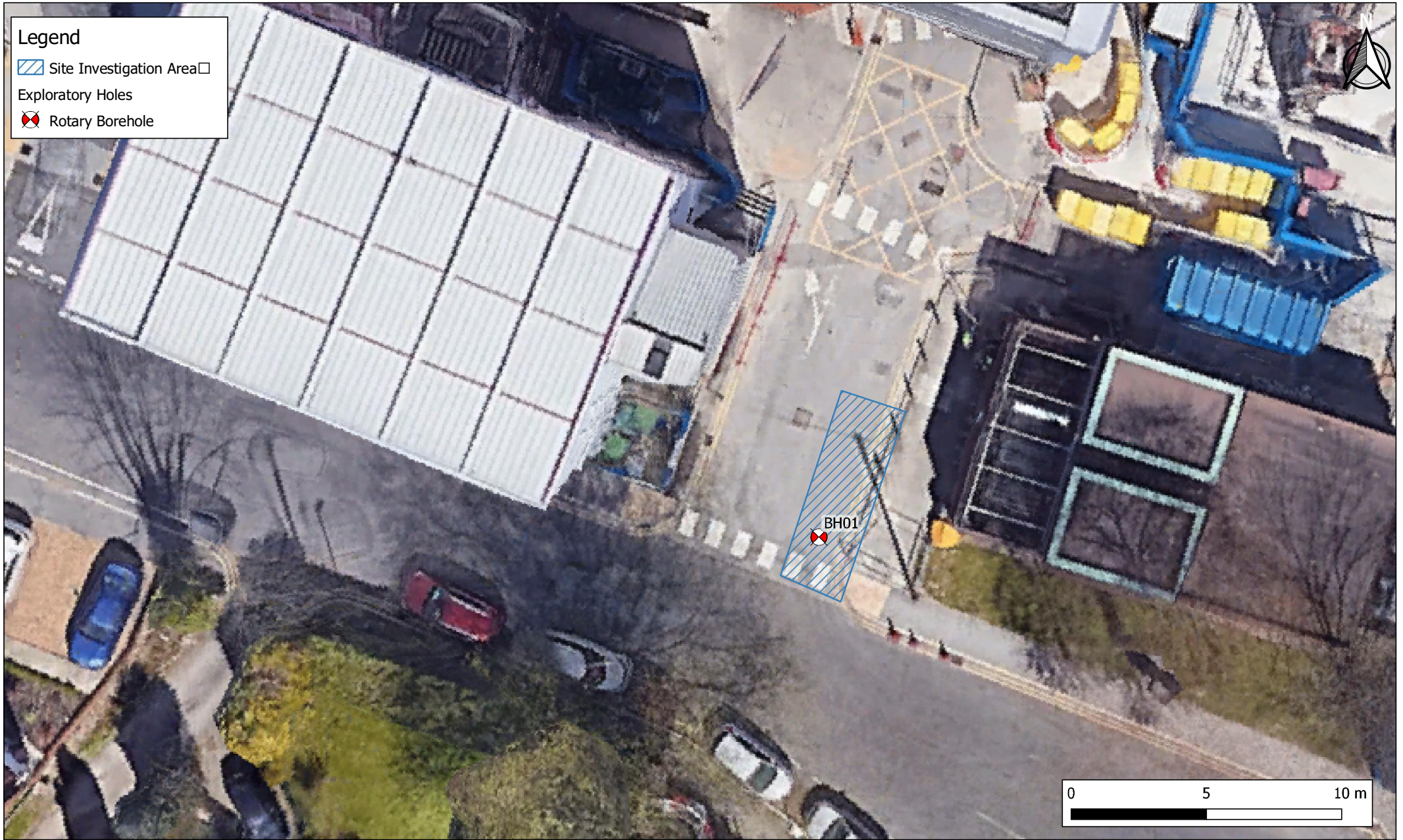
GRM Development Solutions Ltd
Tel: 01283 551 249
mail@grm-uk.com www.grm-uk.com



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GRM Development Solutions Limited, Laurus House, First Avenue, Centrum 100, Burton upon Trent, Staffs DE14 2WH
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NOTES:	CLIENT:	Alan Johnston Partnership Ltd	PROJECT No:	P10197	DATE:	Mar 2023	DESIGN/DRAWN:	AL
	PROJECT:	The Christie Hospital, Manchester	DRAWING NUMBER:	02	ISSUE:	FINAL		
	TITLE:	Exploratory Site Location Plan	© GRM Development Solutions Ltd © Crown Copyright AL 100014100					



GRM Development Solutions Ltd

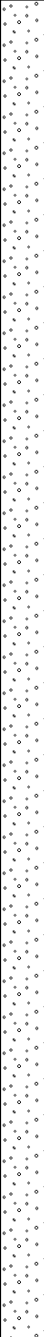
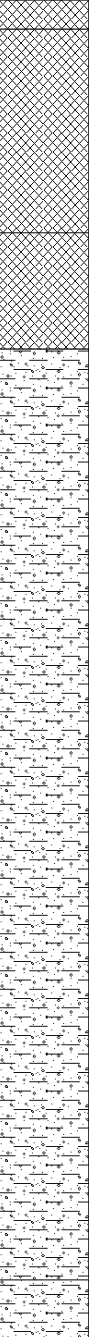
Tel: 01283 551 249
mail@grm-uk.com www.grm-uk.com



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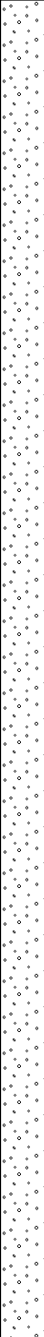
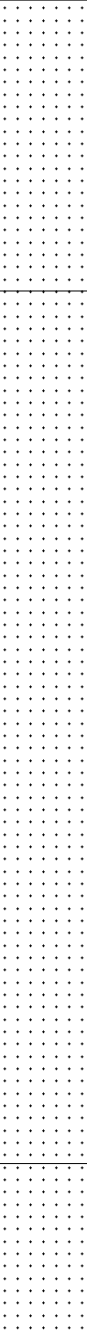
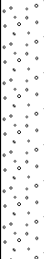
 GRM Development Solution Ltd, Tel (HQ): 01283 551249 Email: info@grm-uk.com Web: www.grm-uk.com		Rotary Core Log				Borehole No. BH01 Sheet 1 of 7					
Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester						Ground Level (mAOD) 33.95					
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership				GRM Project Ref: P10197		Coordinates 384889 E 392402 N					
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
		1.50 - 1.60				N=4 (1,0/1,1,1,1)	0.05	33.90		Black tarmacadam / asphalt. MADE GROUND	1
							0.40	33.55		Dense, light grey, sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-angular of quartzite. MADE GROUND	
							0.60	33.35		Firm, dark brown mottled grey, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, sub-rounded of quartzite. MADE GROUND	
										Soft becoming firm, low to medium strength, reddish brown mottled grey, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse of sandstone, mudstone and quartzite. GLACIAL TILL	
						N=11 (1,3/3,2,3,3)	2.20	31.75		... hand-dug pit to 1.2m begl.	2
Crew: Dynamic Sampling Ltd.			Equipment: Comacchio Geo 205.			Logger: AL.					
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023			Hole Complete: 04/03/2023			Version: FINAL			Scale: 1:13		

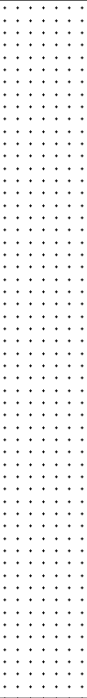
 GRM Development Solution Ltd, Tel (HQ): 01283 551249 Email: info@grm-uk.com Web: www.grm-uk.com		Rotary Core Log				Borehole No. BH01 Sheet 2 of 7					
Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester						Ground Level (mAOD) 33.95					
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership				GRM Project Ref: P10197		Coordinates 384889 E 392402 N					
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
		2.50 - 2.60				N=28 (6,7/6,6,7,9)	3.10	30.85		Firm, medium strength, reddish brown mottled grey, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to sub-rounded of mudstone and sandstone. GLACIAL TILL	3
		3.30 - 3.40								Medium dense becoming very dense, reddish brown, silty fine to medium SAND with rare gravel of fine to coarse, angular weakly cemented sandstone. COMPLETELY WEATHERED CHESTER FORMATION	
										... becoming fine to coarse sand below 4.0m begl. ... rotary coring commenced at 4.2m begl.	
						N=50 (7,9/50 for 150mm)	4.20	29.75		No Recovery 4.2m to 5.5m begl. Assumed highly to completely weathered reddish brown SANDSTONE. Re-circulation tank full of sand after coring run. COMPLETELY WEATHERED CHESTER FORMATION	4
Crew: Dynamic Sampling Ltd.			Equipment: Comacchio Geo 205.			Logger: AL.					
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023		Hole Complete: 04/03/2023		Version: FINAL		Scale: 1:13					

 GRM Development Solution Ltd, Tel (HQ): 01283 551249 Email: info@grm-uk.com Web: www.grm-uk.com		Rotary Core Log					Borehole No. BH01 Sheet 3 of 7				
Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester								Ground Level (mAOD) 33.95			
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership						GRM Project Ref: P10197		Coordinates 384889 E 392402 N			
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
						N=50 (5,20/50 for 135mm)	5.50	28.45		No Recovery 4.2m to 5.5m begl. Assumed highly to completely weathered reddish brown SANDSTONE. Re-circulation tank full of sand after coring run. COMPLETELY WEATHERED CHESTER FORMATION	5
										No recovery 5.5m to 7.0m begl. Assumed highly to completely weathered reddish brown SANDSTONE. COMPLETELY WEATHERED CHESTER FORMATION	6
Crew: Dynamic Sampling Ltd.						Equipment: Comacchio Geo 205.		Logger: AL.			
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023			Hole Complete: 04/03/2023			Version: FINAL			Scale: 1:13		

 GRM Development Solution Ltd, Tel (HQ): 01283 551249 Email: info@grm-uk.com Web: www.grm-uk.com		Rotary Core Log					Borehole No. BH01 Sheet 4 of 7					
Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester								Ground Level (mAOD) 33.95				
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership						GRM Project Ref: P10197		Coordinates 384889 E 392402 N				
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description		
			TCR	SCR	RQD							
		7.56 - 7.61				N=50 (25 for 125mm/50 for 50mm)	7.00	26.95		No recovery 5.5m to 7.0m begl. Assumed highly to completely weathered reddish brown SANDSTONE. COMPLETELY WEATHERED CHESTER FORMATION Extremely weak, highly weathered reddish brown, fine to coarse grained SANDSTONE. Thinly bedded with 4 horizontal fractures present between 7.58m to 7.85m begl along bedded planes, planar, smooth, moderately wide to wide {(3/4/6)}. Completely weathered to sandy clay between 7.85m to 8.30m begl. CHESTER FORMATION 7.00 - 7.55m: AZCL	7	
		7.00 - 8.50	61	46	0							
		8.32 - 8.40										
		8.45 - 8.50										
		8.50 - 9.50	35	18	0		8.50	25.45		Extremely weak, highly to partially weathered, reddish brown, fine to medium grained SANDSTONE. Thinly bedded with eight horizontal fractures along bedding planes, planar, smooth, wide {(2/3/5)}. CHESTER FORMATION 8.50m - 9.12m: AZCL	9	
		9.16 - 9.19										
Crew: Dynamic Sampling Ltd.			Equipment: Comacchio Geo 205.			Logger: AL.						
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.												
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.												
Hole Started: 03/03/2023			Hole Complete: 04/03/2023			Version: FINAL			Scale: 1:13			

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Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester								Ground Level (mAOD) 33.95			
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership						GRM Project Ref: P10197		Coordinates 384889 E 392402 N			
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
						N=50 (25 for 105mm/50 for 30mm)	9.50	24.45		Extremely weak, highly to partially weathered, reddish brown, fine to medium grained SANDSTONE. Thinly bedded with eight horizontal fractures along bedding planes, planar, smooth, wide {{2/3/5}}. CHESTER FORMATION ... 9.38m - 9.48m: NI	10
		9.50 - 10.50 10.04 - 10.11 10.13 - 10.19	55	33	0					Extremely weak, highly to partially weathered, reddish brown, fine to coarse grained SANDSTONE with occasional grey reduction spots. Thinly bedded with 7 horizontal fractures present between 10.05m to 10.40m begl along bedding planes, planar, smooth, open to moderately wide {{2/3/7}}. CHESTER FORMATION ... 9.50 - 10.04m: AZCL ... 10.40 - 10.50: NI	
		10.50 - 12.00	82	66	15	N=50 (25 for 60mm/50 for 25mm)	10.50	23.45		Very weak to weak, partially to highly weathered fine to coarse grained SANDSTONE. Very thinly to thinly bedded with 18 horizontal fractures between 11.01m and 12.00m along bedded planes, planar, smooth, open to moderately wide {{2/5/12}} with some clay infilling. 1 sub-horizontal present at 11.24m begl. CHESTER FORMATION ... 10.5 - 10.76: AZCL ... 10.76 - 11.01: NI	11
		11.45 - 11.55									
Crew: Dynamic Sampling Ltd.				Equipment: Comacchio Geo 205.				Logger: AL.			
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023			Hole Complete: 04/03/2023			Version: FINAL			Scale: 1:13		

 GRM Development Solution Ltd, Tel (HQ): 01283 551249 Email: info@grm-uk.com Web: www.grm-uk.com		Rotary Core Log					Borehole No. BH01 Sheet 6 of 7				
Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester							Ground Level (mAOD) 33.95				
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership					GRM Project Ref: P10197		Coordinates 384889 E 392402 N				
Instal	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
		11.58 - 11.67					12.00	21.95		Very weak to weak, partially to highly weathered fine to coarse grained SANDSTONE. Very thinly to thinly bedded with 18 horizontal fractures between 11.01m and 12.00m along bedded planes, planar, smooth, open to moderately wide ({2/5/12}) with some clay infilling. 1 sub-horizontal present at 11.24m begl. CHESTER FORMATION	12
		11.68 - 11.80									
		11.82 - 11.87									
		11.92 - 12.00									
		12.00 - 12.12									
		12.26 - 12.35								Very weak, partially weathered fine to coarse grained SANDSTONE. Very thinly to thinly bedded with 16 fractures along bedding planes between 12.0m and 13.5m, planar, smooth, tight to moderately wide ({2/3/18}). 1 sub-horizontal fracture present at 12.53m, fresh and most likely drilling induced. CHESTER FORMATION	13
		12.66 - 12.84									
		12.86 - 13.02									
		12.00 - 13.50	100	97	52					... 13.03 - 13.09: NI	
		13.37 - 13.48									
							13.50	20.45		Very weak, partially weathered, reddish brown, fine to coarse grained SANDSTONE. Thinly bedded with 19 fractures present between 13.5m and 15.0m begl, planar, smooth, tight to wide ({2/5/15}). 1 sub-horizontal fracture at 14.28m begl CHESTER FORMATION	
Crew: Dynamic Sampling Ltd.			Equipment: Comacchio Geo 205.			Logger: AL.					
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023		Hole Complete: 04/03/2023		Version: FINAL		Scale: 1:13					

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Site Name: TIF Wards, The Christie, Wilmslow Road, Manchester							Ground Level (mAOD) 33.95				
Client: The Christie NHS Foundation Trust c/o Alan Johnston Partnership					GRM Project Ref: P10197		Coordinates 384889 E 392402 N				
Install	Water Strikes	Depth (m)	Coring			SPT 'N' Value	Depth (m)	Level (m)	Legend	Stratum Description	
			TCR	SCR	RQD						
		13.82 - 14.00								Very weak, partially weathered, reddish brown, fine to coarse grained SANDSTONE. Thinly bedded with 19 fractures present between 13.5m and 15.0m begl, planar, smooth, tight to wide ({2/5/15}). 1 sub-horizontal fracture at 14.28m begl CHESTER FORMATION ... 13.71 - 13.80: NI	14
		14.16 - 14.25									
		13.50 - 15.00	100	80	22						
		14.79 - 14.89									
						15.00	18.95			... 14.72 - 14.78: NI	15
										End of Borehole at 15.000m	16
Crew: Dynamic Sampling Ltd.			Equipment: Comacchio Geo 205.			Logger: AL.					
General Remarks: Hand-dug pit to 1.2m begl. MOT type 1 used to backfill top 1.0m.											
Groundwater Remarks: No possible to determine an accurate groundwater strike. Borehole was dry at start of second day (borehole depth of 10.5m). Upon completion of drilling standing water was recorded at 8.9m begl.											
Hole Started: 03/03/2023		Hole Complete: 04/03/2023		Version: FINAL		Scale: 1:13					



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Kiwa CMT

GRM Development Solutions Limited
Laurus House
First Avenue
Centrum 100
Burton on Trent
DE14 2WH

Kiwa CMT
Unit 5 Prime Park Way
Prime Enterprise Park
Derby
DE1 3QB
T +44 (0)1332 383333
E uk.cmt.enquiries@kiwa.com

www.kiwa.co.uk/cmt

Date: 20th March 2023

Lab Ref: 67037

Order Ref: P10197

Originator: Charlotte Mortimer

Site: P10197-Christie Hospital Manchester

Samples: A total of 19No borehole core samples, nominally 85mmØ and 2 samples of clay were delivered, by the client, to Kiwa CMT on the 9th March 2023. Each of the samples were labelled, individually, with Sample ID and depth range.

Requirements: To assess the individual samples for Axial Point Load (17No) and UCS (2No) at the locations, and depths, delivered and requested by the client. The clay samples to be tested for Plasticity Indices and Water Soluble Sulfate.

Results: Tabulated values for PI & UCS are included overleaf, detailing test results and sample location. Individual certificates for the Plasticity and Sulfate testing are appended.

Amended report, this report replaces report number 87615/67037 dated 14th March 2023 which is now withdrawn.

Kiwa CMT

Gary Peach
Department Head
Concrete & Building Products

Test Results

Ref	Depth (m)	Test Type	I _s (MPa)	I _{s(50)} (MPa)	UCS (N/mm ²)
BH01	7.56-7.61	PL (Ax)	0.066	0.082	-
BH01	8.32-8.40	PL (Ax)	0.032	0.041	-
BH01	8.45-8.50	PL (Ax)	0.094	0.109	-
BH01	9.16-9.19	PL (Ax)	0.019	0.022	-
BH01	10.04-10.11	PL (Ax)	0.034	0.042	-
BH01	10.13-10.19	PL (Ax)	0.057	0.070	-
BH01	11.43-11.55	PL (Ax)	0.100	0.126	-
BH01	11.58-11.67	PL (Ax)	0.047	0.059	-
BH01	11.68-11.80	PL (Ax)	0.143	0.180	-
BH01	11.82-11.87	PL (Ax)	0.101	0.122	-
BH01	11.92-12.00	PL (Ax)	0.142	0.173	-
BH01	12.00-12.12	PL (Ax)	0.129	0.167	-
BH01	12.26-12.35	PL (Ax)	0.126	0.173	-
BH01	12.66-12.84	UCS	-	-	10.7
BH01	12.86-13.02	PL (Ax)	0.179	0.233	-
BH01	13.37-13.48	PL (Ax)	0.122	0.151	-
BH01	13.82-14.00	PL (Ax)	0.051	0.068	-
BH01	14.16-14.25	PL (Ax)	0.059	0.081	-
BH01	14.79-14.89	PL (Ax)	0.150	0.189	-

Comments:

- i) I_{s(50)}, reported in N/mm², is the corrected Point Load strength when converted to a value of I_s, reported in N/mm², that would have been measured by a diametral test with a Ø of 50mm.
- ii) Compressive strength values (UCS), reported in N/mm², have been adjusted to a strength that would have been obtained by a 2:1 length to diameter specimen.
- iii) BH01 12.86-13.02 unsuitable for UCS so tested for Point Load.
- iv) Samples tested on the 9th March 2023.
- v) MPa is equivalent to N/mm².

Kiwa CMT



Gary Peach
Department Head
Concrete & Building Products

Kiwa CMT



Certificate of Analysis for Plasticity Index & Water Content

Client: GRM Development Solutions

Site: Christie Hospital, Manchester

Lab Ref: 67037

Date of Test: 10-14/03/2023

Test Methods: BS EN ISO 17892-12:2018 - Liquid Limit/Plastic Limit/Plasticity Index - Fall Cone Method
BS EN ISO 17892-1:2014 - Water Content

Results:

Sample Ref	Material Description	LL Cone Data			LL (%)	PL (%)	PI (%)	% Retained on 425µm	Modified PI (%)*	Soil Classification	WC (%)
		Cone Pen	Water %	Factor ¹							
BH01 1.5-1.6m	Brown slightly sandy CLAY	18.1 18.3	46.1 46.2	1.0324	48	20	28	3	27	CIM	27.5
BH01 2.5-2.6m	Brown slightly sandy slightly gravelly CLAY	19.4 19.4	22.9 23	1.0108	23	10	13	18	11	CIL	12.8

The samples tested were disturbed and in their natural condition. Results relate only to the samples tested.

LL Test method - Fall Cone / One Point / Cone Spec 80g / 30 degrees

* Modified plasticity index relates to BRE Digest 240 that is not included in the UKAS schedule for this Laboratory.

LL = Liquid Limit

PL = Plastic Limit

PI = Plasticity Index

WC = Water Content

¹ BS EN 1377-2:1990 table 1

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Signed: J Eckford
Geotechnical Site Supervisor



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**DETAILED ANALYTICAL RESULTS - SULFATES**

Client	GRM Development Solutions	Job No.	67037
Contact	Charlotte Mortimer	Site	Christie Hospital
Order Ref	P10197	Date Received	10/03/2023
Sample Description	Clay	Date Analysed	10-14/03/2023
		Date Reported	14/03/2023
Test Method:	BS 1377: Part 3: 2018: Clause 5		

Analyte:	As:	BH01 1.5-1.6	BH01 2.5-2.6
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pH		7.90	8.00
Water Soluble sulfate mg/l	SO ₃	70	100
	mg/l SO ₄	80	120
Class*		DS-1	DS-1
(BRE SD1 : June 2005)		Non-Aggressive	Non-Aggressive

Comments: *The class relates to BRE SD1 : June 2005 table C1 or C2 where the material may be considered **non-aggressive**, **potentially aggressive** or **aggressive** to Portland Cement

Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation
Results apply to the samples as received.

Authorised By

PP

B Fairweather
Technical Administrator

Checked/Authorised By

D. Mullee
Departmental Manager

Further interpretation or advice is a chargeable service and may be obtained by contacting the above signatory.



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