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Our Ref: P9700 / Let.Rep

Date: 19/11/2021

Vexford Homes
96 Leicester Road
Wigston
Leicester
LE18 1DR

Attention of Mohamed Moti

Dear Mohamed,

Re: Ground Investigation at 87 High Street, Barwell.

Vexford Homes Ltd has instructed GRM to undertake a geo-environmental assessment at 87 High Street, Barwell to assess for potential contamination beneath the former residential structure, associated gardens and outbuildings. Current proposals are for the site to be re-developed with new build, terraced housing incorporating private gardens and areas of hardstanding; accordingly, the Client has also instructed that an initial assessment of the soils geotechnical characteristics is made.

A copy of GRM's standards and limitations of reporting are presented in Appendix A and a Proposed Development Plan is presented in Appendix B.

A previous Short Form Desk Study and walkover conducted by GRM (ref: GRM/P9700/SFDS.1) and dated May 2021 identified the following potential sources of contamination:

- Former pond in south eastern corner.
- Asbestos cement sheet roofing to outbuildings.
- Potential made ground from site use as a residential development (including both recent and earlier terraced housing present between c.1888 and c.1972).

Ground Investigation

GRM attended the site on the 4th November 2021. The intrusive investigation comprised four hand-held window sample boreholes (WS01 to WS04) conducted to depths of between 1.6m and 2.8m below existing ground level (begl).



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WS01 and WS02 were positioned beneath the recently demolished residential structure, WS03 in the area of a former outbuilding noted to have possessed asbestos cement sheeting roofing and WS04 in the vicinity of the former pond. An Exploratory Hole Location Plan is presented in Appendix C and the Exploratory Hole Logs in Appendix D.

The materials encountered within the window sample boreholes were generally consistent and comprised:

- Re-laid topsoil
- Made ground
- Bosworth Clay Member

Re-laid topsoil was only encountered in WS01 from ground level to a depth of 0.6m below existing ground level (begl) and comprised dark brown, slightly gravelly, clayey SAND with gravel of quartzite, coal, brick and with abundant rootlets. The re-laid topsoil was observed to directly overlie natural strata of the Bosworth Clay Member.

Made ground was encountered in three of the exploratory holes, the exception being WS01, to depths of between 0.3m begl and 1m begl (typically 0.5m begl). The full thickness of the made ground was proven at each of the three locations.

The made ground generally comprised:

- Dark greyish brown, slightly gravelly SAND and was observed in WS03 and WS04, both located on the eastern site boundary.
- Dark greyish brown sandy, gravelly CLAY with gravel including brick, glass and ceramic insulation fragments in WS02. The made ground was noted as being very soft to soft between 0.5m and 1m in WS02, which is likely to be due to the recent demolition works.

The made ground was observed to lie directly over natural strata considered to be representative of the Bosworth Clay Member.

The Bosworth Clay Member was variable both laterally and vertically ranging from a light brown, slightly sandy CLAY to a yellowish brown, slightly gravelly, clayey SAND with orangish-brown very sandy SILT also present. Engineer assessed consistencies identified soft or very soft strata to be present in:

- WS02 1m to 1.7m begl and 2.0m to 2.4m begl
- WS03 0.7m to 1.6m begl
- WS04 0.6m to 1.2m begl and 1.5m to greater than 2.5m begl.

The remaining clay strata was assessed as firm or stiff. The shallow granular strata were assessed as varying from loose to dense. Strata of the Bosworth Clay Member were encountered to the full depth of the exploratory holes. There was no apparent pattern to the encountered soil distribution within the Bosworth Clay Member.

Drilling activities ceased at depths of between 1.6m begl and 2.8m begl generally due to the competency of the basal cohesive unit, except for WS04 where borehole collapse prevented further penetration.

No evidence of the former pond was observed in WS04. No visual or olfactory evidence of potentially volatile or readily mobile contamination was observed during the fieldwork and no tradition indicators of soil contamination such as ash or clinker were observed.

Groundwater

Groundwater was encountered in WS02 at 1m begl and WS04 at 1.5m begl during the ground investigation works, associated with the presence of a silt horizon. Groundwater was not observed in WS01 or WS03 where silt was absent.

As part of the fieldworks four gas / groundwater monitoring points were installed within the window sample holes. One monitoring visit has been completed to date and groundwater has not been detected in any of the four installations.

The groundwater observed is considered representative of minor perched volumes within the more granular horizons of the Bosworth Clay Member. The true groundwater table is only likely to be encountered at significant depth within the more granular horizons of the underlying solid geology (Mercia Mudstone Formation), which was not encountered during the investigation.

Chemical Assessment of the Shallow Soils

Three samples, one of the re-laid topsoil and two of the made ground, were analysed for a general suite of contaminants (metals, speciated PAH, TPHCWG and an asbestos screen). A copy of the chemical analysis is presented in Appendix E.

Whilst the number of samples tested is not sufficient to undertake statistical analysis it is considered suitable to provide an initial characterisation of the materials encountered. Development proposals comprise residential end use with gardens. Accordingly, the chemical laboratory results for the re-laid topsoil and made ground has been compared directly against the Tier 1 Acceptance Criteria for residential end use with plant uptake and a soil organic matter (SOM) content of 6%. A copy of the relevant thresholds is presented in Appendix F.

The majority of contaminants tested for did not show elevated concentrations above the relevant threshold. The exception to the above was lead concentrations above the threshold of 200mg/kg:

- 230mg/kg in WS01 (re-laid topsoil).
- 400mg/kg in WS02 (made ground).
- 390mg/kg in WS03 (made ground).

Accordingly, based on the available data, the risk to end users from soil contamination is assessed as moderate and remediation will be required to protect end users from the concentrations of lead present in both the re-laid topsoil and made ground.

No asbestos was detected within the three samples of made ground submitted for a screen. Accordingly, the risk to end users from asbestos within the soils is assessed as negligible.

Three samples, one of the re-laid topsoil and two of the made ground underwent TPHCWG analysis. No significantly elevated concentrations above the respective aliphatic or aromatic bands were detected. Accordingly, the risk to end users from TPH is assessed as negligible.

The risk to groundworkers is assessed as very low. It is recommended that PPE and established working protocols are adopted at the groundworks stage of the development.

Based on the chemical data the re-laid topsoil and made ground are unlikely to be classified as hazardous waste. The natural strata is likely to be classified as inert, though further testing will be required to confirm this. At this stage, we would recommend allowing for the re-laid topsoil and made ground to be disposed of as Non-Hazardous Waste and the natural soils as inert; however, early consultation with the relevant landfill sites over their particular acceptance criteria may produce cost savings. Reference should be made to the relevant notes presented in Appendix A (x).

Based on the available data and the UKWIR guidance the concentrations of petroleum hydrocarbons within the soils tested are such that PE water supply pipes should be suitable. It is recommended that the local water supply company for the site be contacted to confirm their requirements with regard to water pipes.

Ground Gas

No significant source of ground gas was identified by the intrusive works; however, to assess for potential liabilities all four of the window sample holes (WS01 to WS04) were installed with standpipes to allow for gas / groundwater monitoring. The standpipe in WS02 was emplaced into the made ground and at the remaining positions into the natural strata.

The gas risk assessment methodology used by GRM is outlined in Appendix A (v).

The post fieldwork monitoring has been designed to identify and assess the groundwater and gas regimes below the site. The results are enclosed for reference and are summarised below:

Borehole	Response Zone (m begl) / Strata	Contamination	No. of Monitoring Visits	Methane (%v/v)	Carbon Dioxide (%v/v)	Oxygen (%v/v)	Flow (l/hr)	Atmospheric Pressure Range
WS01	0.6m-1.6m NS	None	1	0.0	1.6	19.8	0.0	1008
WS02	0.5m-1.0m MG	None	1	0.0	1.6	18.4	0.0	1008
WS03	0.5m-1.7m NS	None	1	0.0	1.6	20.1	0.0	1008
WS04	0.5m-1.8m NS	None	1	0.4	0.4	20.8	0.0	1008
Notes: NS= Natural Strata, MG = Made Ground.				Atmospheric Pressure: 1008mb				

The primary guidance document to determine if gas protection measures are required is BS8485:2015+A1:2019. This uses hazardous gas flow rates (Q_{hg}), which are gas concentrations multiplied by borehole flow rates, to derive a Gas Screening Value (GSV) for the site. The gas regime is then determined based on the GSV and other limiting factors including gas concentrations and flow rates.

As flow rate and methane concentrations to date have been below the detection limit a default flow rate of 0.1l/hr and a default methane concentration of 0.1%v/v has been used in the following assessment. Based on the results of the monitoring visits and using the default flow rate of 0.1l/hr and the default methane concentration of 0.1%v/v a Q_{hg} of 0.0001l/hr has been calculated for methane. Using the default flow rate of 0.1l/hr and the maximum carbon dioxide concentration of 1.6v/v, a Q_{hg} of 0.0016l/hr has been calculated for carbon dioxide. On this basis the GSV for the site is determined as 0.0016l/hr.

As the GSV is less than 0.07l/hr and the maximum recorded concentrations of methane and carbon dioxide are less than 1%v/v and 5%v/v respectively, the site is currently assessed as 'Characteristic Situation 1' (very low hazard potential) as outlined in Table 2 of BS8485:2015, for which gas protection measures are not required. As no significant source of ground gas has been identified it is considered unlikely that gas protection measures will be required; however, at this stage it would be prudent to budget for gas protection measures in accordance with Characteristic Situation 2.

In addition, the site is not in an area that is recorded to require radon precautions.

A copy of the gas and groundwater monitoring sheets is presented in Appendix G.

Remediation

Based on the recorded levels of lead contamination across the site remediation will be required to protect end users of the proposed residential development.

The re-laid topsoil and made ground encountered are generally poorly developed with a typical thickness of just 0.5m. It is anticipated that such thicknesses will be fully excavated as part of the sites enabling works. Due to the high Soil Organic Matter content (7% and 11% respectively) the materials are not suitable for containment beneath plots as they could potentially form a source of ground gas. The materials could potentially be placed beneath drives, where any gas produced could vent to the atmosphere; however, consideration would need to be given to the geotechnical suitability of the material for this purpose. Accordingly, off-site disposal to a suitable waste facility is recommended.

Should any of the re-laid topsoil or made ground remain present within areas of soft landscaping then a 600mm clean soil capping layer will be required.

Any imported material for use in constructing the capping layer or growing medium in garden areas will require chemical validation to confirm that it is chemically suitable for use. Samples of the topsoil will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs and other contaminants such as, speciated hydrocarbons and asbestos depending on the source. The number of samples that require analysis will depend on the source of the materials. Typically, an analysis rate of one sample per two gardens and one sample per four gardens (minimum of three samples per source and material type) applies for generated and virgin soils respectively. It is also recommended that the topsoil be subjected to analysis to BS3882 to confirm that it conforms to this standard. A typical analysis rate of one sample per 5,000m³ is considered appropriate.

Geotechnical Assessment

As part of the investigation three samples of the Bosworth Clay Member (two of silt and one of clay) were submitted for plasticity index, water soluble sulphate and pH analysis.

The Atterberg Limit classification has confirmed that the samples of the silt analysed are non-plastic whilst the sample of clay from WS03 returned a result of 28% indicating it is of medium volume change potential. Accordingly, a minimum foundation depth for new foundations of 0.9m begl is considered appropriate. Foundation depths will also need to take consideration of the thickness of soft strata encountered, together with the presence of trees and cohesive strata, which will result in increased depth of foundations.

Whilst the projects structural engineer will design the foundations, the available results suggest traditional foundations are not likely to be suitable for the long structure in proximity to the existing

road and adjacent off-site structures. More detailed geotechnical testing in the form of mechanically driven window sample holes, trial pits, boreholes and load testing will need to be considered if traditional foundations are proposed.

Based on the water-soluble sulphate and pH analysis a buried concrete grade of DS-1; AC-1s is considered suitable.

Summary

The works has determined that elevated lead concentrations within both the re-laid topsoil and made ground pose a risk to end users and require remediation by excavation. The lack of significantly elevated concentrations of petroleum hydrocarbons are such that PE water pipes should be acceptable; however, it is recommended that the local water supply company should be contacted to determine their exact requirements with regard to the concentration of contaminants reported.

The site is likely to be deficient in topsoil, and some may need to be imported. Any imported topsoil for use in constructing a growing medium will require chemical validation to confirm that it is chemically suitable for use. GRM would recommend the use of a 300mm thick growing medium.

Care should be taken during the demolition works to ensure that made ground is not mixed with the natural soils.

Further works will be required to confirm the most appropriate foundation design and the results of the ground investigation should be passed to the projects structural engineer.

Given the presence of trees it is recommended that all plots adopt beam and block floors.

Gas precautions are considered unlikely to be required; however, an allowance for CS2 protection measures would be prudent at this stage until the remaining monitoring visits are conducted. A separate Gas Addendum Letter will be produced on completion of the monitoring program.

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,



Paul Wardle BSc MA FGS
Acting Principal Geologist



Geoffrey Beckett BSc (Hons) CGeol
Director

Appendices

Appendix A – GRM Standards and Limitations of Reporting
Appendix B – Proposed Development Plan
Appendix C – Exploratory Hole Location Plan
Appendix D – Exploratory Hole Logs
Appendix E – Chemical Laboratory Results
Appendix F – Thresholds
Appendix G - Gas and Groundwater Results
Appendix H – Geotechnical Laboratory 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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Proposed Planting Details:

Tree Planting:

2 x Sorbus Aucuparia (Mountain Ash) Sa
2 x Acer Campestre (Field Maple) Ac

Hedge Planting:

Cultivate and grade hedging bed, bring top 300mm of soil to a fine tilth, including Enmag fertilizer applied and worked into 100mm rake and bring to given levels. Remove all stone and debris over 50mm, dig planting holes (Average 300 x 300 x 300). Supply and plant specified shrubs and plants in densities specified. Backfill with excavated materials as above. Water in and mulch with 75mm bark chippings 20-40mm size. Water and weed regularly for 12months.

- 65% *Crateagus Monogyna* (Hawthorn)
- 10% *Prunus Spinosa* (Blackthorn)
- 10% *Acer Campestre* (Field Maple)
- 10% *Cornus Sanguinea* (Dogwood)
- 5% *Euonymus Europaeus* (Spindle)

Bark Mulch:

All planting beds to have 75mm depth of bark mulch chippings to cover bare ground in order to suppress weed growth and aid moisture retention to assist with plant establishment.

Turfed Lawns

25% Dwarf Perennial Ryegrass
30% Slender creeping red fescue
45% Strong creeping red fescue

Hard Landscaping:



Tegula Priora Traditional permeable paving.

Boundary Treatments:

 Site Boundary

Existing boundary to be retained

Existing boundary to be retained
1.9m high steel palisade fence.

1.9m high timber close boarded fence with timber posts and gravel boards. Gates where indicated.



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Notes:

This drawing is to be read in conjunction with all relevant drawings and specifications.

Do not scale from this drawing. Use figured dimensions only. All levels and dimensions to be checked on site. All level and dimension discrepancies must be reported to the Engineer immediately. The Engineer will not be responsible for any errors or omissions. Responsibility cannot be accepted for alteration or deviation from this design without prior acknowledgement of the Engineer.

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For all works commencing on site, the engineer is to be contacted regarding the current status, revision or regulatory approval of this drawing.

For the entire satisfaction of the HESB or Local Authority not withdrawing anything shown or indicated on these drawings. All workmanship and materials to be to the best of their respective kind and of least equivalent of the appropriate British Standard Code of Practice. All relevant dimensions and levels to be ascertained or checked and confirmed before commencing work.

This drawing is to be read in conjunction with clients specifications/employers requirements and structural engineers

PLANNING

Rev.	Date.	Drawn.
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Pera Innovation Park, Nottingham Road
Melton Mowbray, LE13 0PB

Telephone: 01664 563 288 Fax: 01664 503 360
E-Mail Info@hssparchitects.co.uk Web www.hssparchitects.co.uk
Project.

Proposed New Dwellings
87 High Street
Barwell
For Vexford Homes

Title.	Proposed Site Plan
--------	--------------------

Scale. 1:100@A1	Drawn. SM	Checked. JB	Date. Jan 19
Drawing No. 7819-03-002			Revision. -

HSSP A1



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Legend

Site Boundary

Exploratory Holes

Window Sample Borehole with Gas/Groundwater Monitoring Installation

NOTES: NOTES	CLIENT: VEXFORD HOMES LTD	PROJECT No: P9700	DATE: 11/2021	DESIGN/DRAWN: AM	 GRM Development Solutions Ltd Tel: 01283 551 249 mail@grm-uk.com www.grm-uk.com
	PROJECT: 87 HIGH STREET, BARWELL	DRAWING NUMBER: 001		ISSUE: DRAFT	
	TITLE: EXPLORATORY HOLE LOCATION PLAN				
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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 WS01 Sheet 1 of 1	
Site Name: 87 High Street, Barwell								Ground Level (mAOD)	
Client: Vexford Homes Ltd						GRM Project Ref: P9700		Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.40	ES						Dark brown speckled black, slightly gravelly, clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded quartzite, coal and brick. Abundant rootlets with occasional roots. RELAIID TOPSOIL	
		0.60	D			0.60				
		0.90	D			0.80			Dense, yellowish brown, slightly gravelly clayey SAND. Sand is fine to coarse. Gravel is fine to coarse, subangular to subrounded coal and quartzite. BOSWORTH CLAY MEMBER	1
		1.50 - 1.60	D			1.60			Stiff to very stiff, approximately high to very high strength, reddish brown, slightly sandy, slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, subangular coal. BOSWORTH CLAY MEMBER	
End of Borehole at 1.600m										2
										3
										4

Crew: GRM Development Solutions			Logger: AM			Weather: Overcast.		
Equipment: Handheld Window Sampling Equipment								
Reason for termination of borehole: Sampler refusal on very stiff strata at 1.60m.								
Groundwater Remarks: No groundwater encountered.								
General Remarks:								
Hole Started: 04/11/2021			Hole Complete: 04/11/2021			Version: FINAL		Scale: 1:25

		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 WS02 Sheet 1 of 1	
Site Name: 87 High Street, Barwell								Ground Level (mAOD)	
Client: Vexford Homes Ltd						GRM Project Ref: P9700		Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.20	ES					Soft, dark greyish brown, sandy, gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded brick, glass, ceramic and insulation. MADE GROUND	1	
		0.60 - 0.70	D					Very soft to soft, dark brown mottled orange, slightly gravelly, silty, sandy CLAY. Sand is fine to coarse. Gravel is fine to coarse coal, brick and ceramic. MADE GROUND		
		1.40	D					Very soft to soft, approximately very low to low strength, orangish-brown, very sandy SILT with occasional sand pockets. Sand is fine to coarse. Recovered wet. BOSWORTH CLAY MEMBER		
								<i>Fine to coarse sand lense between 1.50m and 1.60m.</i>	2	
		1.70						Firm, approximately medium strength, orangish brown, silty CLAY. BOSWORTH CLAY MEMBER		
		2.20	D					Soft locally very soft, approximately low strength, slightly sandy, silty CLAY. Sand is fine to coarse. BOSWORTH CLAY MEMBER		
		2.40						Stiff, approximately high strength, becoming very stiff, approximately very high strength, orangish-brown, slightly sandy, silty CLAY. Sand is fine to coarse. BOSWORTH CLAY MEMBER	3	
	2.60	D								
		2.80						End of Borehole at 2.800m	4	

Crew: GRM Development Solutions		Logger: AM		Weather: Overcast	
Equipment: Handheld Window Sampling Equipment					
Reason for termination of borehole:		Sampler refusal on very stiff strata at 2.80m.			
Groundwater Remarks: Recovered wet from 1.00m.					
General Remarks:					

Hole Started:	04/11/2021	Hole Complete:	04/11/2021	Version:	FINAL	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 WS03 Sheet 1 of 1	
Site Name: 87 High Street, Barwell								Ground Level (mAOD)	
Client: Vexford Homes Ltd						GRM Project Ref: P9700		Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.35	ES					Loose to medium dense, dark greyish brown, slightly gravelly, clayey SAND with occasional clay clods. Sand is fine to coarse. Gravel is fine to coarse, angular to subrounded brick, sandstone, quartzite and coal. MADE GROUND		
		0.55	D			0.50		Loose to medium dense, yellowish brown, slightly clayey, very gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, sub-angular to sub-rounded quartzite and sandstone. BOSWORTH CLAY MEMBER		
		0.90	D			0.70		Soft to firm, approximately low to medium strength, orangish-brown, silty, sandy, locally very sandy CLAY with occasional sand pockets. Sand is fine to coarse. BOSWORTH CLAY MEMBER	1	
		1.60	D			1.60 1.70		Stiff, approximately high strength, becoming very stiff, approximately very high strength, orangish-brown, silty, sandy, locally very sandy CLAY with occasional sand pockets. Sand is fine to coarse. BOSWORTH CLAY MEMBER End of Borehole at 1.700m	2	
									3	
									4	

Crew: GRM Development Solutions		Logger: AM		Weather: Overcast	
Equipment: Handheld Window Sampling Equipment					
Reason for termination of borehole:		Sampler refusal on very stiff strata at 1.70m.			
Groundwater Remarks: No groundwater encountered.					
General Remarks:					
Hole Started: 04/11/2021		Hole Complete: 04/11/2021		Version: FINAL	
				Scale: 1:25	

		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 WS04 Sheet 1 of 1	
Site Name: 87 High Street, Barwell								Ground Level (mAOD)	
Client: Vexford Homes Ltd					GRM Project Ref: P9700			Coordinates E N	

Installation/ Backfill	Water Strike	Samples/Tests			Dynamic Probing (Blows per 100mm)	Depth (m)	Level (m)	Legend	Stratum Description	
		Depth	Type	Result						
		0.20	ES						Loose to medium dense, dark greyish brown, slightly clayey, gravelly SAND. Sand is fine to coarse. Gravel is fine to coarse, angular to subangular demolition rubble including brick and concrete. MADE GROUND	1
		0.45	D					Firm, approximately medium strength, light brown, slightly sandy CLAY. Sand is fine to coarse. BOSWORTH CLAY MEMBER		
		0.80	D				Soft to very soft, approximately very low to low strength, light brown, very sandy SILT. Sand is fine to coarse. BOSWORTH CLAY MEMBER			
		1.30	D					Firm, approximately medium strength, light brown, slightly sandy CLAY. Sand is fine to coarse. BOSWORTH CLAY MEMBER		
		1.80	D						Very soft to soft, approximately very low to low strength, sandy SILT. Sand is fine to coarse. Recovered damp between 1.50m and 2.00m. Recovered wet from 2.00m. BOSWORTH CLAY MEMBER	
		2.50						End of Borehole at 2.500m		3
									4	

Crew: GRM Development Solutions		Logger: AM		Weather: Overcast	
Equipment: Handheld Window Sampling Equipment					
Reason for termination of borehole: Terminated due to hole collapsing in during sampling.					
Groundwater Remarks: Recovered damp between 1.50m and 2.00m. Recovered wet from 2.00m.					
General Remarks: Hole collapsed back up to 1.75m. Monitoring well installed to 1.75m begl.					
Hole Started: 04/11/2021		Hole Complete: 04/11/2021		Version: FINAL	
				Scale: 1:25	



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Nicholls Colton Group
7 - 11 Harding Street
Leicester
LE1 4DH

GRM Development Solutions

Laurus House
First Avenue
Centrum 100
Burton Upon Trent
DE14 2WH

Analytical Test Report: L21/04030/GRM - 21-21895

Your Project Reference: **P9700 87 High Street Barwell**

Your Order Number: P9700 Samples Received / Instructed: 05/11/2021 / 05/11/2021

Report Issue Number: 1 Sample Tested: 05/11 to 12/11/2021

Samples Analysed: 6 soil samples Report issued: 12/11/2021

Signed

James Gane
Data Manager
Nicholls Colton 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 NC 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 NC 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 10/12/2020

Owned by Emily Blissett - Customer Services Supervisor

Authorised by James Gane - Commercial Manager

L:\DATA\REPORTS\GRM495\L21-04030-GRM - 21-21895.XLSX\JTPH Codes

L21/04030/GRM - 21-21895

Project Reference - P9700 87 High Street Barwell

Analytical Test Results - Soil

NC Reference			198077	198078	198079	198080	198081	198082
Client Sample ID			WS01	WS02	WS03	WS04	WS03	WS02
Client Sample Location			-	-	-	-	-	-
Client Sample Type			-	-	-	-	-	-
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			0.40	0.20	0.35	1.80	1.60	1.40
Depth - Bottom (m)			0.40	0.20	0.40	1.90	1.60	1.40
Date of Sampling			04/11/2021	04/11/2021	04/11/2021	04/11/2021	04/11/2021	04/11/2021
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Sand	Clay	Sand
Determinant	Units	Accreditation						
Arsenic	(mg/kg)	MCERTS	17	18	17	-	-	-
Cadmium	(mg/kg)	MCERTS	1.1	1.6	1.4	-	-	-
Chromium (Total)	(mg/kg)	UKAS	19	27	22	-	-	-
Copper	(mg/kg)	MCERTS	76	130	160	-	-	-
Lead	(mg/kg)	MCERTS	230	400	390	-	-	-
Mercury	(mg/kg)	UKAS	< 2.5	< 2.5	< 2.5	-	-	-
Nickel	(mg/kg)	MCERTS	26	36	30	-	-	-
Selenium	(mg/kg)	u	< 8.0	< 8.0	< 8.0	-	-	-
Zinc	(mg/kg)	MCERTS	180	400	350	-	-	-
Total Phenols	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	-	-	-
Cyanide (Total)	(mg/kg)	MCERTS	< 1.0	< 1.0	< 1.0	-	-	-
Chromium (Hexavalent)	(mg/kg)	u	< 1.0	< 1.0	< 1.0	-	-	-
pH	pH Units	MCERTS	7.6	7.4	7.7	7.8	7.7	8.3
Sulphate (Water soluble)	(mg/l)	u	< 10	250	35	32	22	17
Acenaphthene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	-	-	-
Acenaphthylene	(mg/kg)	UKAS	< 0.02	0.06	0.06	-	-	-
Anthracene	(mg/kg)	UKAS	0.04	0.11	0.09	-	-	-
Benzo (a) anthracene	(mg/kg)	MCERTS	0.10	0.35	0.39	-	-	-
Benzo (a) pyrene	(mg/kg)	MCERTS	0.09	0.38	0.43	-	-	-
Benzo (b) fluoranthene	(mg/kg)	MCERTS	0.15	0.60	0.69	-	-	-
Benzo (g, h, i) perylene	(mg/kg)	MCERTS	0.09	0.34	0.37	-	-	-
Benzo (k) fluoranthene	(mg/kg)	MCERTS	0.04	0.19	0.20	-	-	-
Chrysene	(mg/kg)	MCERTS	0.11	0.41	0.44	-	-	-
Dibenzo (a,h) anthracene	(mg/kg)	MCERTS	< 0.02	0.05	0.07	-	-	-
Fluoranthene	(mg/kg)	MCERTS	0.19	0.57	0.60	-	-	-
Fluorene	(mg/kg)	MCERTS	< 0.02	< 0.02	< 0.02	-	-	-
Indeno (1, 2, 3-cd) pyrene	(mg/kg)	MCERTS	0.07	0.34	0.38	-	-	-
Naphthalene	(mg/kg)	MCERTS	< 0.02	< 0.02	0.03	-	-	-
Phenanthrene	(mg/kg)	MCERTS	0.08	0.21	0.21	-	-	-
Pyrene	(mg/kg)	MCERTS	0.17	0.53	0.56	-	-	-
Total PAH (Sum of USEPA 16)	(mg/kg)	UKAS	1.3	4.2	4.6	-	-	-
SOM (via TOC)	(%)	UKAS	7.2	11	11	-	-	-
Asbestos	-	UKAS	No asbestos detected	No asbestos detected	No asbestos detected	-	-	-

L21/04030/GRM - 21-21895

Project Reference - P9700 87 High Street Barwell

Analytical Test Results - TPH CWG

NC Reference			198077	198078	198079
Client Sample ID			WS01	WS02	WS03
Client Sample Location			-	-	-
Client Sample Type			-	-	-
Client Sample Number			-	-	-
Depth - Top (m)			0.40	0.20	0.35
Depth - Bottom (m)			0.40	0.20	0.40
Date of Sampling			04/11/2021	04/11/2021	04/11/2021
Time of Sampling			-	-	-
Sample Matrix			Clay	Clay	Clay
Determinant	Units	Accreditation			
Aliphatics					
>C ₅ to C ₆ [HS_MS_1D_AL]	(mg/kg)	u	< 0.04	0.07	0.10
>C ₆ to C ₈ [HS_MS_1D_AL]	(mg/kg)	u	< 0.04	< 0.04	< 0.04
>C ₈ to C ₁₀ [HS_MS_1D_AL]	(mg/kg)	u	< 0.04	0.14	0.07
>C ₁₀ to C ₁₂ [EH_CU_1D_AL]	(mg/kg)	u	< 10	< 10	< 10
>C ₁₂ to C ₁₆ [EH_CU_1D_AL]	(mg/kg)	u	< 10	< 10	< 10
>C ₁₆ to C ₂₁ [EH_CU_1D_AL]	(mg/kg)	u	< 10	< 10	< 10
>C ₂₁ to C ₃₅ [EH_CU_1D_AL]	(mg/kg)	u	36	54	29
Aromatics					
>C ₅ to C ₇ [HS_MS_1D_AR]	(mg/kg)	u	< 0.04	< 0.04	< 0.04
>C ₇ to C ₈ [HS_MS_1D_AR]	(mg/kg)	u	< 0.04	< 0.04	< 0.04
>C ₈ to C ₁₀ [HS_MS_1D_AR]	(mg/kg)	u	< 0.04	0.06	< 0.04
>C ₁₀ to C ₁₂ [EH_CU_1D_AR]	(mg/kg)	u	< 10	< 10	< 10
>C ₁₂ to C ₁₆ [EH_CU_1D_AR]	(mg/kg)	u	< 10	< 10	< 10
>C ₁₆ to C ₂₁ [EH_CU_1D_AR]	(mg/kg)	u	< 10	12	< 10
>C ₂₁ to C ₃₅ [EH_CU_1D_AR]	(mg/kg)	u	36	61	43
Total					
>C ₅ to C ₄₀ [EH_CU+HS_1D_Total]	(mg/kg)	u	73	140	72

L21/04030/GRM - 21-21895

Project Reference - P9700 87 High Street Barwell

Sample Descriptions

NC Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
198077	WS01	-	-	-	Dark greyish brown very silty gravelly sandy clay with occasional brick fragments rootlets	22	0.1	55
198078	WS02	-	-	-	Black very silty gravelly sandy clay with occasional brick fragments	19	19	40
198079	WS03	-	-	-	Black very silty gravelly sandy clay with occasional brick fragments	21	11	48
198080	WS04	-	-	-	Orangish brown clayey slightly gravelly sand	-	-	58
198081	WS03	-	-	-	Brown slightly silty sandy clay	-	-	34
198082	WS02	-	-	-	Brown clayey slightly gravelly sand	-	-	58



Nicholls Colton Group
7 - 11 Harding Street
Leicester
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Project Reference - P9700 87 High Street Barwell

Sample Comments

NC Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
198077	WS01	-	-	-	
198078	WS02	-	-	-	
198079	WS03	-	-	-	
198080	WS04	-	-	-	
198081	WS03	-	-	-	
198082	WS02	-	-	-	

L21/04030/GRM - 21-21895

Project Reference - P9700 87 High Street Barwell

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	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

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Project Reference - P9700 87 High Street Barwell

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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	GRM TIER 1 ASSESSMENT CRITERIA		
LAND USE	Residential with Plant Uptake		
CONTAMINANT	1%	2.50%	6%
^a Arsenic	37	37	37
^a Cadmium	22	22	22
^b Chromium III	910	910	910
^a Chromium VI	21	21	21
^a Lead	200	200	200
^{b/c} Mercury	40	40	40
^b Selenium	250	250	250
^b Nickel	180	180	180
^b Phenols	280	550	1100
^b Copper	2400	2400	2400
^b Zinc	3700	3700	3700
^d Cyanide	34	34	34
^a Benzene	0.20	0.33	0.87
^b Toluene	130	290	660
^b Ethylbenzene	47	110	260
^b <i>o</i> - xylene	60	140	330
^b <i>m</i> - xylene	59	140	320
^b <i>p</i> - xylene	56	130	310
Non Genotoxic PAHs			
^b Acenaphthene	210	510	1100
^b Acenaphthylene	170	420	920
^b Anthracene	2400	5400	11000
^b Fluoranthene	280	560	890
^b Fluorene	170	400	860
^b Naphthalene	2.3	5.6	13
^b Phenanthrene	95	220	440
^b Pyrene	620	1200	2000
Genotoxic PAHs			
^{a/e} Benzo(a)pyrene	5	5	5
ALIPHATIC HYDROCARBONS			
^b C5-C6	42	78	160
^b C6-C8	100	230	530
^b C8-C10	27	65	150
^b C10-C12	130	330	760
^b C12-C16	1100	2400	4300
^b C16-35	65000	92000	110000
AROMATIC HYDROCARBONS			
^b C5-7 (benzene)	70	140	300
^b C7-8 (toluene)	130	290	660
^b C8-C10	34	83	190
^b C10-C12	74	180	380
^b C12-C16	140	330	660
^b C16-C21	260	540	930
^b C21-C35	1100	1500	1700

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
- e 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

Contaminant Thresholds for Subsurface Water Pipes

Contaminant	Thresholds (mg/kg)
Corrosion	
Wrapped Steel	pH<7 Cond >400µS/cm
Wrapped Ductile Iron	pH<5 Cond >400µS/cm, he not neutral
Copper	pH<5 >8 and Eh +ve
Toxic Substances	
Chromium (total) (Cr)	Applies to above pipe materials
Organic Contaminants	
VOC's	0.5 PE/0.125 PVC
BTEX & MTBE	0.1 PE/0.03 PVC
SVOC	2 PE/1.4 PVC
Phenols	2 PE/0.4 PVC
Cresols & Chlorinated Phenols	2 PE/0.04 PVC
Mineral Oil C11-C20	10 PE
Mineral Oil C21 - C40	500
Ether/Ketone/Amines, Nitrobenzene/Aldehydes	0.5 PE/0.02-1 PVC

Notes.

It is not recommended that water pipes should be laid in sites where these substances are identified or suspected
Local Utility Companies should be consulted prior to pipe specifications being finalised.

Ref: Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites. UKWIR Ref. No. 10/WM/03/21. 2010.



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In-Situ Gas Monitoring Results

Project Name	87 High Street, Barwell
Project Number	9700
Client	Vexford Homes Ltd
Date	09/11/2021
Weather	Cloudy
Atmospheric Pressure (mb)	1008
Pressure Trend	Steady
Equipment	Gas Data LMSXi
Operator	Bryan Burgh

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	0.60	1.60	NS	0.00	0.00	1.60	1.60	19.80	19.80	0.00	0.00	Not Recorded	
WS02	0.50	1.00	MG	0.00	0.00	1.60	1.60	18.40	18.40	0.00	0.00	Not Recorded	
WS03	0.70	1.70	NS	0.00	0.00	1.60	1.60	20.10	20.10	0.00	0.00	Not Recorded	
WS04	0.50	1.75	NS	0.00	0.00	0.40	0.40	20.80	20.80	0.00	0.00	Not Recorded	

Groundwater	
Depth to Groundwater	Total Well Depth
mbegl	mbegl
Not Detected	1.52
Not Detected	1.70
Not Detected	1.70
Not Detected	1.94

Notes

L.E.L.	Lower Explosive Limit (100% L.E.L.= 5% Flammable Gas)
N.D.	Not Detected
N.R.	Not Recorded
PID	Photo-Ionising Detector
%	By volume

Ground Material Key

MG	Made Ground
NS	Natural Strata

Comments

White pipe fitted



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GRM Development Solutions

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Burton Upon Trent
DE14 2WH

Analytical Test Report: L21/04030/GRM - 21-21903

Your Project Reference:	P9700 - 87 High Street Barwell		
Your Order Number:	P9700	Testing Received / Instructed:	05/11/2021 / 05/11/2021
Report Issue Number:	1	Sample Tested:	05/11 to 16/11/2021
Samples Analysed:	3 soil samples	Report issued:	16/11/2021

Signed

Lee Harbottle
GCM Operations Manager
Nicholls Colton Group

Notes:

Samples will be retained for 14 days after issue of this report unless otherwise requested.

The results included within the report are representative of the samples submitted for analysis.

A certificate of sampling was not supplied

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

Within the report any information provided by the client is identified with a '#'

Accreditation Key

UKAS = UKAS Accreditation, u = Unaccredited

Date of Issue 10/12/2020

Owned by Emily Blissett - Commercial Reporting Supervisor

Authorised by Lee Harbottle - GCM Operations Manager

J:\Public\Projects\2021\L21\GRM - GRM\L21-4030-GRM P9700\L21-04030-GRM - 21-21903.XLSX\Cover Sheet

L21/04030/GRM - 21-21903

Project Reference - P9700 - 87 High Street Barwell

Analytical Test Results - Soil

NC Reference		198098	198099	198100
Client Sample ID (#)		WS04	WS03	WS02
Client Sample Location (#)		-	-	-
Depth - Top (m) (#)		1.80	1.60	1.40
Depth - Bottom (m) (#)		1.90	1.60	1.40
Date of Sampling (#)		04/11/2021	04/11/2021	04/11/2021
Sample type		Disturbed	Disturbed	Disturbed
Sample Description		Brown sandy silt	Brown slightly silty clay	Brown slightly gravelly slightly sandy silt
Determinant	Units			
Moisture Content	(%)	29	26	24
Moisture Content Prep	-	3.2.3.1 (fine)	3.2.3.1 (fine)	3.2.3.2 (medium)
Fines passing 425µm test sieve	(%)	100	100	99
Liquid Limit	(%)	29	48	24
Plastic Limit	(%)	Non Plastic	20	Non Plastic
Plasticity Index	(%)	Non Plastic	28	Non Plastic
PI preparation	-	from its natural state	from its natural state	from its natural state
PI Test Method		clause 4.4 (one point)	clause 4.4 (one point)	clause 4.4 (one point)



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Project Reference - P9700 - 87 High Street Barwell

Analysis Methodologies

Determinant	Title	Details and Test method used
1377 PI/MC	BS1377 PI and Moisture Content	1377 Plasticity Index 1. Sample preparation was in accordance with BS1377:Part 1:2016. 2. Testing was in accordance with BS1377:Part 2:1990 1377 Moisture Content 1. Sample preparation was in accordance with BS1377:Part 1:2016. 2. Moisture content testing was in accordance with BS1377 : Part 2 :1990