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LAND OFF OAKAMOOR ROAD, CHEADLE

REMEDIATION METHOD STATEMENT FOR BELLWAY HOMES (WEST MIDLANDS)

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P9119

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Prepared for:
Bellway Homes (West Midlands)
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This report has been prepared in accordance with GRM's Accredited Quality Procedures

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1 INTRODUCTION

1.1 PREAMBLE

GRM Development Solutions Limited (GRM) has been appointed by Bellway Homes (West Midlands) (Client) to produce a Remediation Method Statement (Remedial Strategy) for the re-development of the land off Oakamoor Road, in Cheadle.

The following reports have been used in the preparation of this document:

- Ground Investigation & Piling Limited (GIP) – Phase 1 & Phase 2 Ground Investigation Report for a Proposed Residential & Foodstore Development at the JCB Cecilly Mills Site, Cheadle (dated 2 Sept 2014; Ref: DAP/22187).
- Applied Geology – Report on Supplementary Ground Investigation at Cecilly Mill, Cheadle (dated Jan 2019; Ref: AG2939-18-AH11).
- 'Additional Contamination Risk Assessment Letter Report' by GRM (Ref: P9119/CRA-LR), dated December 2019.

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

The site is located within the north eastern outskirts of Cheadle in Staffordshire, approximately 500m from the town centre. A Site Location and Boundary Plan is provided in Appendix B.

The proposed development comprises 120 residential properties (anticipated to be generally 2-storey houses) with associated gardens / soft landscaping and an area of public open space on the south eastern side of Cecilly Brook. The latest development proposal layout provided by the Client is presented in Appendix C.

1.2 OBJECTIVES OF THIS ASSESSMENT

The principal aims of the Remediation Method Statement (Remedial Strategy) were as follows:

a) Set out the remediation and validation processes to be followed on site to ensure the site developed does not pose a risk to human health and controlled waters.

Whilst every effort has been made to pre-empt the likely requirements of the Local Authority and the Environment Agency, they are likely to have specific requirements that will need to be discussed and addressed at a later date.

2 SUMMARY PHASE I DESK STUDY AND SITE OBSERVATIONS

The site covers approximately 3.82 Ha and can be roughly split into a northern half and a southern half. The northern half comprised an undeveloped open field bordered by mature trees and hedgerows. The southern half was previously occupied by the former JCB Cecilly Mills facility, but is now a vacant area of hardstanding / concrete floor slabs and stockpiles of demolition rubble following demolition of all the buildings. Cecilly Brook is present on the eastern boundary and flows within an open channel (this was partly covered by a building previously) towards the south.

Beyond the southern and western site boundaries are Oakamoor Road and Churchhill Road, respectively. An open field forms the north western site boundary, whilst a tributary of Cecilly Brook forms the north eastern site boundary. The site is largely bounded by residential housing, with some open fields present to the north of the site.

The earliest available OS map dated 1880 showed a single large building in the southern half of the site area identified as a 'silk manufactory'. Between 1899 and 1925, the former silk manufactory is identified as a cotton mill and later as 'Cecilly Mills (Silk & Coton), with the mill building having expanded northwards and westwards. A well was shown adjacent to the northern end of the mill building but continued expansion between 1937 and 1957 saw the mill building expand northwards covering the well feature. Between 1970 and 1986, the mill building expanded eastwards over the existing watercourse (Cecilly Brook) which was shown partly culverted. It is believed that the site was taken over by JCB in 1982 and the OS maps between 1988 and 2014 show the former mill building as a works with parts of the building having been demolished. The JCB facility was demolished in 2017.

Across the northern half of the site area, where the open field is located, topsoil is present with no made ground. Made ground of variable thickness is present across the southern half of the site (existing hardstanding areas). Superficial deposits comprising Alluvium are present on the eastern site boundary, associated with Cecilly Brook. The majority of the site area (both northern and southern halves) is directly underlain by the Sherwood Sandstone Group, which comprises weathered sand and gravel deposits becoming interbedded sandstone and conglomerate. These strata unconformably overlie strata of the Pennine Lower Coal Measures Formation (clay grading into mudstone), which outcrop at surface across the southern end of the site.

The nearest surface water receptor is Cecilly Brook, which flows roughly north to south along the eastern site boundary. The eastern edge of the site area is within flood zones 2 & 3, and is potentially at risk from river flooding.

The Environment Agency has classified the alluvial superficial deposits and the Pennine Lower Coal Measures Formation as Secondary A Aquifers, whilst the underlying Sherwood Sandstone Group is classified as a Principal Aquifer. There are no recorded groundwater abstraction licenses within 1km of the site. The site is within a 'Groundwater Source Protection Zone III'. Likely groundwater flow is to the south and east, generally following the topography and towards Cecilly Brook.

3 SUMMARY PHASE II INVESTIGATIONS AND RISK ASSESSMENT

3.1 GROUND INVESTIGATIONS

Previous ground investigation fieldwork has been undertaken by GIP in 2014 and Applied Geology in early 2019. The GIP investigation works comprised five cable percussion boreholes (to a maximum depth of 5.45m begl), thirteen window sample boreholes (to a maximum depth of 4.15m begl) and thirteen trial pits (to a maximum depth of 4.4m begl). Applied Geology then undertook further investigation works following demolition of the former JCB facility, comprising seven rotary openhole boreholes (to a maximum depth of 40.0m begl) and fifteen additional trial pits (to a maximum depth of 3.8m begl). An exploratory hole location plan prepared by Applied Geology is presented in Appendix D.

GRM have now undertaken some further ground investigation fieldwork comprising five combined window sample / rotary cored boreholes (to a maximum depth of 10.5m begl) as part of a slope stability assessment along the Cecilly Brook and a further seven window sample boreholes (to a maximum depth of 4m begl). The window sample boreholes were undertaken to allow the installation of new gas monitoring wells as well as further sampling of the made ground for contamination risk assessment. An exploratory hole location plan of the recently completed boreholes has been prepared by GRM and is presented in Appendix D.

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

- Topsoil
- Made Ground
- Alluvium
- Pennine Lower Coal Measures
- Weathered Sherwood Sandstone Group
- Sherwood Sandstone Group

Topsoil

Topsoil was encountered from the existing ground surface across the northern half of the site (undeveloped open field area). This ranged in thickness from 0.2m to 0.5m begl.

Across the southern half of the site, topsoil was absent, with concrete / tarmac / gravel hardcore hardstanding typically encountered from the ground surface.

Made Ground

Made ground was encountered across the southern half of the site area only, where hardstanding areas currently exist. The hardstanding comprised concrete, tarmac or gravel hardcore, with buried concrete encountered up to a maximum depth of 0.7m begl.

The hardstanding was underlain by a variable thickness of made ground, ranging from 0.15m to 2.8m begl. The made ground generally comprised a gravel subbase overlying gravelly sand or sandy gravelly clay, with ash, clinker, brick, concrete, pottery, slate, sandstone and quartzite.

Superficial Deposits - Alluvium
These deposits were encountered along the eastern edge of the site close to Cecilly Brook. The thickness of the Alluvium ranged from 0.4m to 1.4m begl. These deposits were variable and comprised gravelly clay, sandy silt and gravelly sand.

Pennine Lower Coal Measures
These strata were only encountered at the southern end of the site, comprising very stiff clay with mudstone lithorelicts overlying mudstone or siltstone.

Sherwood Sandstone Group
These strata were encountered across the vast majority of the site (both northern and southern areas), from relatively shallow depths. They comprised weathered deposits of medium dense / dense gravelly or clayey sand, overlying uncemented sandstone (recovered as gravelly sand), sandstone and conglomerate.

Groundwater
Groundwater was encountered during the GIP investigation within the made ground, Pennine Coal Measures and weathered Sherwood Sandstone Group, between depths of 1.6m and 4.7m begl. Subsequent groundwater monitoring by GIP, recorded water levels between 1.3m and 3.3m begl.

During the GRM investigations, groundwater was encountered at depths of between 1.3m and 3.0m begl, with subsequent monitoring recording water levels of between 0.41m and 2.90m begl.

3.2 GROUND GAS RISK ASSESSMENT

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, 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.

Historical gas monitoring was undertaken by GIP in 2014, with 10 installations monitored over six visits.

Two installations were located in the field area (northern half of site), where no made ground was present. No elevated methane or carbon dioxide concentrations were recorded. It is considered that Characteristic Situation 1 is appropriate for the northern half of the site and no gas protection measures will be required.

Eight installations were located in the former factory area (southern half of site), where made ground is present. Three installations recorded elevated carbon dioxide (>5%), of which two installations only recorded carbon dioxide concentrations of 5.0% and 5.1% respectively on one occasion, whilst one installation (southern edge of site) recorded elevated carbon dioxide concentrations on each visit ranging between 6.7% and 10.1%. The maximum flow rate recorded was 2.5l/hr. Using the maximum recorded steady state carbon dioxide concentration of 10.1%v/v and a maximum

recorded flow rate of 2.5l/hr, a Q_{hg} of 0.25l/hr has been calculated for carbon dioxide. On this basis, the GSV for the site is determined as 0.25l/hr.

As a result, for the southern part of the site, based on the GSV value and carbon dioxide above 5%, consideration should be given to using Characteristic Situation 2. If the marginal one-off carbon dioxide concentrations of around 5% are ignored, then the area of the site requiring gas protection measures (appropriate for Characteristic Situation 2) should be limited to where deep made ground (greater than 1.0m in thickness) is present in the southern part of the site.

GRM have subsequently installed six new gas installations across the southern part of the site and are currently in the process of undertaking a monitoring program. Depending on the results of this new monitoring phase, the requirement for gas protection measures will be reviewed.

At this stage, prior to completion of the current gas monitoring program, gas protection measures for the southern part of the site (as shown on the Remediation Plan presented in Appendix E) appropriate for Characteristic Situation 2 will be required. If gas protection measures are required, a Gas Protection Measures Design and Verification Plan will be required.

It should also be noted that radon gas protection measures are not required.

3.3 HUMAN HEALTH RISK ASSESSMENT

The proposed development comprises 120 residential properties with associated gardens / soft landscaping and an area of public open space on the south eastern side of Cecilly Brook.

The northern half of the site (field area) was covered by topsoil only, with no made ground. Testing of the topsoil as part of the previous investigations confirmed no presence of contamination. Therefore, no contamination risk to human health exists and no remediation is required.

However, the southern half of the site (former factory area) is covered by hardstanding / made ground, ranging between 0.15m and 2.80m thick. No obvious contamination (visual or olfactory) was identified during the various phases of investigation.

The material on site identified as being the most likely to be contaminated was the made ground (which includes ash, clinker and slag) in the southern half of the site area. A number of representative samples of made ground were tested during the previous investigations and also as part of GRM's most recent phase of investigation. A suite of contaminants were tested for including metals, non-metals, phenol, PAH, TPH and asbestos. The test results were compared against the GRM Tier 1 Acceptance Criteria / Remedial Targets for a residential with plant uptake end-use, presented in Appendix F.

The only contaminant of concern from the previous chemical testing undertaken was Lead. Two samples recorded elevated Lead concentrations above the screening value / remedial target of 200mg/kg. From GRM's most recent phase of investigation,

five samples (out of eight) had elevated Lead concentrations above the screening value / remedial target of 200mg/kg. It can be concluded that elevated Lead concentrations, that pose a risk to human health, are pervasive throughout the made ground. In addition, one of the GRM samples recorded an elevated concentration of Benzo(a)pyrene (15mg/kg) above the screening value / remedial target of 5mg/kg. This is considered to represent a hotspot.

From the previous investigations, the potential for asbestos containing material was only screened for in a few samples tested. Asbestos fibres were identified in a couple of locations. As part of GRM's most recent phase of investigation, all samples were screened for asbestos. No asbestos fibres were detected in any of the samples tested, and no visual evidence of asbestos fragments was observed during the investigation works.

No visual or olfactory evidence of petroleum hydrocarbon contamination was observed during any of the phases of investigation. As part of GRM's most recent phase of investigation, representative samples of the made ground were tested for banded TPHCWG. The sample analysis did not reveal elevated concentrations of either Aliphatic or Aromatic hydrocarbons in excess of the relevant screening values / remedial targets. Therefore, it is considered that petroleum hydrocarbon contamination does not pose a risk to end-users.

At this stage, remediation within the southern half of the site will be required where deep made ground is present (as shown on the Remediation Plan presented in Appendix E). However, there is a proposal to uplift levels across the area to be remediated and the soils used for this will need to be chemically tested to prove suitability. Where only a thin cover of made ground is present (sub-base material) below the hardstanding, this is not considered a contamination risk and is likely to be removed as part of the redevelopment works.

3.4 CONTROLLED WATERS RISK ASSESSMENT

For controlled waters, the primary receptors for the site have been identified as follows:

- Cecilly Brook (surface water receptor), which flows roughly north to south along the eastern site boundary.
- Principal Aquifer of the Sherwood Sandstone Group. The site is within a 'Groundwater Source Protection Zone III'.
- Secondary A Aquifers of Alluvium and the Pennine Lower Coal Measures Formation.

The primary pathways of concern for the surface water receptor (Cecilly Brook) are leaching of contaminants and lateral migration to the watercourse. The primary pathways of concern for the aquifers are leaching of contaminants and vertical migration to the groundwater. Likely groundwater flow is to the south and east, generally following the topography and towards Cecilly Brook.

As part of GRM's most recent phase of investigation, three samples of water were obtained and tested. This included two samples of groundwater and one sample of

surface water from Cecilly Brook (obtained from the bridge within the southern half of the site).

From the groundwater test results, the recorded concentrations of most of the analysed contaminants were below the relevant UKDWS or EQS threshold values. Only concentrations of copper (5µg/l in brook), iron (280µg/l in brook), phenol (2.24µg/l in groundwater) and benzo(a)pyrene (0.04-0.06µg/l in groundwater / brook) were elevated above either the UKDWS or EQS screening criteria, however none of these are considered likely to pose any risk to the quality of the groundwater.

No significantly elevated TPH concentrations have been recorded in the groundwater or the brook. As there is a general absence of TPH in the soils and a lack of an obvious source, it is considered unlikely that significant petroleum hydrocarbon contamination is present within the site area. However, a watching brief should be undertaken during development of the southern part of the site to further assess the made ground. Once the hardstanding within the southern part of the site has been removed, the near surface ground should be inspected for any potential contamination issues (such as oil staining etc).

At this stage, it is considered that the risk to the surface water receptor and groundwater beneath the site is negligible, and no remedial action is required.

Phase II Conceptual Model (pre-remediation)

HUMAN HEALTH			
Source	**Pathway**	**Receptor**	**Solution**
Southern half of site area only – Made Ground (contaminated with Lead and asbestos fibres).	Indoor and outdoor inhalation of soil dust; the ingestion of, and dermal contact with, contaminated soil and soil dust; ingestion of vegetables that have taken up contamination and contaminated soil attached to vegetables.	End users and construction workers.	Remediation required (clean soil capping layer in all garden areas).
		Construction workers.	Working method statements required to reduce risk from asbestos fibres to acceptable.
Southern half of site area only - Elevated ground gases (carbon dioxide) recorded.	Inhalation.	End users.	Gas precautions required (gas monitoring on-going).

CONTROLLED WATERS			
None.	Leaching of contaminants and vertical migration to the groundwater.	Principal Aquifer (Sherwood Sandstone Group).	No remediation required.
		Secondary A Aquifer (Alluvium / Pennine Upper Coal Measures Formation).	
None.	Leaching of contaminants and lateral migration to surface waters.	Cecilly Brook.	No remediation required.

CONSTRUCTION MATERIALS			
None.	Migration of contamination through leaks and joints, degradation of pipe materials.	Water supply pipes.	PE/Barrier Type water supply pipes and clean backfill required (to be confirmed by water supply company).

4 REMEDIAL STRATEGY

The works outlined below are those considered necessary to commence the development of the site.

4.1 REMEDIATION AND VALIDATION

4.1.1 Remedial Strategy for Human Health (Soil Contamination)

The proposed development comprises 120 residential properties with associated gardens / soft landscaping and an area of public open space on the south eastern side of Cecilly Brook.

Remediation will only be required within the southern half of the site where deep made ground is present (as shown on the Remediation Plan presented in Appendix E). It is considered that the use of a soil capping system in the affected soft landscaped garden areas to break the source-pathway-receptor linkage would represent a suitable form of remediation.

The recommended remedial measures will comprise a 600mm thick capping layer of clean soil (e.g. combination of subsoil / topsoil) to be placed in the proposed soft landscaped garden areas. This will reduce any exposure pathways to end-users in respect of Lead and asbestos fibres (if present).

At this stage, it is assumed that the subsoil and topsoil to be used as the clean capping layer can be sourced from within the site area. The subsoil would comprise mainly natural granular soils from the foundation / service trench excavations and the topsoil from the northern half of the site within the field area. Both the subsoil and topsoil would still need to be chemically tested to prove suitability, and this can be done once these materials have been stockpiled during the construction works.

As part of the redevelopment works, it is currently proposed that the ground levels within some parts of the area to be remediated are to be increased by approximately 0.5m to 2.0m above the current ground surface. For some other parts of the area to be remediated, the ground surface will remain more or less unchanged. At this stage, the source of the soils to be used to raise the ground levels is unknown. As these soils will be placed in the garden areas, chemical validation of these soils will be required.

Where current ground levels are to be generally maintained then sufficient made ground should be removed to facilitate the capping layer. Any made ground removed to facilitate the capping layer can be sensibly re-used elsewhere under areas of hardstanding or disposed appropriately off-site.

There is the potential risk of double handling the contaminated made ground when it comes to foundation excavations. Both clean fill placed to raise proposed site levels and contaminated made ground below will be excavated during the digging for foundations. Both types of material will probably be stockpiled together, thus increasing the amount of contaminated made ground to deal with. An alternative to this would be the bulk excavation of all contaminated made ground as a form of remediation. This would also further mitigate any risk to controlled waters.

On the eastern side of Cecilly Brook, there is a proposed public open space area and a few proposed garden areas at the south eastern end of the site. Further shallow sampling and testing of soils in these areas will be required to confirm that no remedial works would be required in this part of the development.

Should the extent of the made ground be greater than expected or any additional material suspected of being significantly contaminated be encountered during the redevelopment of the site, GRM can be contacted to undertake additional investigation if necessary. The local Environmental Health Officer should be contacted and informed of any additional remedial work required.

4.1.2 Remedial Strategy for Human Health (Ground Gas)

It is considered that Characteristic Situation 1 is appropriate for the northern half of the site and no gas protection measures will be required.

GRM have installed six new gas installations across the southern part of the site and are currently in the process of undertaking a monitoring program. Depending on the results of this new monitoring phase, the requirement for gas protection measures will be reviewed.

At this stage, prior to completion of the current gas monitoring program, gas protection measures for the southern part of the site (as shown on the Remediation Plan presented in Appendix E) appropriate for Characteristic Situation 2 will be required.

The gas protection measures are likely to comprise the provision of a methane resistant membrane (such as Monarflex Reflex Super or Juta GP1), fully sealed at joints and service penetrations, with a beam and block floor slab. These would provide a score of 4.5 points under BS8545 and so will be suitable for the type of building proposed (Type A – private / residential).

If gas protection measures are required, a Gas Protection Measures Design and Verification Plan will be required.

4.1.3 Remedial Strategy for Site Workers

Although the risk to site workers from soil contamination is considered negligible, previous ground investigations have recorded occasion asbestos fibres within the made ground. The risk can be mitigated with the adoption of dust suppression measures, providing that appropriate health and safety procedures are adhered to during the construction phase. Any visible asbestos containing material (such as cemented asbestos sheeting) should be screened / separated from the made ground where reasonably practicable and disposed of separately.

The use of suitable PPE should be enforced during the ground works stage of construction and suitable precautions should be taken, especially when excavating any made ground materials.

In addition, depleted oxygen concentrations have been detected and therefore consideration should be given to avoiding work in confined spaces or deep excavations.

A site-specific risk assessment should be undertaken prior to the commencement of site works and any subsequent maintenance works.

4.1.4 Remedial Strategy for Controlled Waters

Considering the general absence of TPH in the soils and the lack of an obvious source, it is considered unlikely that significant petroleum hydrocarbon contamination is present within the site area. No significantly elevated TPH concentrations have been recorded in the groundwater or the brook. However, further testing of the water in Cecilly Brook may be required.

To further mitigate any risk to controlled waters, it is recommended that a watching brief is undertaken during development of the southern part of the site to further assess the made ground. Once the hardstanding within the southern part of the site has been removed, GRM can inspect the near surface ground for any potential contamination issues (such as oil staining etc) previously unrecorded.

At this stage, it is considered that remediation to protect controlled waters is unnecessary.

4.1.5 Remedial Strategy for Construction Materials

It is considered that the concentrations of contaminants recorded to date, based on the UKWIR guidance, is such that standard water supply pipes (e.g. PE/Barrier Type water supply pipes) should be suitable for the site.

However, it is recommended that the local water supply company for the site be contacted to confirm their requirements with regard to pipe materials.

4.1.6 Disposal and Classification

At this stage, it is anticipated that all excavated soils will remain on site.

Based on the Waste Classification Report (Appendix G), the made ground has generally been classified as Non-Hazardous Waste. However, one of sample of made ground has been classified as Hazardous Waste due to the zinc concentration recorded.

Although not identified during the site works, visible asbestos containing materials (ACMs) within soils will result in the soils being classified as Hazardous Waste. Visible ACMs should be removed, employing appropriate health and safety protocols and where possible, prior to disposal.

At this stage, as all the made ground will be excavated and stockpiled together, allowance should be made for the made ground to be assumed to be non-hazardous. Once all the made ground has been stockpiled, it is recommended that the made ground is re-tested to confirm its waste classification prior to any disposal.

It should be noted that early consultation with the relevant landfill sites over their particular acceptance criteria may produce additional cost savings. Reference should be made to the relevant notes presented in Appendix A (x).

The natural strata underlying the site is likely to be classified as Inert for disposal purposes, however, further testing will be required to confirm this. Due to the organic content within the alluvial deposits, these may be classified as non-hazardous. Further testing will be required to determine this and confirmed by the receiving landfill.

Natural soils may be suitable for re-use on-site as part of any capping layer and consideration should be given to retaining this material on-site. Care should be taken to keep natural arisings separate from the made ground and free from construction materials.

Where site-won materials (i.e. made ground or natural soils) are to be re-used on site, or materials are to be imported, it is recommended that this should be carried out under a Materials Management Plan produced in accordance with the CL:AIRE Definition of Waste Code of Practice. This document should be approved by a CL:AIRE-registered Qualified Person prior to excavation of materials, and be maintained throughout the duration of the project. A Verification Report should be produced on completion of the project in order to confirm the control and recording of material movements around or between sites in accordance with current waste management legislation and guidance.

4.1.7 Post Remediation Validation

Validation of Residential Gardens / Open Space Area

Remediation will only be required within the southern half of the site where deep made ground is present (as shown on the Remediation Plan presented in Appendix E).

The made ground in the proposed residential garden / soft landscaped areas should be removed to natural strata or 0.6m below finished ground levels whichever is shallower. Where natural strata are encountered before the full capping thickness, excavations can be stopped. Photographic evidence of the excavation surface will be required to confirm the presence of natural strata / absence of made ground.

The validation of the capping layer will include confirmation that it is of sufficient thickness. This will take the form of hand dug trial pits to determine the exact thickness of the soil capping layer; test pits will be excavated and photographic evidence of the layer thickness and nature of the capping material will be collected for inclusion in the validation report. It is GRM policy that the depth validations will be carried out on every plot.

At this stage, it is assumed that the subsoil (natural granular soils from the foundation / service trench excavations) and topsoil (from field area) to be used as the clean capping layer can be sourced from within the site area. Both the subsoil and topsoil would still need to be chemically tested to prove suitability, and this can be done once these materials have been stockpiled during the construction works. Samples of

these materials will need to be analysed for a suite of contaminants including metals, inorganics, speciated PAHs, speciated hydrocarbons and a screen for asbestos. The analysis results will be screened against GRMs Tier 1 Assessment Criteria / Remedial Targets (presented in Appendix F) for a residential with plant uptake end-use.

If a source of topsoil or subsoil is required off-site, then the number of samples that require analysis will depend on the volume and the source of the materials. Typically an analysis rate of one sample per 50m^3 and one sample per 250m^3 (minimum of three samples per source and material type) applies for generated and virgin soils respectively.

4.1.8 Validation Reporting

A Remediation Validation (Verification) Completion Report will be required by the Local Authority to confirm that the remedial strategy has been implemented appropriately. The report should include the following:

- Confirmation of the suitability of the on-site subsoil / topsoil material to be used for the clean capping layer, including chemical analysis results.
- Confirmation of the capping thickness placed to the required depth, along with a photographic record.
- Copies of site waste consignment / haulage notes, confirming the export of any excavated contaminated soils.

The validation report confirming all the above measures have been undertaken should be submitted to the relevant Local Authority and the NHBC / Warrantee provider.

5 FURTHER WORKS

It is considered that further works are necessary these include;

- A watching brief should be undertaken during development of the southern part of the site to further assess the made ground. Once the hardstanding within the southern part of the site has been removed, GRM should inspect the near surface ground for any potential contamination issues (such as oil staining etc). Any evidently contaminated soils encountered would need to be excavated and removed from site.
- Further shallow sampling and testing of soils within the proposed public open space area on the eastern side of Cecilly Brook and a few garden areas at the south eastern end of the site. This will be required to confirm that no remedial works would be required in this part of the development.
- Further testing of the water in Cecilly Brook.
- Sampling and testing of stockpiled natural granular soils from foundation / service trench excavations and topsoil stripped from across the northern field area of the site. This will be required to prove suitability for re-use as clean capping material.
- Placement and validation of the clean capping layer within proposed gardens / soft landscaped areas (southern half of site only).

APPENDIX A

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

- Geotechnical and Geo-environmental Services
- Civil and Infrastructure Services
- Structural Engineering Services
- Construction Management
- Site Services

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

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

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 I Screening values.

ix CONSTRUCTION MATERIALS RISK ASSESSMENT METHODOLOGY

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

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

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

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

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

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

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

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

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

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

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

xi GEOTECHNICAL ASSESSMENT GENERAL COMMENTS

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

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

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

xii GEOTECHNICAL ASSESSMENT – ENGINEERING GROUND TREATMENT

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

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

xiii GEOTECHNICAL ASSESSMENT – EXCAVATIONS

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

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

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

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

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

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

xiv GEOTECHNICAL ASSESSMENT – SUBSTRUCTURES

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

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

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

xv GEOTECHNICAL ASSESSMENT – SOAKAWAYS

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

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

- Soakaways should not be placed so that water can be discharged through potentially contaminated made ground.
- The Environment Agency may require soakaways to be sealed systems such that only roof run off falls to soakaway.

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

xvi GEOTECHNICAL ASSESSMENT – FOUNDATIONS

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

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

NOTES ON LIMITATIONS

General

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

GRM Development Solutions Limited accepts no responsibility or liability for:

a) the consequences of this document being used for any purpose or project other than for which it was commissioned, and

b) the consequences of this document being used by any third party with whom an agreement has not been executed.

Phase I Environmental Audits/ Desk Studies

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

Phase II Environmental Audits (Contamination Investigations)

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

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

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

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

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

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

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

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

The comments made on groundwater conditions are based on observations made at the time the site work was conducted. It should be noted that groundwater levels will vary owing to seasonal, tidal and weather related effects.

The scope of the investigation was selected on the basis of the specific development proposed by the Client and may be inappropriate to another form of development or scheme.

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

APPENDIX B

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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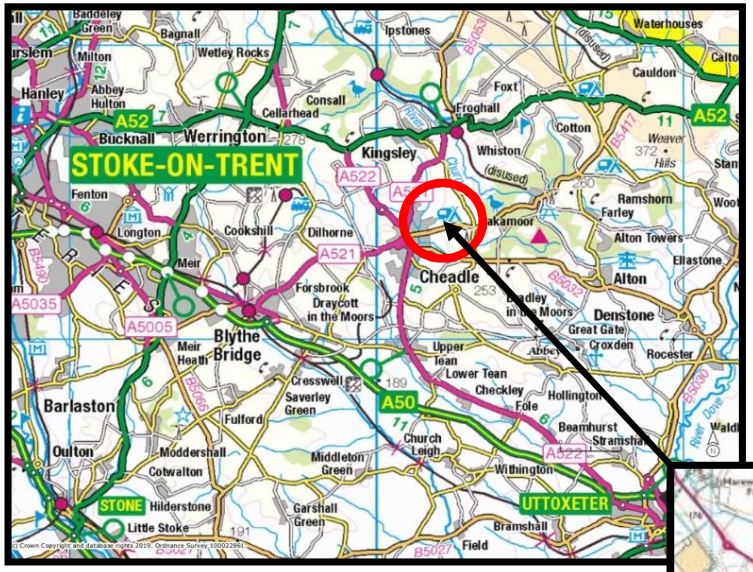





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DO NOT SCALE

NOTES:

Approximate site location

Approximate site boundary

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info@grm-uk.com www.grm-uk.com

CLIENT:

Bellway Homes West Midlands

PROJECT:

Land off Oakamoor Road, Cheadle

TITLE:

Site Location and Boundary Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
RHC	Dec 2019
PROJECT No:	DRAWING No:
P9119	Figure 1

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APPENDIX C

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CLIENT:

Bellway Homes West Midlands

PROJECT:

Land off Oakamoor Road, Cheadle

TITLE:

Proposed Development Layout Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN : RHC	DATE: Dec 2019
PROJECT No: P9119	DRAWING No: Figure 2

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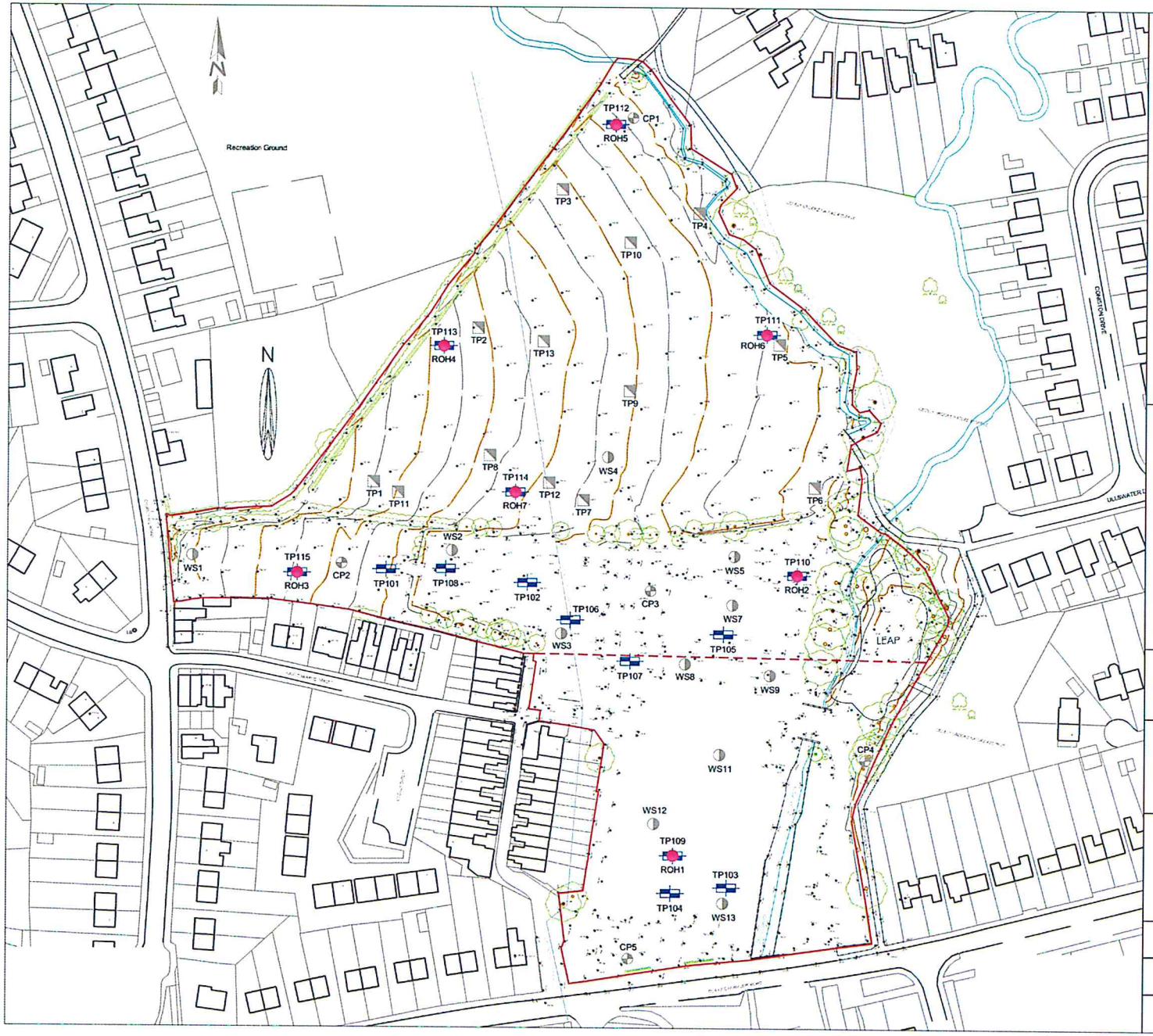

KEY:

- TP101 — Trial Pit (Applied Geology December 2018)
- ROH1 — Rotary Percussive Open Hole Borehole (Applied Geology December 2018)
- TP1 — Machine Excavated Trial Pit (GIP August 2014)
- CP1 — Cable Percussive Borehole (GIP August 2014)
- WS1 — Driven Continuous Sampling Borehole (GIP August 2014)
- Consideration should be given to reinforcement of foundations south of this line

Drawing based on BI Design Architecture, Job reference 1343 JCB, drawing No:01 dated September 2017 and GIP, Contract No.22187, drawing No.1.

APPLiED GEOLOGY

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email:admin@appliedgeology.co.uk

Client: B CHEADLE PROPERTY HOLDINGS LTD

Project: CECILLY MILL, CHEADLE

Title: EXPLORATORY HOLE LOCATION PLAN

Drawn By:	Checked By:	Paper Size:
JS	JMS	A3

Scale:	Date:
1:1250	10.12.2018

Drawing No:	Revision:
AG2939-18-02	0



NOTES: DO NOT SCALE

- Window Sample / Rotary Borehole Location
- Window Sample Borehole Location (with standpipe)
- Window Sample Borehole Location (without standpipe)

CLIENT: Bellway Homes West Midlands

PROJECT: Land off Oakamoor Road, Cheadle

TITLE: Revised Exploratory Hole Location Plan

SCALE@SIZE: NTS	ISSUE: FINAL
DESIGN/DRAWN: RHC	DATE: Dec 2019
PROJECT No: P9119	DRAWING No: Figure 3

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APPENDIX E

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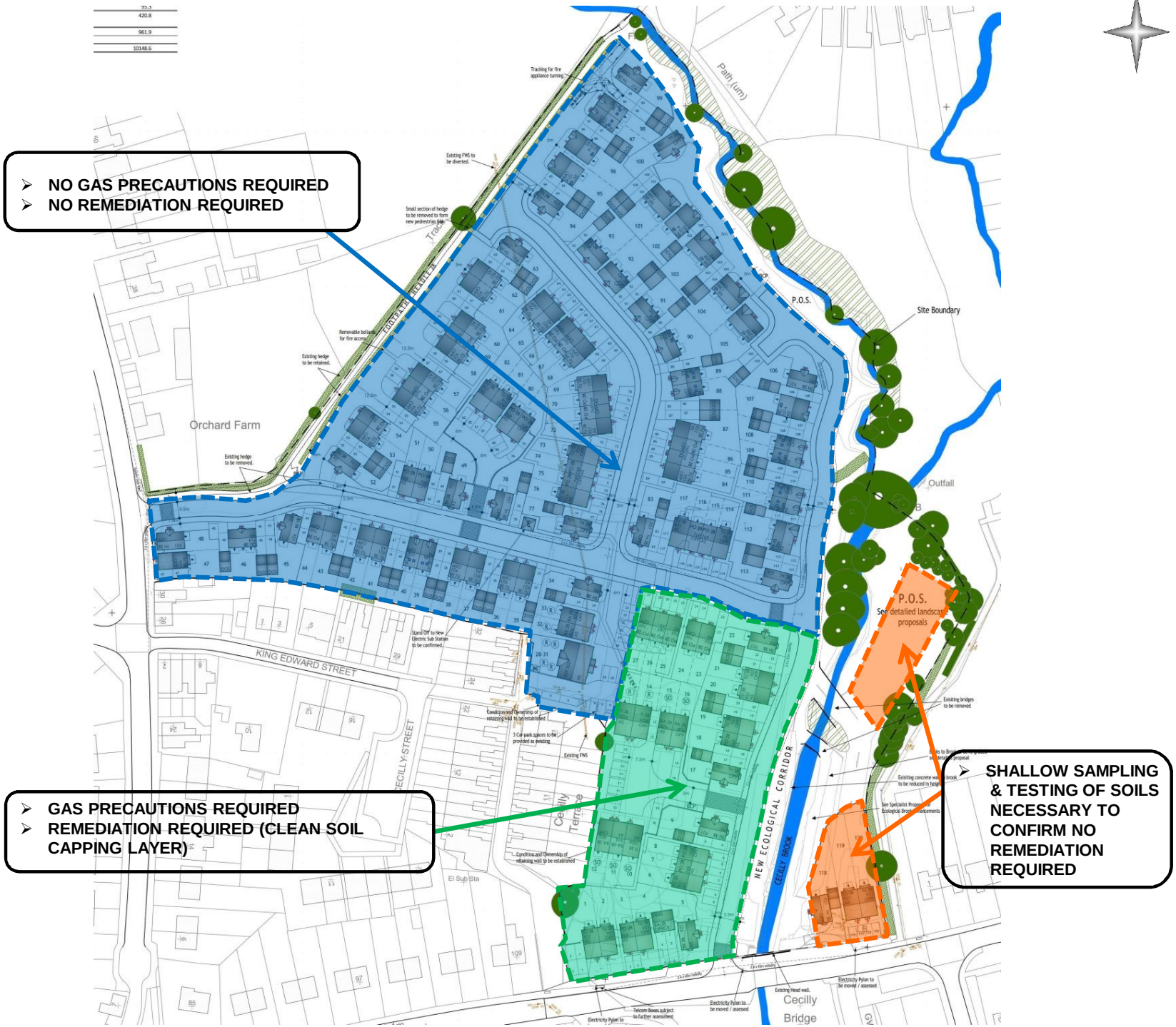

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CLIENT:
Bellway Homes West Midlands

PROJECT:
Land off Oakamoor Road, Cheadle

TITLE:
Remediation Plan

SCALE@SIZE :	ISSUE:
NTS	FINAL
DESIGN/DRAWN :	DATE:
RHC	Dec 2019
PROJECT No:	DRAWING No:
P9119	Figure 4

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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] *o* - xylene	60	140	330
[b] *m* - xylene	59	140	320
[b] *p* - 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.

GRM Controlled Waters Tier 1 Assessment Criteria

Table 1a

UKDWS			EQS freshwater (µg/l)*	EQS other surface water (µg/l)* (Including saline waters)
Parameter	**Concentration**	**Units**		
Acrylamide	0.1	µg/l	-	
Aluminium	200	µgAl/l	-	
Ammonium	0.5	mgNH4/l	0.2 as N	0.021 unionised as N
Antimony	5	µgSb/l	-	
Arsenic	10	µgAs/l	50 (dissolved)	25 (dissolved)
Benzene	1	µg/l	10	8
Boron	1	mgB/l	750[#]	-
Bromate	10	µgBrO3/l	-	-
Cadmium	5	µgCd/l	See Table 2b	0.2
Chromium	50	µgCr/l	-	-
Chromium (III)	-	µg/l	4.7	-
Chromium (VI)	-	µg/l	3.4	0.6
Chloride (i)	250	mgCl/l	188mg/l[#]	
Conductivity (i)	2500	µS/cm at 20°C	-	
Copper(ii)	2	mg/l	1	3.76 (where DOC <1mg/l)
Cyanide	50	µgCN/l	1	1
1, 2 dichloroethane	3	µg/l	10	
Dichloromethane	-	µg/l	20	20
Epichlorohydrin	0.1	µg/l	-	
Fluoride	1.5	mgF/l	1mg/l[#]	
Hydrogen ion	10	pH value	-	
Iron	200	µgFe/l	1000 (dissolved)	1000 (dissolved)
Lead (ii)	10	µgPb/l	1.2 (dissolved & bioavailable)	1.3
Manganese	50	µgMn/l	130 (bioavailable)	-
Mercury	1	µgHg/l	0.07 (dissolved)	0.07 (dissolved)
Mineral Oil (TPH)	10	µg/l	5000 (total) ****	5000 (total) ****
Nickel (ii)	20	µgNi/l	4 (dissolved & bioavailable)	8.6
Nitrate (iii)	50	mgNO3/l	-	-
Nitrite (iii)	0.5	mgNO2/l	-	-
Phenol	0.5	µg/l	7.7	7.7
Polycyclic Aromatic Hydrocarbons (vii) *	0.1	µg/l	-	-
Fluoranthene	-	µg/l	0.0063	0.0063
Naphthalene	-	µg/l	2	2
Benzo(a)pyrene	0.01	µg/l	0.00017	0.00017
Benzo(b)fluoranthene	-	µg/l	-	-
Benzo(k)fluoranthene	-	µg/l	-	-
Benzo(g,h,i)perylene	-	µg/l	-	-
Indeno(1,2,3-cd)pyrene	-	µg/l	-	-
Anthracene	-	µg/l	0.1	0.1
Selenium	10	µgSe/l	7.5	-
Sodium	200	mgNa/l	150mg/l[#]	-
Sulphate (i)	250	mgSO4/l	188mg/l[#]	-
Tetrachloroethene and Trichloroethene (viii)	10	µg/l	10	10
Tetrachloroethane	-	µg/l	140	-
Tetrachloromethane	3	µg/l	12	12
Toluene	700***	µg/l	74	74
Xylene	500***	µg/l	30[+]	30[+]
Ethylbenzene	300***	µg/l	20**	20**
1,1,1-Trichloroethane	-	µg/l	100[+]	100[+]
Trichlorobenzenes	-	µg/l	0.4	0.4
Trichloromethane	-	µg/l	2.5	2.5
Tributyltin	-	µg/l	0.0002	0.0002
Vinyl chloride	0.5	µg/l	-	-
Carbon Tetrachloride	-	µg/l	12	12
Zinc	5000	µg/l	10.9 (dissolved & bioavailable) + background concentration	6.8 (dissolved & bioavailable) + 1.1

Table 1b

Pesticides			EQS freshwater (µg/l)*	EQS other surface water (µg/l)* (Including saline waters)
Aldrin	0.03	µg/l	-	
Dieldrin	0.03	µg/l	-	-
Heptachlor	0.03	µg/l	-	-
Heptachlor epoxide	0.03	µg/l	-	-
other pesticides	0.1	µg/l	-	-
Cyclodiene pesticides: Sum of Aldrin, Dieldrin, Endrin & Isodrin	-	µg/l	0.01 (sum)	0.005
DDT total	-		0.025	0.025
Pesticides: Total (vi)	0.5	µg/l	-	-

Table 2

EQS for Hardness Related Substances*						
Substance	**EQS Type**	**EQS (µg/l) for hardness classes (mg/l $CaCO_3$)**				
		Class 1: <40	Class 2: 40-50	Class 3: 50-100	Class 4: 100-200	Class 5: >200
Cadmium (dissolved)	Annual average	<0.08	0.08	0.09	0.15	0.25

Reference

* The Water Framework Directive (Standards and Classification) Directions (England and Wales) Directions 2015

** Provisional EQS Value

*** WHO Drinking Water Standard

**** EA PPG3

[+] The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010 - Now Withdrawn

[#] Groundwater Drinking Water Protected Zones Only

Ambient Background Concentrations for dissolved zinc in freshwaters in England and Wales (to be used in conjunction with Table 1a)	
Catchment/Group of catchments (ii)	*ABC (µg/l)*
Tyne	4.8
Tees	4.1
Ouse, Humber	2.9
Nene	4.0
Great Ouse	3.1
River Stour	3.0
Blackwater/Chelmer	3.6
Lee	3.3
Thames	2.0
Test	2.0
Avon/Hants	3.1
Exe	1.4
Dart	1.7
Clywd/Conwy	2.0
Dee	2.9
Eden	1.2
Anglesey	3.0
Tamar	2.9
Fal	5.8
Camel	7.1
Tone/Parrett	3.3
Frome, Bristol Avon	2.3
Wye	2.0
Usk	2.2
Taff	2.8
Neath	2.8
Loughar	3.9
Tywi	2.0
Teifi	2.5
Rheidol/Ystwyth	4.1
Dovey	3.2
Glaslyn	2.6
All other freshwaters not listed above	1.4

APPENDIX G

GRM Development Solutions provides multi-disciplinary consultancy services, UK-wide:

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Waste Classification Report

6PK2B-8A98Z-4XXES

Job name

P9119 - Oakamoor Road, Cheadle

Description/Comments

Assessment based upon chemical data from ground investigation.

Project

P9119

Site

Cheadle

Related Documents

#	Name	Description
None		

Waste Stream Template

GRM Standard Suite - incl TPH (NOT Petrol or Diesel)

Classified by

Name:
Charlotte Mortimer
Date:
04 Dec 2019 13:46 GMT
Telephone:
01283 551 249

Company:
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Laurus House
Centrum 100, First Avenue
Burton Upon Trent
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Report

Created by: Charlotte Mortimer
Created date: 04 Dec 2019 13:46 GMT

Job summary

#	Sample Name	Depth [m]	Classification Result	Hazard properties	Page
1	WS01	0.8	Non Hazardous		3
2	WS02	0.6	Non Hazardous		5
3	WS03	0.4	Hazardous	HP 14	7
4	WS04	0.8	Non Hazardous		10
5	WS04[2]	1.3	Non Hazardous		13
6	WS05	0.7	Non Hazardous		15
7	WS05[2]	1.6	Non Hazardous		17
8	WS07	0.5	Non Hazardous		20

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