



The Christie Proposed Northern Pathology Development

Ground Investigation Specification and Bill of
Quantities

June 2025

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The Christie Proposed Northern Pathology Development

Ground Investigation Specification and Bill of Quantities

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INTRODUCTION

1.1 General Specification

The Technical Specification shall be the UK Specification for Ground Investigation, Third Edition (ICE, 2022) published by Thomas Telford, with information, amendments and additions as described in the accompanying Schedules below.

Schedule 1	Information and site-specific requirements
Schedule 2	Exploratory Holes
Schedule 3	Investigation Supervisor's Facilities
Schedule 4	Specification Amendments
Schedule 5	Specification Additions

In so far as any of the numbered Appendices, Substitute, Additional or Amended Clauses may conflict or be inconsistent with any provisions of the above mentioned Specification then the numbered Appendices, Substitute, Additional or Amended Clauses shall always prevail. For ease of reference the numbering system used in these schedules corresponds to that used in the published Specification.

Any Clause in the Specification, which relates to the work or materials not required for the Investigation shall be deemed not to apply.

The ground investigation (GI) works are to be undertaken in accordance with Eurocode 7, Part 2 – Ground Investigation and Testing, including the UK National Annex to Eurocode 7, Part 2, and its associated complimentary standards.

The Conditions of Contract shall be the Infrastructure Condition of Contract (“ICC”) - Ground Investigation Version, August 2011 published by the Association of Construction Engineers (“ACE”) and Civil Engineering Contractors’ Association (“CECA”) (herein after referred to as “the ICC Conditions”) save in so far as the same are hereby expressly varied herewith and shall form part of these Conditions.

1.2 Purpose of this document

This document forms the Ground Investigation Technical specification for the planned intrusive investigations works for the Christie Proposed Northern Pathology Development. These intrusive investigation works are based on the information available at the time of writing.

1.3 Related documents

This document should be read in conjunction with the Bill of Quantities (NTHPAT-MMD-XX-ZZ-BQ-C-000001) and the Phase I Geo-environmental Desk Study (NTHPAT-MMD-XX-XX-RP-C-000001-P01) , contained in Appendix F and H respectively.

SCHEDULE S1. Information and site specific requirements

S1.1 Contract Details

S1.1.1 Name of Contract

The name of the contract shall be ‘The Proposed Northern Pathology Development’.

S1.1.2 Employer

The Employer for the Project will be the Northern Pathology Developments Ltd.

Address:

The Christie Charity,
550 Wilmslow Road,
Manchester,
M20 4BX

S1.1.3 Project Information

Details of the site location and project objectives are provided in Sections S1.4 and S1.5.

S1.2 Investigation Supervisor

The ‘Investigation Supervisor’ is hereby defined as equivalent to the ‘Engineer’s Representative’ under the Infrastructure Conditions of Contract.

The Investigation Supervisor for the Project will be appointed by the Client.

S1.3 Description of site

Details of the site are provided in Table 1 and Figure 1.

Table 1: Site Details

Aspect	Details
Site Name	The Christie, Manchester
National Grid Reference	384904, 392659
Site Location & Description	The site is within the Christie Hospital campus in Withington, Greater Manchester and is bordered by Wilmslow Road (including a cycle lane) to the East. The site is of the Proposed Northern Pathology Development is located in the north-east corner of the Christie Hospital campus. It is bounded to the east by Wilmslow Road, shops and residential housing/gardens to the north and other hospital buildings to the south and west. The existing Christie Derek Crowther building is formed of two storey modular units and is to be demolished and a new three storey building, Proposed Northern Pathology Development, is to be constructed in its place in the north-east corner of the site. The footprint of the proposed building will be larger than the existing but will not extend into the access road that runs east/west through the site. A link bridge provided between the plant and the new building. The site location plan is shown within the red line boundary in the figure below.

Aspect	Details
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Figure 1: Site Location Plan



Site Access	Due to the constrained nature and existing buildings on the site, the exploratory hole will need to be undertaken in the land immediately east of the existing Derek Crowther Building (indicated by the green hatch below). Key - Site boundary - Existing buildings - Areas suitable for GI - Areas possibly suitable for hand dug trial pits - Areas unlikely to be suitable for GI Key - Site boundary - Existing buildings - Areas suitable for GI - Areas possibly suitable for hand dug trial pits - Areas unlikely to be suitable for GI Access to the site will be through the private access road from Wilmslow Road. It is envisaged that any GI equipment can be stored in the green hatched area shown above. However, agreement from the NHS Trust is required prior to undertaking the works. The access road (red hatch) must be kept free during the works as this is used by the hospital at all times. The orange hatch show areas where hand dug trial pits could be undertaken. Access is through an external gate at the south-west corner of the existing building. Coordination with the NHS Trust will be required to unlock the gate for the works. This area is heavily overgrown, however it is anticipated this will be devegetated by the NHS Trust prior to commencement of the works.
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Aspect	Details
	Refer to the Ground Investigation Location Plan (NTHPAT-MMD-XX-ZZ-DR-C-000001) in Appendix A for the proposed exploratory hole location.
Current Land Use	The site is part of the Christie Hospital in an urbanised area of Manchester.
Topography	The site is relatively flat at approximately 35m above ordnance datum (AOD).
Existing GI Data	A summary of the anticipated geology on site is outlined in Section S1.6., based on the levels of the Christie Imaging Centre Development (CASICD) and Paterson Building Ground Investigations is included in the Table 2 below.
Hazards	Possible ground obstructions, variable Made Ground, buried services strike, works adjacent to an above ground liquid nitrogen tank, working adjacent to public highway and private access road, working in a live hospital environment. For all hazards and mitigation measures, please refer to the Designer's Hazard Elimination and Management Record (DHEMR).
UXO	Low Risk (via Zetica Desk Study and Risk Assessment Document Ref. P14466-24-R1, included separately within Appendix I and included in the Phase 1 Desktop Study)

S1.4 Main works proposed and purpose of Contract

The existing Derek Crowther building at The Christie Hospital is formed of two storey modular units and is to be demolished. A new three storey building, the Proposed Northern Pathology Development, is to be constructed in its place to accommodate laboratory spaces, staff offices and plant space.

A link bridge is to be provided between the new and existing building that will cantilever from the proposed. The existing liquid nitrogen tank which is external to the existing Derek Crowther building, will be retained as part of the Proposed Northern Pathology Development.

The ground investigation is intended to be the main combined geotechnical and geo-environmental ground investigation for the site. A Preliminary Sources Study Report (PSSR) / Desk Study Report is not required to be provided by the ground investigation Contractor.

S1.4.1 Construction (design and Management) Regulations, 2015

With regard to the Construction (Design and Management) Regulations, 2015 (CDM, 2015), the main works described above will be notifiable, but have not yet been notified.

However, for the purposes of this contract the proposed ground investigation is a "project" in itself for which the following matters should be noted:

- The GI Contract is not considered likely to be 'Notifiable'.
- The Client is the Northern Pathology Developments Ltd.
- The Principal Designer is TBC
- The Principal Contractor is Renaker.

S1.5 Objectives and Scope of Investigation

The Contract is for the geotechnical and geo-environmental ground investigation for the proposed development described in Section S1.4. The objective of the ground investigation is to primarily address ground related risks highlighted within the Desk Study to support design development to ultimately aid in the planning process.

The key objectives include:

- Obtaining geotechnical and geo-environmental data to progress the technical design, to permit:
- Addressing of key geotechnical risks, e.g.:
 - Identification of potential ground obstructions.
 - Nature and suitability of superficial deposits.
 - Nature, depth and suitability of bedrock geology to progress foundation design. At this stage, based on the anticipated building loads, both a pad/raft foundation and a piled foundation are being considered.
 - Management of groundwater during construction.
- Addressing of key contamination risks, e.g.:
 - Identification of any contaminants in soil to assess risk to construction workers and disposal costs.

The ground investigation scope will comprise:

- Dynamic sample with rotary follow-on borehole:
 - Hand dug inspection pit.
 - Dynamic sample borehole with in-situ testing and retrieval of geotechnical and geo-environmental soil samples.
 - Rotary follow-on borehole with in-situ testing and retrieval of geotechnical and geo-environmental soil/rock samples.
- Hand-dug Trial Pits to verify depth and form of existing wall foundations to adjacent buildings, to locate and record tree roots along the west elevation of the existing building and obtain soil samples for geo-environmental testing.
- Installation of standpipes and/or other piezometers.
- In situ testing, including standard penetration testing.
- Associated geotechnical and geo-environmental laboratory testing of soil, rock and groundwater samples.
- Groundwater monitoring.
- Factual reporting and provision of AGS data for ongoing analysis.

Further details of the ground investigation scope including the frequency of sampling and testing can be found in Schedule S2 and Appendix E of the specification.

S1.6 Geology and Ground Conditions

The previous ground investigation information, primarily the 2024 ground investigation for the CASICD and the 2019 ground investigation for the Paterson Building (both adjacent to the southern site boundary), has been reviewed to give an understanding of the ground conditions in the area.

The existing ground investigation information indicates ground conditions consisting of Made Ground underlain by superficial deposits consisting of Devensian Till (clay / sand). The superficial deposits are underlain by the Wilmslow Formation (Very weak to weak Sandstone).

It should be noted that Devensian Till was not identified in the CASICD ground investigation, however was present in the Paterson Building ground investigation.

Groundwater in the CASICD and Paterson GI was encountered between 2.3 and 5.0mBGL.

A summary ground model for expected ground conditions can be seen in Table 2 below.

Table 2: Anticipated Ground Conditions

Stratum	Depth to top of stratum (mbgl)	Elevation at top of stratum (mAOD)*	Thickness (m)
Made Ground**	0	34.72 – 35.26	0.45 - 2.20
Devensian Till*	0.70 – 2.20*	32.52 – 34.22*	0.50 - 2.20*
Weathered Sandstone	0.45 – 2.70	31.43 – 33.06	0.70 - 2.80
Extremely weak to weak Sandstone (Wilmslow Formation)	2.70 – 5.00	29.92 – 31.76	Not proven

*only present in Paterson GI - may not be present on site

**the thickness of the Made Ground on the site is unknown and may vary from other locations

An Arup contamination risk assessment based on 2019 ground investigation for the Paterson Building noted that for the 23no. soil samples tested for a suite of contaminants, there were no exceedances of the Generic Assessment Criteria (GAC), nor were there any notably elevated concentrations of contaminants.

Twelve soil samples collected from the CASICD ground investigation were tested for a suite of organic and inorganic determinants, there were no exceedances of the Generic Assessment Criteria (GAC), nor were there any notably elevated concentrations of contaminants. Five selected soil samples were subjected to soil leachate testing. Leachate extract from soil recorded generally low-level exceedances of the UK Drinking Water Standards

No suspected asbestos containing materials were identified in the exploratory hole logs and laboratory screening confirmed that asbestos was absent in the soil samples tested.

Asbestos refurbishment surveys undertaken by Acorn Analytical Services Limited from 2021 to 2022 indicate presence of asbestos in the CASICD basement. The basement does not extend to the Derek Crowther site covered in this investigation however, historical site maps show that there was a residential property on the site, within the footprint of the existing modular building, that may have had a basement that has since been backfilled. As such, the Contractor should remain vigilant on site for potential asbestos and backfilled material.

S1.7 Schedule of drawing(s) and documents

The following drawings and documents are relevant to the proposed ground investigation works.

Table 3: Drawings and Documents Schedule

Document Reference	Document Title	Type of Document	Company	Date
NTHPAT-MMD-XX-XX-RP-C-000001-P01	Phase I Geotechnical and Geo-environmental Desk Study	Report	Mott MacDonald	May 2025
P14466-24-R1	UXO Desk Study / Risk Assessment	Report	Zetica	May 2024
CDEREK-LSL-XX-XX-DR-X-000001	Topographical Survey	Drawing	Layer Surveys	June 2024

CDEREK-LSL-XX-XX-DR-X-000002	Utilities Survey	Drawing	Layer Surveys	June 2024
NTHPAT-MMD-XX-XX-HS-C-000001	Geotechnical DHEMR	Report	Mott MacDonald	June 2025
NTHPAT-MMD-XX-ZZ-DR-C-000001	Ground Investigation Location Plan	Drawing	Mott MacDonald	June 2025
NTHPAT-MMD-XX-ZZ-BQ-C-000001	Bill of Quantities	Report	Mott MacDonald	June 2025

The proposed ground investigation layout plan/s showing the indicative exploratory hole position is included in Appendix A and requirements provided in Schedule 2.

S1.8 General requirements (Specification Section 3) Particular restrictions/relaxations & requirements

The ground investigation contractor is to act as Principal Contractor under the CDM Regulations 2015. They shall prepare the Construction Phase Plan (CPP) and manage the works. No other activities will be taking place during the ground investigation. The CPP is a site-specific document and is to be issued to the Principal Designer not less than 2 weeks prior to the works commencing on site.

The Principal Contractor shall agree the date of mobilisation, a programme and sequence of undertaking exploratory holes and dates for submission of draft and factual reports with the Investigation Supervisor. An indicative programme for completion of the ground investigation and factual reporting shall be agreed with the Investigation Supervisor prior to mobilisation to the site.

S1.8.1 Data Management Plan (Clause 3.2)

A Data Management Plan shall be developed by the ground investigation contractor in accordance with BS 8574:2014 and provided to the Principal Designer and Investigation Supervisor not less than 2 weeks prior to commencing work on site.

S1.8.2 Quality Management System (Clause 3.3)

All works shall be carried out in accordance with a Quality Management System established in accordance with:

- BS EN ISO 9001 – Quality
- BS EN ISO 14001 – Environment, and;
- BS OHSAS 18001 – Occupational Health & Safety.

Records to confirm compliance with the quality management system shall be made to the Investigation Supervisor on request.

S1.8.3 Project management, supervision and execution personnel (Clause 3.2, 4.4 and 4.5)

The Contractor shall provide full time professional attendance on site for the duration of the ground investigation works with a suitably qualified and experienced engineering geologist or geotechnical engineer nominated to act as Site Agent. The technical direction of all fieldwork

shall be their responsibility. Additional supervision of a single activity may be required where constant supervision is required. As a minimum, the nominated Site Agent shall have at least 5 years' experience of delivering ground investigation projects of a similar scale and scope of works.

The description of soils and logging shall be carried out by a graduate engineer or engineering geologist with a minimum of 2 years' experience in the examination and logging of soil and rock cores in accordance with BS EN ISO 14688 – 1:2002 (+A2 2013), BS EN ISO 14688 – 2:2004 (+A1:2013), and BS EN ISO 14689 – 1:2013 and CIRIA C547.

All Contractors' supervisory staff shall be acceptable to the Investigation Supervisor. The Investigation Supervisor may reject a nominated person after arriving at Site, if he/she considers that the person does not have the necessary skill, knowledge, or experience to carry out the required work. The proposed personnel for contamination sampling and testing, and geotechnical sampling and testing may be one and the same person if suitable qualifications and experience can be demonstrated.

All site operatives should have undertaken CSCS training and certification before working on the Site.

In addition, at least one member of the Contractor's Site personnel must be trained and competent in accordance with the Health and Safety Executive documentation, HS(G)47: Avoiding Danger from Underground Services.

CVs of all supervisory staff and copies of all current training certificates/records for operatives undertaking the works shall be submitted to the Investigation Supervisor and Client for approval 5 working days prior to commencement of the site works.

The Contractor shall give written instructions to their site staff on all relevant aspects of the specification and sampling requirements. Evidence that a detailed briefing has been given to all staff engaged on the project shall be retained by the Site Agent for inspection by the Investigation Supervisor on request.

The Investigation Supervisor will confirm in writing any changes to scope or variance from instructions contained within this specification.

The Contractor will be expected to maintain close liaison with the Investigation Supervisor and be in close attendance on the Site to ensure the highest quality of sampling and testing is achieved and to ensure that adequate safety standards are maintained.

At least one representative of the Contractors staff shall be a fully trained first aider and hold a current certificate. Should this person not be in attendance for the whole of the works, a replacement first aider shall form part of the Contractors staff.

All drillers employed on the contract shall be British Drillers Association (BDA) accredited. Selection of drillers shall be to the Approval of the Investigation Supervisor, and preference will be given to those with local experience of drilling.

S1.8.4 Provision of ground practitioners and other personnel (Clauses 4.3.6, 4.4.7 and 4.5.4)

No additional requirements for specialist technical support are anticipated.

S1.8.5 Hazardous ground, land affected by contamination and notifiable and invasive weeds (Clauses 3.5.2 and 3.5.4)

The site has been classified yellow site in accordance with the British Drillers Association (2008) 'Guidance For Safe Intrusive Activities On Contaminated Or Potentially Contaminated Land'. If presence of Asbestos is found on site during GI works, the classification shall automatically change to a red site.

S1.8.6 Additional information on utilities not shown on Contract drawings (Clause 3.5.1 and 5.5)

The GPR survey is contained within Appendix K.

The Principal Contractor is responsible for undertaking a STAT search to identify and locate any buried services which may be influenced by the proposed GI works.

All available information obtained by the Designer shall be made available to the Principal Contractor prior to commencement. The Principal Contractor shall also be made aware of all outstanding enquiries. However, no guarantee is given in relation to the accuracy or completeness of the information provided. The Principal Contractor must satisfy themselves that adequate documentary searches have been undertaken and exercise judgement as to the suitability of all proposed exploratory hole locations.

Irrespective of the above, the Principal Contractor will be required to use an appropriate device to check for buried services before commencing each exploratory location and undertake his own safe digging practices.

All proposed works for the site and operatives working on the site must follow the requirements of the HSE Guidance Notes 'HSG47: Avoiding danger from underground services' (Third Edition) and 'GS6: Avoiding danger from overhead power lines' (Fourth Edition). These documents can be downloaded free of charge from the HSE website (<http://www.hse.gov.uk/>).

S1.8.7 Known/suspected mine workings, mineral extractions, etc (Clause 3.5.2 and 3.5.5)

As per the Phase 1 Geo-environmental Desk Study there are no active or closed surface or underground workings recorded on site or within 500m of the site. There are no coal mining or non-coal mining areas within 500m of the site.

There are two historical surface ground workings, identified from historical mapping, within 250m of the site:

- Water body – approximately 150m southeast
- Pond – approximately 250m southwest

S1.8.8 Protected species (Clause 3.5.3)

No ecological surveys or reports were available for review at the time of this specification. There has been an Ecological Impact Assessment in which the risk was reported to be low. If invasive species are seen on site, the Contractor is to make the Principal Designer and Investigation Supervisor aware. Risk of invasive species is low due to the site being located in an urban area.

S1.8.9 Archaeological remains (Clause 3.5.6)

Greater Manchester Archaeological Advisory Service (GMAAS) have reviewed the Site and do not consider there to be any features of archaeological significance present on the Site. A Letter from GMAAS supporting this conclusion is submitted in support of the planning application.

S1.8.10 Security of site (Clause 4.3.5)

The Principal Contractor shall agree a suitable compound location with the landowner and Client prior to the ground investigation works commencing. The Principal Contractor shall arrange any site/plant security requirements considered necessary to undertake the works, as specified in Clause 4.3.5.

The Principal Contractor shall make suitable arrangements to provide security at the Site Compound to ensure that plant and equipment are secured and that there is no unauthorised access outside working hours.

Site access shall be via accepted routes agreed in advance with the landowner, Client and Investigation Supervisor. Exploratory holes shall be fenced off using Heras fencing or similar to demarcate the working area, and to prevent unauthorised access and create a safe work zone. No plant, equipment or open excavations shall be left unattended unless adequately secured.

S1.8.11 Traffic management measures (Clause 4.3.6)

The Contractor should undertake a site walkover prior to mobilisation to determine access routes for each of the exploratory holes. If the Contractor deems that any of the exploratory holes will require traffic management measures; then it will be the Contractors responsibility to implement traffic and safety measures for the site operations.

S1.8.12 Working hours (Clause 4.3.7)

The date and time of the works are to be agreed with the NHS Trust prior commencing. Allowance to be made for weekend working between 08:00 to 18:00 hrs.

The Principal Contractor is responsible for ascertaining any local authority conditions in relation to Sections 60 and 61 of The Control of Pollution Act 1974 which may limit working hours.

Any further restrictions on working hours or access hours will be notified by the Investigation Supervisor.

The Principal Contractor is required to agree variations to working hours and any time restrictions with the Investigation Supervisor prior to commencement of the ground investigation.

S1.8.13 Trainee site operatives (Clause 4.5.2)

Trainee operatives will be permitted but only as an addition to a fully qualified Lead Driller. If the Contractor chooses to have trainee site operatives on site, they shall notify the Investigation Supervisor 48 hours before the trainees attend site and demonstrate that appropriate safety measures are in place.

Trainee operatives in boring and drilling may hold a red CSCS trainee card but must be under the direct supervision on site of a CSCS Land Drilling (Lead Driller) cardholder and under any other constraints set by the induction at works commencement.

S1.8.14 Contamination avoidance and/or aquifer protection measures required (Clauses 3.6.7, 3.6.8 and 6.1)

The Contractor shall operate an Environmental Management System compliant with ISO 14001.

The Contractor shall be responsible for dealing with any waste, whether it be solid, liquid or gaseous, arising during the course of the ground investigation works, or after the works, and shall clean and make good all working areas to their previous condition or equivalent to the satisfaction of the Investigation Supervisor, Client and the land owner or stakeholder.

Excess spoil shall be removed from the site by the Contractor and disposed of in an appropriate manner to an appropriate permitted landfill, in accordance with Landfill Regulations 2002 (as amended) and the waste classification and assessment technical guidance WM3.

Contaminated materials and arisings shall where necessary be disposed of at an appropriate licensed landfill site. Copies of licence agreements and chains of custody for disposal of contaminated samples shall be submitted to the Investigation Supervisor for quality assurance purposes.

Borehole casing shall be used when drilling through contaminated ground to prevent the spread of contaminants and to protect against cross-contamination of samples. If drilling is likely to penetrate an aquifer then a double casing arrangement may be necessary.

Aquifer protection will be required when exploratory holes penetrate through an aquiclude into an underlying aquifer to prevent upward/downward groundwater migration i.e. into the underlying sandstone. Aquifer protection is particularly important where the ground overlying the aquiclude is contaminated. Multiple aquifers (including perched water systems) will need the protection measures repeated for each aquiclude/aquifer system. The protection measures may be formed by:

1. Boring or drilling (both with temporary casing) a suitable depth into but not penetrating through the aquiclude.
2. Forming a bentonite plug in the base of the hole then pulling back the temporary casing to just below the top of the bentonite seal.
3. Installing a secondary smaller diameter temporary casing through the seal to the depth required.

When only a single aquiclude/aquifer boundary is penetrated the depth to which the secondary temporary casing extends will be governed by the need to prevent collapse of the exploratory hole wall. Where the hole is to penetrate through more than one aquiclude/aquifer boundary the secondary temporary casing must be extended into the lower aquiclude, then steps 'b' and 'c' above repeated with a tertiary casing.

Arisings shall be placed upon polythene sheeting, and in wet, or windy weather shall also be covered, to prevent the spread of contaminated material. Where necessary provision shall be made for collection and disposal of contaminated wash water and groundwater to an approved disposal site.

All equipment shall be thoroughly cleaned before being used on site. Jet washing equipment shall be provided to wash down relevant equipment and tools before starting each exploratory hole.

A clean, stainless-steel trowel shall be used to collect soil samples for geo-environmental testing and shall be cleaned between samples. When working on land affected by contamination, the Contractor shall clean equipment before leaving the site.

The Contractor may only use vegetable-oil-based lubricants on any equipment that may contact ground or groundwater.

S1.8.14.1 Prevention and Minimisation of Pollution of Controlled Waters

The Contractor shall develop and implement as necessary any contingency measures for the control of spillages of hazardous substances either on land or into local watercourses. Preventative measures to avoid any such spillages should be reviewed to avoid any recurrences.

In executing any ground investigation works precautions must be taken to secure the complete protection of rivers, streams, ditches other watercourses and water in underground strata against silting, erosion or pollution. If notwithstanding these precautions, such silting, erosion or pollution does take place then the Environment Agency should be advised immediately and immediate action should be agreed and taken to minimise the effect on the watercourse.

No material intended for or arising from the ground investigation works and no equipment or other items for use in executing the works shall be stored or disposed of in a watercourse or in a position where it may fall or be washed into a watercourse or water body. Any such material or equipment that gets into a water body shall be removed immediately.

Washwaters from mobile pressure washers shall not be discharged to surface water drains, watercourses or soakaways. Detergents, including those described as bio-degradable shall not be discharged into surface water drains. Where possible washing activities shall be carried out in a designated area draining to the foul sewer or contained within a sealed drainage system or catchpit for offsite disposal by a licensed waste Contractor. It is the responsibility of the Contractor to obtain authorisation to discharge to the foul sewer from the sewerage undertaker.

The Contractor shall obtain approval for all temporary discharges to and abstractions from watercourses from the appropriate Agency and other appropriate bodies and shall comply in all respects with their requirements.

No water shall be discharged from the site to any watercourse, drain or soakaway without obtaining the appropriate consents, permissions or licences.

The Contractor shall use bio-degradable hydraulic oils in equipment working over or adjacent to water, and within aquifers.

S1.8.15 Maximum period for boring, pitting or trenching through hard stratum or obstruction (Clauses 2.11, 6.3.5 and 7.5)

Where a hard stratum or obstruction is encountered, the Contractor shall employ hard boring techniques for a period of up to 1 hour. Should this not penetrate through the hard stratum or obstruction the Contractor shall immediately inform the Investigation Supervisor and await instruction.

S1.8.16 Reinstatement requirements (Clauses 3.6.5 and 4.3.2)

The Investigation Supervisor shall be consulted prior to backfilling of any exploratory excavation, or demobilisation of plant at any location. On completion of drilling or excavation works all exploratory holes, trench locations and access ways shall be reinstated to the satisfaction of the Investigation Supervisor, Client, the land owner and/or stakeholder.

Arisings requiring disposal may only be disposed of on site with prior agreement from the Investigation Supervisor.

Trial pits shall be neatly backfilled and left slightly proud of the ground surface to allow for settlement. Reference should be made to S1.14.6 for backfilling requirements

Prior to commencement of the works a pre-entry photographic survey of all investigation works and access routes shall be undertaken by the Principal Contractor. Upon completion an exit survey shall also be undertaken.

On completion of the site works, or at other periods if required by the Investigation Supervisor, the Contractor shall reinstate the site and access routes and remove all plant, equipment, surplus material, spoil etc. to the satisfaction of the Investigation Supervisor, Client and the land owner or stakeholder. The expense of reinstating avoidable damage shall be borne by the

Contractor. Damage assessed as unavoidable and agreed by the Investigation Supervisor shall also be reinstated but the Contractor will be reimbursed accordingly.

The Contractor shall be responsible for removing and dispensing all spoil and contaminated materials off site, including all costs, arising from the ground investigation works.

S1.8.17 Welfare and other facilities required (Clauses 2.25, 4.3.2 and 4.3.4)

Welfare facilities shall be provided by the Contractor. The welfare facilities must meet the requirements set out in Schedule 2 of CDM (2015) regardless of whether an investigation is notifiable or not.

Activities which involve hand to mouth contact, such as eating and smoking, shall be restricted to designated “clean” areas where hygiene facilities are provided.

S1.8.18 Unavoidable damage to be reinstated by Contractor (Clauses 4.3.1 and 13.1)

Clause 3.6.1 should be followed by the contractor where unavoidable damage occurs onsite.

All parties are to agree the condition of the site prior to work commencing. Damage resulting from the work should be subject to an agreed joint record by the Investigation Supervisor and the Principal Contractor. Photographic condition surveys are to be carried out before and after the works.

All damage, or claims by owners or occupiers for compensation, shall be reported to the Investigation Supervisor. All damage is required to be made good by the Principal Contractor prior to leaving the site and in a manner to be agreed with the Investigation Supervisor. Damage assessed and agreed by the Investigation Supervisor as unavoidable (e.g., rutting of access routes under normal plant passage) will be reimbursed in accordance with the Contract.

Protection measures to be taken and reinstatement standards in respect of crops and cultivated areas shall be agreed with the Investigation Supervisor in advance of commencement of the works.

S1.8.19 Surveys (Clauses 5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8 and 5.9)

The indicative locations of the exploratory holes are shown on the Exploratory Hole Location Plans provided in Appendix A.

The positions of the exploratory holes are to be set-out by the Principal Contractor, and to be agreed with the Investigation Supervisor on site.

On completion of the fieldwork, the Contractor shall be responsible for locating each exploratory hole location with a horizontal accuracy of +/- 100mm and reported to National Grid co-ordinates. The level of each exploratory hole shall be established with an accuracy of +/- 10mm. As-built drawings showing the location and elevation of all exploratory holes shall be completed and presented within the Principal Contractors Factual Report.

The Principal Contractor may elect to survey the exploratory hole locations using a Differential Geographical Positioning System (DGPS) or alternative surveying method, as approved, in advance, by the Investigation Supervisor. All co-ordinate information (Easting and Northing) and levels (m AOD) shall be provided to the Investigation Supervisor on all exploratory hole logs as well as in XYZ format within the AGS data.

Where exploratory holes are assessed to be within 10m of a known buried utility, a PAS 128 Level B survey is required at the exploratory location to aid the avoidance of buried utilities. The survey shall comprise a M3P clearance survey and cover a suitable distance (approximately 5

m ×5 m) around each location to allow satisfactory results to be obtained, including adequate post-processing.

The Principal Contractor should provide details within their proposal clarifying the programming of the ground-penetrating radar (GPR) clearance and associated post-processing, in relationship to the intrusive field work, ensuring adequate time is allowed for between these activities.

The positions of the exploratory holes are to be set-out by the Contractor.

S1.8.20 Inspection and survey records requirements (Clauses 5.2 and 5.10)

A pre and post-condition survey shall be carried out by the Principal Contractor in consultation with the Investigation Supervisor. The pre-condition survey shall be carried out at least 48 h prior to when the ground investigation works are to commence.

As specified in Clause 5.2. The Contractor shall take the photographs as detailed in Clause 5.10. Once the raw files have been approved by the Investigation Supervisor, the Contractor should present them with the Ground Investigation Factual Report.

Sufficient colour photographs are required to show the condition of the site prior to the start of the investigation works and an analogous set of photographs on completion of the investigation.

Each core box should be photographed after the liner has been split and prior to logging. Each photograph shall clearly show all the necessary details and contain a graduated scale along with a standard colour chart and monochrome step wedge.

S1.8.21 Contractor's key programme dates

The Contractor shall agree a date of mobilisation, programme, sequence of implementing the fieldworks and dates of submissions of preliminary engineering logs, draft and final factual reports and other deliverables with the Employer and Investigation Supervisor's Representative in accordance with the timescales given in the Table below and S1.24.

Table 4: Programme Dates

Work Item	Reporting & Timescales	Investigation Supervisor approval/response time periods
Preliminary records (including exploratory holes, in situ test results and geotechnical laboratory schedule)	Submission within 2 working days of completion of the exploratory hole	5 Working days
Draft engineering log	Submission within 3 working days of completion of the exploratory hole	5 Working days
Laboratory test schedules	Submission of laboratory test schedules to the Investigation Supervisor's within 3 working days of completion of each exploratory hole	5 Working days
Laboratory testing results (contamination)	Provide within 10 working days of each completed schedule being submitted to the contractor	5 Working days
Laboratory testing results (geotechnical and chemical)	Provide within 20 working days of each completed schedule being submitted to the contractor	5 Working days
Health and Safety file (in accordance with CDM 2015)	Provide within 10 working days after the completion of the site works and demobilisation	10 Working days

Work Item	Reporting & Timescales	Investigation Supervisor approval/response time periods
Draft Factual Report (including AGS data)	Provide within 5 working days after the completion of the laboratory testing	10 Working days
Final Factual Report (including AGS data)	Provide within 10 working days after comments from the Investigation Supervisor's Representative	10 Working days

S1.8.22 Land entry, access routes and restrictions (Clause 3.6.3)

The Client will be responsible for landowner agreements and licensing. The Contractor will be responsible for daily correspondence with the land agents and ensuring all landowners or stakeholders are notified of the commencement date of any ground investigation works on their land and anticipated occupation period.

For day to day liaison with the land agents and landowners or stakeholders, including agreeing access times, access routes, working space requirements and protection measures, it will be the responsibility of the Contractor to follow the protocol developed by the Land Agent on behalf of the Employer

S1.8.23 Sub-Contractors

Particular details of the Nominated Sub-Contractor(s) and the services they will provide to the ground investigation shall be stipulated by the Contractor prior to commencement of the works.

Any sub-contractor not nominated by the Investigation Supervisor, to be engaged by the Contractor shall require the prior approval of the Investigation Supervisor.

The Contractor shall be responsible for the services to be provided by the sub-contractor, whether nominated or not and shall be liable for defects and omissions from them.

S1.8.24 General safety requirements (Clause 3.4)

S1.8.24.1 Safety legislation (Clause 3.4.2)

The investigation shall comply with all relevant safety legislation as stated in the ICE Specification, in addition account should also be taken of the guidance contained in:

- Health and Safety Manual for Land Drilling: A Code of Safe Drilling Practice (BDA, 2002).
- Guidance notes for the protection of persons from rotating parts and ejected or falling material – involved in the drilling process. (BDA)
- Guidance for the safe operation of cable percussion rigs and equipment (BDA).
- Guidance for the safe operation of dynamic sampling rigs and equipment (BDA, 2007).
- Guidance for safe intrusive activities on contaminated or potentially contaminated land (BDA, 2008).
- Working practices shall conform with the Health and Safety Executive Guide “Protection of Workers and the General Public during Development of Contaminated Land, 1991” and the “Site Investigation in Construction Part 4: Guidelines for the safe investigation by drilling of landfills and contaminated land” published by Thomas Telford in 1993.
- The Contractor shall draw the attention of all personnel working on the chemical investigation to the nature of the possible contamination and the need to take any precautionary measures in handling the material.

S1.8.24.2 Construction (design and management) Regulations (2015)

Ground Investigation falls within the CDM 2015 definition of “construction work” and apply to ground investigation projects.

The Contractor shall allow within their rates, for compliance with their obligations under CDM 2015 as ‘Contractor’ or ‘Principal Contractor’ to include but not limited to the production of all supporting health and safety documentation, and provision of sufficient welfare facilities in respect of the number of personnel, type and duration of works.

S1.8.24.3 Risk assessment and method statements (Clause 3.4.3)

Prior to the start of Site Operations, the Contractor shall provide to the Investigation Supervisor risk assessments and method statements covering all aspects of the work to be carried out. **A Construction Phase Plan shall be prepared in accordance with CDM 2015 and submitted to the Investigation Supervisor whether the project is notifiable or not.** Mott MacDonald shall provide to the Contractor their design CDM risk register for the GI highlighting any residual risks that may not be obvious to a competent Contractor.

The Contractor's risk assessment and method statement should address, but not limited to:

- All Site Operations activities (e.g. percussion drilling, dynamic sampling, rotary drilling, excavations, sampling, in-situ testing, etc.).
- Provisions for dealing with ground gas.
- Working on land affected by contamination.
- Working safely in the vicinity of buried services.
- Working on/in derelict sites and structures.
- Provisions for dealing with mine workings, mineral extractions, quarries, shafts or similar works within the area and at a depth likely to affect the proposed investigation.
- Working on railway land.
- Working on highways.
- Provisions for dealing with asbestos.
- Controlling the risk of excavation instability.
- Measures when unexploded ordnance may be present.
- Biological hazards (e.g. Weil's disease, tetanus).
- Confined spaces working.
- Exposure to noise.
- Manual handling.
- The proposals for restoration of exploratory holes so that they do not become a hazard to the public or the environment; backfilling with arisings may not be acceptable.
- Provision for the collection and safe disposal of contaminated soil and liquid arisings from exploratory holes.
- Procedures to be adopted to protect the environment (e.g. not to place contaminated soil onto unprotected ground and aquifer protection).
- Very restricted addition of water because of the danger of spreading contamination.
- Procedures to be adopted where routine geotechnical testing is required on samples suspected or known to be contaminated.

NO WORK SHALL BE CARRIED OUT WITHOUT RECORDED EVIDENCE THAT A RISK ASSESSMENT HAS BEEN CARRIED OUT AND METHOD STATEMENTS HAVE BEEN PREPARED AND ARE AVAILABLE.

S1.8.24.4 Buried and overhead services detection (Clauses 5.5, 3.4.3 and 3.5.1)

Buried and overhead services present a risk to safety, especially where work involves penetrating the ground. Where such work is undertaken precautions must be implemented to manage and/or reduce the risk of encounter with services.

Unless strong evidence suggests otherwise, the presence of services must be expected. Therefore, all exploratory hole locations shall be undertaken through the implementation of a Safe System of Work.

The key elements of the Contractor's Safe System of Work shall include but not be limited to the following:

- Planning and risk assessment.
 - The Works shall be carefully planned and risk assessed before it commences.
- Obtaining buried and overhead services maps and plans.
 - CDM 2015 places duties on Clients to 'provide appropriate pre-construction information to designers and contractors' and task all parties with 'allowing sufficient time to obtain vital pre-construction safety information'. Services maps and plans shall be available at the respective worksite at all times.
- Scanning with a Cable Avoidance Tool (CAT) and generator by a Qualified Operator.
 - Cable Avoidance tools and signal generators should be selected as appropriate to the site conditions and services expected. All staff that uses such tools/equipment must be competent to do so and similarly must understand the limitations of the equipment. CAT scanning shall be carried out prior to commencement, at frequent intervals during and on completion of the inspection pit.
- Safe digging practices.
 - Where the presence of services is suspected or known to be within an area likely to be disturbed by the works, it must be positively located and identified. Such works shall be undertaken by operatives who are trained and competent in safe digging practices. Further guidance on safe digging practices and avoiding the dangers from underground services is given in the HSE publication HSG 47.
 - Excavations should be risk assessed prior to commencement and monitored during excavation by a Qualified Operator.

S1.8.24.5 Permit to Dig System

A "Permit to Dig" system shall form part of the 'safe digging practices' and be employed for all exploratory holes. The details of the Contractor's proposed "Permit to Dig" system shall be provided with the necessary health and safety documentation.

Copies of the Permit to Dig shall be provided with the respective method statement. Copies of the permit to dig and service location plans shall be held at each exploratory hole location and be readily available for inspection. Consultation of service drawings, CAT scanning and hand excavation of an inspection pit shall be considered by the Contractor for all excavations.

S1.8.24.6 Excavations

Excavations should be risk assessed by the Contractor's Qualified Operator prior to commencement. The risk assessments should include but not be limited to risks associated with:

- Excavation stability.
- Confined spaces working.

- Groundwater ingress.
- Falling into excavations.

S1.8.24.7 Specific Rig and Equipment Safety Requirements

Hazards related to drill rig operations are included in BS EN 791:1996, Drill Rigs – Safety. These should be referred to when the Contractor undertakes any risk assessment for any specific drill rig type.

Rig Examination Report (LOLER)

- The Lifting Operations and Lifting Equipment Regulations (LOLER) define lifting equipment as:
 - “work equipment for lifting and lowering loads and includes its attachments used for anchoring, fixing or supporting it”.
 - Therefore, LOLER applies to the drilling rigs included in the Ground Investigation Services Framework Agreement Document (2014). As such, the following requirements apply as a minimum for the Ground Investigation Services Framework Agreement (2014):
- The rig must be thoroughly examined in accordance with an examination scheme drawn up by a competent person/Qualified Operator, or, in the absence of such an examination scheme, at least every 12 months (Regulation 9 of LOLER).
- The rig must be accompanied by a certificate to the effect that the last thorough examination has been carried out and has not expired.
- Accessories for lifting (e.g. shackles, swivels, etc) are subject to a regular examination scheme by a competent person, or, in the absence of such an examination scheme, at least every 6 months (Regulation 9 of LOLER).
- Lifting accessories must be accompanied by a certificate to the effect that the last thorough examination has been carried out.
- All lifting accessories must have sufficient load carrying capacity for the operation to be undertaken safely and should be tagged with their Safe Working Load (SWL) and a unique identification mark.
- Wire ropes in use with the rig shall be thoroughly inspected, before each shift, by a competent person/ Qualified Operator, and the results recorded and readily available.

Rotating Transmission Parts (PUWER)

- Access to dangerous parts of machinery must be prevented by using “fixed guards where practicable” under the Provision and Use of Work Equipment Regulations 1998 (PUWER).
- PUWER lays out a clear hierarchy of protective measures to prevent access to EVERY dangerous parts of machinery. This is further clarified with direct reference to the drilling industry in “Guidance Notes for the Protection of Persons from Rotating Parts & Ejected or Falling Material Involved in the Drilling Process” (BDA). The hierarchy is as follows:
 - A fixed guard that requires physically unbolting.
 - A moveable guard with an interlock cutting rotational power or significantly reducing rotational speed, when opened.
 - An adjustable guard (i.e. a fixed or moveable guard with adjustable parts or whole), the adjustable part must be interlocked. These are commonly described as “telescopic”.
 - A caged working area that is interlocked thus preventing risk from rotation when anyone is in the area.

Each worksite shall be kept tidy with the Contractor paying particular attention to eliminating slip and trip hazards. The Contractor shall ensure, before work commences:

- That work area is cleared of debris, brambles and the like.
- Drill equipment (e.g. SPT hammers, drill rods, casings, etc) are kept clear of the working area.
- Arisings are kept clear of the working area.
- Where ground protection is required by the Contract that the working surface is covered with a suitable non-slip covering (e.g. "Mayo mats"). Plastic sheeting alone is not acceptable as these create severe slip hazards.

The Investigation Supervisor may reject rig and/ or equipment after arriving at site, if it is considered that the rig and/or equipment fails to comply with the rig and equipment safety requirements.

S1.8.24.8 Personal protective equipment

All site staff shall be provided with, and properly use, the Personal Protective Equipment (PPE) appropriate to the work involved and the categorisation of the site as per Guidance for safe intrusive activities on contaminated or potentially contaminated land (BDA, 2008).

Where the Investigation Supervisor is aware of the need for PPE over and above statutory requirements, this shall be identified. If additional PPE is to be provided by the Contractor for sole use of the Investigation Supervisor this shall be identified in Schedule S3.6.

S1.8.24.9 Task/activity briefing

The Contractor shall prepare Task/Activity Briefing sheets describing both the site specific information and task/activity details. This will include but not be limited to the management and control of health, safety and environmental protection. This information is required to be briefed by the Contractor's Agent for the Works to all personnel on site involved in the works.

S1.8.24.10 Health and safety monitoring and reporting

Where required a health and safety report shall be submitted to the Investigation Supervisor on completion of key stages of the Contract or at set Contract intervals. The report shall include the requirements set out below, as appropriate to the Contract.

- Statutory Reporting – Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR)
- Details of accidents and incidents as reportable under RIDDOR. This information shall identify:
 - Fatalities in the period.
 - Reportable injuries as defined under RIDDOR regulations.
 - Lost Time Reportable Injuries other than those reported as a Specified Injury (above) – i.e. over seven day injuries.
- Other non RIDDOR events
 - Accidents Lost Time – Accidents where an employee is absent from work for part of a shift but less than 3 days.
 - Accidents other – all accidents involving personal injury.
 - Incidents – All other incidents, irregular working and near misses.
- Hours Worked
 - All contractors' hours worked at all work site locations by permanent, temporary and subcontract staff on activities directly delivering, or in support of, the Contract.
- Other

- Records of drills, testing, Fire Officer visits, etc.
- Tool box talks, task/activity briefings, etc records.

S1.8.25 British Standards and Equivalent (Clause 3.1)

As specified in Clause 3.1.

The Works shall be carried out in accordance with relevant British Standards or equivalent European Standards. The suite of applicable British Standards is undergoing change in light of the publication of new European Standards.

These include, but are not limited to, the following:

- BS EN 1997-2:2007 – Ground Investigation and Testing.
 - NA to BS EN 1997-2:2007:2009 - UK National Annex to Eurocode 7: Geotechnical design. Ground investigation and testing.
 - BS EN ISO 14688 – Identification and classification of soil.
 - BS EN ISO 14688-2:2018 – Identification and description.
 - BS EN ISO 14688-2:2018 – Principles for classification.
 - BS EN ISO 22475 – Sampling Methods and Groundwater Measurement.
 - BS EN ISO 22475-1:2006 - Technical principles for execution.
 - BS EN ISO 22475-2:2011 - Qualification criteria for enterprises and personnel.
 - BS 22475-3:2011- Conformity assessment of enterprises and personnel by third party.
 - BS EN ISO 22476 – Field Testing.
 - BS EN ISO 22476-3+A1:2011 – Standard Penetration Test
- BS 5930:2015 + A1 2020 - Code of practice for site investigations.
- BS 1377:1990 Parts 1 to 9 – Methods of test for soils for civil engineering purposes. [With the exception of the following which partially supersede BS 1377-2]
 - BS EN ISO 17892-1:2014 Geotechnical Investigation and Testing – Laboratory testing of soil. Determination of water content.
 - BS EN ISO 17892-2:2014 Geotechnical Investigation and Testing – Laboratory testing of soil. Determination of bulk density.
 - BS EN ISO 17892-3:2014 Geotechnical Investigation and Testing – Laboratory testing of soil. Determination of particle density.
 - BS EN ISO 17892-4:2016 Geotechnical Investigation and Testing – Laboratory testing of soil. Determination of particle size distribution.
 - BS EN ISO 17892-5:2017 Geotechnical Investigation and testing – Laboratory testing of soil. Incremental Loading Oedometer Test.
 - BS EN ISO 17892-8:2018 Geotechnical Investigation and testing – Laboratory testing of soil. Unconsolidated Undrained Triaxial Test.
 - BS EN ISO 17892-12:2018 Geotechnical Investigation and testing – Laboratory testing of soil. Determination of Liquid and Plastic Limit.
- BS 10175:2011+A2 2017 – Investigation of potentially contaminated sites – Code of Practice.
- BS EN 12475-3:2002 - Characterisation of waste. Leaching. Compliance test for leaching of granular waste materials and sludges. Two stage batch test at a liquid to solid ratio of 2 l/kg and 8 l/kg for materials with a high solid content and with a particle size below 4 mm (without or with size reduction).
- BS EN ISO 5667 (also BS 6068-6-11:2009) – Water Quality Sampling.

- BS EN ISO 5667-3:2012 – Preservation and handling of water samples.
- BS EN ISO 5667-11:2009 – Guidance on sampling of groundwaters.
- BS EN ISO 18512:2008 – Soil quality – Guidance on long and short term storage of soil samples.
- BS EN ISO/IEC 17025:2017 – General requirements for the competence of testing and calibration laboratories.
- EN 791:1996 – Drill Rigs – Safety.
- BS EN 953:1998 - Safety of Machinery – Safety of machinery. Guards. General requirements for the design and construction of fixed and movable guards (incorporating Amendment No. 1, 2009)
- BS 5228 - Code of practice for noise and vibration control on construction and open sites.
 - BS 5228-1:2009 (+A1:2014) – Noise.
 - BS 5228-2:2008 (+A1:2014) – Vibration.
- BS EN 197-1:2011 – Cement Part 1. Composition, specifications and conformity for common cements
- BS EN ISO 9001 - Quality
- BS EN ISO 14001 – Environmental Management Systems
- BS OHSAS 18001 – Management systems – requirements

S1.8.26 General environmental requirements

The Contractor shall include pollution, noise and vibration, dust, dirt and emissions management and prevention measures within the site planning and implement an Environment Protection Plan (EPP), which must be submitted to the Investigation Supervisor prior to the commencement of the Site Operations. The form and extent of the EPP should reflect the size and environmental risks associated with the particular Contract.

The Contractor must provide recorded evidence that an environmental risk assessment (ERA) identifying what aspects of the Contractor's work on the Contract will have an environmental impact and require action by the Contractor. The ERA shall be included within the EPP.

S1.8.26.1 Control of pollution

The Contractor shall include pollution prevention measures within the site planning and implement an Environmental Protection Plan (EPP).

In executing any works, precautions must be taken to ensure the complete protection of encountered watercourses and water in underground strata against silting, erosion, or pollution. Notwithstanding these precautions, if such silting, erosion or pollution does take place then the Environment Agency should be advised immediately and immediate action should be taken to minimise the effect on the watercourse.

The Contractor must implement measures to prevent and minimise pollution of surface water.

These shall include, but not be limited to:

- No material intended for or arising from the Works and no equipment or other items for use in executing the Works shall be stored or disposed of in the watercourse or in a position where it may fall or be washed into the watercourse. Any such material or equipment that gets into a watercourse shall be removed immediately.
- Wash waters from mobile pressure washers shall not be discharged to surface water drains, watercourses, or soakaways.

- Detergents, including those described as biodegradable, shall not be discharged to surface water drains.
- Where possible, washing activities shall be carried out in a designated area draining to the foul sewer or contained within a sealed drainage system or catch pit for offsite disposal by a licensed waste contractor.
- It is the responsibility of the Contractor to obtain authorisation to discharge to the foul sewer from the sewerage undertaker.
- No water shall be discharged from the site to any watercourse, drain, or soakaway without obtaining the appropriate consents, permissions, or licences.
- The Contractor shall use biodegradable hydraulic oils in equipment.
- All oil stored on site shall comply with the Control of Pollution (Oil Storage) Regulations 2001 and the guidance contained within Environment Agency Pollution Prevention Guidance Note 2 (PPG2).
- Only construction equipment and vehicles free of all oil and/or fuel leaks will be permitted on site.
- All stationary plant shall be positioned on drip trays to contain oil leaks.
- Development of a refuelling protocol for the Site Operations.
- All site personnel shall be aware of the appropriate action in the event of an emergency, such as the spillage of potentially polluting substances.
- Spill kits are available on site.

S1.8.26.2 Noise and vibration

The Contractor shall include noise and vibration prevention measures within the site planning and implement an Environment Protection Plan (EPP). The Contractor must also confirm that consultation with the Local Authority has taken place in order to ascertain local authority conditions in relation to Sections 60 and 61 of The Control of Pollution Act 1974.

Mitigation measures should include, but not be limited to:

- The Contractor will as a minimum comply with BS 5228 'Code of practice for noise and vibration control on construction and open sites.
- Avoid unnecessary revving on engines and switch off equipment when not required.
- Ensure plant and vehicles are properly maintained to meet the manufacturers' noise rating levels.
- Keep all access/egress routes well maintained.
- Use enclosures for noisy plant such as pumps or generators.
- Minimise drop height of materials.
- Ensure that plant and vehicles operate with noise control hoods closed.

The Contractor shall maintain a record of all complaints received concerning noise and shall promptly notify the Investigation Supervisor of such complaints.

If complaints about excessive noise and/or vibration are received, the Contractor shall immediately take all measures necessary to demonstrate to the Investigation Supervisor that all requirements are being complied with not more than 24 hours after notification of the complaint.

S1.8.26.3 Dust/Dirt and Emissions

The Contractor shall include measures to reduce as low as reasonably practicable (ALARP) the generation/spread of dust/dirt and emissions associated with the Site Operations. Such measures shall be presented in the Environment Protection Plan (EPP).

Such measures shall include, but not be limited to:

- Clean the wheels of vehicles leaving the site so that mud is not spread onto the highways.
- Ensure all plant and vehicles are in good working order with an up to date maintenance log.
- Vehicles shall keep to a maximum site speed limit of 5mph.
- Vehicles shall meet European Union (EU) emissions standard Euro 3 for particulate matter as a minimum.

S1.8.26.4 Complaints and interaction with the local community and/or site users

The Contractor shall maintain a record of all complaints received regarding the Site Operations, and shall promptly notify the Investigation Supervisor of any complaints.

All enquiries by site users and/or the local community regarding the Site Operations shall be referred to the Investigation Supervisor.

S1.8.26.5 Environmental monitoring and reporting

Where required an Environment report shall be submitted to the Investigation Supervisor on completion of key stages of the Contract or at set Contract intervals. The report shall include the requirements set out below, as appropriate to the Contract.

- Pollution Incidents
 - The number of major pollution incidents e.g. oil/diesel spill more than 20 litres.
 - The number of minor pollution incidents e.g. oil/diesel spill less than 20 litres.
 - The number of other types of contravention of environmental law, including the sub categories:
 - Disturbance to protected species.
 - Damage to protected sites.
 - All other incidents, irregular working and near misses.
- Complaints/ Enquiries
 - The number of approaches (including complaints and enquires) from environmental regulators.
 - The number of complaints/enquiries from Local Authorities (Including Section 60).
 - The number of Section 60 notices received.
 - The number of complaints/enquiries from other stakeholders including the general public.
- Other
 - Tool box talks, task/activity briefings, etc records.

S1.8.27 Unexploded Ordnance (Clause 5.6)

A UXO desk study / risk assessment has been completed by Zetica and is included in Appendix I. The site was found to be low risk. Any necessary mitigation measures shall be informed by this assessment.

S1.8.28 Other Contract restrictions/relaxations and requirements

NOT REQUIRED.

S1.9 Dynamic Sampling (Clause 6.2) – Particular restrictions/relaxations

S1.9.1 Permitted methods and restrictions (Clauses 6.1, 6.2.1, 6.2.2, 6.2.3, 6.2.4 and 6.2.5)

As specified in Clauses 6.2.1 – 6.2.5.

The text below applies to dynamic sample borehole with rotary core follow-on (BH201).

Dynamic sampler boreholes shall be commenced by a hand excavated inspection pit to 1.20m depth. All inspection pits shall be scanned with a cable avoidance tool (CAT) prior to commencement.

Should services be encountered, the borehole position shall be moved in accordance with the requirements of the Principal Contractor and Investigation Supervisor. The location and depth of any services or features encountered within the inspection pit shall be recorded and shown as a sketch to be presented with the borehole log.

No water shall be added to assist boring or drilling unless the Investigation Supervisor has given prior approval.

In potentially contaminated ground, appropriate measures are to be taken to avoid cross contamination between different borehole positions. Between exploratory holes, all equipment shall be cleaned (pressure washed) in a suitably bunded area. All arisings shall be contained, recovered, and disposed of appropriately as directed within S1.8.21.

Any groundwater encountered should be contained such that no groundwater will be discharged to the ground. The groundwater shall be contained, sampled, and analysed. If groundwater is found to be contaminated, then an appropriate waste management route shall be sought.

The use of mineral based oils and lubricants is prohibited. If lubrication of the drilling equipment is required, vegetable oils should be used and the quantities used must be kept to a minimum.

All surplus arisings from the boreholes shall be bagged and stockpiled before being disposed of at a licensed facility. Any material which appears to be contaminated (e.g. with odorous material, sheens, etc.) shall be double bagged and clearly labelled, and stored separately from the other material.

Apparently contaminated material shall not be disposed of until chemical testing is completed, and the quality of the arisings is known.

The Investigation Supervisor must approve termination of exploratory positions. If the Investigation Supervisor is not on site, the GI Contractor shall contact the Investigation Supervisor before terminating an exploratory position.

Where monitoring instruments (i.e. groundwater monitoring wells) are specified in any borehole, they shall be installed by the GI Contractor no later than 24hrs after completion of the exploratory holes. Details of installations shall be provided by the Investigation Supervisor who shall be consulted by the GI Contractor prior to the exploratory hole reaching its target depth to allow an instruction to be raised and mitigate against unnecessary standing time being incurred.

The GI Contractor shall ensure that soil or rock at the bottom of the exploratory hole is not disturbed by water entering or leaving the hole, or by stress relief. To this end, the water level in all exploratory holes shall be kept at least 1.00m above the groundwater level at all times during

the ground investigation. The removal of water from the casing by rapid withdrawal or close-fitting sampling equipment shall be avoided.

For dynamic sampler boreholes with rotary follow-on, temporary casing shall be left in place upon completion of the dynamic sampling borehole. Alternative methods for preventing hole closure/collapse prior to rotary follow on will only be permitted following agreement from the Investigation Supervisor.

S1.9.2 Backfilling (Clauses 6.1.2 and 6.2.6)

Backfill with arisings and minimum 1m bentonite seal unless otherwise stated in Schedule 2.

Groundwater monitoring installations shall have response zones that do not cross geological boundaries and should be adequately sealed though made ground to minimise potential cross-contamination of geological strata.

Approval shall be sought from the Investigation Supervisor prior to the termination and backfilling of each hole.

S1.10 Cable Percussion boring (Clause 6.3) - Particular restrictions/relaxations & requirements

NOT REQUIRED.

S1.11 Rotary drilling (Clauses 6.1, 6.4 and 6.4.6) - Particular restrictions/relaxations & requirements

Rotary drilling is required. A schedule of provisional rotary drilled borehole depths and locations is provided in Schedule 2.

S1.11.1 Augering requirements and restrictions (Clauses 6.1 and 6.4.3)

NOT REQUIRED.

S1.11.2 Particular rotary drilling techniques (Clauses 6.1 and 6.4.1)

The aim of the rotary drilling is:

- to obtain continuous high-quality cores that can be used for detailed logging and from which subsamples can be selected for laboratory testing
- to obtain samples for contamination analysis (if required).

The rotary drilling procedures shall be aimed at minimising the mechanical disturbance and the changes in water content and suction in the sample caused by the sampling process.

The equipment used shall incorporate triple-tube core barrels capable of obtaining cores from which Class 1 samples may be taken.

Rotary core drilling shall be carried out incorporating a semi-rigid removable inner liner to improve core recovery. A minimum Total Core Recovery of 95% is required for each run.

The Contractor shall achieve not less than 95% core recovery. If recovery falls below 95% the Contractor shall contact the Engineer immediately to discuss steps to rectify the problem. If in the opinion of the Engineer, the Contractor fails to take appropriate steps the Contractor may be required to re-drill all or parts of the drill hole again at his own expense.

Where 95% core recovery is not achieved a Standard Penetration Test (SPT) will be carried out in the rotary cored hole. The following core run will not be greater than 1m. This sequence will be continued until 95% or greater core recovery is achieved.

The Contractor should have access to a combination of methods, equipment and flushes to enable the coring technique to be varied to obtain maximum core recovery and minimise environmental impact. A method statement for drilling techniques and the range of equipment is to be maintained on site.

Rotary core drilling shall be carried out incorporating a semi-rigid removable inner liner to improve core recovery.

The Contractor should have access to a combination of methods, equipment and flushes to enable the coring technique to be varied to obtain maximum core recovery and minimise environmental impact. A method statement for drilling techniques and the range of equipment is to be maintained on site.

S1.11.3 Drilling fluid type and collection (Clause 6.4.2)

The drilling fluid shall normally be clean water, air or air mist. However, with the agreement of the Investigation Supervisor, non-toxic drilling muds, additives or foam may be used.

The Contractor shall propose appropriate flush that is suitable for the ground conditions and to ensure that the required total core recovery is achievable in the anticipated strata. The use of an appropriate flush medium shall be agreed with the Investigation Supervisor before the start of site works.

No drilling flush or returns are to escape to surface drainage or outside the limits of the designated working areas. All drilling flush is to be contained close to the hole by utilising, for example, sandbags and polythene sheeting to form an impermeable bund, as necessary. Drilling flush that is expended shall be pumped into a container to avoid ground contamination. All excess drilling flush is to be removed following completion of each hole. It shall be collected and stored prior to disposal at an appropriately licensed facility. Contamination testing of the flush may be required before disposal.

S1.11.4 Rotary core drilling equipment and core diameter (Clauses 6.4.1 and 6.4.4.1)

Rotary coring shall be carried out to recover core of a minimum diameter of 102 mm.

The Contractor shall select, maintain and operate all items of the drilling equipment to obtain not less than 95% recovery and the highest possible quality of core in the strata penetrated by each core run. Equipment that is broken, or worn to the extent that this recovery cannot be achieved shall be replaced.

The first drill run in each hole shall not exceed 1m in length. Subsequent drill runs shall not normally exceed 1.5m in length and the core barrel shall be removed from the drillhole as often as required to obtain the best possible core recovery.

The types, sequence, depths and variations in consistency of each stratum shall be recorded as drilling proceeds. Standard penetration testing shall be undertaken at the agreed depths in the boreholes.

Recovered cores shall be carefully transported and stored to prevent disturbance and interference from the weather at the end of each working day, a method shall be proposed by the Contractor, for approval by the Investigation Supervisor, to ensure recovered cores are adequately sealed to prevent loss of moisture and sample disturbance.

S1.11.5 Core logging (Clause 6.4.4.5)

The Contractor's site compound shall include all necessary facilities for core logging to be carried out on site. These shall include but not be limited to the following:

- Sheltered area to protect the logging engineer and the cores from the elements, with appropriate temperature control to allow for comfortable working conditions.
- Suitable lighting to allow for examination of the cores within the sheltered area.
- Suitable array of benches or stools to allow for comfortable working conditions for the logging engineer.
- Access to a water supply.

If the above detailed facilities are not available cores shall be logged at the Contractor's office facility that shall also include all necessary facilities for core logging.

Core logging shall include geological unit identification which shall be included within the borehole logs.

S1.11.6 Core sub-samples for laboratory testing (Clause 8.7.8)

Core subsamples shall be chosen in consultation with the Investigation Supervisor without delay following core retrieval (maximum of 2 days, assuming they are stored in a sealed liner) and avoiding any visible areas of drilling disturbance.

Methodology for sealing samples as set out in Clause 8.7.8 is to be followed, but the Contractor can supply changes/amendments to this methodology for the Investigation Supervisor's approval.

When transporting samples to the laboratory, the samples shall be handled with great care and be protected from vibration, sudden movement and excessive changes in temperature or humidity.

S1.11.7 Address for delivery of selected cores (Clause 6.4.4.8)

To be advised where applicable.

S1.11.8 Rotary open-hole drilling general requirements (Clauses 6.4.5 and 6.4.6)

NOT REQUIRED.

S1.11.9 Rotary open-hole drilling for locating mineral seams, mine workings, etc. general requirements (Clauses 6.4.5 and 6.4.6)

NOT REQUIRED.

S1.11.10 Core photographic requirements (Clause 5.8)

Photographs shall be taken using a minimum camera resolution of 10 megapixels. This photography shall be carried out in controlled conditions such that the colour temperature of the lighting can be maintained at a constant level. Each frame shall contain no more than two core boxes together. Photographs shall be in focus with colour charts and core box labels clearly set out. Sample photos shall be provided to the Investigation Supervisor for review and acceptance.

All cores shall be photographed with consistent lighting in a fresh condition. All excess flush shall be removed, as well as any smearing or surface disturbance. The photographs shall be photographed to meet the requirements in Clause 6.4.4.6.

S1.11.11 Core scanning requirements (Clause 6.4.4.7)

NOT REQUIRED.

S1.11.12 Backfilling (Clauses 6.1.2 and 6.4.7)

Approval shall be sought from the Investigation Supervisor prior to the termination and backfilling of each drillhole. All drillholes without instrumentation shall be backfilled with pumpable cement bentonite grout to the satisfaction of the Investigation Supervisor.

Groundwater monitoring installations shall have response zones that do not cross geological boundaries unless instructed by the Investigation Supervisor and shall be adequately sealed though all strata to minimise leakage and/or potential cross-contamination across geological strata.

S1.12 Sonic drilling (Clause 6.5) – particular restrictions/relaxations

S1.12.1 Permitted methods and restrictions (Clauses 6.1, 6.5.1, 6.5.2 and 6.5.3)

NOT REQUIRED.

S1.12.2 Backfilling (Clauses 6.1.2 and 6.5.4)

NOT REQUIRED.

S1.13 Pavement/concrete or structural coring (Clause 6.6) – particular restrictions/relaxations

S1.13.1 Permitted methods and restrictions (Clauses 6.1, 6.6.1 and 6.6.3)

Some exploratory holes may require breaking through/coring through hard-standing material.

S1.13.2 Backfilling (Clauses 6.1.2 and 6.6.4)

As per Schedule 2, concrete reinstatement required for areas in which hard standing material will be broken through/cored through.

S1.14 Pitting and trenching (Specification Section 6) Particular restrictions/ relaxations & requirements

All excavation works shall be undertaken in accordance with safe practices set out within HS(G)47 'Avoiding Danger from Underground Services'. Reasons for the premature termination of trial pits in soil strata above the scheduled depths shall be clearly shown on the trial pit logs, and shall be subject to the agreement of the Investigation Supervisor. Exposed services, obstructions, groundwater conditions and excavation stability shall be recorded and included in the exploratory hole records.

S1.14.1 PAS 128:2014 survey and inspection pits (Clauses 5.5 and 7.1)

A PAS:2014 survey (Type D and C) is a required procedure for the detection of buried services.

This shall include the excavation of inspection pits to 1.20m depth by hand prior to beginning drilling works. The area around the pit shall be scanned using a cable avoidance tool (CAT) prior to beginning excavation. If services are encountered in the pit, their location and depth

shall be recorded and shown as a sketch to be presented with the exploratory hole log. The exploratory hole shall then be moved to an alternative position as instructed by the Investigation Supervisor.

The GI Contractor shall make all reasonable on-site checks for buried services. The GI Contractor shall take all reasonable precautions to avoid damage to ducts, pipes or cables which are present on site in carrying out the works and shall protect and support them adequately during the contract and reinstate them on completion of the Site Operations to the satisfaction of the Investigation Supervisor.

For trial pits TP201 and TP202, the data listed below will be required:

- Dimensions of foundations
- Depths of foundations
- Sketches of foundations
- Foundation material
- Photographs

S1.14.2 Restrictions on machines or pitting/trenching methods (Clauses 7.2 and 7.4)

As specified in Clauses 7.2 and 7.4.

Reason for the premature termination of excavations in soil strata above the maximum scheduled depths shall be clearly shown on the exploratory hole logs and shall be subject to the agreement of the Investigation Supervisor. Exposed services, obstructions, groundwater conditions and excavation stability shall be recorded and included on the exploratory hole records. Machine excavated trial pits shall be progressed to the scheduled depth (or rockhead if encountered at shallow depth).

On land affected by contamination, the excavation shall proceed in a series of shallow 0.20m – 0.30m thick ‘scrapes’. Arisings from distinctly different soil strata shall be stockpiled on separate polythene sheets.

S1.14.3 Utility pits and trenches (Clause 7.3)

NOT REQUIRED.

S1.14.4 Alternative pit and trench dimensions (Clause 7.7)

NOT REQUIRED.

S1.14.5 Groundwater (Clause 7.9)

Groundwater abstracted from land suspected to be contaminated should be contained and should not be allowed to penetrate potentially non-contaminated strata and disposed of appropriately, as specified in Clause 7.9.

S1.14.6 Backfilling (Clauses 6.1.2 and 7.10)

Excavations shall be backfilled with the arisings in the reverse order to which they were excavated (i.e. last out, first in) corresponding to their excavated location. Topsoil (if present) shall be kept separate from the other soil layers. Backfill shall be nominally compacted in layers not greater than 200mm thick using the back of the excavator's bucket and the area left at approximate grade with the surrounding area. Excess arisings must be removed and not spread around the pit location. Where possible, turf shall be carefully replaced on top.

Where exploratory pits occur in areas of hardstanding, road pavements or similar, reinstatement to previous condition will be required and backfilling should be carried out using excavated material and compacted in layers to approximately 95% relative compaction (subject to the approval of the Investigation Supervisor) to minimise future settlement.

S1.14.7 Photographic requirements (Clauses 7.8 and 7.12)

Photographs shall be taken using a minimum camera resolution of 10 megapixels. Three photographs per trial pit should be taken; 1 x short face, 1 x long face and 1 x excavated spoil. Minimum number of 5 photographs shall be taken per each trench. The trench photographs shall document all found underground obstructions, short trench faces, long trench faces (1 photo every 3m) and excavated spoil.

Photographic records of the exploratory hole location shall be taken before and after the works.

S1.14.8 Artificial lighting (Clause 7.12)

NOT REQUIRED.

S1.14.9 Daily provision of trial pitting/trenching machine, equipment and crew (Clause 7.13)

Inspection pit depths are expected to be 1.2m or less. Ground support measures are not anticipated to be required.

S1.15 Sampling and monitoring during intrusive investigation (Specification Section 8) Particular restrictions/relaxations and requirements

This Schedule addresses sampling during the Site Operations phase of an investigation. Sampling from installations during and beyond the Site Operations phase of the investigation shall be addressed in Schedule S1.18.

The following sample types shall be collected:

- Small disturbed samples;
- Bulk disturbed samples.
- UT100 samples;
- Environmental soil samples and groundwater samples;
- Rotary core sub-samples.

Samples shall be taken in accordance with:

- BS EN 1997-2:2007 – Ground Investigation and Testing.
 - NA to BS EN 1997-2:2007:2009 - UK National Annex to Eurocode 7: Geotechnical design. Ground investigation and testing.
 - BS EN ISO 22475 – Sampling Methods and Groundwater Measurement.
 - BS EN ISO 22475-1:2006 - Technical principles for execution.
 - BS EN ISO 22475-2:2011 - Qualification criteria for enterprises and personnel.
 - BS EN ISO 22475-3:2011 - Conformity assessment of enterprises and personnel by third party.

All geotechnical samples shall be removed from the vicinity of the exploratory holes at the end of each day's work and shall be protected from frost damage or excessive heat by being stored on or near the site in a structure that is under cover and is secure from interference.

Refer to Schedule S2 for sampling requirements.

S1.15.1 Retention and disposal of geotechnical samples (Clauses 8.10.3 and 8.10.4)

The Contractor shall take full responsibility for the care and storage of all samples for a minimum of 3 months after issue of the Final Factual Report. Thereafter, the Contractor shall seek instruction from the Investigation Supervisor regarding arrangements to continue with the storage requirements, or for sample disposal.

S1.15.2 Frequency of sampling for geotechnical purposes (Clauses 8.2 and 8.7.2)

The sampling requirements detailed below shall be observed unless otherwise instructed by the Investigation Supervisor. Sampling for chemical testing for land affected by contamination shall be as detailed in S1.15.9.2.

Attention is drawn to the sample storage and handling requirements of the “Concrete in Aggressive Ground, BRE Special Digest No. 1 (2005)” and the “Sulphate specification for structural backfills, TRL Report 447 (2005)” in respect of sulphate and pH testing. Suitable storage facilities appropriate to the proposed time of on-site storage shall be provided.

The following types of samples are envisaged.

- Small (1 kg) disturbed samples. Small disturbed samples shall be placed immediately in airtight containers, which they should sensibly fill.
- Bulk (25 kg) disturbed samples. Bulk samples may be placed in two bags to aid ease of manual handling the sample.
- Class 1 undisturbed samples in cohesive strata.

Geotechnical soil sampling requirements are set out in Table 5.

Table 5: Geotechnical Sampling Requirements

Investigation Technique	Sample Type	Sampling Frequency
Inspection Pits	Small disturbed (1kg) samples	At 0.5m and 1.0m, thereafter at 1.0m intervals and at every change of strata / soil consistency.
	Bulk disturbed (25kg) samples	At 1.0m depth.
Dynamic Sampling with Rotary Core follow-on	Small disturbed (1kg) samples	At 1m intervals until commencement of rotary coring, relaxed to 1.5m intervals thereafter. Also at every change of strata. It's noted that sufficient sample from dynamic sampler boreholes is unlikely.
	Bulk disturbed (25kg) samples	Granular - 1.0m intervals in granular strata from 1.2m bgl until commencement of rotary coring. Cohesive - SPTs shall be alternated at 1.0m intervals with the collection of Class 1 undisturbed samples (in accordance with Eurocode 7) in cohesive strata until commencement of rotary coring.
	SPTs with recovered small disturbed samples and UT100 undisturbed samples	Granular - 1.0m intervals in granular strata from 1.2m bgl until commencement of rotary coring. Cohesive - SPTs shall be alternated at 1.0m intervals with the collection of Class 1 undisturbed samples (in accordance with Eurocode 7) in cohesive strata until commencement of rotary coring.

Investigation Technique	Sample Type	Sampling Frequency
	Rotary cores. SPTs if core recovery is poor, as directed by the Investigation Supervisor.	Continuous rotary core logs from start of rotary coring until termination point of boreholes.

Notes:

1. Where soil samples are taken at a depth corresponding to a boundary between two different materials, the GI Contractor shall clearly state which material the sample is associated with.

S1.15.3 Open tube and piston sample diameters (Clauses 8.7.3.1, 8.7.3.2 and 8.7.3.3)

Thin-walled samples shall be collected as specified in Clauses 8.7.3.1, 8.7.3.2 and 8.7.3.3.

Undisturbed samples shall be taken within cohesive deposits to achieve Class 1 quality samples in accordance with Eurocode 7. Should the undisturbed sample fail, the GI Contractor shall immediately carry out repeat sampling or SPT testing after consultation with the Investigation Supervisor.

Thin-walled open-tube samples (UT100) should be taken within soft to very stiff cohesive deposits to achieve Class 1 quality samples in accordance with Eurocode 7.

Thick-walled open-tube samples (U100) do not currently form part of the anticipated sampling strategy, however, dependant on the ground conditions at the Site, the GI Contractor may request approval from the Investigation Supervisor to use of these samples as a substitute for thin-walled open-tube samples (UT100) if good reason exists.

S1.15.4 Retention of cutting shoe samples (Clauses 8.7.3.2 and 8.7.3.3)

Soil from the cutting shoe of an open tube shall be retained as an additional small disturbed sample. These samples should be collected in tubs suitable for moisture content testing.

S1.15.5 Mostap sampling (Clause 8.7.10)

NOT REQUIRED.

S1.15.6 Groundwater samples and groundwater level measurements during exploratory hole formation (Clauses 8.7.11 and 8.8.1)

All groundwater strikes, seepage and flow levels shall be recorded at the time of them being encountered, and then again after 20 minutes.

S1.15.7 Special geotechnical sampling (Clause 8.7.12)

NOT REQUIRED.

S1.15.8 Address for delivery of selected samples (Clauses 8.10.2 and 8.10.3)

To be advised. Geotechnical samples shall be protected to ensure that their temperature is kept the range of 5–25°C. Samples shall also be protected from frost, direct heat and sunlight.

S1.15.9 Retention and disposal of contamination/waste acceptance criteria (WAC) samples (Clause 8.10.3)

Retention and disposal shall generally be in accordance with the ICC requirements for retention and Waste Management Regulations for disposal.

S1.15.9.1 Labelling, protection and transportation of samples

- Samples shall be securely packaged with clear labelling to minimise the risk of damage or loss during transit through improper handling.
- Where ice packs are included with the samples, then care shall be taken to ensure that condensation or melt water does not contact the samples and does not affect the legibility of the sample labels / documentation.
- Each sample box will contain a Chain of Custody form signed by the GI Contractors representative and the courier. A copy of the chain of custody document shall be available for inspection by the Investigation Supervisor. The form will document the following:
 - All the samples in the box
 - The exploratory hole location number and depth and a unique sample reference number
 - The type of sample contained
 - A note of any special sample handling, preservation or storage requirements
 - Date and time of sampling
 - Date and time of delivery to the courier
- The maximum transit time is dictated by the period over which the samples can be kept cool but should be less than 24 hours.
- Samples from land affected by contamination are likely to be of a hazardous nature. The transport of 'dangerous' samples is controlled by statutory regulations. The GI Contractor shall be aware of such restrictions and accommodate them within the investigation plan at the outset of the project. These restrictions may include, for example, the requirement to use approved carriers only and to ensure that the sample transport vehicle displays appropriate hazard warning diamonds. The outside of the shipping container shall be labelled in such a way as to comply with current legislation. In the UK, the relevant legislation is the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009.
- Samples due for testing shall generally not be stored on site for more than eight hours. Samples should be despatched to the laboratory at the earliest opportunity, preferably at the end of each working shift, so as to minimise the time between collection and analysis or storage at the laboratory.
- Water and soil samples containing biodegradable contaminants shall be stored at a temperature below 4°C. Such samples may be temporarily stored in insulated cooler boxes with ice packs during the course of the working shift. For extended periods of on-site storage greater than 8 hours, they shall be kept in a refrigerator at below 4°C. Care shall be taken to avoid rupturing of sample bottles when refrigerating, (glass containers are generally unsuitable for freezing).
- The onsite storage facility shall protect all samples from extreme fluctuations in temperature and direct sunlight
- The storage facility shall be secure with access to the samples restricted to authorised personnel only
- Arrangements for sample collection and delivery to the laboratory should be made at least one day in advance of the anticipated collection.

S1.15.10 Frequency of sampling for geo-environmental purposes (Clause 8.9.2)

The standard geo-environmental sampling sequence summarised below shall be adopted.

Table 6: Geo-environmental Sampling Requirements

Investigation Technique	Sampling Frequency
Inspection Pits	0.3m bgl, 0.5m bgl and 1.0m bgl.
Boreholes	Below the inspection pit, sampling to be taken at 2.0m bgl and then at 1.0m intervals through any Made Ground. It should be ensured that at least one sample is taken 0.5m to 1.0m into the natural strata below Made Ground. Further samples shall be collected where any visual and/ or olfactory evidence of contamination is encountered.

Contamination sampling shall also be taken upon visual/olfactory evidence of contamination and from within the natural material as directed by the Investigation Supervisor. The following containers shall be filled for each contamination soil sample (to be confirmed with the testing laboratory):

- 1 x 1kg sample in a plastic tub;
- 1 x 1kg sample in a borosilicate jar; and
- 1 x VOC vial.

Soil samples shall also be collected for Waste Acceptance Criteria (WAC) testing as directed by the Investigation Supervisor and should consist of the following:

- 1 x 1kg sample in plastic tub;
- 1 x 250g sample in a borosilicate jar; and
- 2 x 60g VOC vials.

During excavation/drilling, the Contractor shall record visual and olfactory evidence of contamination on the daily record (borehole or trial pit log). Environmental samples are required from the inspection pits. The precise requirement for geo-environmental sampling will be dependent on the strata encountered.

The logging engineer shall look for and record any visual or olfactory indicators of contamination. This shall include the presence of anthropogenic materials such as ash, unusual odours, colours or sheens, and hydrocarbon staining. Where contaminated horizons are encountered, the start and end of these zones shall be noted.

Sampling of groundwater for geo-environmental testing during borehole construction is not required, unless evidence of contamination is identified.

S1.15.11 Sampling method (Clause 8.9.3)

As per Clause 8.9.3.

Samples taken from boreholes and trial pits shall use the procedures identified in BS 10175 (2011) to avoid cross-contamination between samples, spreading of existing contamination and the introduction of external contamination.

S1.15.12 Headspace testing (Clause 7.9.8)

Headspace testing should be undertaken using a photoionization detector (PID) should visual / olfactory evidence of contamination be encountered.

S1.16 Field testing (Specification Section 9) Particular restrictions/relaxations and requirements

The purpose, type and frequency of tests required are given in Schedule S2. Testing sequences may be altered during the course of the investigation by the Investigation Supervisor to suit the actual ground conditions encountered.

S1.16.1 Tests in accordance with British Standards or other standards or methods (Clause 9.1)

Tests shall be carried out in accordance with:

- BS EN ISO 22476 – Field Testing.
- BS EN ISO 22476-3:2005 – Standard Penetration Test.

Relevant calibration certificates, including SPT hammer efficiency certificates, shall be submitted to the Investigation Supervisor prior to any testing being undertaken.

S1.16.2 Cone penetration testing (Clause 9.2) – particular restrictions/relaxations.

NOT REQUIRED.

S1.16.3 Capacity and equipment requirements for cone penetration testing (Clause 9.2.2)

NOT REQUIRED.

S1.16.4 Reporting of cone penetration testing parameters (Clause 9.2.3)

NOT REQUIRED.

S1.16.5 Seismic cone equipment requirements (Clause 9.2.4)

NOT REQUIRED.

S1.16.6 Interpretation of cone tests (Clause 9.2.3)

NOT REQUIRED.

S1.16.7 Other cone or specialist probes (Clauses 9.2.5, 9.2.6 and 9.2.7)

NOT REQUIRED.

S1.16.8 Standard penetration tests and reporting requirements (Clause 9.3)

To be undertaken in the exploratory holes and at the depths as indicated in Schedule 2 or as instructed by the Investigation Supervisor.

The SPT will be conducted in accordance with BS EN ISO 22476-3:2005+A1:2011, and the energy ratio (Er) of the SPT equipment used shall be reported. The Contractor shall provide all relevant SPT calibration certificate(s), which shall not be more than 12 months old, before any SPT testing commences. The calibration certification shall include a statement of the energy ratio (Er) of the SPT equipment to be used at the site.

The water surface and casing levels in the borehole at the time of each SPT shall be reported. When an SPT is carried out, the Contractor shall record and include in their report the blow count for each 75 mm increment of penetration (or part thereof).

S1.16.9 Type(s) and reporting of dynamic probing (Clause 9.4)

NOT REQUIRED.

S1.16.10 Self-boring pressuremeter and high-pressure dilatometer testing and reporting (Clause 9.5.1)

NOT REQUIRED.

S1.16.11 Full displacement driven or push-in pressuremeter testing and reporting requirements (Clause 9.5.2)

NOT REQUIRED.

S1.16.12 Menard pressuremeter tests and reporting requirements (Clause 9.5.3)

NOT REQUIRED.

S1.16.13 Flat Plate dilatometer tests and reporting requirements (Clause 9.5.4)

NOT REQUIRED.

S1.16.14 Hand or torsion vane tests and reporting requirements (Clause 9.6.1.1 and 9.6.1.2)

NOT REQUIRED.

S1.16.15 Penetration/borehole vane for shear strength (Clauses 9.6.1.1 and 9.6.1.3)

NOT REQUIRED.

S1.16.16 Hand penetrometer tests and reporting requirements (Clause 9.6.2)

NOT REQUIRED.

S1.16.17 Plate load tests and reporting requirements (Clause 9.6.3)

NOT REQUIRED.

S1.16.18 Density tests and reporting requirements (Clause 9.7.1)

NOT REQUIRED.

S1.16.19 Permeability tests and reporting requirements (Clauses 9.8.1 and 9.8.2)

NOT REQUIRED.

S1.16.20 Packer tests and reporting requirements (Clause 9.8.3)

NOT REQUIRED.

S1.16.21 Pumping tests and reporting requirements (Clause 9.8.4)

NOT REQUIRED.

S1.16.22 California bearing ratio tests and reporting requirements (Clause 9.9.1)

NOT REQUIRED.

S1.16.23 Dynamic cone penetrometer tests and reporting requirements (Clause 9.9.2)

NOT REQUIRED.

S1.16.24 Deflectometer tests and reporting requirements (Clause 9.9.3)

NOT REQUIRED.

S1.16.25 Soil infiltration tests and reporting requirements (Clauses 9.10.1 and 9.10.2)

NOT REQUIRED.

S1.16.26 Contamination screening tests and reporting requirements (Clause 9.11)

As detailed within S1.23 and to be directed by Investigation Supervisor.

S1.16.27 Interface probe tests and reporting requirements (Clause 9.12)

NOT REQUIRED.

S1.16.28 Special field testing and reporting requirements (Clause 9.13)

NOT REQUIRED.

**S1.17 Geophysical testing (Specification Section 10)
Particular restrictions/relaxations and requirements**

S1.17.1 Geophysical survey objectives (Clause 10.1)

NOT REQUIRED.

S1.17.2 Information provided (Clause 10.2)

NOT REQUIRED.

S1.17.3 Data density (Clause 10.3)

NOT REQUIRED.

S1.17.4 Level datum (Clause 10.4)

NOT REQUIRED.

S1.17.5 Geophysical survey report (Clauses 10.6, 10.7 and 10.8)

NOT REQUIRED.

S1.18 Instrumentation (Specification Section 11) Particular restrictions/relaxations and requirements

Groundwater and gas monitoring installations shall be installed in the completed exploratory holes as specified in Schedule S2.

S1.18.1 Protective covers and terminal boxes for installations (Clauses 11.2, 11.4.2 and 11.4.3)

Lockable flush covers shall be installed as part of any monitoring well installation. Investigation Supervisor to confirm whether these are raised or flush when providing installation instructions.

S1.18.2 Protective fencing (Clauses 11.3, 11.4.2 and 11.4.3)

Protective covers shall be protected by protective fencing consisting of a minimum of three red and white marker posts projecting a minimum of 1.5m above ground level, secured together with horizontal rails.

S1.18.3 Groundwater observation wells and piezometer installations (Clauses 11.4.1, 11.4.2 and 11.4.3)

The installation of 50mm HDPE combined groundwater and ground gas monitoring standpipes shall be in accordance with the amended Clauses provided in Schedule 4. On attaining the full depth of each hole where an instrument is to be installed, the Contractor should inform the Investigation Supervisor of the sequence of materials encountered and water strike/standing water levels. Details of installation location, diameter, depth and other details shall be instructed by the Investigation Supervisor.

The filter pack is to comprise clean washed 4-10mm gravel. Any proposed amendment shall be agreed with the Investigation Supervisor.

S1.18.4 Other types of observation wells and piezometer installations (Clauses 11.4.1, 11.4.2, 11.4.3 and 11.4.4)

NOT REQUIRED.

S1.18.5 Development of observation wells and standpipe piezometers (Clause 11.4.6)

At the completion of drilling and well installation, each well shall be cleaned and developed prior to any subsequent sampling for groundwater (see BS ISO 14686:2003).

Well development is to be achieved by either removing three well volumes of water, or by measuring the chemical quality of the pumped water until the following parameters stabilise:

- Electrical conductivity.
- pH, temperature.
- Dissolved oxygen.

Cleaning and development shall take place at least 1 week prior to sampling.

S1.18.5.1 Proof of operation (Clause 11.4.4)

The Contractor shall prove hydraulic continuity between standpipes/standpipe piezometers and the groundwater within 5 days following installation.

The proof of operation of the standpipes/standpipe piezometers shall form part of the installation process and therefore be included in the rates for the installation.

S1.18.6 Ground gas observation wells (Clause 11.5)

NOT REQUIRED.

S1.18.7 Vapour observation wells (Clause 11.6)

NOT REQUIRED.

S1.18.8 Inclinometer installations (Clause 11.7)

NOT REQUIRED.

S1.18.9 Extensometers and settlement gauges (Clause 11.8)

NOT REQUIRED.

S1.18.10 Settlement monuments (Clause 11.9)

NOT REQUIRED.

S1.18.11 Other instrumentation (Clause 11.10)

NOT REQUIRED.

S1.18.12 Decommissioning and removal of installations

Standpipes shall be decommissioned only with the prior approval of the Investigation Supervisor.

Typical decommissioning details shall include:

- Remove any monitoring equipment (if present).
- Removal of protective cover and marker posts.
- Removal of top section of standpipe, typically 1-2mbgl (if present).
- Fully grout standpipe to surface.
- Reinstatement ground surface in accordance with S1.8.16 and S1.20.

**S1.19 Installation monitoring and sampling (Specification
Section 12) Particular restrictions/relaxations and
requirements**

S1.19.1 Groundwater readings in installations (Clauses 12.1 and 12.2)

A programme of groundwater monitoring shall be undertaken by the GI Contractor. Groundwater levels shall be monitored on a daily basis for the duration of the fieldwork operations and on completion of the site works.

Groundwater monitoring shall then be undertaken on subsequent visits after the site works have been completed. It is envisaged that six monitoring visits will take place over two months following completion of the ground investigation works. Groundwater sampling should be undertaken during a minimum of two of these monitoring rounds, or as directed by the Investigation Supervisor.

Each monitoring visit shall include recording the depth of water (m bgl) and depth to the base of installation (m bgl). Additionally, visual or olfactory evidence of contamination should be recorded.

Should free product be suspected within any borehole an interface probe shall be used to record the thickness of product above the water table.

S1.19.2 Groundwater sampling from installations (Clause 12.3.1)

Installations shall be developed following fieldworks and completed at least 1 week prior to first samples being retrieved.

Sampling shall be undertaken as specified within Clause 12.3.1. Groundwater sampling should be undertaken during two of the monitoring rounds, or as directed by the Investigation Supervisor.

Groundwater samples shall be retrieved from installations selected by the Investigation Supervisor for chemical analysis. Installations shall be purged, tested and samples preserved and stored in accordance with the requirements set out in Schedule 4.7.1.

S1.19.3 Purging/low-flow purging (Clause 12.3.2)

Installations shall be purged (by 3 well volumes) using low flow techniques prior to sampling and groundwater removed and stored in accordance with the requirements set out in Clause 12.3.2.

The GI Contractor shall submit for approval to the Investigation Supervisor their RAMS (Risk Assessments Method Statements) for sampling. As a minimum, the GI Contractors RAMS must specify:

- The proposed method of low flow sampling.
- Details on the proposed storage and disposal of purge water.

Low flow sampling will ensure stabilisation of in-situ water quality parameters (electrical conductivity, pH, temperature, dissolved oxygen) prior to collection of groundwater samples

S1.19.4 Multi-parameter meter (Clause 12.3.3)

As specified in Clause 12.3.3.

During water quality sampling, the following should be recorded:

- pH
- electrical conductivity
- dissolved oxygen
- temperature
- redox potential

S1.19.5 Gas and vapour monitoring (Clause 12.4)

NOT REQUIRED.

S1.19.6 Continuous gas monitoring (Clause 12.5)

NOT REQUIRED.

S1.19.7 Sampling from ground gas installations (Clause 12.6)

NOT REQUIRED.

S1.19.8 Vapour sampling (Clauses 12.4 and 12.7)

NOT REQUIRED.

S1.19.9 Monitoring of ground movements (Clause 12.8)

NOT REQUIRED.

S1.19.10 Other monitoring (Clause 12.9)

NOT REQUIRED.

S1.19.11 Sampling and testing of surface water bodies (Clause 12.10)

NOT REQUIRED.

S1.19.12 Other instrumentation monitoring and sampling restrictions/relaxations and requirements

NOT REQUIRED.

S1.20 Reinstatement (Specification Section 13) – Particular restrictions/relaxations

The Investigation Supervisor shall be notified prior to backfilling of any exploratory excavation, or demobilisation of plant at any location. On completion of excavation works all exploratory holes and access ways shall be reinstated its previous condition to the satisfaction of the Investigation Supervisor. Reinstatement to the previous condition will be required.

S1.20.1 General reinstatement (Clause 13.1)

Requirements for the backfilling and reinstatement of trial pits are defined in S1.14.6 above.

S1.20.2 Turf and topsoil surfacing (Clause 13.2)

NOT REQUIRED.

S1.20.3 Gravel or rubble surfacing (Clause 13.3)

NOT REQUIRED.

S1.20.4 Paved surfacing (Clause 13.4)

NOT REQUIRED.

S1.21 Daily records (Specification Section 14) Particular restrictions/relaxations and requirements

S1.21.1 Information for daily records (Clause 14.2)

The Contractor shall maintain daily contact with the Investigation Supervisor on occasions when the Investigation Supervisor is not present on site. The Contractor shall contact the Investigation Supervisor without delay to report any incident, accident, disruption to progress, or completion or termination of an exploratory hole.

The Contractor shall also provide the Investigation Supervisor with daily site records and journals within 1 working day of the period to which they relate. Daily reports and logs should

include preliminary in situ test data and results where undertaken. Alternatively, should the Contractor have access to email facilities, electronic copies of the daily site records may be sent directly to the Investigation Supervisor.

A template of the daily report shall be submitted to the Investigation Supervisor for approval on commencement of the Ground Investigation.

Preliminary typed exploratory holes shall be submitted to the Investigation Supervisor within 2 working days of completion of each hole

S1.21.2 Chain of custody (Clause 14.3)

Chain of custody shall be maintained for all geoenvironmental samples and for selected geotechnical samples. All samples shall be clearly labelled in accordance with BS 5930:2015+A1:2020 and BS EN ISO 22475-1:2021, as specified in Clause 8.4.

The Contractor is required to ensure that environmental samples collected are labelled and stored correctly while on site, contain a chain of custody and are collected by the laboratory within 24 hours of sampling.

It is the responsibility of the Contractor to maintain contact with the laboratory in order to arrange timely collections and ensure sampling containers are available on site.

It is the responsibility of the Contractor to ensure that each batch of samples collected from the site contains a chain of custody detailing all the environmental samples within that batch. Should any potentially hazardous material be encountered and sampled on site (e.g. asbestos), this should also be detailed on the chain of custody.

A copy of the chain of custody and the exploratory hole logs should be provided to the Investigation Supervisor within 24 hours of collection to enable prompt scheduling of analysis.

The Contractor shall be responsible for any incurred resampling costs should they be found to be at fault for failing to ensure environmental samples are collected by the laboratory within the 24-hour time scale.

Appropriate records (copies of the chain of custody) should be retained by the Contractor to ensure they have sufficient evidence they have sufficient evidence to demonstrate they are not at fault in the event of any batch samples being damaged/misplaced.

The chain of custody process details the links in the transfer of samples between the time of collection and their arrival at the laboratory. The minimum information to be included on the form is listed below.

Sender of chain of custody:

- Mandatory information:
 - name of organisation carrying out the sampling
 - name of organisation receiving samples
 - time and date of sampling
 - Contractor name and contact details
 - Contract identifier and site name
 - details of the samples (location, depth, etc.).
- Additional information:
 - other information for the safe handling of potentially hazardous samples, (e.g. special safety precautions) samples that might contain high levels of substances that might interfere with analysis (if known)
 - test turnaround times required.

Receiver of chain of custody:

- Mandatory information:
 - time and date samples are received by the laboratory

S1.21.3 Special field tests and instrumentation records (Clause 14.4)

NOT REQUIRED.

S1.22 Geotechnical Laboratory testing (Specification Section 15) Particular restrictions/relaxations and requirements

Contract specific restrictions/relaxations are indicated below.

S1.22.1 Investigation Supervisor or Contractor to schedule testing (Clause 15.1)

As specified in Clause 15.1. The Investigation Supervisor will schedule all testing.

The Contractor shall supply blank test schedule forms, along with the preliminary engineering logs within one working day of completion of the exploratory hole, which should include the following information:

- Project details;
- Exploratory hole details; and,
- Details of every sample, including type and depth (separate line for each sample) together with sample recovery details as applicable.

Additional testing may be specified by the Investigation Supervisor if appropriate.

S1.22.2 Tests required (Clause 15.4)

All soil testing shall be carried out in accordance with Eurocode 7 and BS 1377:1990 (or BS EN ISO 1789 where this has replaced sections of BS 1377) unless otherwise indicated in the Schedules. The following geotechnical tests may be carried out:

- Moisture Content Tests
- Liquid Limit, Plastic Limit and Plasticity Index Tests (Atterberg)
- Particle Density/Specific Gravity tests
- Bulk Density (unit weight) tests
- Particle Size Distribution (Mechanical sieving and sedimentation as applicable)
- One-dimensional Consolidation Tests (Oedometer)
- California Bearing Ratio test
- Total Stress Triaxial Tests
- Effective Stress Triaxial Tests
- Compaction and Earthworks Testing
- Unconfined Compressive Strength Tests (UCS)
- Point Load Tests
- Organic Matter Content Tests.
- Geo-chemical testing of both soil and groundwater samples; BRE testing

The Investigation Supervisor will prepare a schedule of tests following receipt of the provisional borehole logs. The GI Contractor shall list all available samples per borehole on a convenient schedule for this purpose.

The GI Contractor shall be responsible for co-ordinating sample dispatch, maintaining the chain of custody, reporting of test results and arranging payment to the laboratory.

S1.22.3 Specifications for tests not covered by the British Standards (Clauses 15.2.1 and 15.4)

NOT REQUIRED.

S1.22.4 Accreditation to be adopted (Clauses 3.3 and 15.3)

The laboratory undertaking the laboratory testing shall be UKAS accredited, where applicable, to:

- BS EN ISO/IEC 17025:2005 – General requirements for the competence of testing and calibration laboratories.
- The precise scope of a laboratory's accreditation shall be submitted to the Investigation Supervisor with the test schedules.

Where UKAS/MCERTS accreditation has not been achieved for a specific test, approval to undertake the test shall be sought from the Investigation Supervisor prior to the test being undertaken.

S1.22.5 Rock testing requirements (Clause 15.5)

No special requirements.

S1.22.6 Geo-environmental testing for aggressive ground/groundwater for concrete (Clause 15.6) (Test Suites A-D)

Geochemical testing will be required for soil and groundwater samples, and specified by the Investigation Supervisor in accordance with the following:

- Suite D – Brownfield Site, pyrite present (derived from BRE Special Digest SD1) as given in UK Specification for Ground Investigation (2022).

Testing will be undertaken on samples from the exploratory holes and on groundwater samples retrieved from boreholes.

The GI Contractor shall be responsible for co-ordinating sample dispatch, maintaining the chain of custody, reporting of test results and arranging payment to the laboratory.

S1.22.7 Laboratory testing on site (Clause 15.8)

NOT REQUIRED.

S1.22.8 Special laboratory testing (Clause 15.9)

NOT REQUIRED.

S1.22.9 Specimen preparation and abortive tests (Clause 15.10)

As specified in Clause 15.10.

S1.23 Geoenvironmental laboratory testing (Specification Section 16) Particular restrictions/relaxations and requirements

The Contractor shall provide the investigation supervisor with blank testing schedules showing a full list of all geo-environmental samples taken within 24h of completion of each day's work.

S1.23.1 Investigation Supervisor or Contractor to schedule testing (Clause 16.1)

The Investigation Supervisor shall schedule all geo-environmental laboratory tests upon receipt of the blank testing schedules and the daily reports. The completed schedules shall be returned to the Contractor for testing at the selected laboratory (laboratory to be accepted by the Employer before the ground investigation works commence).

S1.23.2 Accreditation required (Clauses 3.3 and 16.2)

Information regarding the extent of UKAS accreditation of the Contractor shall be submitted with the tender documentation.

Chemical laboratory testing shall be carried out to:

- BS EN ISO/IEC 17025:2005 – General requirements for the competence of testing and calibration laboratories.

Any laboratory test data on soil samples that is to be submitted to the Environment Agency shall conform to Monitoring Certification Scheme (MCERTS) accredited by UKAS where applicable. In accordance with The Control of Asbestos Regulations 2012 asbestos testing shall be accredited. Precision and bias data for tests on reference control samples shall be provided in each report. All tests not MCERTS certified shall be clearly identified.

The scope of a laboratory's accreditation shall be submitted to the Investigation Supervisor with the test schedule.

S1.23.3 Chemical testing for contamination (Clauses 8.9.4 and 16.3)

Testing turnaround time of 5 days from receipt of the testing schedule are expected generally and should be specified, except Waste Acceptance Criteria Testing which has a normal turnaround time of 10 days. If guaranteed turnaround time of 5 days or 10 days or less are required by the Contract this shall be stated.

Full details of each of the testing suites likely to be required and the required limits of detection are included in Appendix B.

S1.23.4 Waste characterisation and hazardous classification of soils (Clause 16.4)

NOT REQUIRED.

S1.23.5 Waste Acceptance Criteria testing (Clauses 8.9.4 and 16.5)

Where directed by the *Investigation Supervisor*, Waste Acceptance Criteria testing comprising the test suites detailed below shall be carried out.

Table 7: Waste Acceptance Criteria Testing

Analytical Suite	Determinants
Full WAC Suite	Leachate Suite: As, Ba, Cd, Cr, Cu, Hg, Mo, Ni, Pb, Sb, Se, Zn, Cl ⁻ , F ⁻ , SO ₄ , total dissolved solids (TDS), phenol index, dissolved organic carbon. Solid Waste Suite: Total organic carbon (TOC), loss on ignition, BTEX by GC-FID, pH, acid neutralisation capacity (ANC), PAHs (total), pH, PCBs (7 congeners), mineral oil (C10 – C40 compounds).

S1.23.6 Laboratory testing on-site (Clause 16.6)

NOT REQUIRED.

S1.23.7 Special laboratory testing (Clause 16.7)

NOT REQUIRED.

S1.24 Reporting (Specification Section 17) Particular restrictions/relaxations and requirements

S1.24.1 Raw data (Clause 17.2.2)

As specified in Clause 17.2.2, raw data shall be made available to the Investigation Supervisor upon request.

S1.24.2 Preliminary exploratory hole logs (Clause 17.2.3)

Preliminary logs shall be submitted to the Investigation Supervisor within 2 working days of completion of the exploratory hole to which they refer.

S1.24.3 Exploratory hole logs (Clause 17.2.4)

As specified in Clause 17.2.4. Fracture spacing is also required on rotary cored borehole logs. The Contractor is to submit a proforma or an example record for approval by the Investigation Supervisor.

S1.24.4 Field results (Clause 17.2.5)

In addition to the requirements of Clause 17.2.5, work sheets shall be provided to the Investigation Supervisor within 48h of completion of the exploratory hole.

S1.24.5 Laboratory test results (Clause 17.2.6)

Laboratory test results shall be provided in accordance with a programme to be agreed with the Investigation Supervisor at commencement of the investigation.

S1.24.6 Plans and drawings (Clause 17.2.7)

The site plan may be provided as an AutoCAD DWG or DXF drawing file. Where such digital information is provided to the Contractor, the Contractor's as-constructed exploratory hole layout drawing shall be returned in a similar digital format.

Drawings shall present the actual as-built locations in their proper surveyed location

S1.24.7 Type of reports required (Clause 17.3)

The Contractor is required to submit both a Draft and Final Factual Report for the investigation works.

An electronic copy of the factual part of the Geotechnical Investigation Report shall be submitted to the Investigation Supervisor, in both Draft and Final form on the dates agreed.

All analytical testing results shall also be provided to the Investigation Supervisor in Excel and AGS format.

S1.24.8 Desk Study (Clause 17.3.2)

NOT REQUIRED.

S1.24.9 Ground Investigation Report (GIR) (or specified part thereof) (Clauses 4.4.7, 17.3.3 and 17.3.5)

NOT REQUIRED – factual portion only, as detailed in Clause 17.3.5.

S1.24.10 Geotechnical Design Report (GDR) (or specified part thereof) (Clauses 4.4.7 and 17.3.4)

NOT REQUIRED.

S1.24.11 Report approval (Clause 17.3.6)

The draft of the factual account of the GIR shall be provided to the Investigation Supervisor within 1 week of the completion of the laboratory testing. The Investigation Supervisor will approve (or instruct any required revisions or amendments) within 10 working days following its receipt.

The final factual account of the GIR shall be submitted within 2 weeks of the Investigation Supervisor's final comments.

Refer to S1.8.21 for key programme allowed required by the Investigation Supervisor.

The results of post-field-work monitoring shall be supplied as an addendum report once monitoring is completed.

S1.24.12 Digital data (Clauses 5.10 and 17.4.1)

As per Clauses 5.10 and 17.4.1.

S1.24.13 Digital data format (Clauses 17.2.7, 17.3.1, 17.3.5, 17.4.1 and 17.4.2)

As per Clauses 17.2.7, 17.3.1, 17.3.5, 17.4.1 and 17.4.2.

Timely submission of complete, combined and correct digital data is considered to be of paramount importance.

The digital data shall comply with the requirements of "Electronic Transfer of Geotechnical & Geo-environmental Data" published by the Association of Geotechnical and Geo-environmental Specialists (AGS). The data shall comply with Version 4.0 or newer. In addition, where in situ

monitoring or testing is carried out, digital data shall be submitted in compliance with “The AGS-M Format for the electronic transfer of monitoring data” edition 3M published by the AGS.

S1.24.14 Preliminary data (Clause 17.4.3)

As per Clause 17.4.3.

S1.24.15 Data submissions (Clause 17.4.4)

As per Clause 17.4.4.

All AGS format data shall be checked using AGS format-checking software. The data shall comply with Version 4.0 or newer.

One electronic copy of the final AGS data shall be submitted to the Investigation Supervisor within 5 working days of draft copy approval or receipt of instructed revisions / amendments.

S1.24.16 Timing for submission of digital information files (Clause 17.4.5)

As specified in Clause 17.4.5.

S1.24.17 File transfer (Clause 17.4.6)

As specified in Clause 17.4.6.

Prior to issue of electronic data, the files shall be checked for AGS compliance by a Format Checker program and for viruses by a commercial anti-virus program that has been updated within the previous three months.

A protocol for the sharing and transfer of all documents shall be agreed in advance of the investigation works commencing.

SCHEDULE S2. Exploratory Holes

The following table outlines the proposed exploratory holes for the ground investigation at the site. Refer to Appendix A for indicative exploratory hole locations.

Table 8: Exploratory Hole Locations

Hole ID	Hole Type	Location	Depth (m bgl)	Installation			Monitoring		In-situ Testing		Environmental Lab Testing	Comment
				Standpipe	Piezometer	Installation Cover Type*	Groundwater	Ground Gas	SPT	Undisturbed UT100	Comprehensive Soil and soil leachate test suites	
BH201	Dynamic Sampling + Rotary Core Follow-On Borehole	Refer to Appendix A. In area/pavement in front of building – see location plan	18	X	X	F	X		X	X	X	To be logged in accordance with BS5930:201+A1:2020
TP201	Hand-Dug Trial Pit	Refer to Appendix A. To boundary wall on west side of existing building.	1.2								X	To be logged in accordance with BS5930:201+A1:2020 Record foundation form, depth and extent. Tree roots must not be damaged (under a TPO). Record extent of tree roots, approximate root diameter, and root depth below ground level.
TP202	Hand-Dug Trial Pit	Refer to Appendix A. To boundary wall on north side of existing building.	1.2								X	To be logged in accordance with BS5930:201+A1:2020. Record foundation form, depth and extent.

All exploratory holes should be commenced by CAT scanning at ground surface, hand excavation to 1.2m below ground level and CAT scanning at the base of the pit prior to setting up plant

All exploratory shall have elevation levels provided to +/- 0.1m.

Actual exploratory hole locations are to be agreed on site with the Investigation Supervisor.

Environmental samples to be collected from all exploratory holes at 0.2m, 0.5m, 1m then every 1m in Made Ground and 1m in to undisturbed natural. In addition, env. sample(s) to be collected upon encountering visual or olfactory evidence of contamination.

* Installation cover type stated as either flush cover (F) or raised cover (R)

* Required installation, monitoring, in-situ testing, lab testing (X)

SCHEDULE S3. Investigation Supervisor's Facilities

The Contractor shall provide a welfare vehicle for use by the investigation supervisor. The welfare vehicle shall be serviced for the duration of the ground investigation works.

SCHEDULE S4. Specification Amendments

Minor specification amendments are contained in Schedule S1 above.

SCHEDULE S5. Specification Additions

Minor specification additions are contained in Schedule S1 above.

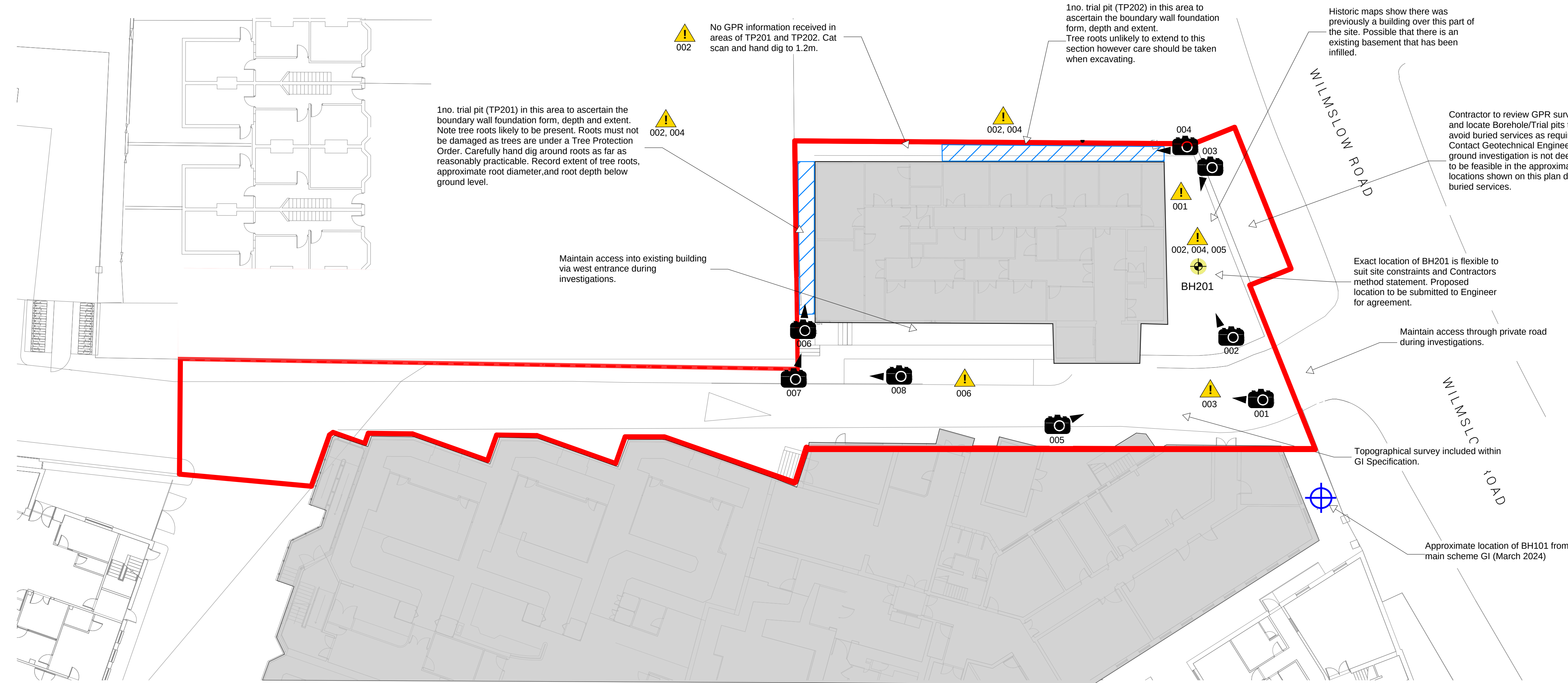
SCHEDULE S6 Specification for the Investigation of Land Affected By Contamination

NOT REQUIRED.

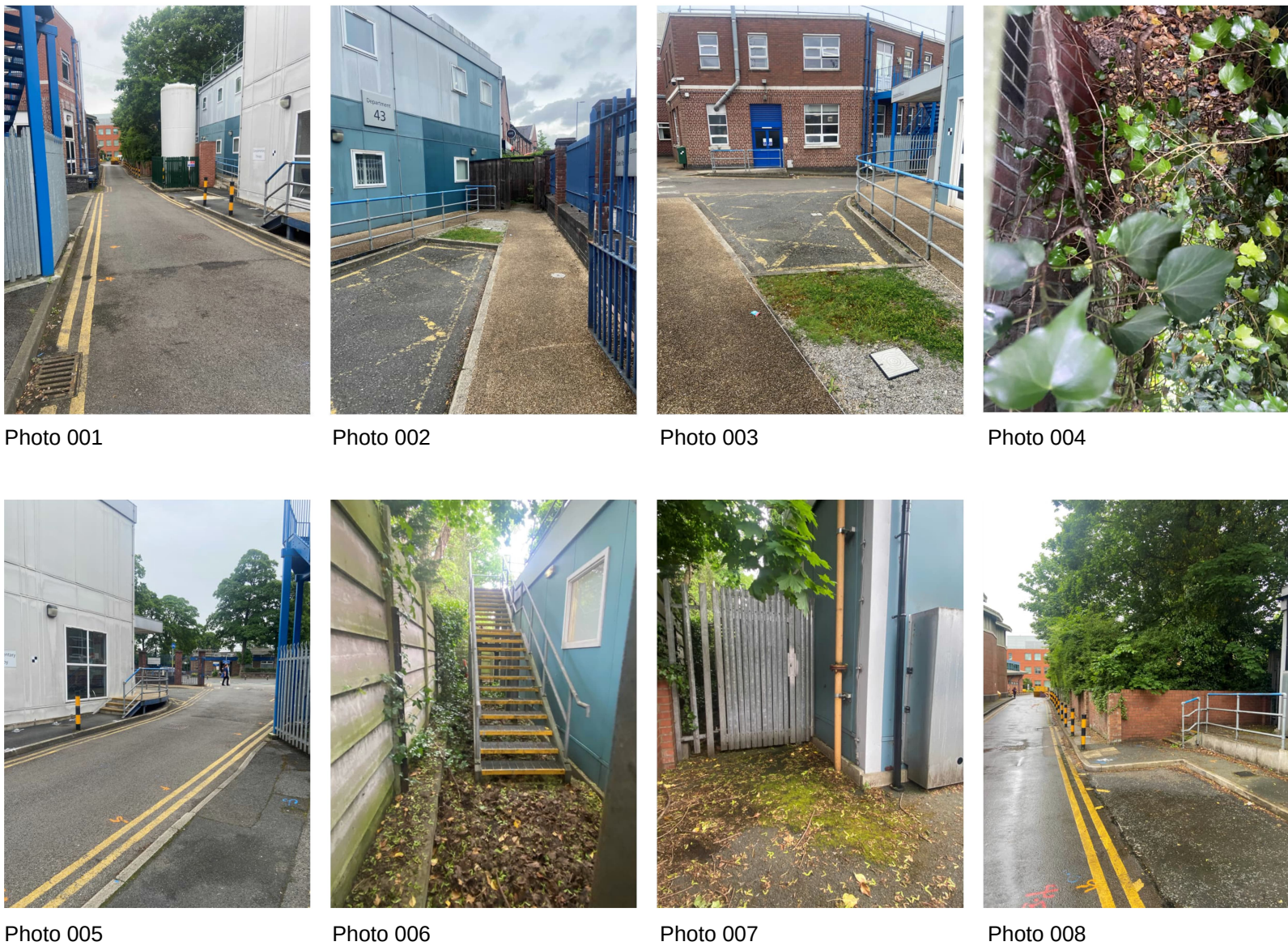
Appendices

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A. PROPOSED GROUND INVESTIGATION LAYOUT



Ground Investigation Locaton Plan
1:200



Exploratory Hole Schedule					
Borehole ID	Type	Depth (m)	Groundwater monitoring required?	Easting	Northing
BH201	DS + RC	18	Yes	E384904	N392659
TP201	HDTP	1.2	No	-	-
TP202	HDTP	1.2	No	-	-

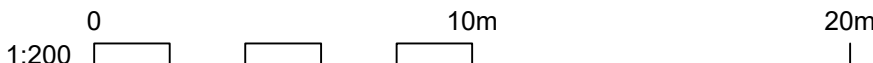
SIGNIFICANT RESIDUAL RISK Notes below are additional to the hazards/risks normally associated with this stage of works refer to Designer's Hazard Elimination & Management record for more information.		
Ref.	Hazard	Activity / Process
001	Existing basement may be present.	Possibility of encountering buried structures or voids in ground. Risk to be managed through Contractors method statement.
002	Clash with existing services.	Borehole located away from buried services as far as reasonably practicable. Sub-contractor to ensure that GPR survey is reviewed prior to commencing works. CAT scan and hand dig to 1.2m bgl.
003	Working adjacent to the public highway and private road.	Appropriate segregation to be used and agreed with Trust/council.
004	Contaminated ground.	Unknown made ground. Asbestos and other contaminants may be present in the ground.
005	Working in a live hospital.	Noise/vibration and general disruption to be kept to a minimum and agreed with the NHS Trust prior to commencing work. Appropriate segregation to be used around investigations.
006	Working near Liquid Nitrogen Tank	Intrusive investigations to be located away from Liquid Nitrogen storage tank. Care to be taken when moving any equipment through the site extents.

Ground Investigation Requirements

Requirements for the ground investigation are outlined below. Full specification contained in NTHPAT-MMD-XX-ZZ-SP-C-000001. This drawing should be read in conjunction with the Geotechnical and Geoenvrionmental Desk Study NTHPAT-MMD-XX-XX-RP-C-000001. An indicative ground model has been produced based on the adjacent Paterson Development and CASICD Ground Investigation.

Stratum	Depth to top of stratum (mBGL)	Elevation at top of stratum (mAOD)	Thickness (m)
Made ground	0	34.72-35.26	0.45-2.20
Devensian till	0.70-2.20	32.52-34.22	0.50-2.20
Weathered sandstone	0.45-2.70	31.43-33.06	0.70-2.80
Extremely weak to weak sandstone (Wilmslow Formation)	2.70-5.00	29.92-31.76	Not proven

- Made ground samples required from all exploratory hole locations for contamination testing.
- Exploratory hole required to a depth of 18m below ground level. DS + RC refers to Dynamic Sampling borehole with Rotary Coring follow-on. HDTP refers to Hand-Dug Trial Pit. GI Sub-Contractor to agree methodology and date/time of exploratory holes with NHS Trust prior to undertaking the works.
- CAT Scan and hand dug trial pits required to a depth of 1.2m at all exploratory hole locations to identify any buried services and/or foundations of adjacent buildings.
- Trial pits to be undertaken in the locations highlighted to determine the extent of existing foundations and tree roots. Dimensioned sketches and photographs to be provided to Structural Engineer.
- If invasive species are seen on site the Contractor is to make the Principal Designer and Investigation Supervisor aware. Risk of invasive species is low due to the site being located in an urban area.



- Notes
- Do not scale from this drawing
 - Boreholes are shown in approximate required position only, the sub-contractor shall be responsible for ensuring that the proposed borehole locations are suitable and do not disrupt any live services or other ground obstructions below.
 - Proposed access routes are to be agreed with the Trust prior to commencement of works. No consideration has been made to storage or site compound areas.

Key to symbols	
	Existing Buildings
	Red Line Boundary
	Trial Pits Location Plan
	Proposed Indicative Borehole Location
	Existing Boreholes Location

Reference drawings	
Topographical Survey CDEREK-LSL-XX-XX-DR-X-000001 GPR Survey CDEREK-LSL-XX-XX-DR-X-000002 DAY Location Plan 1608-24-DAY-V1-00-DR-A-020101-Location Plan-P02	

P01	04/06/2025	EM	First Issue	CS	AS
Rev	Date	Drawn	Description	Ch'k'd	App'd

Status Stamp	PRELIMINARY
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Client	The Christie NHS Foundation Trust
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Title	The Christie Derek Crowther Ground Investigation Location Plan
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Designed	L Brooks	LB	Eng check	C Smith	CS
Drawn	E Lythgoe	MU	Coordination	C Smith	CS
Dwg check	C Smith	CS	Approved	A Simpson	AS
MMD Project Number		Scale at A1			Security
100123912		1:200			STD
Suitability Description					Suit. Code
Suitable for Review and Comment					S3
Drawing Number					Revision
NTHPAT-MMD-XX-ZZ-DR-C-000001					P01

B. CHEMICAL TESTING SUITES FOR LAND AFFECTED BY CONTAMINATION

B.1 General

The following are generic MM chemical testing suites. The testing suites present the recommended required detection limits for the testing. The Contractor should complete the “offered” columns to demonstrate compliance.

B.2 Soils Suites

B.2.1 Mott MacDonald Comprehensive Soil Suite

Table 9: Comprehensive Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Antimony	mg/kg	1		*	
Arsenic	mg/kg	1		*	
Asbestos Screen	Type and presence	N/A	N/A	*	
Barium	mg/kg	1		*	
Beryllium	mg/kg	1		*	
Boron	mg/kg	1		*	
BTEX (speciated)	mg/kg	0.02		*	
Cadmium	mg/kg	1		*	
Chromium (III)	mg/kg	1		*	
Chromium (VI)	mg/kg	1		*	
Copper	mg/kg	1		*	
Cyanide (Free)	mg/kg	1		*	
Fraction of Organic Carbon	%	0.1		*	
Iron	mg/kg	36		*	
Lead	mg/kg	1		*	
Manganese	mg/kg	1		*	
Inorganic Mercury	mg/kg	1		*	
Methylmercury	mg/kg	1		*	
Elemental Mercury	mg/kg	1		*	
Molybdenum	mg/kg	1mg/kg		*	
Nickel	mg/kg	1		*	
pH	N/A	-	N/A	N/A	
Phenols (speciated: phenol, cresols, dimethylphenols, trimethylphenols)	mg/kg	0.6		*	
Polyaromatic Hydrocarbons (USEPA 16 speciated),	mg/kg	0.1		*	
Selenium	mg/kg	1		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Sulphate (Water soluble),	mg/l	10		*	
Sulphur (Total),	%	0.01		*	
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split, TPHCWG Bands	mg/kg	4		*	
Vanadium	mg/kg	1		*	
Volatile Organic Compounds, (Speciated USEPA Method 8260 Target List – Refer Table 9)	µg/kg	1		*	
Zinc	mg/kg	3		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.2 Mott MacDonald VOC Soil Suite

Table 10: VOC Soil Suite Speciated USEPA Method 8260 Target List

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
C10-13 Chloroalkanes	µg/kg	1		*	
Benzene	µg/kg	1		*	
Bromobenzene	µg/kg	1		*	
Bromochloromethane	µg/kg	1		*	
Bromodichloromethane	µg/kg	1		*	
Bromoform	µg/kg	1		*	
Bromomethane	µg/kg	1		*	
n-Butylbenzene	µg/kg	1		*	
sec-Butylbenzene	µg/kg	1		*	
tert-Butylbenzene	µg/kg	1		*	
Carbon tetrachloride	µg/kg	1		*	
Chlorobenzene	µg/kg	1		*	
Chlorodibromomethane	µg/kg	1		*	
Chloroethane	µg/kg	1		*	
Chloroform	µg/kg	1		*	
Chloromethane (methyl chloride)	µg/kg	1		*	
2-Chlorotoluene	µg/kg	1		*	
4-Chlorotoluene	µg/kg	1		*	
1,2-Dibromo-3- chloropropane	µg/kg	1		*	
1,2-Dibromoethane	µg/kg	1		*	
Dibromomethane	µg/kg	1		*	
1,2-Dichlorobenzene	µg/kg	1		*	
1,3-Dichlorobenzene	µg/kg	1		*	
1,4-Dichlorobenzene	µg/kg	1		*	
Dichlorodifluoromethane	µg/kg	1		*	
1,1-Dichloroethane	µg/kg	1		*	
1,2-Dichloroethane	µg/kg	1		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
1,1-Dichloroethene	µg/kg	1		*	
cis-1,2-Dichloroethene	µg/kg	1		*	
trans-1,2-Dichloroethene	µg/kg	1		*	
1,2-Dichloropropane	µg/kg	1		*	
2,2-Dichloropropane	µg/kg	1		*	
1,3-Dichloropropane	µg/kg	1		*	
1,1-Dichloropropene	µg/kg	1		*	
Ethylbenzene	µg/kg	1		*	
Hexachlorobutadiene	µg/kg	1		*	
Isopropylbenzene	µg/kg	1		*	
p-Isopropyltoluene	µg/kg	1		*	
Methylene chloride (dichloromethane)	µg/kg	1		*	
Naphthalene	µg/kg	1		*	
n-Propylbenzene	µg/kg	1		*	
Styrene	µg/kg	1		*	
1,1,1,2-Tetrachloroethane	µg/kg	1		*	
1,1,2,2-Tetrachloroethane	µg/kg	1		*	
Tetrachloroethene	µg/kg	1		*	
Toluene	µg/kg	1		*	
1,2,4-Trichlorobenzene	µg/kg	1		*	
1,2,3-Trichlorobenzene	µg/kg	1		*	
1,1,1-Trichloroethane	µg/kg	1		*	
1,1,2-Trichloroethane	µg/kg	1		*	
Trichloroethene	µg/kg	1		*	
Trichlorofluoromethane	µg/kg	1		*	
1,2,3-Trichloropropane	µg/kg	1		*	
1,2,4-Trimethylbenzene	µg/kg	1		*	
1,3,5-Trimethylbenzene	µg/kg	1		*	
Vinyl chloride	µg/kg	1		*	
o-Xylene	µg/kg	1		*	
m-Xylene	µg/kg	1		*	
p-xylene	µg/kg	1		*	
Methyl-t-butyl ether	µg/kg	1		*	
Dichlorofluoromethane	µg/kg	1		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.3 Mott MacDonald TPH Soil Suite

Table 11: Mott MacDonald TPH Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Total Petroleum Hydrocarbon – Criteria	mg/kg	4		*	

Deterimamd	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Working Group: Ali-Aro Split, TPHCWG Bands					
* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated					

B.2.4 Mott MacDonald BTEX Soil Suite

Table 12: BTEX Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Benzene	mg/kg	0.1		*	
Toluene	mg/kg	0.1		*	
Xylene (o, m, p speciated)	mg/kg	0.1		*	
Ethylbenzene	mg/kg	0.1		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.5 Mott MacDonald PCB Soil Suite

Table 13: PCB Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Polychlorinated Biphenyls (PCB's) 12 Congeners (WHO Standard): 77, 167, 169, 189, 81, 105, 114, 118, 123, 126, 156, 157	mg/kg	0.003		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.6 Mott MacDonald Blacktop Soil Suite

Table 14: Blacktop Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Polyaromatic Hydrocarbons (USPA 16 speciated)	mg/kg	0.1		*	
Total Petroleum Hydrocarbon- Criteria Working Group: Ali-Aro Split, TPHCWG Bands	mg/kg	4		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.7 Mott MacDonald Heavy Metals Soil Suite

Table 15: Heavy Metals Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Antimony	mg/kg	1		*	
Arsenic	mg/kg	1		*	
Barium	mg/kg	1		*	
Beryllium	mg/kg	1		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Boron	mg/kg	1		*	
Cadmium	mg/kg	1		*	
Chromium (III)	mg/kg	1		*	
Chromium (VI)	mg/kg	1		*	
Copper	mg/kg	1		*	
Iron	mg/kg	36		*	
Lead	mg/kg	1		*	
Manganese	mg/kg	1		*	
Inorganic Mercury	mg/kg	1		*	
Methylmercury	mg/kg	1		*	
Elemental Mercury	pH Units	1		*	
Molybdenum	%	1		*	
Nickel	mg/l	1		*	
Vanadium	mg/kg	1		*	
Zinc	mg/kg	3		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.8 Mott MacDonald Pesticides Soil Suite

Table 16: Pesticides Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Cypermethrin	mg/kg	0.05		*	
Diazinon	mg/kg	0.05		*	
Dimethoate	mg/kg	0.05		*	
Linuron	mg/kg	0.05		*	
Mecoprop	mg/kg	0.05		*	
Permethrin	mg/kg	0.05		*	
Alachlor	mg/kg	0.05		*	
Atrazine	mg/kg	0.05		*	
Carbaryl	mg/kg	0.05		*	
Chlorfenvinphos	mg/kg	0.05		*	
Chlorpyrifos-ethyl	mg/kg	0.05		*	
Aldrin	mg/kg	0.05		*	
Dieldrin	mg/kg	0.05		*	
Endrin	mg/kg	0.05		*	
Isodrin	mg/kg	0.05		*	
DDT	mg/kg	0.05		*	
DDE	mg/kg	0.05		*	
DDD	mg/kg	0.05		*	
Diuron	mg/kg	0.05		*	
Alpha-Endosulfan	mg/kg	0.05		*	
Beta-Endosulfan	mg/kg	0.05		*	
Isoproturon	mg/kg	0.05		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Simazine	mg/kg	0.05		*	
Trifluralin	mg/kg	0.05		*	
Bentazone	mg/kg	0.05		*	
Fentitrothion	mg/kg	0.05		*	
Malathion	mg/kg	0.05		*	
Dichlorvos	mg/kg	0.05		*	
Alpha-Hexachlorocyclohexanes (including Lindane)	mg/kg	0.05		*	
Beta-Hexachlorocyclohexanes (including Lindane)	mg/kg	0.05		*	
Gamma-Hexachlorocyclohexanes (including Lindane)	mg/kg	0.05		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.2.9 Mott MacDonald Marine Pesticides Soil Suite

Table 17: Marine Pesticides Soil Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Triphenyltin	mg/kg	0.05		*	
Tributyltin	mg/kg	0.05		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.3 Leachate Suites

B.3.1 Mott MacDonald Comprehensive Leachate Suite (BS EN 12457)

Table 18: Comprehensive Leachate Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Arsenic	mg/l	0.001		*	
Ammoniacal Nitrogen	mg/l	0.01		*	
Antimony	mg/l	0.005		*	
Barium	mg/l	0.01		*	
Beryllium	mg/l	0.01		*	
Boron	mg/l	0.01		*	
Cadmium	mg/l	0.00008		*	
Calcium	mg/l	1		*	
Chloride	mg/l	1		*	
Chromium (III)	mg/l	0.004		*	
Chromium (VI)	mg/l	0.0006		*	
Copper	mg/l	0.001		*	
Cyanide (Free)	mg/l	0.001		*	
Cyanide (Complex)	mg/l	0.02		*	
Fluoride	mg/l	1		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Iron	mg/l	0.01		*	
Lead	mg/l	0.001		*	
Magnesium	mg/l	1		*	
Manganese	mg/l	0.002		*	
Mercury	mg/l	0.00001		*	
Molybdenum	mg/l	0.07		*	
Nickel	mg/l	0.001		*	
pH		-		*	
Phenols (speciated: phenol, cresols, dimethylphenols, trimethylphenols)	mg/l	0.0005		*	
Selenium	mg/l	0.001		*	
Sulphate	mg/l	3		*	
Vanadium	mg/l	0.001		*	
Zinc	mg/l	0.001		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.3.2 Mott MacDonald VOC Leachate Suite (BS EN 12457)

Table 19: VOC Leachate Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
C10-13 Chloroalkanes	µg/l	0.4		*	
Benzene	µg/l	1		*	
Bromobenzene	µg/l	5		*	
Bromochloromethane	µg/l	5		*	
Bromodichloromethane	µg/l	5		*	
Bromoform	µg/l	5		*	
Bromomethane	µg/l	5		*	
n-Butylbenzene	µg/l	5		*	
sec-Butylbenzene	µg/l	5		*	
tert-Butylbenzene	µg/l	5		*	
Carbon tetrachloride	µg/l	0.1		*	
Chlorobenzene	µg/l	5		*	
Chlorodibromomethane	µg/l	5		*	
Chloroethane	µg/l	5		*	
Chloroform	µg/l	0.1		*	
Chloromethane (methyl chloride)	µg/l	5		*	
2-Chlorotoluene	µg/l	5		*	
4-Chlorotoluene	µg/l	5		*	
1,2-Dibromo-3-chloropropane	µg/l	0.1		*	
1,2-Dibromoethane	µg/l	0.4		*	
Dibromomethane	µg/l	5		*	
1,2-Dichlorobenzene	µg/l	5		*	
1,3-Dichlorobenzene	µg/l	5		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
1,4-Dichlorobenzene	µg/l	5		*	
Dichlorodifluoromethane	µg/l	5		*	
1,1-Dichloroethane	µg/l	5		*	
1,2-Dichloroethane	µg/l	1		*	
1,1-Dichloroethene	µg/l	5		*	
cis-1,2-Dichloroethene	µg/l	5		*	
trans-1,2-Dichloroethene	µg/l	5		*	
1,2-Dichloropropane	µg/l	0.1		*	
2,2-Dichloropropane	µg/l	5		*	
1,3-Dichloropropane	µg/l	5		*	
1,1-Dichloropropene	µg/l	5		*	
Ethylbenzene	µg/l	2		*	
Hexachlorobutadiene	µg/l	0.005		*	
Isopropylbenzene	µg/l	5		*	
p-Isopropyltoluene	µg/l	5		*	
Methylene chloride (dichloromethane)	µg/l	5		*	
Naphthalene	µg/l	1		*	
n-Propylbenzene	µg/l	5		*	
Styrene	µg/l	4		*	
1,1,1,2-Tetrachloroethane	µg/l	5		*	
1,1,2,2-Tetrachloroethane	µg/l	5		*	
Tetrachloroethene	µg/l	0.1		*	
Toluene	µg/l	4		*	
1,2,4-Trichlorobenzene	µg/l	0.01		*	
1,2,3-Trichlorobenzene	µg/l	0.01		*	
1,1,1-Trichloroethane	µg/l	0.1		*	
1,1,2-Trichloroethane	µg/l	0.1		*	
Trichloroethene	µg/l	0.1		*	
Trichlorofluoromethane	µg/l	5		*	
1,2,3-Trichloropropane	µg/l	5		*	
1,2,4-Trimethylbenzene	µg/l	5		*	
1,3,5-Trimethylbenzene	µg/l	5		*	
Vinyl chloride	µg/l	0.3		*	
o-Xylene	µg/l	3		*	
m-Xylene	µg/l	3		*	
p-Xylene	µg/l	3		*	
Methyl-t-butyl ether	µg/l	5		*	
Dichlorofluoromethane	µg/l	5		*	

* = BS EN ISO/IEC 17025:2005 / MCERTS unless otherwise stated

B.3.3 Mott MacDonald TPH Leachate Suite (BS EN 12457)

Table 20: Mott MacDonald TPH Leachate Suite (BS EN 12457, 2:1 Liquid : Solid Ratio)

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split TPHCWG Bands	µg/l	10		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.3.4 Mott MacDonald PAH Leachate Suite (BS EN 12457)

Table 21: Mott MacDonald PAH Leachate Suite (BS EN 12457, 2:1 Liquid : Solid Ratio)

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Polyaromatic Hydrocarbons (USEPA 16 speciated)	µg/l	0.002		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.3.5 Mott MacDonald Comprehensive Leachate Suite (NRA 301)

Table 22: Comprehensive Leachate Suite (NRA 301)

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Arsenic	mg/l	0.001		*	
Ammoniacal Nitrogen	mg/l	0.01		*	
Antimony	mg/l	0.005		*	
Barium	mg/l	0.01		*	
Beryllium	mg/l	0.01		*	
Boron	mg/l	0.01		*	
Cadmium	mg/l	0.00008		*	
Calcium	mg/l	1		*	
Chloride	mg/l	1		*	
Chromium (III)	mg/l	0.004		*	
Chromium (VI)	mg/l	0.0006		*	
Copper	mg/l	0.001		*	
Cyanide (Free)	mg/l	0.001		*	
Cyanide (Complex)	mg/l	0.02		*	
Fluoride	mg/l	1mg/l		*	
Iron	mg/l	0.01		*	
Lead	mg/l	0.001		*	
Magnesium	mg/l	1		*	
Manganese	mg/l	0.002		*	
Mercury	mg/l	0.00001		*	
Molybdenum	mg/l	0.07		*	
Nickel	mg/l	0.001		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
pH		-		*	
Phenols (speciated: phenol, methylphenol, dimethylphenol, trimethylphenol)	mg/l	0.0005		*	
Selenium	mg/l	0.001		*	
Sulphate	mg/l	3		*	
Sulphide	ug /l	0.25		*	
Vanadium	mg/l	0.001		*	
Zinc	mg/l	0.001		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4 Water Suites

B.4.1 Mott MacDonald Comprehensive Water Suite

Table 23: Comprehensive Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Ammoniacal Nitrogen	mg/l	0.01mg/l		*	
Antimony	mg/l	0.005mg/l		*	
Arsenic	mg/l	0.001mg/l		*	
Barium	mg/l	0.01mg/l		*	
Beryllium	mg/l	0.01mg/l		*	
Boron	mg/l	0.01mg/l		*	
Cadmium	mg/l	0.00008mg/l		*	
Calcium	mg/l	1mg/l		*	
Chloride	mg/l	1mg/l		*	
Chromium (III)	mg/l	0.004mg/l		*	
Chromium (VI)	mg/l	0.0006mg/l		*	
Copper	mg/l	0.001mg/l		*	
Cyanide (Free)	mg/l	0.001mg/l		*	
Cyanide (Total)	mg/l	0.02mg/l		*	
Fluoride	mg/l	1mg/l		*	
Hardness (CaCO ₃)	mg/l	10mg/l		*	
Iron	mg/l	0.01mg/l		*	
Lead	mg/l	0.001mg/l		*	
Magnesium	mg/l	1mg/l		*	
Manganese	mg/l	0.002mg/l		*	
Mercury	mg/l	0.00005mg/l		*	
Molybdenum	mg/l	0.07mg/l		*	
Nickel	mg/l	0.001mg/l		*	
Nitrate as NO ₃	mg/l	1mg/l		*	
pH		-		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Phenols (speciated: phenol, cresols, dimethylphenols, trimethylphenols)	mg/l	0.0005mg/l		*	
Polyaromatic Hydrocarbons (USEPA 16 speciated)	µg/l	0.002µg/l (each and every PAH)		*	
Selenium	mg/l	0.001mg/l		*	
Sodium	mg/l	1mg/l		*	
Sulphate	mg/l	3mg/l		*	
Sulphur	mg/l	3mg/l		*	
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split TPHCWG Bands	µg/l	10µg/l (each and every TPH Band)		*	
Vanadium	mg/l	0.001mg/l		*	
Volatile Organic Compounds, (Speciated USEPA Method 8260 Target List) (detection limits detailed in Table 24)	mg/l	Various: See Table 24		*	
Zinc	mg/l	0.001mg/l		*	
Total Dissolved Solids	mg/l	0.1		*	
Alkalinity – Bicarbonate	Mg/l	1		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.2 Mott MacDonald Heavy Metals Water Suite

Table 24: Heavy Metals Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Antimony	mg/l	0.005mg/l		*	
Arsenic	mg/l	0.001mg/l		*	
Barium	mg/l	0.01mg/l		*	
Beryllium	mg/l	0.01mg/l		*	
Boron	mg/l	0.01mg/l		*	
Cadmium	mg/l	0.00008mg/l		*	
Calcium	mg/l	1mg/l		*	
Chromium (III)	mg/l	0.004mg/l		*	
Chromium (VI)	mg/l	0.0006mg/l		*	
Copper	mg/l	0.001mg/l		*	
Hardness (CaCO ₃)	mg/l	10mg/l		*	
Iron	mg/l	0.01mg/l		*	
Lead	mg/l	0.001mg/l		*	
Magnesium	mg/l	1mg/l		*	
Manganese	mg/l	0.002mg/l		*	
Mercury	mg/l	0.00001mg/l		*	
Molybdenum	mg/l	0.07mg/l		*	
Nickel	mg/l	0.001mg/l		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Phenols (speciated: phenol, cresols, dimethylphenols, trimethylphenols)	mg/l	0.0005mg/l		*	
Selenium	mg/l	0.001mg/l		*	
Vanadium	mg/l	0.001mg/l		*	
Zinc	mg/l	0.001mg/l		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.3 Mott MacDonald VOCs Water Suite

Table 25: VOC Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
C10-13 Chloroalkanes	µg/l	0.4		*	
Benzene	µg/l	1		*	
Bromobenzene	µg/l	5		*	
Bromochloromethane	µg/l	5		*	
Bromodichloromethane	µg/l	5		*	
Bromoform	µg/l	5		*	
Bromomethane	µg/l	5		*	
n-Butylbenzene	µg/l	5		*	
sec-Butylbenzene	µg/l	5		*	
tert-Butylbenzene	µg/l	5		*	
Carbon tetrachloride	µg/l	0.1		*	
Chlorobenzene	µg/l	5		*	
Chlorodibromomethane	µg/l	5		*	
Chloroethane	µg/l	5		*	
Chloroform	µg/l	0.1		*	
Chloromethane (methyl chloride)	µg/l	5		*	
2-Chlorotoluene	µg/l	5		*	
4-Chlorotoluene	µg/l	5		*	
1,2-Dibromo-3-chloropropane	µg/l	0.1		*	
1,2-Dibromoethane	µg/l	0.4		*	
Dibromomethane	µg/l	5		*	
1,2-Dichlorobenzene	µg/l	5		*	
1,3-Dichlorobenzene	µg/l	5		*	
1,4-Dichlorobenzene	µg/l	5		*	
Dichlorodifluoromethane	µg/l	5		*	
1,1-Dichloroethane	µg/l	5		*	
1,2-Dichloroethane	µg/l	1		*	
1,1-Dichloroethene	µg/l	5		*	
cis-1,2-Dichloroethene	µg/l	5		*	
trans-1,2-Dichloroethene	µg/l	5		*	
1,2-Dichloropropane	µg/l	0.1		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
2,2-Dichloropropane	µg/l	5		*	
1,3-Dichloropropane	µg/l	5		*	
1,1-Dichloropropene	µg/l	5		*	
Ethylbenzene	µg/l	2		*	
Hexachlorobutadiene	µg/l	0.005		*	
Isopropylbenzene	µg/l	5		*	
p-Isopropyltoluene	µg/l	5		*	
Methylene chloride (dichloromethane)	µg/l	5		*	
Naphthalene	µg/l	1		*	
n-Propylbenzene	µg/l	5		*	
Styrene	µg/l	4		*	
1,1,1,2-Tetrachloroethane	µg/l	5		*	
1,1,2,2-Tetrachloroethane	µg/l	5		*	
Tetrachloroethene	µg/l	0.1		*	
Toluene	µg/l	4		*	
1,2,4-Trichlorobenzene	µg/l	0.01		*	
1,2,3-Trichlorobenzene	µg/l	0.01		*	
1,1,1-Trichloroethane	µg/l	0.1		*	
1,1,2-Trichloroethane	µg/l	0.1		*	
Trichloroethene	µg/l	0.1		*	
Trichlorofluoromethane	µg/l	5		*	
1,2,3-Trichloropropane	µg/l	5		*	
1,2,4-Trimethylbenzene	µg/l	5		*	
1,3,5-Trimethylbenzene	µg/l	5		*	
Vinyl chloride	µg/l	0.3		*	
o-Xylene	µg/l	3		*	
m-Xylene	µg/l	3		*	
p-Xylene	µg/l	3		*	
Methyl-t-butyl ether	µg/l	5		*	
Dichlorofluoromethane	µg/l	5		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.4 Mott MacDonald BTEX Water Suite

Table 26: BTEX Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Benzene	µg/l	1		*	
Toluene	µg/l	4		*	
Xylene	µg/l	3		*	
Ethylbenzene	µg/l	2		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.5 Mott MacDonald PCB Water Suite

Table 27: PCB Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Polychlorinated Biphenyls (PCB's) 12Congeners (WHO standard)	µg/l	0.001		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.6 Mott MacDonald TPH Water Suite

Table 28: TPH Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split TPHCWG Bands	µg/l	10		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.7 Mott MacDonald 3 Band TPH Water Suite

Table 29: Mott MacDonald 3 Band TPH Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
C6-C10: Aliphatic and Aromatic	µg/l	10		*	
>C10-C21: Aliphatic and Aromatic	µg/l	10		*	
>C21-C40: Aliphatic and Aromatic	µg/l	10		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.8 Mott MacDonald PAH Water Suite

Table 30: Mott MacDonald PAH Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Polycyclic Aromatic Hydrocarbons (USEPA 16 speciated)	µg/l	0.002		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.9 Mott MacDonald Pesticides Water Suite

Table 31: Mott MacDonald Pesticide Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Cypermethrin	ng /l	0.1		*	
Diazinon	ug /l	0.01		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Dimethoate	ug /l	0.48		*	
Linuron	ug /l	0.5		*	
Mecoprop	ug /l	18		*	
Permethrin	ug /l	0.01		*	
Alachlor	ug /l	0.3		*	
Atrazine	ug /l	0.6		*	
Carbaryl	ug /l	1		*	
Chlorfenvinphos	ug /l	0.1		*	
Chlorpyrifos	ug /l	0.03		*	
Aldrin	ug /l	0.001		*	
Dieldrin	ug /l	0.001		*	
Endrin	ug /l	0.001		*	
Isodrin	ug /l	0.001		*	
DDT	ug /l	0.01		*	
DDE	ug /l	0.01		*	
DDD	ug /l	0.01		*	
Diuron	ug /l	0.2		*	
Endosulphan	ug /l	0.0005		*	
Isoproturon	ug /l	0.3		*	
Simazine	ug /l	1		*	
Trifluralin	ug /l	0.03		*	
Bentazone	ug /l	500		*	
Fenitrothion	ug /l	0.01		*	
Malathion	ug /l	0.01		*	
Dichlorvos	ug /l	0.001		*	
Hexachlorocyclohexane (Lindane)	ug /l	0.002		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.10 Mott MacDonald Marine Pesticides Water Suite

Table 32: Mott MacDonald Marine Pesticides Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Triphenyltin	µg/l	0.008		*	
Tributyltin	µg/l	0.0002		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.11 Mott MacDonald Major Ion Balance Water Suite: Cations

Table 33: Mott MacDonald Major Ion Balance Water Suite: Cations

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Calcium	mg/l	1		*	
Magnesium	mg/l	0.5		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Potassium	mg/l	1		*	
Sodium	mg/l	1		*	
Ammoniacal Nitrogen	mg/l	0.01		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.12 Mott MacDonald Major Ion Balance Water Suite: Anions

Table 34: Mott MacDonald Major Ion Balance Water Suite: Anions

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Bicarbonate	mg/l	10		*	
Sulphate	mg/l	3		*	
Chloride	mg/l	1		*	
Nitrate	mg/l	1		*	
Flouride	mg/l	1		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.13 Mott MacDonald Oxygen Demand Water Suite

Table 35: Mott MacDonald Oxygen Demand Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Biochemical Oxygen Demand	mg/l	02.5		*	
Chemical Oxygen Demand	mg/l	30		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.14 Mott MacDonald Hardness Water Suite

Table 36: Mott MacDonald Hardness Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Hardness as CaCO ₃	mg/l	10		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.15 Mott MacDonald Nitrogen Oxides Water Suite

Table 37: Mott MacDonald Nitrogen Oxides Water Suite

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Nitrate as NO ₃	mg/l	1		*	
Nitrite as NO ₂	µg/l	10		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.16 Mott MacDonald Electrical Conductivity Water Suite

Table 38: Mott MacDonald Electrical Conductivity Water Suite

Determinand	Unit	Detection Limit		Accreditation	
		Required	Offered	Required	Offered
Electrical Conductivity	uS/cm (@20°C)	1		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.4.17 Mott MacDonald Phenols Water Suite

Table 39: Mott MacDonald Phenols Water Suite

Determinand	Unit	Detection Limit		Accreditation	
		Required	Offered	Required	Offered
Phenol	mg/l	0.0005		*	
cresols	mg/l	0.0005		*	
dimethylphenols	mg/l	0.0005		*	
trimethylphenols	mg/l	0.0005		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.5 Waste Acceptance Criteria

B.5.1 Mott MacDonald Waste Acceptance Suite

Table 40: Waste Acceptance Criteria

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Total organic carbon	%	3		*	
Loss on ignition	%	10		*	
BTEX	mg/kg	6		*	
PCB's (7 congeners)	mg/kg	1		*	
Mineral Oil, C10 – C40	mg/kg	500		*	
PAH's (Total of 17)	mg/kg	100		*	
pH	N/A	N/A			
Arsenic, As	mg/kg	0.5		*	
Barium, Ba	mg/kg	20		*	
Cadmium, Cd	mg/kg	0.04		*	
Chromium, Cr	mg/kg	0.5		*	
Copper, Cu	mg/kg	2		*	
Mercury, Hg	mg/kg	0.01		*	
Molybdenum, Mo	mg/kg	0.5		*	
Nickel, Ni	mg/kg	0.4		*	
Lead, Pb	mg/kg	0.5		*	
Antimony, Sb	mg/kg	0.06		*	
Selenium, Se	mg/kg	0.1		*	
Zinc, Zn	mg/kg	4		*	
Chloride, Cl	mg/kg	800		*	
Fluoride, F	mg/kg	10		*	

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Sulphate, SO ₄	mg/kg	1000		*	
Total dissolved Solids (TDS)	mg/kg	4000		*	
Phenol index	mg/kg	1		*	
Dissolved organic carbon	mg/kg	500		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.6 Soil Gas Suites

B.6.1 Mott MacDonald Soil Gas Suite SG1 – Bulk Gases

Table 41: Mott MacDonald Soil Gas Suite SG1 – Bulk Gases

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Bulk Gas Total	%	0.1		*	
Carbon Dioxide	% vol	0.05		*	
Carbon Monoxide	ppm	1		*	
Carbon Monoxide %	%	0.05		*	
Hydrogen Sulphide	ppm	1		*	
Hydrogen	% vol	0.5		*	
Methane	% vol	0.05		*	
Nitrogen	% vol	0.5		*	
Oxygen	% vol	0.5		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

B.6.2 Mott MacDonald Soil Gas Suite SG2 – C1-C7 Gases

Table 42: Mott MacDonald Soil Gas Suite SG2 – C1-C7 Gases

Determinand	Unit	Detection Limits		Accreditation	
		Required	Offered	Required	Offered
Ethane	ppm v/v	1		*	
Methane	ppm v/v	1		*	
n-Butane	ppm v/v	1		*	
Pentane	ppm v/v	1		*	
Propane	ppm v/v	1		*	
Heptane	ppm v/v	1		*	
Hexane	ppm v/v	1		*	
Isobutane	ppm v/v	1		*	
Isopentane	ppm v/v	1		*	
Total Volatile Gases (C1-C7)	ppm v/v	1		*	
Concentration of other compounds	ppm v/v	1		*	

* = UKAS (BS EN ISO/IEC 17025:2005 unless otherwise stated)

C. CHEMICAL TESTING SUITES FOR POTENTIALLY AGGRESSIVE GROUND/GROUNDWATER

C.1 General

The following are potentially aggressive ground/ groundwater testing suites. The testing suites present the recommended required detection limits for the testing. The Contractor should complete the “offered” columns to demonstrate compliance.

C.2 Soils Suites

C.2.1 BRE SD1 Soils Suite A (Greenfield site – pyrite absent)

Table 43: BRE SD1 Soils Suite A (Greenfield site – pyrite absent)

Determinand	Test Method	Accreditation	
		Required	Offered
pH in 2.5:1 water/soil extract	BR 279 BS1377 Part 3, Section 9	**	
SO ₄ in 2:1 water/soil extract	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.2 BRE SD1 Soils Suite B (Greenfield site – pyrite present)

Table 44: BRE SD1 Soils Suite B (Greenfield site – pyrite present)

Determinand	Test Method	Accreditation	
		Required	Offered
pH in 2.5:1 water/soil extract	BR 279 BS1377 Part 3, Section 9	**	
SO ₄ in 2:1 water/soil extract	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	
Acid Soluble SO ₄	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 2	**	
Total sulphur	BR 279 TRL Report 447, Test 4A TRL Report 447, Test 4B	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.3 BRE SD1 Soils Suite C (Brownfield site – pyrite absent)

Table 45: BRE SD1 Soils Suite C (Brownfield site – pyrite absent)

Determinand	Test Method	Accreditation	
		Required	Offered
pH in 2.5:1 water/soil extract	BR 279 BS1377 Part 3, Section 9	**	
SO ₄ in 2:1 water/soil extract	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	
Mg (only required if water soluble SO ₄ >3000mg/l)	BR 279 – AAS method BR 297 – ISP-AES	**	
NO ₃ in 2:1 water/soil extract (only required if pH <5.5)	BR 279	**	
Cl in 2:1 water/soil extract (only required if pH <5.5)	BR 279 BS 1377-3:2018+A1:2021	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.4 BRE SD1 Soils Suite D (Brownfield site – pyrite present)

Table 46: BRE SD1 Soils Suite D (Brownfield site – pyrite present)

Determinand	Test Method	Accreditation	
		Required	Offered
pH in 2.5:1 water/soil extract	BR 279 BS1377 Part 3, Section 9	**	
SO ₄ in 2:1 water/soil extract	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	
Acid Soluble SO ₄	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 2	**	
Total sulphur	BR 279 TRL Report 447, Test 4A TRL Report 447, Test 4B	**	
Mg (only required if water soluble SO ₄ >3000mg/l)	BR 279 – AAS method BR 297 – ISP-AES	**	
NO ₃ in 2:1 water/soil extract (only required if pH <5.5)	BR 279	**	
Cl in 2:1 water/soil extract (only required if pH <5.5)	BR 279 BS 1377-3:2018+A1:2021	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.5 TRL447 Test 1

Table 47: TRL Test 1

Determinand	Test Method	Accreditation	
		Required	Offered
Water Soluble Sulphur (WSS)	TRL447: Test 1	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.6 TRL447 Test 2

Table 48: TRL Test 2

Determinand	Test Method	Accreditation	
		Required	Offered
Acid Soluble Sulphur (ASS)	TRL447: Test 2	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.2.7 TRL447 Test 4

Table 49: TRL Test 4

Determinand	Test Method	Accreditation	
		Required	Offered
Total Sulphur (TS)	TRL447: Test 4	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.3 Waters/Leachate Suites

C.3.1 BRE SD1 Waters / Leachate Suite A (Greenfield site – pyrite absent)

Table 50: BRE SD1 Waters/ Leachate Suite A (Greenfield site – pyrite absent)

Determinand	Test Method	Accreditation	
		Required	Offered
pH	BR 279	**	
	BS1377 Part 3, Section 9		
SO ₄	BR 279	**	
	BS1377 Part 3, Section 5		
	TRL Report 447, Test 1		

** = UKAS (BS EN ISO/IEC 17025:2005)

C.3.2 BRE SD1 Waters / Leachate Suite B (Greenfield site – pyrite present)

Table 51: BRE SD1 Waters / Leachate Suite B (Greenfield site – pyrite present)

Determinand	Test Method	Accreditation	
		Required	Offered
pH	BR 279	**	
	BS1377 Part 3, Section 9		
SO ₄	BR 279	**	
	BS1377 Part 3, Section 5		
	TRL Report 447, Test 1		

Determinand	Test Method	Accreditation	
		Required	Offered
Acid Soluble SO ₄	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 2	**	
Total sulphur	BR 279 TRL Report 447, Test 4A TRL Report 447, Test 4B	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.3.3 BRE SD1 Waters / Leachate Suite C (Brownfield site – pyrite absent)

Table 52: BRE SD1 Waters / Leachate Suite C (Brownfield site – pyrite absent)

Determinand	Test Method	Accreditation	
		Required	Offered
pH	BR 279 BS1377 Part 3, Section 9	**	
SO ₄	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	
Mg (only required if water soluble SO ₄ >3000mg/l)	BR 279 – AAS method BR 297 – ISP-AES	**	
NO ₃ (only required if pH <5.5)	BR 279	**	
Cl (only required if pH <5.5)	BR 279 BS 1377-3:2018+A1:2021	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

C.3.4 BRE SD1 Waters / Leachate Suite D (Brownfield site – pyrite present)

Table 53: BRE SD1 Waters / Leachate Suite D (Brownfield site – pyrite present)

Determinand	Test Method	Accreditation	
		Required	Offered
pH in 2.5:1 water/soil extract	BR 279 BS1377 Part 3, Section 9	**	
SO ₄ in 2:1 water/soil extract	BR 279 BS1377 Part 3, Section 5 TRL Report 447, Test 1	**	
Mg (only required if water soluble SO ₄ >3000mg/l)	BR 279 – AAS method BR 297 – ISP-AES	**	
NO ₃ (only required if pH <5.5)	BR 279	**	
Cl (only required if pH <5.5)	BR 279 BS 1377-3:2018+A1:2021	**	

** = UKAS (BS EN ISO/IEC 17025:2005)

D. AGS USER DEFINED CHEMICAL SUITES

D.1 General

The following tables provide AGS data transfer code descriptions for fields CNMT_TYPE, CMNT_TTYP and CNMT_UNIT which shall be used for reporting of geo-environmental test results.

D.2 Soils Suites

D.2.1 Mott MacDonald Comprehensive Soil Suite

Table 54: Mott MacDonald Comprehensive Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYP" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Antimony	1mg/kg	SB	SOLID	mg/kg
Arsenic	1mg/kg	AS	SOLID	mg/kg
Asbestos Screen	N/A	Lab determined	Lab determined	Lab determined
Barium	1mg/kg	BA	SOLID	mg/kg
Beryllium	1mg/kg	BE	SOLID	mg/kg
Boron	1mg/kg	B	SOLID	mg/kg
Benzene	0.02mg/kg	BENZ	SOLID	mg/kg
Toluene	0.02mg/kg	TOL	SOLID	mg/kg
Ethylbenzene	0.02mg/kg	ETHYL	SOLID	mg/kg
m xylene	0.02mg/kg	MXYL	SOLID	mg/kg
p xylene	0.02mg/kg	PXYL	SOLID	mg/kg
o xylene	0.02mg/kg	OXYL	SOLID	mg/kg
Cadmium	1mg/kg	CD	SOLID	mg/kg
Chromium (III)	1mg/kg	CRIII	SOLID	mg/kg
Chromium (VI)	1mg/kg	CRVI	SOLID	mg/kg
Copper	1mg/kg	CU	SOLID	mg/kg
Cyanide (Free)	1mg/kg	GHYDC	SOLID	mg/kg
Fraction of Organic Carbon	0.1%	FOC	SOLID	
Iron	36mg/kg	FE	SOLID	mg/kg
Lead	1mg/kg	PB	SOLID	mg/kg
Manganese	1mg/kg	MN	SOLID	mg/kg
Inorganic Mercury	1mg/kg	HGII	SOLID	mg/kg
Methylmercury	1mg/kg	METHHG	SOLID	mg/kg
Elemental Mercury	1mg/kg	HG	SOLID	mg/kg
Molybdenum	1mg/kg	MO	SOLID	mg/kg
Nickel	1mg/kg	NI	SOLID	mg/kg
pH (2.5:1 deionised water : soil extract)	N/A	PHS	SOLID	
Phenol	0.6mg/kg	PHE	SOLID	mg/kg

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYP" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
cresols	0.6mg/kg	CRES	SOLID	mg/kg
dimethylphenols	0.6mg/kg	DIMPH	SOLID	mg/kg
trimethylphenols	0.6mg/kg	TMPHE	SOLID	mg/kg
Polyaromatic Hydrocarbons (USEPA 16 speciated),	0.1mg/kg	PAHS	SOLID	mg/kg
naphthalene	0.1mg/kg	NAPTHH	SOLID	mg/kg
acenaphthylene	0.1mg/kg	ACNAP	SOLID	mg/kg
acenaphthene	0.1mg/kg	ACNEN	SOLID	mg/kg
fluorene	0.1mg/kg	FLN	SOLID	mg/kg
phenanthrene	0.1mg/kg	PPENN	SOLID	mg/kg
anthracene	0.1mg/kg	ANTHN	SOLID	mg/kg
fluoranthene	0.1mg/kg	FLNN	SOLID	mg/kg
pyrene	0.1mg/kg	PYRN	SOLID	mg/kg
benzo[a]anthracene	0.1mg/kg	BENA	SOLID	mg/kg
chrysene	0.1mg/kg	CRYN	SOLID	mg/kg
benzo[b]fluoranthene	0.1mg/kg	BENB	SOLID	mg/kg
benzo[k]fluoranthene	0.1mg/kg	BENK	SOLID	mg/kg
benzo[a]pyrene	0.1mg/kg	BENAP	SOLID	mg/kg
dibenz(ah)anthracene	0.1mg/kg	DIABN	SOLID	mg/kg
benzo[ghi]perylene	0.1mg/kg	BENGI	SOLID	mg/kg
indeno(1,2,3-cd)pyrene	0.1mg/kg	INDP	SOLID	mg/kg
Selenium	1mg/kg	SE	SOLID	mg/kg
Sulphate Total (as SO4)	10mg/l	SO4	SOLID_TOT	mg/kg
Sulphur	0.01%	SULES	SOLID	%
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split, TPHCWG Bands	4mg/kg	TPH	SOLID	mg/kg
TPH Aliphatics EC5-6	4mg/kg	AL_C5_6	SOLID	mg/kg
TPH Aliphatics EC >6-8	4mg/kg	AL_C6_8	SOLID	mg/kg
TPH Aliphatics EC >8-10	4mg/kg	AL_C8_10	SOLID	mg/kg
TPH Aliphatics EC >10-12	4mg/kg	AL_C10_12	SOLID	mg/kg
TPH Aliphatics EC >12-16	4mg/kg	AL_C12-16	SOLID	mg/kg
TPH Aliphatics EC >16-35	4mg/kg	AL_C16_35	SOLID	mg/kg
TPH Aromatics EC5-7	4mg/kg	AR_C5_7	SOLID	mg/kg
TPH Aromatics EC >7-8	4mg/kg	AR_C7_8	SOLID	mg/kg
TPH Aromatics EC >8-10	4mg/kg	AR_C8_10	SOLID	mg/kg
TPH Aromatics EC >10-12	4mg/kg	AR_C10_12	SOLID	mg/kg
TPH Aromatics EC >12-16	4mg/kg	AR_C12_16	SOLID	mg/kg
TPH Aromatics EC >16-21	4mg/kg	AR_C16_21	SOLID	mg/kg
TPH Aromatics EC >21-35	4mg/kg	AR_C21_35	SOLID	mg/kg
Vanadium	1mg/kg	V	SOLID	mg/kg
Volatile Organic Compounds, (Speciated)	1µg/kg	See Table 55	SOLID	µg/kg

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYPE" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
USEPA Method 8260 Target List)				
Zinc	3mg/kg	ZN	SOLID	mg/kg

D.2.2 Mott MacDonald VOC Soil Suite

Table 55: Mott MacDonald VOC Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYPE" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
C10-13 Chloroalkanes	1µg/kg	CHA_C10_13	SOLID	µg/kg
Benzene	1µg/kg	BENZ	SOLID	µg/kg
Bromobenzene	1µg/kg	BROMBE	SOLID	µg/kg
Bromochloromethane	1µg/kg	BROMCM	SOLID	µg/kg
Bromodichloromethane	1µg/kg	BROMO	SOLID	µg/kg
Bromoform	1µg/kg	BROMF	SOLID	µg/kg
Bromomethane	1µg/kg	BROMM	SOLID	µg/kg
n-Butylbenzene	1µg/kg	NBUT	SOLID	µg/kg
sec-Butylbenzene	1µg/kg	SECB	SOLID	µg/kg
tert-Butylbenzene	1µg/kg	TERTB	SOLID	µg/kg
Carbon tetrachloride	1µg/kg	CTET	SOLID	µg/kg
Chlorobenzene	1µg/kg	CBENZ	SOLID	µg/kg
Chlorodibromomethane	1µg/kg	DIBM	SOLID	µg/kg
Chloroethane	1µg/kg	CETH	SOLID	µg/kg
Chloroform	1µg/kg	CFM	SOLID	µg/kg
Chloromethane (methyl chloride)	1µg/kg	CMN	SOLID	µg/kg
2-Chlorotoluene	1µg/kg	2CT	SOLID	µg/kg
4-Chlorotoluene	1µg/kg	4CT	SOLID	µg/kg
1,2-Dibromo-3-chloropropane	1µg/kg	12D3C	SOLID	µg/kg
1,2-Dibromoethane	1µg/kg	12DIB	SOLID	µg/kg
Dibromomethane	1µg/kg	DIBROM	SOLID	µg/kg
1,2-Dichlorobenzene	1µg/kg	12DB	SOLID	µg/kg
1,3-Dichlorobenzene	1µg/kg	13DB	SOLID	µg/kg
1,4-Dichlorobenzene	1µg/kg	14DB	SOLID	µg/kg
Dichlorodifluoromethane	1µg/kg	DCFM	SOLID	µg/kg
1,1-Dichloroethane	1µg/kg	11DEA	SOLID	µg/kg
1,2-Dichloroethane	1µg/kg	12DEA	SOLID	µg/kg
1,1-Dichloroethene	1µg/kg	11DEE	SOLID	µg/kg
cis-1,2-Dichloroethene	1µg/kg	T12DE	SOLID	µg/kg
trans-1,2-Dichloroethene	1µg/kg	T12DE	SOLID	µg/kg
1,2-Dichloropropane	1µg/kg	12DP	SOLID	µg/kg

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
2,2-Dichloropropane	1µg/kg	22DP	SOLID	µg/kg
1,3-Dichloropropane	1µg/kg	13DP	SOLID	µg/kg
1,1-Dichloropropene	1µg/kg	11DCP	SOLID	µg/kg
Ethylbenzene	1µg/kg	ETHYL	SOLID	µg/kg
Hexachlorobutadiene	1µg/kg	HEXBUT	SOLID	µg/kg
Isopropylbenzene	1µg/kg	IPB	SOLID	µg/kg
p-Isopropyltoluene	1µg/kg	IPT	SOLID	µg/kg
Methylene chloride (dichloromethane)	1µg/kg	DICM	SOLID	µg/kg
Naphthalene	1µg/kg	NAPTHH	SOLID	µg/kg
n-Propylbenzene	1µg/kg	NPB	SOLID	µg/kg
Styrene	1µg/kg	STY	SOLID	µg/kg
1,1,1,2-Tetrachloroethane	1µg/kg	1112TCE	SOLID	µg/kg
1,1,2,2-Tetrachloroethane	1µg/kg	1122TCE	SOLID	µg/kg
Tetrachloroethene	1µg/kg	TETC	SOLID	µg/kg
Toluene	1µg/kg	TOL	SOLID	µg/kg
1,2,4-Trichlorobenzene	1µg/kg	124TCB	SOLID	µg/kg
1,2,3-Trichlorobenzene	1µg/kg	123TCB	SOLID	µg/kg
1,1,1-Trichloroethane	1µg/kg	111TCE	SOLID	µg/kg
1,1,2-Trichloroethane	1µg/kg	112TCE	SOLID	µg/kg
Trichloroethene	1µg/kg	TRCE	SOLID	µg/kg
Trichlorofluoromethane	1µg/kg	TCFE	SOLID	µg/kg
1,2,3-Trichloropropane	1µg/kg	123TCP	SOLID	µg/kg
1,2,4-Trimethylbenzene	1µg/kg	124TMB	SOLID	µg/kg
1,3,5-Trimethylbenzene	1µg/kg	135TMB	SOLID	µg/kg
Vinyl chloride	1µg/kg	VCHL	SOLID	µg/kg
o-Xylene	1µg/kg	OXYL	SOLID	µg/kg
m-Xylene	1µg/kg	MXYL	SOLID	µg/kg
p-Xylene	1µg/kg	PXYL	SOLID	µg/kg
Methyl-t-butyl ether	1µg/kg	MTBE	SOLID	µg/kg
Dichlorofluoromethane	1µg/kg	DCF	SOLID	µg/kg

D.2.3 Mott MacDonald TPH Soil Suite

Table 56: Mott MacDonald TPH Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split, TPHCWG Bands	4mg/kg	TPH	SOLID	mg/kg
TPH Aliphatics EC5-6	4mg/kg	AL_C5_6	SOLID	mg/kg
TPH Aliphatics EC >6-8	4mg/kg	AL_C6_8	SOLID	mg/kg

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TY P E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
TPH Aliphatics EC >8-10	4mg/kg	AL_C8_10	SOLID	mg/kg
TPH Aliphatics EC >10-12	4mg/kg	AL_C10_12	SOLID	mg/kg
TPH Aliphatics EC >12-16	4mg/kg	AL_C12-16	SOLID	mg/kg
TPH Aliphatics EC >16-35	4mg/kg	AL_C16_35	SOLID	mg/kg
TPH Aromatics EC5-7	4mg/kg	AR_C5_7	SOLID	mg/kg
TPH Aromatics EC >7-8	4mg/kg	AR_C7_8	SOLID	mg/kg
TPH Aromatics EC >8-10	4mg/kg	AR_C8_10	SOLID	mg/kg
TPH Aromatics EC >10-12	4mg/kg	AR_C10_12	SOLID	mg/kg
TPH Aromatics EC >12-16	4mg/kg	AR_C12_16	SOLID	mg/kg
TPH Aromatics EC >16-21	4mg/kg	AR_C16_21	SOLID	mg/kg
TPH Aromatics EC >21-35	4mg/kg	AR_C21_35	SOLID	mg/kg

D.2.4 Mott MacDonald BTEX Soil Suite

Table 57: Mott MacDonald BTEX Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TY P E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Benzene	0.1mg/kg	BENZ	SOLID	mg/kg
Toluene	0.1mg/kg	TOL	SOLID	mg/kg
Xylene (o, m, p, speciated)	0.1mg/kg	OXYL/MXYL	SOLID	mg/kg
Ethylbenzene	0.1mg/kg	ETHYL	SOLID	mg/kg

D.2.5 Mott MacDonald PCB Soil Suite

Table 58: Mott MacDonald PCBs Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
WHO PCB Congener 77	0.003mg/kg	PCB77S	SOLID	mg/kg
WHO PCB Congener 167	0.003mg/kg	PCB167S	SOLID	mg/kg
WHO PCB Congener 169	0.003mg/kg	PCB169S	SOLID	mg/kg
WHO PCB Congener 189	0.003mg/kg	PCB189S	SOLID	mg/kg
WHO PCB Congener 81	0.003mg/kg	PCB81S	SOLID	mg/kg
WHO PCB Congener 105	0.003mg/kg	PCB105S	SOLID	mg/kg
WHO PCB Congener 114	0.003mg/kg	PCB114S	SOLID	mg/kg
WHO PCB Congener 118	0.003mg/kg	PCB118S	SOLID	mg/kg
WHO PCB Congener 123	0.003mg/kg	PCB123S	SOLID	mg/kg
WHO PCB Congener 126	0.003mg/kg	PCB126S	SOLID	mg/kg
WHO PCB Congener 156	0.003mg/kg	PCB156S	SOLID	mg/kg
WHO PCB Congener 157	0.003mg/kg	PCB157S	SOLID	mg/kg
Total WHO PCBs	0.003mg/kg	PCBS	SOLID	mg/kg

D.2.6 Mott MacDonald Blacktop Soil Suite

Table 59: Mott MacDonald Blacktop Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TY P" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Polyaromatic Hydrocarbons (USEPA 16 speciated)	0.1mg/kg	PAHS	SOLID	mg/kg
naphthalene	0.1mg/kg	NAPTHH	SOLID	mg/kg
acenaphthylene	0.1mg/kg	ACNAP	SOLID	mg/kg
acenaphthene	0.1mg/kg	ACNEN	SOLID	mg/kg
fluorene	0.1mg/kg	FLN	SOLID	mg/kg
phenanthrene	0.1mg/kg	PPENN	SOLID	mg/kg
anthracene	0.1mg/kg	ANTHN	SOLID	mg/kg
fluoranthene	0.1mg/kg	FLNN	SOLID	mg/kg
pyrene	0.1mg/kg	PYRN	SOLID	mg/kg
benzo[a]anthracene	0.1mg/kg	BENA	SOLID	mg/kg
chrysene	0.1mg/kg	CRYN	SOLID	mg/kg
benzo[b]fluoranthene	0.1mg/kg	BENB	SOLID	mg/kg
benzo[k]fluoranthene	0.1mg/kg	BENK	SOLID	mg/kg
benzo[a]pyrene	0.1mg/kg	BENAP	SOLID	mg/kg
dibenz(ah)anthracene	0.1mg/kg	DIABN	SOLID	mg/kg
benzo[ghi]perylene	0.1mg/kg	BENGI	SOLID	mg/kg
indeno(1,2,3-cd)pyrene	0.1mg/kg	INDP	SOLID	mg/kg

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Total Petroleum Hydrocarbon – Criteria Working Group: Ali-Aro Split, TPHCWG Bands	4mg/kg	TPH	SOLID	mg/kg
TPH Aliphatics EC5-6	4mg/kg	AL_C5_6	SOLID	mg/kg
TPH Aliphatics EC >6-8	4mg/kg	AL_C6_8	SOLID	mg/kg
TPH Aliphatics EC >8-10	4mg/kg	AL_C8_10	SOLID	mg/kg
TPH Aliphatics EC >10-12	4mg/kg	AL_C10_12	SOLID	mg/kg
TPH Aliphatics EC >12-16	4mg/kg	AL_C12_16	SOLID	mg/kg
TPH Aliphatics EC >16-35	4mg/kg	AL_C16_35	SOLID	mg/kg
TPH Aromatics EC5-7	4mg/kg	AR_C5_7	SOLID	mg/kg
TPH Aromatics EC >7-8	4mg/kg	AR_C7_8	SOLID	mg/kg
TPH Aromatics EC >8-10	4mg/kg	AR_C8_10	SOLID	mg/kg
TPH Aromatics EC >10-12	4mg/kg	AR_C10_12	SOLID	mg/kg
TPH Aromatics EC >12-16	4mg/kg	AR_C12_16	SOLID	mg/kg
TPH Aromatics EC >16-21	4mg/kg	AR_C16_21	SOLID	mg/kg
TPH Aromatics EC >21-35	4mg/kg	AR_C21_35	SOLID	mg/kg

D.2.7 Mott MacDonald Heavy Metals Soil Suite

Table 60: Mott MacDonald Heavy Metals Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYP " field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Antimony	1mg/kg	SB	SOLID	mg/kg
Arsenic	1mg/kg	AS	SOLID	mg/kg
Barium	1mg/kg	BA	SOLID	mg/kg
Beryllium	1mg/kg	BE	SOLID	mg/kg
Boron	1mg/kg	B	SOLID	mg/kg
Cadmium	1mg/kg	CD	SOLID	mg/kg
Chromium (III)	1mg/kg	CRVI	SOLID	mg/kg
Chromium (VI)	1mg/kg	CRIII	SOLID	mg/kg
Copper	1mg/kg	CU	SOLID	mg/kg
Iron	36mg/kg	FE	SOLID	mg/kg
Lead	1mg/kg	PB	SOLID	mg/kg
Manganese	1mg/kg	MN	SOLID	mg/kg
Inorganic Mercury	1mg/kg	HGII	SOLID	mg/kg
Methylmercury	1mg/kg	METHHG	SOLID	mg/kg
Elemental Mercury	1mg/kg	HG	SOLID	mg/kg
Molybdenum	1mg/kg	MO	SOLID	mg/kg
Nickel	1mg/kg	NI	SOLID	mg/kg
Vanadium	1mg/kg	V	SOLID	mg/kg
Zinc	3mg/kg	ZN	SOLID	mg/kg

D.2.8 Mott MacDonald Pesticides Soil Suite

Table 61: Mott MacDonald Pesticides Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Cypermethrin	0.05mg/kg	CYPM	SOLID	mg/kg
Diazinon	0.05mg/kg	DIAZ	SOLID	mg/kg
Dimethoate	0.05mg/kg	DMETH	SOLID	mg/kg
Linuron	0.05mg/kg	LINU	SOLID	mg/kg
Mecoprop	0.05mg/kg	MECP	SOLID	mg/kg
Permethrin	0.05mg/kg	PERMT	SOLID	mg/kg
Alachlor	0.05mg/kg	ALAC	SOLID	mg/kg
Atrazine	0.05mg/kg	ATZ	SOLID	mg/kg
Carbaryl	0.05mg/kg	CARB	SOLID	mg/kg
Chlorfenvinphos	0.05mg/kg	CFP	SOLID	mg/kg
Chlorpyrifos	0.05mg/kg	CPYR	SOLID	mg/kg
Aldrin	0.05mg/kg	ALD	SOLID	mg/kg
Dieldrin	0.05mg/kg	DIEL	SOLID	mg/kg
Endrin	0.05mg/kg	ENDR	SOLID	mg/kg
Isodrin	0.05mg/kg	ISOD	SOLID	mg/kg
DDT	0.05mg/kg	DDT	SOLID	mg/kg
DDE	0.05mg/kg	DDE	SOLID	mg/kg
DDD	0.05mg/kg	DDD	SOLID	mg/kg
Diuron	0.05mg/kg	DCMU	SOLID	mg/kg
Alpha-Endosulfan	0.05mg/kg	ENDOA	SOLID	mg/kg
Beta-Endosulfan	0.05mg/kg	ENDOB	SOLID	mg/kg
Isoproturon	0.05mg/kg	IPU	SOLID	mg/kg
Simazine	0.05mg/kg	SIMZ	SOLID	mg/kg
Trifluralin	0.05mg/kg	TRIF	SOLID	mg/kg
Bentazone	0.05mg/kg	BENTZ	SOLID	mg/kg
Fentitrothion	0.05mg/kg	FTT	SOLID	mg/kg
Malathion	0.05mg/kg	MALTH	SOLID	mg/kg
Dichlorvos	0.05mg/kg	DCV	SOLID	mg/kg
Alpha-Hexachlorocyclohexanes (including Lindane)	0.05mg/kg	ALIND	SOLID	mg/kg
Beta-Hexachlorocyclohexanes (including Lindane)	0.05mg/kg	BLIND	SOLID	mg/kg
Gamma-Hexachlorocyclohexanes (including Lindane)	0.05mg/kg	GLIND	SOLID	mg/kg

D.2.9 Mott MacDonald Marine Pesticides Soil Suite

Table 62: Mott MacDonald Marine Pesticides Soil Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Triphenyltin	0.05mg/kg	TPT	SOLID	mg/kg
Tributyltin	0.05mg/kg	TBT	SOLID	mg/kg

D.3 Leachate Suites

D.3.1 Mott MacDonald Comprehensive Leachate Suite (BS EN 12457)

Table 63: Mott MacDonald Comprehensive Leachate Suite (BS EN 12457) AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTYP" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Arsenic (Dissolved)	0.001mg/l	AS	LEACHATE_CEN_2:1	mg/l
Ammoniacal Nitrogen	0.01mg/l	AMMNS	LEACHATE_CEN_2:1	mg/l
Antimony (Dissolved)	0.005mg/l	SB	LEACHATE_CEN_2:1	mg/l
Barium (Dissolved)	0.01mg/l	BA	LEACHATE_CEN_2:1	mg/l
Beryllium (Dissolved)	0.01mg/l	BE	LEACHATE_CEN_2:1	mg/l
Boron (Dissolved)	0.01mg/l	B	LEACHATE_CEN_2:1	mg/l
Cadmium (Dissolved)	0.00008mg/l	CD	LEACHATE_CEN_2:1	mg/l
Calcium (Dissolved)	1mg/l	CA	LEACHATE_CEN_2:1	mg/l
Chloride	1mg/l	CL	LEACHATE_CEN_2:1	mg/l
Chromium (III) (Dissolved)	0.004mg/l	CRIII	LEACHATE_CEN_2:1	mg/l
Chromium (VI) (Dissolved)	0.0006mg/l	CRVI	LEACHATE_CEN_2:1	mg/l
Copper (Dissolved)	0.001mg/l	CU	LEACHATE_CEN_2:1	mg/l
Cyanide (Free)	0.001mg/l	GHYDC	LEACHATE_CEN_2:1	mg/l
Cyanide (Complex)	0.02mg/l	CNCOMP	LEACHATE_CEN_2:1	mg/l
Fluoride	1mg/l	FLS	LEACHATE_CEN_2:1	mg/l
Iron (Dissolved)	0.01mg/l	FE	LEACHATE_CEN_2:1	mg/l
Lead (Dissolved)	0.001mg/l	PB	LEACHATE_CEN_2:1	mg/l
Magnesium (Dissolved)	1mg/l	MG	LEACHATE_CEN_2:1	mg/l
Manganese (Dissolved)	0.002mg/l	MN	LEACHATE_CEN_2:1	mg/l
Mercury (Dissolved)	0.00001mg/l	HG	LEACHATE_CEN_2:1	mg/l
Molybdenum (Dissolved)	0.07mg/l	MO	LEACHATE_CEN_2:1	mg/l
Nickel (Dissolved)	0.001mg/l	NI	LEACHATE_CEN_2:1	mg/l
pH	-	PHS	LEACHATE_CEN_2:1	
phenol	0.0005mg/l	PHE	LEACHATE_CEN_2:1	mg/l
cresols	0.0005mg/l	CRES	LEACHATE_CEN_2:1	mg/l
dimethylphenols	0.0005mg/l	DIMPH	LEACHATE_CEN_2:1	mg/l
trimethylphenols	0.0005mg/l	TMPHE	LEACHATE_CEN_2:1	mg/l
Selenium (Dissolved)	0.001mg/l	SE	LEACHATE_CEN_2:1	mg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE " field	"CNMT_TTYP" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Sulphate (as SO ₄)	3mg/l	SO4	LEACHATE_CEN_2:1	mg/l
Vanadium (Dissolved)	0.001mg/l	V	LEACHATE_CEN_2:1	mg/l
Zinc (Dissolved)	0.001mg/l	ZN	LEACHATE_CEN_2:1	mg/l

D.3.2 Mott MacDonald VOC Leachate Suite

Table 64: Mott MacDonald VOC Leachate Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTYP" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Benzene	1µg/l	BENZ	LEACHATE_CEN_2:1	µg/l
Bromobenzene	5µg/l	BROMBE	LEACHATE_CEN_2:1	µg/l
Bromochloromethane	5µg/l	BROMCM	LEACHATE_CEN_2:1	µg/l
Bromodichloromethane	5µg/l	BROMO	LEACHATE_CEN_2:1	µg/l
Bromoform	5µg/l	BROMF	LEACHATE_CEN_2:1	µg/l
Bromomethane	5µg/l	BROMM	LEACHATE_CEN_2:1	µg/l
n-Butylbenzene	5µg/l	NBUT	LEACHATE_CEN_2:1	µg/l
sec-Butylbenzene	5µg/l	SECB	LEACHATE_CEN_2:1	µg/l
tert-Butylbenzene	5µg/l	TERTB	LEACHATE_CEN_2:1	µg/l
Carbon tetrachloride	0.1µg/l	CTET	LEACHATE_CEN_2:1	µg/l
Chlorobenzene	5µg/l	CBENZ	LEACHATE_CEN_2:1	µg/l
Chlorodibromomethane	5µg/l	DIBM	LEACHATE_CEN_2:1	µg/l
Chloroethane	5µg/l	CETH	LEACHATE_CEN_2:1	µg/l
Chloroform	0.1µg/l	CFM	LEACHATE_CEN_2:1	µg/l
Chloromethane (methyl chloride)	5µg/l	CMN	LEACHATE_CEN_2:1	µg/l
2-Chlorotoluene	5µg/l	2CT	LEACHATE_CEN_2:1	µg/l
4-Chlorotoluene	5µg/l	4CT	LEACHATE_CEN_2:1	µg/l
1,2-Dibromo-3-chloropropane	0.1µg/l	12D3C	LEACHATE_CEN_2:1	µg/l
1,2-Dibromoethane	0.4µg/l	12DIB	LEACHATE_CEN_2:1	µg/l
Dibromomethane	5µg/l	DIBROM	LEACHATE_CEN_2:1	µg/l
1,2-Dichlorobenzene	5µg/l	12DB	LEACHATE_CEN_2:1	µg/l
1,3-Dichlorobenzene	5µg/l	13DB	LEACHATE_CEN_2:1	µg/l
1,4-Dichlorobenzene	5µg/l	14DB	LEACHATE_CEN_2:1	µg/l
Dichlorodifluoromethane	5µg/l	DCFM	LEACHATE_CEN_2:1	µg/l
1,1-Dichloroethane	5µg/l	11DEA	LEACHATE_CEN_2:1	µg/l
1,2-Dichloroethane	1µg/l	12DEA	LEACHATE_CEN_2:1	µg/l
1,1-Dichloroethene	5µg/l	11DEE	LEACHATE_CEN_2:1	µg/l
cis-1,2-Dichloroethene	5µg/l	T12DE	LEACHATE_CEN_2:1	µg/l
trans-1,2-Dichloroethene	5µg/l	T12DE	LEACHATE_CEN_2:1	µg/l
1,2-Dichloropropane	0.1µg/l	12DP	LEACHATE_CEN_2:1	µg/l
2,2-Dichloropropane	5µg/l	22DP	LEACHATE_CEN_2:1	µg/l
1,3-Dichloropropane	5µg/l	13DP	LEACHATE_CEN_2:1	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTYP" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
1,1-Dichloropropene	5µg/l	11DCP	LEACHATE_CEN_2:1	µg/l
Ethylbenzene	2µg/l	ETHYL	LEACHATE_CEN_2:1	µg/l
Hexachlorobutadiene	0.005µg/l	HEXBUT	LEACHATE_CEN_2:1	µg/l
Isopropylbenzene	5µg/l	IPB	LEACHATE_CEN_2:1	µg/l
p-Isopropyltoluene	5µg/l	IPT	LEACHATE_CEN_2:1	µg/l
Methylene chloride (dichloromethane)	5µg/l	DICM	LEACHATE_CEN_2:1	µg/l
Naphthalene	1µg/l	NAPTHH	LEACHATE_CEN_2:1	µg/l
n-Propylbenzene	5µg/l	NPB	LEACHATE_CEN_2:1	µg/l
Styrene	4µg/l	STY	LEACHATE_CEN_2:1	µg/l
1,1,1,2-Tetrachloroethane	5µg/l	1112TCE	LEACHATE_CEN_2:1	µg/l
1,1,2,2-Tetrachloroethane	5µg/l	1122TCE	LEACHATE_CEN_2:1	µg/l
Tetrachloroethene	0.1µg/l	TETC	LEACHATE_CEN_2:1	µg/l
Toluene	4µg/l	TOL	LEACHATE_CEN_2:1	µg/l
1,2,4-Trichlorobenzene	0.01µg/l	124TCB	LEACHATE_CEN_2:1	µg/l
1,2,3-Trichlorobenzene	0.01µg/l	123TCB	LEACHATE_CEN_2:1	µg/l
1,1,1-Trichloroethane	0.1µg/l	111TCE	LEACHATE_CEN_2:1	µg/l
1,1,2-Trichloroethane	0.1µg/l	112TCE	LEACHATE_CEN_2:1	µg/l
Trichloroethene	0.1µg/l	TRCE	LEACHATE_CEN_2:1	µg/l
Trichlorofluoromethane	5µg/l	TCFE	LEACHATE_CEN_2:1	µg/l
1,2,3-Trichloropropane	5µg/l	123TCP	LEACHATE_CEN_2:1	µg/l
1,2,4-Trimethylbenzene	5µg/l	124TMB	LEACHATE_CEN_2:1	µg/l
1,3,5-Trimethylbenzene	5µg/l	135TMB	LEACHATE_CEN_2:1	µg/l
Vinyl chloride	0.3µg/l	VCHL	LEACHATE_CEN_2:1	µg/l
o-Xylene	3µg/l	OXYL	LEACHATE_CEN_2:1	µg/l
m-Xylene	3µg/l	MXYL	LEACHATE_CEN_2:1	µg/l
p-Xylene	3µg/l	PXYL	LEACHATE_CEN_2:1	µg/l
Methyl-t-butyl ether	5µg/l	MTBE	LEACHATE_CEN_2:1	µg/l
Dichlorofluoromethane	5µg/l	DCF	LEACHATE_CEN_2:1	µg/l
C10-13 Chloroalkanes	0.4µg/l	CHA_C10_13	LEACHATE_CEN_2:1	µg/l

D.3.3 Mott MacDonald TPH Leachate Suite

Table 65: Mott MacDonald TPH Leachate Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTYP" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Total TPH Aromatic and Aliphatic EC5-70	10µg/l	TPH	LEACHATE_CEN_2:1	µg/l
TPH Aliphatics EC5-6	10µg/l	AL_C5_6	LEACHATE_CEN_2:1	µg/l
TPH Aliphatics EC >6-8	10µg/l	AL_C6_8	LEACHATE_CEN_2:1	µg/l
TPH Aliphatics EC >8-10	10µg/l	AL_C8_10	LEACHATE_CEN_2:1	µg/l
TPH Aliphatics EC >10-12	10µg/l	AL_C10_12	LEACHATE_CEN_2:1	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTYP" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
TPH Aliphatics EC >12-16	10µg/l	AL_C12-16	LEACHATE_CEN_2:1	µg/l
TPH Aliphatics EC >16-35	10µg/l	AL_C16_35	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC5-7	10µg/l	AR_C5_7	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >7-8	10µg/l	AR_C7_8	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >8-10	10µg/l	AR_C8_10	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >10-12	10µg/l	AR_C10_12	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >12-16	10µg/l	AR_C12_16	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >16-21	10µg/l	AR_C16_21	LEACHATE_CEN_2:1	µg/l
TPH Aromatics EC >21-35	10µg/l	AR_C21_35	LEACHATE_CEN_2:1	µg/l

D.3.4 Mott MacDonald PAH Leachate Suite

Table 66: Mott MacDonald PAH Leachate Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE " field	"CNMT_TTYP" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Total Polyaromatic Hydrocarbons (USEPA 16)	0.002µg/l	PAH_16	LEACHATE_CEN_2:1	µg/l
naphthalene	0.002µg/l	NAPTHH	LEACHATE_CEN_2:1	µg/l
acenaphthylene	0.002µg/l	ACNAP	LEACHATE_CEN_2:1	µg/l
acenaphthene	0.002µg/l	ACNEN	LEACHATE_CEN_2:1	µg/l
fluorene	0.002µg/l	FLN	LEACHATE_CEN_2:1	µg/l
phenanthrene	0.002µg/l	PPENN	LEACHATE_CEN_2:1	µg/l
anthracene	0.002µg/l	ANTHN	LEACHATE_CEN_2:1	µg/l
fluoranthene	0.002µg/l	FLNN	LEACHATE_CEN_2:1	µg/l
pyrene	0.002µg/l	PYRN	LEACHATE_CEN_2:1	µg/l
benzo[a]anthracene	0.002µg/l	BENA	LEACHATE_CEN_2:1	µg/l
chrysene	0.002µg/l	CRYN	LEACHATE_CEN_2:1	µg/l
benzo[b]fluoranthene	0.002µg/l	BENB	LEACHATE_CEN_2:1	µg/l
benzo[k]fluoranthene	0.002µg/l	BENK	LEACHATE_CEN_2:1	µg/l
benzo[a]pyrene	0.002µg/l	BENAP	LEACHATE_CEN_2:1	µg/l
dibenz(ah)anthracene	0.002µg/l	DIABN	LEACHATE_CEN_2:1	µg/l
benzo[ghi]perylene	0.002µg/l	BENGI	LEACHATE_CEN_2:1	µg/l
indeno(1,2,3-cd)pyrene	0.002µg/l	INDP	LEACHATE_CEN_2:1	µg/l

D.3.5 Mott MacDonald Comprehensive Leachate Suite (NRA 301)

Table 67: Mott MacDonald Comprehensive Leachate Suite (NRA 301) AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE " field	"CNMT_TTYP" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Arsenic (Dissolved)	0.001mg/l	AS	LEACHATE_NRA_10:1	mg/l
Ammoniacal Nitrogen	0.01mg/l	AMMNS	LEACHATE_NRA_10:1	mg/l
Antimony (Dissolved)	0.005mg/l	SB	LEACHATE_NRA_10:1	mg/l
Barium (Dissolved)	0.01mg/l	BA	LEACHATE_NRA_10:1	mg/l
Beryllium (Dissolved)	0.01mg/l	BE	LEACHATE_NRA_10:1	mg/l
Boron (Dissolved)	0.01mg/l	B	LEACHATE_NRA_10:1	mg/l
Cadmium (Dissolved)	0.00008mg/l	CD	LEACHATE_NRA_10:1	mg/l
Calcium (Dissolved)	1mg/l	CA	LEACHATE_NRA_10:1	mg/l
Chloride	1mg/l	CL	LEACHATE_NRA_10:1	mg/l
Chromium (III) (Dissolved)	0.004mg/l	CR	LEACHATE_NRA_10:1	mg/l
Chromium (VI) (Dissolved)	0.0006mg/l	CR	LEACHATE_NRA_10:1	mg/l
Copper (Dissolved)	0.001mg/l	CU	LEACHATE_NRA_10:1	mg/l
Cyanide (Free)	0.001mg/l	GHYDC	LEACHATE_NRA_10:1	mg/l
Cyanide (Complex)	0.02mg/l	CNCOMP	LEACHATE_NRA_10:1	mg/l
Fluoride	1mg/l	FLS	LEACHATE_NRA_10:1	mg/l
Iron (Dissolved)	0.01mg/l	FE	LEACHATE_NRA_10:1	mg/l
Lead (Dissolved)	0.001mg/l	PB	LEACHATE_NRA_10:1	mg/l
Magnesium (Dissolved)	1mg/l	MG	LEACHATE_NRA_10:1	mg/l
Manganese (Dissolved)	0.002mg/l	MN	LEACHATE_NRA_10:1	mg/l
Mercury (Dissolved)	0.00001mg/l	HG	LEACHATE_NRA_10:1	mg/l
Molybdenum (Dissolved)	0.07mg/l	MO	LEACHATE_NRA_10:1	mg/l
Nickel (Dissolved)	0.001mg/l	NI	LEACHATE_NRA_10:1	mg/l
pH	-	PHS	LEACHATE_NRA_10:1	mg/l
phenol	0.0005mg/l	PHE	LEACHATE_NRA_10:1	mg/l
cresols	0.0005mg/l	CRES	LEACHATE_NRA_10:1	mg/l
dimethylphenols	0.0005mg/l	DIMPH	LEACHATE_NRA_10:1	mg/l
trimethylphenols	0.0005mg/l	TMPHE	LEACHATE_NRA_10:1	mg/l
Selenium (Dissolved)	0.001mg/l	SE	LEACHATE_NRA_10:1	mg/l
Sulphate (as SO ₄)	3mg/l	SO ₄	LEACHATE_NRA_10:1	mg/l
Sulphide	0.25µg/l	SULIS	LEACHATE_NRA_10:1	mg/l
Vanadium (Dissolved)	0.001mg/l	V	LEACHATE_NRA_10:1	mg/l
Zinc (Dissolved)	0.001mg/l	ZN	LEACHATE_NRA_10:1	mg/l

D.4 Water Suites

D.4.1 Mott MacDonald Comprehensive Water Suite

Table 68: Mott MacDonald Comprehensive Water Suite

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Ammoniacal Nitrogen	0.01mg/l	AMMNS	WATER	mg/l
Antimony (Dissolved)	0.005mg/l	SB	WATER	mg/l
Arsenic (Dissolved)	0.001mg/l	AS	WATER	mg/l
Barium (Dissolved)	0.01mg/l	BA	WATER	mg/l
Beryllium (Dissolved)	0.01mg/l	BE	WATER	mg/l
Boron (Dissolved)	0.01mg/l	B	WATER	mg/l
Cadmium (Dissolved)	0.00008mg/l	CD	WATER	mg/l
Calcium	1mg/l	CA	WATER	mg/l
Chloride	1mg/l	CL	WATER	mg/l
Chromium (III) (Dissolved)	0.004mg/l	CRIII	WATER	mg/l
Chromium (VI) (Dissolved)	0.0006mg/l	CRVI	WATER	mg/l
Copper (Dissolved)	0.001mg/l	CU	WATER	mg/l
Cyanide (Free)	0.001mg/l	GHYDC	WATER	mg/l
Cyanide (Complex)	0.02mg/l	CNCOMP	WATER	mg/l
Fluoride	1mg/l	FLS	WATER	mg/l
Hardness (CaCO ₃)	10mg/l	HARDW	WATER	mg/l
Iron (Dissolved)	0.01mg/l	FE	WATER	mg/l
Lead (Dissolved)	0.001mg/l	PB	WATER	mg/l
Magnesium (Dissolved)	1mg/l	MG	WATER	mg/l
Manganese (Dissolved)	0.002mg/l	MN	WATER	mg/l
Mercury (Dissolved)	0.00005mg/l	HG	WATER	mg/l
Molybdenum (Dissolved)	0.07mg/l	MO	WATER	mg/l
Nickel (Dissolved)	0.001mg/l	NI	WATER	mg/l
Nitrate as NO ₃	1mg/l	NIRS	WATER	mg/l
pH	-	PHS	WATER	
Phenol	0.0005mg/l	PHE	WATER	mg/l
Potassium	0.05mg/l	K	WATER	mg/l
Cresols	0.0005mg/l	CRES	WATER	mg/l
dimethylphenols	0.0005mg/l	DIMPH	WATER	mg/l
trimethylphenols	0.0005mg/l	TMPHE	WATER	mg/l
Total Polyaromatic Hydrocarbons (USEPA 16)	0.002µg/l	PAH_16	WATER	µg/l
naphthalene	0.002µg/l	NAPTHH	WATER	µg/l
acenaphthylene	0.002µg/l	ACNAP	WATER	µg/l
acenaphthene	0.002µg/l	ACNEN	WATER	µg/l
fluorene	0.002µg/l	FLN	WATER	µg/l
phenanthrene	0.002µg/l	PPENN	WATER	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
anthracene	0.002µg/l	ANTHN	WATER	µg/l
fluoranthene	0.002µg/l	FLNN	WATER	µg/l
Pyrene	0.002µg/l	PYRN	WATER	µg/l
benzo[a]anthracene	0.002µg/l	BENA	WATER	µg/l
Chrysene	0.002µg/l	CRYN	WATER	µg/l
benzo[b]fluoranthene	0.002µg/l	BENB	WATER	µg/l
benzo[k]fluoranthene	0.002µg/l	BENK	WATER	µg/l
benzo[a]pyrene	0.002µg/l	BENAP	WATER	µg/l
dibenz(ah)anthracene	0.002µg/l	DIABN	WATER	µg/l
benzo[ghi]perylene	0.002µg/l	BENGI	WATER	µg/l
indeno(1,2,3-cd)pyrene	0.002µg/l	INDP	WATER	µg/l
Selenium (Dissolved)	0.001mg/l	SE	WATER	mg/l
Sodium	1mg/l	NA	WATER	mg/l
Sulphate (as SO ₄)	3mg/l	SO4	WATER	mg/l
Sulphur	3mg/l	S	WATER	mg/l
Total TPH Aromatic and Aliphatic EC5-70	10µg/l	TPH	WATER	µg/l
TPH Aliphatics EC5-6	10µg/l	AL_C5_6	WATER	µg/l
TPH Aliphatics EC >6-8	10µg/l	AL_C6_8	WATER	µg/l
TPH Aliphatics EC >8-10	10µg/l	AL_C8_10	WATER	µg/l
TPH Aliphatics EC >10-12	10µg/l	AL_C10_12	WATER	µg/l
TPH Aliphatics EC >12-16	10µg/l	AL_C12-16	WATER	µg/l
TPH Aliphatics EC >16-35	10µg/l	AL_C16_35	WATER	µg/l
TPH Aromatics EC5-7	10µg/l	AR_C5_7	WATER	µg/l
TPH Aromatics EC >7-8	10µg/l	AR_C7_8	WATER	µg/l
TPH Aromatics EC >8-10	10µg/l	AR_C8_10	WATER	µg/l
TPH Aromatics EC >10-12	10µg/l	AR_C10_12	WATER	µg/l
TPH Aromatics EC >12-16	10µg/l	AR_C12_16	WATER	µg/l
TPH Aromatics EC >16-21	10µg/l	AR_C16_21	WATER	µg/l
TPH Aromatics EC >21-35	10µg/l	AR_C21_35	WATER	µg/l
Vanadium	0.001mg/l	V	WATER	mg/l
Volatile Organic Compounds	Refer to Table 70 for fields			
Zinc	0.001mg/l	ZN	WATER	mg/l
Total Dissolved Solids	0.1mg/l	DISS	WATER	mg/l
Alkalinity - Bicarbonate	1mg/l	BICAW	WATER	mg/l

D.4.2 Mott MacDonald Heavy Metals Water Suite

Table 69: Mott MacDonald Heavy Metals Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Aluminium (Dissolved)	0.01mg/l	AL	WATER	mg/l
Antimony (Dissolved)	0.005mg/l	SB	WATER	mg/l
Arsenic (Dissolved)	0.001mg/l	AS	WATER	mg/l
Barium (Dissolved)	0.01mg/l	BA	WATER	mg/l
Beryllium (Dissolved)	0.01mg/l	BE	WATER	mg/l
Boron (Dissolved)	0.01mg/l	B	WATER	mg/l
Cadmium (Dissolved)	0.00008mg/l	CD	WATER	mg/l
Calcium	1mg/l	CA	WATER	mg/l
Chromium (III) (Dissolved)	0.004mg/l	CRIII	WATER	mg/l
Chromium (VI) (Dissolved)	0.0006mg/l	CRVI	WATER	mg/l
Copper (Dissolved)	0.001mg/l	CU	WATER	mg/l
Hardness (CaCO ₃)	10mg/l	HARDW	WATER	mg/l
Iron (Dissolved)	0.01mg/l	FE	WATER	mg/l
Lead (Dissolved)	0.001mg/l	PB	WATER	mg/l
Magnesium (Dissolved)	1mg/l	MG	WATER	mg/l
Manganese (Dissolved)	0.002mg/l	MN	WATER	mg/l
Mercury (Dissolved)	0.00001mg/l	HG	WATER	mg/l
Molybdenum (Dissolved)	0.07mg/l	MO	WATER	mg/l
Nickel (Dissolved)	0.001mg/l	NI	WATER	mg/l
Phenol	0.0005mg/l	PHE	WATER	mg/l
Selenium (Dissolved)	0.001mg/l	SE	WATER	mg/l
Vanadium (Dissolved)	0.001mg/l	V	WATER	mg/l
Zinc (Dissolved)	0.001mg/l	Z	WATER	mg/l

D.4.3 Mott MacDonald VOC Water Suite

Table 70: Mott MacDonald VOC Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
C10-13 Chloroalkanes	0.4µg/l	CHA_C10_13	WATER	µg/l
Benzene	1µg/l	BENZ	WATER	µg/l
Bromobenzene	5µg/l	BROMBE	WATER	µg/l
Bromochloromethane	5µg/l	BROMCM	WATER	µg/l
Bromodichloromethane	5µg/l	BROMO	WATER	µg/l
Bromoform	5µg/l	BROMF	WATER	µg/l
Bromomethane	5µg/l	BROMM	WATER	µg/l
n-Butylbenzene	5µg/l	NBUT	WATER	µg/l
sec-Butylbenzene	5µg/l	SECB	WATER	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE " field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
tert-Butylbenzene	5µg/l	TERTB	WATER	µg/l
Carbon tetrachloride	0.1µg/l	CTET	WATER	µg/l
Chlorobenzene	5µg/l	CBENZ	WATER	µg/l
Chlorodibromomethane	5µg/l	DIBM	WATER	µg/l
Chloroethane	5µg/l	CETH	WATER	µg/l
Chloroform	0.1µg/l	CFM	WATER	µg/l
Chloromethane (methyl chloride)	5µg/l	CMN	WATER	µg/l
2-Chlorotoluene	5µg/l	2CT	WATER	µg/l
4-Chlorotoluene	5µg/l	4CT	WATER	µg/l
1,2-Dibromo-3-chloropropane	0.1µg/l	12D3C	WATER	µg/l
1,2-Dibromoethane	0.4µg/l	12DIB	WATER	µg/l
Dibromomethane	5µg/l	DIBROM	WATER	µg/l
1,2-Dichlorobenzene	5µg/l	12DB	WATER	µg/l
1,3-Dichlorobenzene	5µg/l	13DB	WATER	µg/l
1,4-Dichlorobenzene	5µg/l	14DB	WATER	µg/l
Dichlorodifluoromethane	5µg/l	DCFM	WATER	µg/l
1,1-Dichloroethane	5µg/l	11DEA	WATER	µg/l
1,2-Dichloroethane	1µg/l	12DEA	WATER	µg/l
1,1-Dichloroethene	5µg/l	11DEE	WATER	µg/l
cis-1,2-Dichloroethene	5µg/l	T12DE	WATER	µg/l
trans-1,2-Dichloroethene	5µg/l	T12DE	WATER	µg/l
1,2-Dichloropropane	0.1µg/l	12DP	WATER	µg/l
2,2-Dichloropropane	5µg/l	22DP	WATER	µg/l
1,3-Dichloropropane	5µg/l	13DP	WATER	µg/l
1,1-Dichloropropene	5µg/l	11DCP	WATER	µg/l
Ethylbenzene	2µg/l	ETHYL	WATER	µg/l
Hexachlorobutadiene	0.005µg/l	HEXBUT	WATER	µg/l
Isopropylbenzene	5µg/l	IPB	WATER	µg/l
p-Isopropyltoluene	5µg/l	IPT	WATER	µg/l
Methylene chloride (dichloromethane)	5µg/l	DICM	WATER	µg/l
Naphthalene	1µg/l	NAPTHH	WATER	µg/l
n-Propylbenzene	5µg/l	NPB	WATER	µg/l
Styrene	4µg/l	STY	WATER	µg/l
1,1,1,2-Tetrachloroethane	5µg/l	1112TCE	WATER	µg/l
1,1,1,2,2-Tetrachloroethane	5µg/l	1122TCE	WATER	µg/l
Tetrachloroethene	0.1µg/l	TETC	WATER	µg/l
Toluene	4µg/l	TOL	WATER	µg/l
1,2,4-Trichlorobenzene	0.01µg/l	124TCB	WATER	µg/l
1,2,3-Trichlorobenzene	0.01µg/l	123TCB	WATER	µg/l
1,1,1-Trichloroethane	0.1µg/l	111TCE	WATER	µg/l
1,1,2-Trichloroethane	0.1µg/l	112TCE	WATER	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" " field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Trichloroethene	0.1µg/l	TRCE	WATER	µg/l
Trichlorofluoromethane	5µg/l	TCFE	WATER	µg/l
1,2,3-Trichloropropane	5µg/l	123TCP	WATER	µg/l
1,2,4-Trimethylbenzene	5µg/l	124TMB	WATER	µg/l
1,3,5-Trimethylbenzene	5µg/l	135TMB	WATER	µg/l
Vinyl chloride	0.3µg/l	VCHL	WATER	µg/l
o-Xylene	3µg/l	OXYL	WATER	µg/l
m-Xylene	3µg/l	MXYL	WATER	µg/l
p-Xylene	3µg/l	PXYL	WATER	µg/l
Methyl-t-butyl ether	5µg/l	MTBE	WATER	µg/l
Dichlorofluoromethane	5µg/l	DCF	WATER	µg/l

D.4.4 Mott MacDonald BTEX Water Suite

Table 71: Mott MacDonald BTEX Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Benzene	1µg/l	BENZ	WATER	µg/l
Toluene	4µg/l	TOL	WATER	µg/l
o-Xylene	3µg/l	OXYL	WATER	µg/l
m-Xylene	3µg/l	MXYL	WATER	µg/l
p-Xylene	3µg/l	PXYL	WATER	µg/l
Ethylbenzene	2µg/l	ETHYL	WATER	µg/l

D.4.5 Mott MacDonald PCBs Water Suite

Table 72: Mott MacDonald PCBs Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
WHO PCB Congener 77	0.001µg/l	PCB77S	WATER	µg/l
WHO PCB Congener 167	0.001µg/l	PCB167S	WATER	µg/l
WHO PCB Congener 169	0.001µg/l	PCB169S	WATER	µg/l
WHO PCB Congener 189	0.001µg/l	PCB189S	WATER	µg/l
WHO PCB Congener 81	0.001µg/l	PCB81S	WATER	µg/l
WHO PCB Congener 105	0.001µg/l	PCB105S	WATER	µg/l
WHO PCB Congener 114	0.001µg/l	PCB114S	WATER	µg/l
WHO PCB Congener 118	0.001µg/l	PCB118S	WATER	µg/l
WHO PCB Congener 123	0.001µg/l	PCB123S	WATER	µg/l
WHO PCB Congener 126	0.001µg/l	PCB126S	WATER	µg/l
WHO PCB Congener 156	0.001µg/l	PCB156S	WATER	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
WHO PCB Congener 157	0.001µg/l	PCB157S	WATER	µg/l
Total WHO PCBs	0.001µg/l	PCBS	WATER	µg/l

D.4.6 Mott MacDonald TPH Water Suite

Table 73: Mott MacDonald TPH Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Total TPH Aromatic and Aliphatic EC5-70	10µg/l	TPH	WATER	µg/l
TPH Aliphatics EC5-6	10µg/l	AL_C5_6	WATER	µg/l
TPH Aliphatics EC >6-8	10µg/l	AL_C6_8	WATER	µg/l
TPH Aliphatics EC >8-10	10µg/l	AL_C8_10	WATER	µg/l
TPH Aliphatics EC >10-12	10µg/l	AL_C10_12	WATER	µg/l
TPH Aliphatics EC >12-16	10µg/l	AL_C12-16	WATER	µg/l
TPH Aliphatics EC >16-35	10µg/l	AL_C16_35	WATER	µg/l
TPH Aromatics EC5-7	10µg/l	AR_C5_7	WATER	µg/l
TPH Aromatics EC >7-8	10µg/l	AR_C7_8	WATER	µg/l
TPH Aromatics EC >8-10	10µg/l	AR_C8_10	WATER	µg/l
TPH Aromatics EC >10-12	10µg/l	AR_C10_12	WATER	µg/l
TPH Aromatics EC >12-16	10µg/l	AR_C12_16	WATER	µg/l
TPH Aromatics EC >16-21	10µg/l	AR_C16_21	WATER	µg/l
TPH Aromatics EC >21-35	10µg/l	AR_C21_35	WATER	µg/l

D.4.7 Mott MacDonald 3 band TPH Water Suite

Table 74: Mott MacDonald 3 Band TPH Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
C6-C10: Aliphatic and Aromatic	10µg/l	TPH C6_10	WATER	µg/l
>C10-C21: Aliphatic and Aromatic	10µg/l	TPH C10_21	WATER	µg/l
>C21-C40: Aliphatic and Aromatic	10µg/l	TPH C21_40	WATER	µg/l

D.4.8 Mott MacDonald PAH Water Suite

Table 75: Mott MacDonald PAH Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Total Polyaromatic Hydrocarbons (USEPA 16)	0.002µg/l	PAH_16	WATER	µg/l
naphthalene	0.002µg/l	NAPTHH	WATER	µg/l
acenaphthylene	0.002µg/l	ACNAP	WATER	µg/l
acenaphthene	0.002µg/l	ACNEN	WATER	µg/l
fluorene	0.002µg/l	FLN	WATER	µg/l
phenanthrene	0.002µg/l	PPENN	WATER	µg/l
anthracene	0.002µg/l	ANTHN	WATER	µg/l
fluoranthene	0.002µg/l	FLNN	WATER	µg/l
pyrene	0.002µg/l	PYRN	WATER	µg/l
benzo[a]anthracene	0.002µg/l	BENA	WATER	µg/l
chrysene	0.002µg/l	CRYN	WATER	µg/l
benzo[b]fluoranthene	0.002µg/l	BENB	WATER	µg/l
benzo[k]fluoranthene	0.002µg/l	BENK	WATER	µg/l
benzo[a]pyrene	0.002µg/l	BENAP	WATER	µg/l
dibenz(ah)anthracene	0.002µg/l	DIABN	WATER	µg/l
benzo[ghi]perylene	0.002µg/l	BENGI	WATER	µg/l
indeno(1,2,3-cd)pyrene	0.002µg/l	INDP	WATER	µg/l

D.4.9 Mott MacDonald Pesticides Water Suite

Table 76: Pesticides Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Cypermethrin	0.1ng/l	CYPM	WATER	µg/l
Diazinon	0.01µg/l	DIAZ	WATER	µg/l
Dimethoate	0.48µg/l	DMETH	WATER	µg/l
Linuron	0.5µg/l	LINU	WATER	µg/l
Mecoprop	18µg/l	MECP	WATER	µg/l
Permethrin	0.01µg/l	PERMT	WATER	µg/l
Alachlor	0.3µg/l	ALAC	WATER	µg/l
Atrazine	0.6µg/l	ATZ	WATER	µg/l
Carbaryl	1µg/l	CARB	WATER	µg/l
Chlorfenvinphos	0.1µg/l	CFP	WATER	µg/l
Chlorpyrifos	0.03µg/l	CPYR	WATER	µg/l
Aldrin	0.001µg/l	ALD	WATER	µg/l
Dieldrin	0.001µg/l	DIEL	WATER	µg/l
Endrin	0.001µg/l	ENDR	WATER	µg/l
Isodrin	0.001µg/l	ISOD	WATER	µg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
DDT	0.01µg/l	DDT	WATER	µg/l
DDE	0.01µg/l	DDE	WATER	µg/l
DDD	0.01µg/l	DDD	WATER	µg/l
Diuron	0.2µg/l	DCMU	WATER	µg/l
Endosulphan	0.0005µg/l	ENDO	WATER	µg/l
Isoproturon	0.3µg/l	IPU	WATER	µg/l
Simazine	1µg/l	SIMZ	WATER	µg/l
Trifluralin	0.03µg/l	TRIF	WATER	µg/l
Bentazone	500µg/l	BENTZ	WATER	µg/l
Fenitrothion	0.01µg/l	FTT	WATER	µg/l
Malathion	0.01µg/l	MALTH	WATER	µg/l
Dichlorvos	0.001µg/l	DCV	WATER	µg/l
Hexachlorocyclohexane (Lindane)	0.002µg/l	LIND	WATER	µg/l

D.4.10 Mott MacDonald Marine Pesticides Water Suite

Table 77: Marine Pesticides Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TY P" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Triphenyltin	0.008µg/l	TPT	WATER	µg/l
Tributyltin	0.0002µg/l	TBT	WATER	µg/l

D.4.11 Mott MacDonald Major Ion Balance Water Suite: Cations

Table 78: Major Ion Balance Water Suite: Cations AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Calcium (Dissolved)	1mg/l	CA	WATER	mg/l
Magnesium (Dissolved)	0.5mg/l	MG	WATER	mg/l
Potassium (Dissolved)	1mg/l	K	WATER	mg/l
Sodium (Dissolved)	1mg/l	NA	WATER	mg/l
Ammoniacal Nitrogen	0.01mg/l	AMMNS	WATER	mg/l

D.4.12 Mott MacDonald Major Ion Balance Water Suite: Anions

Table 79: Major Ion Balance Water Suite: Anions AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TY P" field	"CNMT_TTY P" field	"CNMT_UNIT" field
Determinant		Determinand	Test type	Test result unit
Bicarbonate	10mg/l	BICAW	WATER	mg/l

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Sulphate	3mg/l	SO3 or SO4	WATER	mg/l
Chloride	1mg/l	CL	WATER	mg/l
Nitrate	1mg/l	NIRS	WATER	mg/l
Flouride	1mg/l	FLS	WATER	mg/l

D.4.13 Mott MacDonald Oxygen Demand Water Suite

Table 80: Oxygen Demand Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Biochemical Oxygen Demand	2.5mg/l	BOD	WATER	mg/l O2
Chemical Oxygen Demand	30mg/l	COD	WATER	mg/l O2

D.4.14 Mott MacDonald Hardness Water Suite

Table 81: Hardness Water Suite

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Hardness as CaCO ₃	10mg/l	HARDW	WATER	mg/l

D.4.15 Mott MacDonald Nitrogen Oxides Water Suite

Table 82: Nitrogen Oxides Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Nitrite as NO ₃	1mg/l	NIRS	WATER	mg/l
Nitrite as NO ₂	10µg/l	NIIRS	WATER	mg/l

D.4.16 Mott MacDonald Electrical Conductivity Water Suite

Table 83: Electrical Conductivity Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYPE " field	"CNMT_TTY P" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Electrical Conductivity	1uS/cm (@20°C)	CONDW	WATER	uS/cm

D.4.17 Mott MacDonald Phenols Water Suite

Table 84: Phenols Water Suite AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTY P" field	"CNMT_UNI T" field
Determinant		Determinand	Test type	Test result unit
Phenol	0.0005mg/l	PHE	WATER	mg/l
cresols	0.0005mg/l	CRES	WATER	mg/l
dimethylphenols	0.0005mg/l	DIMPH	WATER	mg/l
trimethylphenols	0.0005mg/l	TMPHE	WATER	mg/l

D.5 Waste Acceptance Criteria

D.5.1 Mott MacDonald Waste Acceptance Criteria

Table 85: Waste Acceptance Criteria AGS User Defined

"CNMT_NAME" field	Detection Limit (expressed as dry weight)	"CNMT_TYP E" field	"CNMT_TTYP" field	"CNMT_UNIT " field
Determinant		Determinand	Test type	Test result unit
Total organic carbon	3%	TOC	SOLID	%
Loss on ignition	10%	LOI	SOLID	%
BTEX	6mg/kg	BTEX	SOLID	mg/kg
PCB's (7 congeners)	1 mg/kg	PCBS	SOLID	mg/kg
Mineral Oil, C10 – C40	500 mg/kg	MOILS	SOLID	mg/kg
PAH's (Total of 17)	100 mg/kg	PAH17	SOLID	mg/kg
pH	N/A	PHS	SOLID	-
Arsenic, As	0.5 mg/kg	AS	LEACHATE_CEN_10:1	mg/kg
Barium, Ba	20 mg/kg	BA	LEACHATE_CEN_10:1	mg/kg
Cadmium, Cd	0.04 mg/kg	CD	LEACHATE_CEN_10:1	mg/kg
Chromium, Cr	0.5 mg/kg	CR	LEACHATE_CEN_10:1	mg/kg
Copper, Cu	2 mg/kg	CU	LEACHATE_CEN_10:1	mg/kg
Mercury, Hg	0.01 mg/kg	HG	LEACHATE_CEN_10:1	mg/kg
Molybdenum, Mo	0.5 mg/kg	MO	LEACHATE_CEN_10:1	mg/kg
Nickel, Ni	0.4 mg/kg	NI	LEACHATE_CEN_10:1	mg/kg
Lead, Pb	0.5 mg/kg	PB	LEACHATE_CEN_10:1	mg/kg
Antimony, Sb	0.06 mg/kg	SB	LEACHATE_CEN_10:1	mg/kg
Selenium, Se	0.1 mg/kg	SE	LEACHATE_CEN_10:1	mg/kg
Zinc, Zn	4 mg/kg	ZN	LEACHATE_CEN_10:1	mg/kg
Chloride, Cl	800 mg/kg	CL	LEACHATE_CEN_10:1	mg/kg
Fluoride, F	10 mg/kg	F	LEACHATE_CEN_10:1	mg/kg
Sulphate, SO ₄	1000 mg/kg	SO4	LEACHATE_CEN_10:1	mg/kg
Total dissolved Solids (TDS)	4000 mg/kg	TDS	LEACHATE_CEN_10:1	mg/kg
Phenol index	1 mg/kg	PHEIDX	LEACHATE_CEN_10:1	mg/kg
Dissolved organic carbon	500 mg/kg	DOC	LEACHATE_CEN_10:1	mg/kg

E. AGS DATA SPECIFICATION

A.1 EXAMPLE TEMPLATE DIGITAL DATA SPECIFICATION

A.1.1 Extent of data

All data which is collected during the investigation in accordance with the codes and standards used for the contract are to be transferred in electronic format.

The format of the digital data files shall comply with the Association of Geotechnical and Geoenvironmental Specialists (AGS) publication 'Electronic transfer of geotechnical and geoenvironmental data' Edition 4.0, known as AGS4.

The Contractor is to provide all field and laboratory data in digital form, as well as in paper form. This shall include all data from sub-contractors.

The AGS data and associated files shall be complete and identical to the data provided in the paper copy of the factual report. In order to ensure the AGS4 data provided is identical to the paper copy version, both the paper and digital versions of the data must be generated from the same source software. The preferred approach is to use database software specifically intended for this purpose.

The units of measurement and abbreviations within the data file should match those presented in the AGS publication unless otherwise stated below.

A.1.2 Transfer File

AGS Format data shall be issued as a single file. However, subject to the agreement of the data receiver, separate files may be permitted in the following cases:

- Separate field and laboratory data for preliminary issue (if this serves to expedite the issue of data)
- CPT and other in situ data as separate files for each test where the data files are large.

The associated files that are required to complete the factual data submission shall be provided and referenced in the associated file (FILE_FSET) fields. When these are submitted the Contractor shall provide AGS Format data and associated files within single identifiable submissions.

The digital data provided by the Contractor with the Factual Report is required to be complete and a total replacement of any previous preliminary data submissions.

In addition to the paper copies of the Factual Report, the Contractor shall provide a Report with a digital copy of those field, laboratory data and associated files specified in the Contract to be in digital form. This report shall consist of a disk(s), or other agreed transmission medium, containing the digital data and associated files and paper copies of any data or drawings not included in digital form.

Draft data is that which is represented by the draft factual report. Where data files are too large for practical transmission by email, alternative methods of transmittal may be agreed with the Investigation Supervisor which may include CD/DVD, FTP transfer or distribution via extranet.

If CD/DVD is used, the media shall be clearly labelled with project information and issue details, including unique sequence number. Where more than one disk is required for a particular issue of digital data, this fact shall be clearly identified on the labels in that issue, and referenced

within the transmission issue number (TRAN_ISNO) field of the files concerned (eg. TRAN-ISNO set to 1-1 and 1-2 respectively).

Files shall not be compressed (zipped) without the agreement of the data receiver.

All issues of data, including preliminary, shall be accompanied by an issue record that shall include the following information: This information is also included in the TRAN group.

- The heading 'AGS Format Data'
- The title 'Media Index Record' (or similar)
- The project identification (PROJ_ID)
- The unique issue sequence number (TRAN_ISNO)
- The date of issue to the data receiver (TRAN_DATE)
- The name of the data provider issuing the transmission media (TRAN_PROD)
- The name of the data receiver to whom the transmission media was issued (TRAN_RECV)
- A general description of the data transferred and/or a file listing for associated files
- The status of the data (preliminary, draft or final)

For each AGS Format data set, including all associated files, the index will detail:

- The file name including the file extension
- The date and time the file was created
- The file size in bytes/kilobytes/megabytes as appropriate
- A general description of the data contained in each file and/or a file listing for associated files.

All data shall be checked for AGS format errors / integrity prior to issue using AGS checking software. A list of AGS compatible software is available from the AGS website. All files shall be checked for viruses etc. prior to issue.

A.1.3 Schedule for submission of data

The electronic data is to be submitted in accordance with the following schedule:

Table 86: Schedule for Submission of Data

Data Status	Timing
Field data	Within two days of completion of hole
Preliminary data	Within one week of completion of test
Final prelim	Within two weeks of completion of all testing
Final	Within one week of Engineers approval or final prelim report

A.1.4 Notes on Particular AGS Groups & Fields

Where particular or project-specific requirements are required they are listed below:

Table 87: Project Specific Requirements

Group	Field	Note
PROJ	PROJ_ID	Contractors project/investigation reference
	PROJ_NAME	ACME Gas Works Redevelopment Phase 1
	PROJ_CLNT	ACME Developments plc
	PROJ_ENG	ACME International
TRAN	TRAN_STAT	Preliminary, Draft or Final

Group	Field	Note
LOCA	LOCA_ID	See list in Schedule
	LOCA_TYPE	Compound abbreviations to be used where appropriate, e.g. CP+RC
	LOCA_NATE	Used to report hole collar position in UK National Grid coordinates and datum
	LOCA_NATN	
	LOCA_GL	
	LOCA_LOCX	Used to report hole collar position in site coordinates and datum
	LOCA_LOCY	
	LOCA_LOCZ	
	LOCA_CLST	Set to 'Phase 1'
	LOCA_LOCA	Set to 'Primary Treatment Tanks' or 'Secondary Filters' as appropriate
ISPT		Incremental blows and penetrations must be provided. Use of other fields that duplicate this data (ISPT_MAIN etc.) is optional. The Contractor may determine the format for ISPT_REP.
WETH		Group NOT required

A.1.5 Reported Units of Measurement

The units of measurement for the data presented within the data file shall be those required by the specifications and standards specified in the Contract. Where these are different to the Suggested Units defined in the AGS4 publication they are listed below:

Table 88: Units of Measurement

Group	Field	Unit
IRES	IRES_IRES	ohm cm

A.1.6 Abbreviations

A standard list of abbreviations is provided on the AGS website (www.ags.org.uk). These shall be used except as listed below.

Other abbreviations shall only be used where no alternative exists in AGS4 or this specification and where the data receiver has given prior approval to their use.

Note that all abbreviations used in the data file are to be fully defined in the ABBR Group.

The following groups and fields require specific abbreviations to be used:

Table 89: Specific Abbreviations

Field	Abbreviation	Description
LOCA_TYPE		As AGS website (www.ags.org.uk)
SAMP_TYPE		As AGS website (www.ags.org.uk) plus additions listed below
	SA	Type A Construction Sample (see Specification)
	SB	Type B Construction Sample (see Specification)
	SC	Type C Construction Sample (see Specification)
GEOL_GEOL		As table below
GEOL_GEOL2		As table below

Geology Codes (GEOL_GEOL)

Drift / superficial deposits	
Code	Name
TOP	Topsoil
MG	Made Ground
ALV	Alluvium
PEAT	Peat
HDD	Head Deposits
CF	Clay with flints
RTD	River Terrace Deposits
GTD	Glacial till deposits
Solid Geology	
BKB	Bracklesham Beds
BAG	Bagshot Formation
CGM	Claygate Member
LC	London Clay
HAR	Harwich Formation
LMG-WL	Woolwich Formation
LMG-RF	Reading Formation
LMG-UP	Upnor Formation
TS	Thanet Sand

Secondary Geology Codes (GEOL_GEOL2)

General Type Codes	
Code	Description
CL	Clay
SL	Silt
SD	Sand
GR	Gravel
CO	Cobbles
Conc	Concrete
Trmc	Tarmac / blacktop
Wst	Waste (e.g. landfill)
CK	Chalk
UND	Undifferentiated
EF	Engineered Fill

A.1.7 User defined groups and headings

User defined fields are not required

A.1.8 Associated files

The following associated files are to be included in the AGS data submission. The formats for specific associated files are given below:

File Format (Clause)	Group	File Format
Photographs of cores and trial pits (Cl. 5.8 & 6.12)	FILE	JPG
Drawing(s) (Cl.16.4)	FILE	AutoCAD v 13 DXF

Other formats for these data deliverables shall only be used with the prior approval of the Engineer.

F. BILL OF QUANTITIES FOR GROUND INVESTIGATION



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The Christie Proposed Northern Pathology Development - Bill of Quantities (including Preamble)

NTHPAT-MMD-XX-XX-BQ-C-000001

4 June 2025



Issue and Revision Record

Project The Christie Proposed Northern Pathology Development
Document Bill of Quantities (including Preamble)
Doc. Ref. NTHPAT-MMD-XX-XX-BQ-C-000001

Revision	Date	Originator	Checker	Approver	Description
P01	04/06/2025	L. Brooks	C Yu Li	A Simpson	First Issue

Information class: Standard

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M M MOTT MACDONALD	Project	The Christie Proposed Northern Pathology Development		Number of sheets	
	Subject	Preamble to Bill of Quantities		1	of 1
	Originated by	L. Brooks	Date	04/06/2025	
	Checked by	C Yu Li	Date	04/06/2025	
Reference	Calculation				
	<u>Preamble to the Bill of Quantities</u> Doc Ref: NTHPAT-MMD-XX-ZZ-BQ-C-000001 The Preamble to the Bill of Quantities shall be the standard Preamble to the UK Specification for Ground Investigation, Third Edition, as published by ICE Publishing in 2022, subject to the following additional and amended clauses.				
Ref. / Clause	<u>Additional & Amended Clauses</u>				
1/ (All sections)	In all of the BoQ sections, quantities are provided for pre-measurable items. Where the quantity of an item is dependent on the Contractors proposed programme and /or method of working, this is marked by an [X] in the quantity column. These quantities shall be inserted by the Tenderer. Rates shall then be applied to all pre-measured quantities and all quantities provided by the Tenderer.				
2/ (All sections)	If any items required by the Contractor for the safe and efficient execution of the Investigation Works are not identified in the Bill of Quantities provided, the Tenderer shall insert these items as an additional item and provide the full price for the inclusion of such items in the Tender Total.				
3/ (All sections)	Notes are included at the foot of each BoQ section. These are deemed to be part of the BoQ and are relevant to the measurement of the quantities to which they refer.				
4/	Tenderers shall record any notes or assumptions made in the preparation of their Tender either in the space provided below or in a separate document.				
<u>Notes & Assumptions</u> The following assumptions have been made: 1) 2) 3)					

SECTION A

Number	Item description	Unit	Quantity	Rate	Amount £
A	General items, provisional utilities and additional items				
A1	Establish on site offices, stores and amenities for the Contractor	sum			0.00
A2	Maintenance of offices, stores and amenities for the Contractor	week			0.00
A3	Establish the compound area and amenities prior to mobilising and starting site works, and remove these on completion of site works. Rate to include erection and dismantling of any hoarding, fencing and signage around the compound area	sum			0.00
A4	Establish on site all machines, equipment and utilities for a Green category site				0.00
A5	Establish on site, and remove from site, one cable percussion boring machine and ancillary plant and equipment	nr			0.00
A6	Establish on site, and remove from site, one dynamic sampling machine and ancillary plant and equipment	nr			0.00
A7	Establish on site, and remove from site, one rotary drilling machine and ancillary plant and equipment	nr			0.00
A8	Establish on site, and remove from site, one sonic drilling machine and ancillary plant and equipment	nr			0.00
A9	Establish on site, and remove from site, one dual-purpose rotary drilling and dynamic sampling machine and ancillary plant and equipment	nr	1		0.00
A10	Establish on site, and remove from site, one cone penetration test(CPT) machine and ancillary plant and equipment	nr			0.00
A11	Establish on site, and remove from site, one excavator for machine-dug trial pits and ancillary plant and equipment	nr			0.00
A12	Establish specialist ancillary plant or machinery	sum			0.00
A13	Establish geophysical surveying plant and equipment	sum			0.00
A14	Weekly maintenance of specialist plant or machinery on site	week			0.00
A15	Establish on site Security Industry Authority (SIA) or similar approved Contractor for site security	sum			0.00
A16	Maintain site security	week	X		#VALUE!
A17	Provide and maintain on site all PPE and equipment for a Yellow category site	week	X		#VALUE!
A18	Provide and maintain on site all PPE and equipment for a Red category site	week			0.00
A19	Decontamination of machinery and equipment during and at the end of intrusive investigation for a Yellow or Red category site	sum	X		#VALUE!
	Appropriate storage, transport and off-site disposal of contaminated samples, flush, arisings and any PPE equipment, excluding laboratory testing	provisional sum			0.00
A20	Provide project management, supervision and execution personnel				
A20.1	Project Manager	p.day			0.00
A20.2	Site planner/ programmer	p.day			0.00
A20.3	Site agent (specify grade required)	p.day			0.00
A20.4	Site Health and Safety Coordinator	p.day			0.00
A20.5	Technical Lead (specify grade required)	p.day			0.00
A20.6	Data Coordinator	p.day			0.00
A20.7	Logging and/or Sampling Supervisor (specify grade required)	p.day	X		#VALUE!
A20.8	Technical Drilling Supervisor (specify grade required)	p.day			0.00
A20.9	Drilling Supervisor (Level 3 Vocational Qualification)	p.day			0.00
A20.10	Site Logger (specify grade required)	p.day	X		#VALUE!
A20.11	Geoenvironmental specialist (specify grade required)	p.day			0.00
A20.12	Other specialists (e.g. unexploded ordnance/contaminated waste/environmental specialist, traffic safety control officer or geophysicist)	p.day			0.00
A21	Establish the location and elevation of the ground at each exploratory hole	nr	3		0.00
A22	Preparation of health and safety documentation, including risk assessments	sum	1		0.00
A23	Facilities for the Investigation Supervisor	sum			0.00
A24	Vehicle(s) for the Investigation Supervisor	v.wk			0.00
A25	Fuel for the vehicle for the Investigation Supervisor	provisional sum			0.00
A26	Investigation Supervisor's telecommunication charges	provisional sum			0.00
A27	Deliver selected cores and samples to the specified address	provisional sum			0.00
A28	Special testing and sampling required by Investigation Supervisor	provisional sum			0.00
A29	Traffic safety and management	provisional sum	X		#VALUE!
A30	Reporting				
A30	Digital copy of the draft Desk Study Report	sum			0.00
A31	Digital copy of the final Desk Study Report	sum			0.00
A32	Digital copy of the PAS 128 utilities survey report	sum	1		0.00
A33	Digital copy of a Pre-condition Survey Report	sum	1		0.00
A34	Digital copy of a Post-condition Survey Report	sum	1		0.00
A35	Digital copy of the draft Ground Investigation Report (or specified part thereof)	sum	1		0.00
A36	Digital copy of the interim Ground Investigation Report (or specified part thereof)	sum			0.00
A37	Digital copy of a final Ground Investigation Report (or specified part thereof)	sum	1		0.00
A38	Digital copy of the draft Geotechnical Design Report (or specified part thereof)	sum			0.00
A39	Digital copy of the interim Geotechnical Design Report (or specified part thereof)	sum			0.00
A40	Digital copy of a final Geotechnical Design Report (or specified part thereof)	sum			0.00
A41	Digital copy of the interim Monitoring Report	sum			0.00
A42	Digital copy of a final Monitoring Report	sum	1		0.00
A43	Interim issue of digital data in AGS Data Format	nr	1		0.00
A44	Digital copy of photographs – soil/rock core	nr	20		0.00
A45	Digital copy of photographs – trial pits/trenches	nr	20		0.00
A46	Provision of collateral warranty to third parties	nr			0.00
A47	Provision of a letter of reliance or assignment to third parties	nr			0.00
A48	Temporary works and other matters				
A48	Carry out Principal Contractor's role under CDM 2015	sum	1		0.00
A49	Obtain statutory utility plans in advance of fieldwork	sum	1		0.00
A50	Undertake PAS 128 survey	sum	1		0.00
A51	Attendance at pre-start meetings	nr	1		0.00
A52	Standing time associated with site induction	sum	1		0.00
A53	Preparation of sloping/uneven ground, including clearance of vegetation to create suitable access for plant to exploratory location	day			0.00
A54	Undertaking any temporary works or temporary works design (e.g. scaffolding erection or excavation shoring)	nr			0.00
A55	Construction and removal of bunded wash-down area to control and contain contaminated material/ground or wash water	nr			0.00
A56	Clearance of vegetation, including tree felling, to create suitable access for plant to exploratory location	day	X		#VALUE!
A57	Removal and reinstatement of obstacle to facilitate access for plant to exploratory location	nr			0.00
A58	Mobilisation and demobilisation of materials for laying temporary road to facilitate access for plant to exploratory location (e.g. ground protection, bog mats or track matting) – state size	lin.m			0.00
A59	Maintain ground protection/temporary access track (e.g. bog mats or track matting)	lin.m/wk			0.00
A60	Re-site ground protection/temporary trackway	lin.m			0.00
A61	Construction and reinstatement of temporary level working area at each exploratory hole location on sloping ground in advance of carrying out exploratory hole	nr			0.00
A62	Installation and removal of temporary 'goal posts' required under HSE GS6 for site plant crossing under overhead power lines	nr			0.00
A63	Construction and removal of temporary bridging of water course	nr			0.00
A64	Construction and removal of temporary working platform at each exploratory hole location for mine shaft investigation	nr			0.00
A65	Erect and dismantle fencing to segregate exploratory working area/access/egress route from third parties	nr	X		#VALUE!
A66	Reinstatement using cold bituminous material surfacing	m3			0.00
A67	Reinstatement using hot bituminous material surfacing	m3			0.00
A68	Reinstatement of grassed areas	m2			0.00
A69	Reinstatement of concrete areas	m2	2		0.00
A70	Reinstatement of paved areas	m2			0.00
A71	Reinstatement of masonry or brickwork	m2			0.00
A72	Reinstatement of gravel or rubble (hard standing) areas	m2			0.00
A73	Reinstatement of arable land (excluding the crop) areas	m2			0.00
A74	Contract specific additional bill items				
A75	Vacuum extraction team + equipment to remove fumes inside building during ground investigation works		X		#VALUE!
A76	Provide ground investigation factual report, pdf copy.	sum	1		0.00
A77	Provision of welfare vehicle	sum	X		#VALUE!
A78	Servicing welfare vehicle	wk	X		#VALUE!
Total Bill A carried to Summary					#VALUE!

Number	Item description	Unit	Quantity	Rate	Amount £
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Notes

A1-3, A23 & A4 Are to be provided by the principal contractor

A4-A12

It is recognised that when working on potentially contaminated or contaminated land the site can be zoned with respect to the British Drilling Association (BDA) categorisation (e.g. a Yellow category site can have Red category zones within it). Therefore, Items A4 to A12 may need to be subdivided, or contract-specific additional items provided to take account of additional requirements

A19

Item A19 does not include for laboratory testing to determine the nature of the contaminated arisings. The required testing should be covered by relevant rates under Bill L. It is recommended that a provisional sum is always included under Item A19 and that rates under Bill L are obtained in order to cover for unforeseen contamination not revealed by the Desk Study.

A20

Subject to the following notes, Item A20 enables full identification of professional staff, which the Contractor is required to provide.

A20

Items under Item A20 are intended for detailing the requirements for the provision of Contractor's personnel in accordance with Specification Clauses 4.4.2, 4.4.3 and 4.4.5. Items should be included for different activity roles and where other specialists are required. An estimate of the appropriate number of person-days should be entered under Quantity against each item. It may be necessary to add additional items in order to adequately describe the categories of other specialists (e.g. traffic safety officer or archaeologist) and the grade of person required. Any items listed shall be chargeable only when present on site.

A20

Personnel fulfilling the roles identified under Item A20 must be competent and be able to demonstrate they have the skills, knowledge and experience to be able to safely fulfil their role appropriately.

Where the provision of personnel for work in accordance with Specification Clauses 4.4.2, 4.4.3 and 4.4.5 cannot be adequately specified at tender by the Designer, a minimum requirement should be specified and the Contractor should complete the appropriate items in the bill relevant to the site roles and number of personnel required.

The provision of technical support and other specialists to assist the Investigation Supervisor should be itemised under Bill M of the Bill of Quantities.

A29

Item A29 may be revised to 'sum' if the traffic safety and management requirements are simple and can be fully defined in Schedule S1.8.11. In many cases, it will be appropriate to add additional contract-specific items to cover for the provision and maintenance of the measures. In any event, Schedule S1.8.11 should provide the maximum possible detail of the required traffic management measures.

A66-A73

Items A66 to A73 may not be able to be priced or fully assessed until the works in those areas are complete. For large or more complex works it may be necessary to complete a more detailed contract-specific schedule, which can be priced separately.

A35-A40

In connection with Items A35 to A40, Schedules S1.24.9 and S1.24.10 should specify the required parts of the Ground Investigation Report and Geotechnical Design Report, respectively.

SECTION B

Number	Item description	Unit	Quantity	Rate	Amount	£
B	Cable Percussion Boring					
B1	Move cable percussion boring machine, equipment and crew to the site of each borehole and set up	nr				0.00
B2	Extra over Item B1 for setting up on a slope of gradient greater than 20% and less than 36%	nr				0.00
B3	Break out surface obstruction, where present, at borehole	h				0.00
B4	Advance borehole between existing ground level and 10 m depth	m				0.00
B5	As Item B4 but between 10 and 20 m depth	m				0.00
B6	As Item B4 but between 20 and 30 m depth	m				0.00
B7	As Item B4 but between 30 and 40 m depth	m				0.00
B8	As Item B4 but between 40 and 50 m depth	m				0.00
B9	Extra over Items B4 to B8, inclusive, for working at diameters >200 mm	m				0.00
B10	Advance borehole through hard material or obstruction	h				0.00
B11	Provide aquifer protection measures at a single aquiclude-aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr				0.00
B12	Insert temporary casing in advance of rotary/sonic continuation	m				0.00
B13	Standing time for cable percussion boring machine, equipment and crew	h				0.00
B14	Provision of cable percussion boring machine, equipment and crew as directed by the Investigation Supervisor	day				0.00
B15	Provision of modular/low headroom cable percussion boring machine, equipment and crew as directed by the Investigation Supervisor	day				0.00
B16	Backfill cable percussion boreholes					
B16	Move grout plant, tremie pipe and pump to the site of each exploratory hole and set up	nr				0.00
B17	Backfill borehole with arisings	lin,m				0.00
B18	Backfill borehole with bentonite pellets	lin,m				0.00
B19	Backfill borehole with pre-mixed cement/bentonite pellets	lin,m				0.00
B20	Backfill borehole with cement/bentonite grout (tremie)	lin,m				0.00
B21	Extra over Items B18 to B20 for borehole diameters in excess of 200mm	lin,m				0.00
B22	Return to the site of each borehole and set up where borehole requires topping up	nr				0.00
B23	Dynamic sampling					
B23	Move small tracked/wheeled dynamic sampling machine and equipment to the site of each dynamic sampling hole and set up	nr				0.00
B24	Extra over Item B23 for setting up on a slope of gradient greater than 20% and less than 36%	nr				0.00
B25	Advance dynamic sample hole between existing ground level and 5m depth	m				0.00
B26	As Item B25 but between 5 and 10 m depth	m				0.00
B27	As Item B25 but between 10 and 15 m depth	m				0.00
B28	Standing time for dynamic sampling equipment and crew	h				0.00
B29	Extra over Items B25 to B27, B30 and B31 for use of semi-rigid liner	m				0.00
B30	Provision of dynamic sampling machine (Terrier style rig), equipment and crew for sampling as directed by the Investigation Supervisor, maximum depth 15 m	day				0.00
B31	Provision of modular dynamic sampling machine, equipment and crew as directed by the Investigation Supervisor	day				0.00
B32	Backfill dynamic sampling holes					
B32	Move grout plant, tremie pipe and pump to the site of each exploratory hole and set up	nr				0.00
B33	Backfill borehole with arisings	lin,m				0.00
B34	Backfill borehole with bentonite pellets	lin,m				0.00
B35	Backfill borehole with pre-mixed cement/bentonite pellets	lin,m				0.00
B36	Backfill borehole with cement/bentonite grout (tremie)	lin,m				0.00
B37	Extra over Items B34 to B36 for borehole diameters in excess of 200mm	lin,m				0.00
B38	Return to the site of each borehole and set up where borehole requires topping up	nr				0.00
B39	Contract specific additional bill items					
			Total Bill B carried to Summary			0

Notes

- B1, B16-B23 For certain sites it is optional to introduce an extra over rate to Item B1, as Item B1.1, for moving a cable percussion boring machine and equipment over distances exceeding, say 500 m, to give more flexibility to the Investigation Supervisor's direction of field operations. A similar approach can be taken for Items B16 and B23. Alternatively, additional contract-specific items can be provided.
- B2 and B24 Items B2 and B24 allow for creating a level working area on sloping ground to facilitate the safe setting up and operating of plant. Any requirement for scaffolding, importing materials to create a ramp and working platform, and craning or lifting shall be charged against items listed in contract-specific additional bill items.
- B23, B30, B31 If dynamic probing is to be carried out at the site of a dynamic sampling hole this should be stated in Schedule S1.9 and detailed in Schedule 2. Item B23 should allow for setting up the machine for both dynamic sampling and dynamic probing, and Items F3 to F5 should be used to measure only the metreage of actual probing carried out in addition to any dynamic sampling which has been specified. If this activity is charged for on a time (day rate) basis, Item B30 or B31 rates should allow for the dynamic probing activity as well as the dynamic sampling activity.
- If two or more dynamic sampling machines are required, this should be stated in Schedule S1.9. The requirement for window or liner (windowless) sampling should also be indicated in Schedule S1.9.
- B29-B31 If dynamic sampling machines are used to carry out conventional sampling or testing (e.g. SPTs or UT100/U100 samples), and not charged for on a time basis, quantities should be allowed for under the relevant items in Bills E and F. When dynamic sampling is required to be charged for under Item B30 or B31, the rate should allow for all sampling and testing, excluding the cost for dynamic sampling liner tubes, which will be charged for under Item B29.
- B23-B30 Items B23 to B30 should be limited to small tracked or wheeled dynamic sampling machines (e.g. Premier, Terrier, Dart, Geotool or similar). Where window or liner (windowless) sampling is to be undertaken by a rotary drilling machine within a rotary borehole, allowance should be made for measurement against either Items C9 and C10 or, alternatively, Item C11

SECTION C

Number	Item description	Unit	Quantity	Rate	Amount £
C	Rotary drilling				
C1	Move rotary drilling machine and equipment to the site of each borehole and set up.	nr			0.00
C2	Extra over Item C1 or C9 for setting up on a slope of gradient greater than 20% and less than 36%.	nr			0.00
C3	Extra over Item C1 for setting up drilling plant for inclined borehole	nr			0.00
C4	Extra over Item C1 for setting up for clean water/air/air mist	nr			0.00
C5	Break out surface obstructions where present at borehole	h			0.00
C6	Provide aquifer-protection measures at a single aquiclude-aquifer boundary in a borehole	nr	1		0.00
C7	Standing time for rotary drilling machine, equipment and crew	h	1		0.00
C8	Provision of rotary drilling machine, equipment and crew for sampling as directed by the Investigation Supervisor	day			0.00
C9	Move dual-purpose rotary drilling and dynamic sampling machine and equipment to the site of each borehole and set up	nr	1		0.00
C10	Advance rotary borehole using dynamic sampling equipment	m	5		0.00
C11	Provision of dual-purpose rotary drilling and dynamic sampling machine, equipment and crew for sampling as directed by the Investigation Supervisor	day	2		0.00
	Rotary drilling without cores				
C12	Rotary drill at the specified diameter, from which cores are not required, between existing ground level and 10 m depth	m			0.00
C13	As Item C12 but between 10 and 20 m depth	m			0.00
C14	As Item C12 but between 20 and 30 m depth	m			0.00
C15	As Item C12 but between 30 and 40 m depth	m			0.00
C16	As Item C12 but between 40 and 50m depth	m			0.00
C17	As Item C12 but between 50 and 60 m depth	mm			0.00
C18	As Item C12 but between 60 and 70 m depth	m			0.00
C19	As Item C12 but between 70 and 80 m depth	m			0.00
C20	As Item C12 but between 80 and 90 m depth	m			0.00
C21	As Item C12 but between 90 and 100 m depth	m			0.00
C22	Extra over Items C12 to C21 for inclined drillhole	m			0.00
C23	Extra over Items C12 to C21 for mist/water/polymer/mud flush	m			0.00
C24	Extra over Items C12 to C21 for casing off materials to maintain borehole stability	m			0.00
	Rotary drilling to obtain cores				
C25	Rotary drill to obtain cores of the specified diameter between existing ground level and 10 m depth	m	5		0.00
C26	As Item C25 but between 10 and 20 m depth	m	8		0.00
C27	As Item C25 but between 20 and 30 m depth	m			0.00
C28	As Item C25 but between 30 and 40 m depth	m			0.00
C29	As Item C25 but between 40 and 50 m depth	m			0.00
C30	As Item C25 but between 50 and 60 m depth	m			0.00
C31	As Item C25 but between 60 and 70 m depth	m			0.00
C32	As Item C25 but between 70 and 80 m depth	m			0.00
C33	As Item C25 but between 80 and 90 m depth	m			0.00
C34	As Item C25 but between 90 and 100 m depth	m			0.00
C35	Extra over Items C25 to C34 for use of semi-rigid core liner	m	13		0.00
C36	Extra over Items C25 to C34 for coring inclined rotary drillhole	m			0.00
C37	Extra over Items C25 to C34 for clean water/air/air mist	m			0.00
C38	Extra over Items C25 to C34 for casing off unstable materials to maintain borehole stability	m			0.00
C39	Extra over Items C25 to C34 for coring with wireline techniques	m			0.00
C40	Extra over Items C25 to C34 for recording drilling parameters as specified	nr			0.00
C41	Core box to be retained by the Client	nr			0.00
	Backfill rotary drilled boreholes				
C42	Move grout plant, tremie pipe and pump to the site of each exploratory hole and set up	nr			0.00
C43	Backfill borehole with arisings	lin.m	13		0.00
C44	Backfill borehole with bentonite pellets	lin.m			0.00
C45	Backfill borehole with pre-mixed cement/bentonite pellets	lin.m			0.00
C46	Backfill borehole with cement/bentonite grout (tremie)	lin.m			0.00
C47	Extra over Items C44 to C46 for borehole diameters in excess of 200 mm	lin.m			0.00
C48	Return to the site of each borehole and set up where borehole requires topping up	nr			0.00
	Sonic drilling				
C49	Move sonic drilling machine, equipment and crew to the site of each borehole and set up	nr			0.00
C50	Extra over Item C49 for setting up on a slope of gradient greater than 20% and less than 36%	nr			0.00
C51	Extra over Item C49 for setting up sonic drilling machine for inclined drillhole	nr			0.00
C52	Break out surface obstructions where present at borehole	h			0.00
C53	Provide aquifer-protection measures at a single aquiclude-aquifer boundary in a borehole	nr			0.00
C54	Provision of sonic drilling machine, equipment and crew for sampling as directed by the Investigation Supervisor	day			0.00
C55	Standing time for sonic drilling machine, equipment and crew	h			0.00
	Sonic drilling without cores				
C56	Sonic drill at the specified diameter, from which cores are not required, between existing ground level and 10 m depth	m			0.00
C57	As Item C56 but between 10 and 20 m depth	m			0.00
C58	As Item C56 but between 20 and 30 m depth	m			0.00
C59	As Item C56 but between 30 and 40 m depth	m			0.00
C60	As Item C56 but between 40 and 50 m depth	m			0.00
C61	As Item C56 but between 50 and 60 m depth	m			0.00
C62	As Item C56 but between 60 and 70 m depth	m			0.00
C63	As Item C56 but between 70 and 80 m depth	m			0.00
C64	As Item C56 but between 80 and 90 m depth	m			0.00
C65	As Item C56 but between 90 and 100 m depth	m			0.00
C66	Extra over Items C56 to C65 for inclined sonic borehole	m			0.00
	Sonic drilling to obtain cores				
C67	Sonic drill at the specified diameter, from which cores are required, between existing ground level and 10 m depth	m			0.00
C68	As Item C67 but between 10 and 20 m depth	m			0.00
C69	As Item C67 but between 20 and 30 m depth	m			0.00
C70	As Item C67 but between 30 and 40 m depth	m			0.00
C71	As Item C67 but between 40 and 50 m depth	m			0.00
C72	As Item C67 but between 50 and 60 m depth	m			0.00
C73	As Item C67 but between 60 and 70 m depth	m			0.00
C74	As Item C67 but between 70 and 80 m depth	m			0.00
C75	As Item C67 but between 80 and 90 m depth	m			0.00
C76	As Item C67 but between 90 and 100 m depth	m			0.00
C77	Extra over Items C67 to C76 for inclined sonic borehole	m			0.00
C78	Extra over Items C67 to C76 for use of semi-rigid core liner	m			0.00
	Backfill sonic drilled boreholes				
C79	Move grout plant, tremie pipe and pump to the site of each exploratory hole and set up	nr			0.00
C80	Backfill borehole with arisings	lin.m			0.00
C81	Backfill borehole with bentonite pellets	lin.m			0.00
C82	Backfill borehole with pre-mixed cement/bentonite pellets	lin.m			0.00
C83	Backfill borehole with cement/bentonite grout (tremie)	lin.m			0.00
C84	Extra over Items C81 to C83 for borehole diameters in excess of 200 mm	lin.m			0.00
C85	Return to the site of each borehole and set up where borehole requires topping up	nr			0.00

	Notes
C1	For certain sites it is optional to introduce additional extra over item rates for moving a rotary drilling machine and equipment, dual-purpose rotary drilling machine and equipment, or sonic drilling machine and equipment over distances exceeding, say, 500 m (e.g. Item C1.1). This should give more flexibility to the Investigation Supervisor's direction of field operations. Alternatively, additional contract-specific items can be provided.
C1, C9, C11	If dynamic sampling and rotary drilling is required within a borehole, Item C9 should be used, not Item C1, together with the relevant additional items within this bill. Alternatively, Item C11 can be used. Hole and core diameters will be defined in the Schedules. If more than one hole or core diameter is required, the Bill of Quantities must identify this with appropriate contract-specific items repeated as required for each hole or core size.
C35, C78	The separate bill items for the semi-rigid core liner, Items C35 and C78, should always have quantities corresponding to the lengths of rotary or sonic drilling to obtain cores, unless the Investigation Supervisor wishes to restrict the drilling method used.
C12-C24, C56-C66	Items C12 to C24 should allow for the use of the specified method of drilling without cores (open holing) or using an alternative method agreed with the Investigation Supervisor. These methods could include rotary percussive drilling, using a down the hole hammer or even coring with immediate disposal of the cores. If sonic drilling is the method specified, Items C56 to C66 should be used.
C24, C38	Casing off 'unstable material', referred to in Items C24 and C38, allows for casing off soil, fractured, broken and/or weathered rock, and cavities/voids associated with mine workings or erosional features. Measurement of the casing used in this connection shall be from ground level to depths such that the casing is not required to maintain borehole stability.
C2, C50, C87	Items C2, C50 and C87 allow for the creation of a level working area on sloping ground to facilitate the safe setting up and operation of plant. Any requirement for scaffolding, importing materials to create a ramp and working platform, and craning or lifting shall be charged against items listed in contract-specific additional bill items.

SECTION D

Number	Item description	Unit	Quantity	Rate	Amount £
D	Pitting and trenching				
	Inspection pits				
	Cable percussion boring/dynamic sampling				
D1	Excavate inspection pit by hand to 1.2 m depth	nr			0.00
D2	Extra over Item D1 for breaking out surface obstructions	h			0.00
	Rotary/sonic drilling				
D3	Excavate inspection pit by hand to 1.2 m depth	nr	1		0.00
D4	Extra over Item D3 for breaking out surface obstructions	h	0.5		0.00
	Cone penetration testing				
D5	Excavate inspection pit by hand to 1.2 m depth	nr			0.00
D6	Extra over Item D5 for breaking out surface obstructions	h			0.00
	Concrete coring				
D7	Concrete core through hard materials in advance of borehole (minimum 250 mm diameter, maximum 300 mm diameter)	day	x		#VALUE!
	Machine-dug trial pits and trenches				
D8	Move excavation plant and equipment to the site of each trial pit or trench of not greater than 4.5 m depth	nr			0.00
D9	Extra over Item D8 for setting up on a slope of gradient greater than 20% and less than 36%	nr			0.00
D10	Excavate standard trial pit between existing ground level and 4.5 m depth	m			0.00
D11	Extra over Item D10 for deep logging trial pit between 4.5 and 6 m depth	m			0.00
D12	Excavate trial trench between existing ground level and 4.5 m depth	m3			0.00
D13	As Item D12 but between 4.5 and 6 m depth	m3			0.00
D14	Mobilisation of hydraulic breaker	sum			0.00
D15	Extra over Items D10 to D13, inclusive, for the provision of a hydraulic breaker for breaking out hard material or surface obstructions	h			0.00
D16	Standing time for excavation plant, equipment and crew for machine-dug trial pit or trench (Type 1 trial pits)	h			0.00
	Daily provision of pitting or trenching crew and equipment				
D17	Provision of excavation plant equipment and crew for machine-dug trial pits or trenches as directed by the Investigation Supervisor; maximum depth 4.5 m	day			0.00
D18	As Item D17 but 6 m depth	day			0.00
D19	Provision of vacuum excavation plant, equipment and crew	day			0.00
D20	Provision of equipment and crew for hand-dug trial pits or trenches as directed by the Investigation Supervisor; maximum depth 1.2 m	day	1		0.00
D21	Extra over Items D17, D18, D19 and D20 for the provision of a hydraulic breaker for breaking out hard material or surface obstructions	day			0.00
	General				
D22	Bring pump to the position of each pit or trench	nr			0.00
D23	Pump water from pit or trench	h			0.00
D24	Extra over Item D23 for temporary storage, treatment and disposal of potentially contaminated or contaminated water	provisional sum			0.00
D25	Leave open trial pit or trench	day			0.00
D26	Backfill trial pit with excavated material	nr	2		0.00
D27	Backfill trial pit with imported material	m3			0.00
D28	Backfill trial trench with excavated material	nr			0.00
D29	Backfill trial trench with imported material	m3			0.00
D30	Provision of temporary works design	sum			0.00
D31	Provide shoring, propping or other excavation support and all necessary safety equipment, PPE and emergency procedures to allow safe working where personnel entry is required	day			0.00
D32	Provide safety equipment to allow the safe working of personnel at height	day			0.00
	Contract specific additional bill items				
D33	Excavate trial pit by hand to 1.2 m depth	nr	2		0.00
D34	Extra over Item D33 for breaking out surface obstructions	hr	1		0.00
			Total Bill D carried to Summary		#VALUE!

Notes

- D1, D3, D5 Where exploratory holes are located within 10m of a known service, hand-excavated pits for the purposes of the avoidance of underground services, structures or assets should be undertaken after a PAS 128 survey and in advance of exploratory hole operations. In all other locations an inspection pit may be undertaken without a PAS128 survey. Inspection pits are normally excavated to a minimum depth of 1.2 mbgl. Where underground services, structures or assets are known or suspected to be present below a depth of 1.2 mbgl, the exploratory hole location should be relocated, or steps taken to excavate, using appropriate safe digging techniques, additional trial pits to depths required to positively identify and prove the position of buried utilities.
- D9, D11, D28 Trial pits and their reinstatement shall be measured on a 'number' basis as the size and volumes will depend on the Contractor's proposed methodology.
- D9 Pits and trenches exceeding 4.5 m in depth require the mobilisation of more significant plant, and an extra over item is included for moving to the site of each pit or trench. An additional contract-specific item in Bill A may also be considered appropriate for mobilisation to site.

SECTION E

Number	Item description	Unit	Quantity	Rate	Amount £
E	Sampling during formation of exploratory hole				
E1	Small disturbed sample	nr	9		0.00
E2	Bulk disturbed sample	nr	8		0.00
E3	Large bulk disturbed sample	nr			0.00
E4	Open-tube U100 sample – by cable percussion or dynamic sampling	nr	3		0.00
E5	Open-tube U100 sample – by rotary/sonic methods	nr			0.00
E6	Open-tube UT100 sample – by cable percussion	nr			0.00
E7	Open-tube UT100 sample – by rotary methods	nr			0.00
E8	Static push/piston sample	nr			0.00
E9	Groundwater sample	nr	1		0.00
E10	Cut, prepare and protect core subsample	nr			0.00
E11	Block sample (including provision for taking, containing and protecting block sample)	nr			0.00
	Continuous or semi-continuous sampling				
E12	Move continuous or semi-continuous sampling machine and equipment to the site of each exploratory hole and set up	nr			0.00
E13	Extra over Item E12 for setting up on a slope of gradient greater than 20% and not exceeding 36%	nr			0.00
E14	Break out surface obstruction where present at exploratory hole	h			0.00
E15	Advance sampler between existing ground level and 10 m depth	m			0.00
E16	As Item E15 but between 10 and 20 m depth	m			0.00
	Sampling for potentially aggressive ground/groundwater (BRE SD1)				
E17	Provision of containers and collection of soil samples for contamination or aggressive ground for concrete Suite A (Greenfield site – pyrite absent)	nr			0.00
E18	Provision of containers and collection of groundwater samples for contamination for aggressive groundwater for concrete Suite A (Greenfield site – pyrite absent)	nr			0.00
E19	Provision of containers and collection of soil samples for contamination or aggressive ground for concrete Suite B (Greenfield site – pyrite present)	nr			0.00
E20	Provision of containers and collection of groundwater samples for contamination for aggressive groundwater for concrete Suite B (Greenfield site – pyrite present)	nr			0.00
E21	Provision of containers and collection of soil samples for contamination or aggressive ground for concrete Suite C (Brownfield site – pyrite absent, including dependent options)	nr			0.00
E22	Provision of containers and collection of groundwater samples for contamination for aggressive groundwater for concrete Suite C (Brownfield site – pyrite absent, including dependent options)	nr			0.00
E23	Provision of containers and collection of soil samples for contamination or aggressive ground for concrete Suite D (Brownfield site – pyrite present, including dependent options)	nr	3		0.00
E24	Provision of containers and collection of groundwater samples for contamination for aggressive groundwater for concrete Suite D (Brownfield site – pyrite present, including dependent options)	nr	1		0.00
	Sampling for geoenvironmental contamination assessment				
E25	Provision of containers and collection of soil samples for contamination Suite E (Soil samples)	nr	10		0.00
E26	Provision of containers and collection of water/groundwater samples for contamination Suite F (Water samples)	nr			0.00
E27	Provision of containers and collection of samples for contamination Suite G (Perfluoroalkyl and polyfluoroalkyl substances (PFAS) samples)	nr			0.00
E28	Provision of containers and collection of gas samples for contamination Suite H (Permanent gases)	nr			0.00
E29	Provision of containers and collection of vapour samples for contamination Suite I (Vapour samples)	nr			0.00
	Sampling for waste acceptance criteria (WAC) testing				
E30	Provision of containers and collection of samples for WAC Suite J (Inert waste landfill)	nr	1		0.00
E31	Provision of containers and collection of samples for WAC Suite K (Stable, non-reactive hazardous waste in non-hazardous waste landfill)	nr			0.00
E32	Provision of containers and collection of samples for WAC Suite L (Hazardous waste landfill)	nr			0.00
	Contract specific additional bill items				
E33	Provision of containers and collection of soil samples for contamination Site-specific or Leachate suite as per the specification requirements.	nr	8		0.00
				Total Bill E carried to Summary	0

Notes

- E6 Use of static pushed or thin-walled samplers is recommended where the sample is to be used for laboratory strength and/or compressibility testing. The UT100 can be considered, but the driving mechanism and the number of blows to retrieve the sample should be taken into account.
- E8 Item E8 refers to either static push samples or piston samples. Where these are both required on a project, additional sub-items or contract-specific items should be added.
- E10 Item E10 relates to subsamples obtained from core runs recovered by rotary or sonic methods.
- E1-E9, E11 The rates for Items E1 to E9 and E11 should include for the containers. Items E4 to E7 should include for a small disturbed sample.

SECTION F

Number	Item description	Unit	Quantity	Rate	Amount £
F	Probing and cone penetration testing				
	Dynamic probing				
F1	Bring dynamic probe equipment to the site of each test location	nr			0.00
F2	Extra over Item F1 for setting up on a slope of gradient greater than 20% and less than 36%	nr			0.00
F3	Carry out dynamic probe test from existing ground level to 5 m depth	m			0.00
F4	As Item F3 but between 5 and 10 m depth	m			0.00
F5	As Item F3 but between 10 and 15 m depth	m			0.00
F6	Standing time for dynamic probe test equipment and crew	h			0.00
F7	Provision of dynamic probing equipment and crew for probing as directed by the Investigation Supervisor; maximum depth 15 m	day			0.00
	Cone penetration testing				
F8	Bring cone penetration test (CPT) machine, equipment and crew to the site of each test location	nr			0.00
F9	Extra over Item F8 for setting up on a slope of gradient greater than 20% and less than 36%	nr			0.00
F10	Carry out cone penetration test (CPT), measuring both cone and sleeve resistance from existing ground level to 10 m depth	m			0.00
F11	As Item F10 but between 10 and 20 m depth	m			0.00
F12	As Item F10 but between 20 and 30 m depth	m			0.00
F13	As Item F10 but between 30 and 40 m depth	m			0.00
F14	Extra over Items F10 to F13 for use of piezocone	m			0.00
F15	Extra over Items F10 to F13 for interpretation of cone/piezocone penetration test (CPT/CPTU) data	m			0.00
F16	Carry out dissipation test up to 1-h duration	nr			0.00
F17	Extra over Item F16 for test duration exceeding 1 h	h			0.00
F18	Standing time for static cone penetration test (CPT) equipment and crew	h			0.00
F19	Extra over Items F10 to F13 for use of seismic cone	m			0.00
F20	Carry out seismic cone test	nr			0.00
F21	Extra over Item F20 for interpretation of seismic cone data	nr			0.00
F22	Standing time for seismic cone test equipment and crew	h			0.00
F23	Provision of static cone penetration testing machine, equipment and crew for measuring both cone and sleeve resistance from existing ground level to refusal or as directed by the Investigation Supervisor (rate shall include for interpretation and presentation of data)	day			0.00
F24	Extra over Item F23 for use of a piezocone to provide measurements of pore water pressure	day			0.00
F25	Extra over Item F23 for use of a triaxial magnetometer cone/natural gamma cone/seismic cone/hydraulic profiling tool/membrane interface probe/laser induced fluorescence/electrical conductivity cone	day			0.00
F26	Contract-specific additional bill items				
			Total Bill F carried to Summary		0.00

Notes

F10-F14, F The rates for CPT Items F10 to F14, F16, F17, F19 and F20 shall allow for provision of daily records and presentation of the results on agreed report forms/exploratory hole logs in accordance with BS EN ISO 22476-1:2012 and Schedule S1.16.4.

Number	Item description	Unit	Quantity	Rate	Amount £
G	Geophysical surveys				
	Land-based mapping geophysical techniques				
G1	Collect and process conductivity survey data	lin.m			0.00
G2	Collect and process magnetic survey data	lin.m			0.00
G3	Collect and process electromagnetic survey data	lin.m			0.00
G4	Collect and process micro-gravity survey data	lin.m			0.00
G5	Interpretation of land-based mapping data	sum			0.00
G6	Standing time for land-based mapping geophysical survey crew and equipment	h			0.00
	Land-based profiling geophysical techniques				
G7	Collect and process electrical resistivity tomography data	lin.m			0.00
G8	Collect and process seismic refraction (P wave) data	lin.m			0.00
G9	Collect and process seismic refraction (S wave) data	lin.m			0.00
G10	Collect and process seismic reflection (P wave) data	lin.m			0.00
G11	Collect and process seismic reflection (S wave) data	lin.m			0.00
G12	Collect and process ground penetrating radar data	lin.m			0.00
G13	Interpretation of land-based profiling geophysical data	sum			0.00
G14	Standing time for land-based profiling geophysical survey crew and equipment	h			0.00
	Land-based in situ geophysical techniques				
G15	Collect and process electrical resistivity sounding (four-pin Wenner) data	nr			0.00
G16	Collect and process MASW (1-D) profile	nr			0.00
G17	Collect and process CSW (1-D) profile	nr			0.00
G18	Standing time for land-based field geophysical survey crew and equipment	h			0.00
	Land-based borehole seismic geophysical techniques				
G19	Move downhole seismic equipment to the site of each borehole and set up	nr			0.00
G20	Move cross-hole seismic equipment to the site of each set of borehole and set up	nr			0.00
G21	Move cross-hole seismic tomography (P-wave) equipment to the site of each set of boreholes and set up	nr			0.00
G22	Collect and process downhole seismic data	m			0.00
G23	Collect and process cross-hole seismic data	m			0.00
G24	Collect and process cross-hole seismic tomography (P-wave) data	m			0.00
G25	Standing time for land-based borehole seismic geophysical survey crew and equipment	h			0.00
	Land-based borehole wireline geophysical techniques				
G26	Move hydrogeological investigation suite of wireline geophysical logging tools to the site of each borehole and set up (Caliper, natural gamma, resistivity, fluid temperature and conductivity, and impeller flowmeter)	nr			0.00
G27	Move basic geotechnical investigation suite of wireline geophysical logging tools to the site of each borehole and set up (Caliper, natural gamma acoustic/optical televiever)	nr			0.00
G28	Move intermediate geotechnical investigation suite of wireline geophysical logging tools to the site of each borehole and set up (Caliper, natural gamma acoustic/optical televiever formation density and PS logger)	nr			0.00
G29	Move advanced geotechnical investigation suite of wireline geophysical logging tools to the site of each borehole and set up (Caliper, natural gamma acoustic/optical televiever, formation density, PS logger, conductivity, resistivity, temperature and porosity)	nr			0.00
G30	Move cavity laser scanning wireline logging tools to the site of each borehole and set up	nr			0.00
G31	Move cavity sonar scanning wireline logging tools to the site of each borehole and set up	nr			0.00
G32	Collect and process hydrogeological investigation suite survey data	m			0.00
G33	Collect and process basic geotechnical investigation suite survey data	m			0.00
G34	Collect and process intermediate geotechnical investigation suite survey data	m			0.00
G35	Collect and process advanced geotechnical investigation suite survey data	m			0.00
G36	Collect and process cavity laser scanning wireline logging data	sum			0.00
G37	Collect and process cavity sonar scanning wireline logging data	sum			0.00
G38	Standing time for land-based borehole wireline geophysical survey crew and equipment	h			0.00
	Overwater				
G39	Collect and process echo sounding, side-scan sonar, magnetic, conductivity, seismic reflection, seismic refraction, resistivity imaging or ground-probing radar data	day			0.00
G40	Contract specific additional bill items				
			Total Bill G carried to Summary		0.00

G7 to
G11 Tenderers shall state the inter-sensor spacings for each technique proposed.
G8 to
G11 Geophysical techniques to be determined following Geophysical trail, it is not anticipated that both seismic refraction and seismic reflection will be required.

SECTION H

Number	Item description	Unit	Quantity	Rate	Amount £
H	Field testing				
H1	Standard penetration test in borehole between ground level and 10 m depth	nr	4		0.00
H2	As Item H1 but between 10 and 20 m depth	nr			0.00
H3	As Item H1 but between 20 and 30 m depth	nr			0.00
H4	As Item H1 but between 30 and 40 m depth	nr			0.00
H5	As Item H1 but between 40 and 50 m depth	nr			0.00
H6	Standard penetration test in rotary drillhole between ground level and 10 m depth	nr			0.00
H7	As Item H6 but between 10 and 20 m depth	nr			0.00
H8	As Item H6 but between 20 and 30 m depth	nr			0.00
H9	As Item H6 but between 30 and 40 m depth	nr			0.00
H10	As Item H6 but between 40 and 50 m depth	nr			0.00
H11	Standard penetration test in sonic drillhole between ground level and 10 m depth	nr			0.00
H12	As Item H11 but between 10 and 20 m depth	nr			0.00
H13	As Item H11 but between 20 and 30 m depth	nr			0.00
H14	As Item H11 but between 30 and 40 m depth	nr			0.00
H15	As Item H11 but between 40 and 50 m depth	nr			0.00
	Field density testing				
H16	Small pouring cylinder method	nr			0.00
H17	Large pouring cylinder method	nr			0.00
H18	Water replacement method	nr			0.00
H19	Core cutter method	nr			0.00
H20	Nuclear method	day			0.00
	Pavement and strength field tests				
H21	California bearing ratio (CBR) test	nr			0.00
H22	Plate loading test	nr			0.00
H23	Lightweight deflectometer test	nr			0.00
H24	Falling weight deflectometer test	nr			0.00
H25	Vane shear strength test in borehole	nr			0.00
H26	Borehole/penetration vane test	nr			0.00
H27	Hand penetrometer test (set of 3 readings)	nr			0.00
H28	Hand vane test (set of 3 readings)	nr			0.00
	Geophysical field tests				
H29	Electrical resistivity of soil	nr			0.00
H30	Thermal resistivity of soil	nr			0.00
H31	Redox potential	nr			0.00
	Permeability testing				
H32	Set up and dismantle variable head permeability test in cable percussion borehole	nr			0.00
H33	Set up and dismantle constant head permeability test in cable percussion borehole	nr			0.00
H34	Carry out permeability test in cable percussion borehole	h			0.00
H35	Set up and dismantle variable head permeability test in observation well/open standpipe piezometer	nr			0.00
H36	Set up and dismantle constant head permeability test in observation well/open standpipe piezometer	nr			0.00
H37	Carry out permeability test in observation well/open standpipe piezometer	h			0.00
H38	Set up and dismantle variable head permeability test in rotary/sonic borehole	nr			0.00
H39	Set up and dismantle constant head permeability test in rotary/sonic borehole	nr			0.00
H40	Carry out permeability test in rotary/sonic borehole	h			0.00
H41	Set up and dismantle single packer permeability test	nr			0.00
H42	Set up and dismantle double packer permeability test	nr			0.00
H43	Carry out single packer permeability test	h			0.00
H44	Carry out double packer permeability test	h			0.00
	Pumping tests				
H45	Move and set up pumping test plant and equipment to site of each exploratory hole	nr			0.00
H46	Carry out background monitoring	day			0.00
H47	Carry out equipment test in test well	nr			0.00
H48	Carry out variable rate step test in test well up to 1 day	nr			0.00
H49	Carry out constant rate test in test well up to 1 day	nr			0.00
H50	Extra over Item H49 for additional days pumping	day			0.00
H51	Carry out recovery monitoring	day			0.00
H52	Standing time for pumping test plant, equipment and crew	h			0.00
	Self-boring pressuremeter				
H53	Move and set up self-boring pressuremeter and exploratory hole forming equipment to site of each exploratory hole	nr			0.00
H54	Extra over Item H53 for setting up on a slope of gradient greater than 20% and less than 36%	nr			0.00
H55	Advance exploratory hole to pressuremeter test location between ground level and 10 m depth	m			0.00
H56	As Item H55 but between 10 and 20 m depth	m			0.00
H57	As Item H55 but between 20 and 30 m depth	m			0.00
H58	Advance exploratory hole through hard material or obstruction	h			0.00
H59	Self-bore to form test pocket between ground level and 10 m depth	m			0.00
H60	As Item H59 but between 10 and 20 m depth	m			0.00
H61	As Item H59 but between 20 and 30 m depth	m			0.00
H62	Carry out pressuremeter test, provision of data and report, test duration not exceeding 1.5 h	nr			0.00
H63	Extra over Item H62 for test duration in excess of 1.5 h	h			0.00
H64	Carry out additional calibrations as instructed by the Investigation Supervisor	sum			0.00
H65	Displacement transducers	nr			0.00
H66	Pore pressure transducers	nr			0.00
H67	Total pressure transducers	nr			0.00
H68	Membrane stiffness	nr			0.00
H69	Carry out membrane compression calibrations as instructed by the Investigation Supervisor	nr			0.00
H70	Backfill exploratory hole for pressuremeter with cement/bentonite grout	m			0.00

Notes

Number	Item description	Unit	Quantity	Rate	Amount £
I	Instrumentation				
	Observation wells and piezometers				
I1	Backfill exploratory hole with cement/bentonite grout below observation well or piezometer	m			0.00
I2	Provide and install 19 mm i.d. observation well	m			0.00
I3	Provide and install 19 mm i.d. open standpipe piezometer	m			0.00
I4	Extra over Item I3 to provide a porous filter tip	nr			0.00
I5	Provide and install 25 mm i.d. observation well	m			0.00
I6	Provide and install 25 mm i.d. open standpipe piezometer	m			0.00
I7	Extra over Item I6 to provide porous filter tip	nr			0.00
I8	Provide and install 50 mm i.d. observation well	m			0.00
I9	Provide and install 75 mm i.d. observation well	m			0.00
I10	Provide and install electric piezometer cable	m			0.00
I11	Provide and install electric piezometer tip (e.g. vibrating wire)	m			0.00
I12	Provide and install single-channel datalogger	nr			0.00
I13	Provide and install hydraulic piezometer	m			0.00
I14	Provide and install hydraulic piezometer tip	nr			0.00
I15	Provide terminal box for hydraulic piezometer	nr			0.00
I16	Provide and install pneumatic piezometer	m			0.00
I17	Provide and install terminal box for pneumatic piezometer	nr			0.00
I18	Provide gas tap for ground gas observation well	nr			0.00
I19	Provide and install protective cover (flush)	nr	1		0.00
I20	Provide and install protective cover (raised)	nr			0.00
I21	Extra over Item I20 for heavy-duty cover in highways	nr			0.00
	Observation well and open standpipe piezometer development				
I22	Supply equipment and personnel to carry out development by surging	nr			0.00
I23	Develop observation well or open standpipe piezometer by surging	h			0.00
I24	As Item I23 but by airlift pumping	nr			0.00
I25	As Item I23 but by airlift pumping	h			0.00
I26	As Item I23 but by over pumping	nr			0.00
I27	As Item I23 but by over pumping	h			0.00
I28	As Item I23 but by jetting	nr			0.00
I29	As Item I23 but by jetting	h			0.00
I30	Containment, transport and disposal of development water	m3			0.00
I31	Extra over Item I30 for containment, transport and disposal of contaminated development water	m3			0.00
	Inclinometers				
I32	Supply and install inclinometer guide tubing in exploratory hole (not including hole formation)	m			0.00
I33	Hire of inclinometer probe and read-out unit	day			0.00
I34	Provide and install protective cover for inclinometer installation (flush)	nr			0.00
I35	Provide and install protective cover for inclinometer installation (raised)	nr			0.00
	Extensometers				
I36	Provide and install access extensometer guide tubing	m			0.00
I37	Provide and install magnetic targets (i.e. spider magnet)	nr			0.00
I38	Provide and install datum magnet	nr			0.00
	Fencing and protection				
I39	Supply and erect protective fencing around observation well, piezometer or other installation	nr			0.00
I40	Supply and erect 1.5 m high marker post	nr			0.00
I41	Contract specific additional bill items				
I42	Provide and install 50 mm i.d. open standpipe piezometer	m	7		0.00
Total Bill I carried to Summary					0.00

I12 Covers and terminal boxes will vary depending on the instrument specified, and where larger covers are required to accommodate specialist instrumentation or dataloggers additional contract-specific items should be provided. Item I12 allows for the provision of a singlechannel datalogger. Where additional channels are required, items for additional channels or multi-channel dataloggers should be added as contract-specific additional items.

Sets of readings for instruments following initial installation during fieldwork and during return visits to site should be charged against the relevant items in Bill J.

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Number	Item description	Unit	Quantity	Rate	Amount £
J	Installation monitoring and sampling				
	During fieldwork period				
J1	Reading of water level in observation well or standpipe piezometer or VW piezometer (to include download of data collected since previous visit)	nr			0.00
J2	Ground gas measurement in observation well	nr			0.00
J3	Extra over Item J2 for obtaining a ground gas sample	nr			0.00
J4	Ground vapour measurement in observation well	nr			0.00
J5	Extra over Item J4 for obtaining a vapour sample	nr			0.00
J6	Set of inclinometer readings (as defined in Specification Clause 11.7 or Schedule S1.18.8) per installation and report results	nr			0.00
J7	Water sample from observation well or standpipe piezometer, including purging or low-flow purging up to 1.0 h	nr			0.00
J8	Extra over Item J7 for purging or low-flow purging in excess of 1.0 h	h			0.00
J9	Reading of free product level in observation well using an interface probe	nr			0.00
J10	Obtain surface water body sample	nr			0.00
J11	Containment, transport and disposal of purged water	nr			0.00
J12	Containment, transport and disposal of contaminated purged water	provisional sum			0.00
	Post-fieldwork period				
J13	Return visit to site following completion of fieldwork to take readings from installations (to include ALL installations)	nr	6		0.00
J14	Extra over Item J13 for reading of water level in observation well or piezometer during return visit	nr	6		0.00
J15	Extra over Item J13 for ground gas measurement in observation well during return visit	nr	4		0.00
J16	Extra over Item J13 for ground vapour measurement in observation well during return visit	nr			0.00
J17	Extra over Item J13 for reading of free product level in observation well using an interface probe during return visit to site	nr			0.00
J18	Extra over Item J13 for set of inclinometer readings (as defined in Specification Clause 11.7 or Schedule S1.18.8) per installation during return visit and report results	nr			0.00
J19	Extra over Item J13 for ground gas sample	nr			0.00
J20	Extra over Item J13 for vapour sample	nr			0.00
J21	Extra over Item J13 for water sample from observation well or standpipe piezometer during return visit to site, including purging or low-flow purging up to 1.0 h	nr	1		0.00
J22	Extra over Item J13 for purging or low-flow purging in excess of 1.0 h	h			0.00
J23	Obtain surface water body sample during return visit	nr			0.00
J24	Containment, transport and disposal of purged water	nr			0.00
J25	Containment, transport and disposal of contaminated purged water	provisional sum			0.00
J26	Determination of dissolved oxygen, conductivity, pH and temperature of surface water body during fieldwork period	nr			0.00
J27	Determination of dissolved oxygen, conductivity, pH and temperature of surface water body during return visit to site	nr			0.00
J28	Provide and install water level logger in installation for monitoring	nr	1		0.00
J29	Provide and install barometric logger in installation for monitoring	nr			0.00
J30	Extra over Items J28 and J29 for obtaining readings	nr			0.00
J31	Contract specific additional bill items				
			Total Bill J carried to Summary		0

J12, J25 The rate for disposal of contaminated waters should be charged under Items J12 or J25, as appropriate. Associated geoenvironmental testing necessary to enable the safe disposal of the purged water should be charged and included per number under Bill L.

SECTION K

Number	Item description	Unit	Quantity	Rate	Amount £
K	Geotechnical laboratory testing				
	Classification				
K1	Water content	nr	8		0.00
K2	Liquid limit (four-point method), plastic limit and plasticity index	nr	8		0.00
K3	Liquid limit (one-point method), plastic limit and plasticity index	nr			0.00
K4	Non-plastic sample determination after preparation	nr			0.00
K5	Methylene blue test	nr			0.00
K6	Volumetric shrinkage	nr			0.00
K7	Linear shrinkage	nr			0.00
K8	Density by linear measurement	nr	3		0.00
K9	Density by immersion in water or water displacement	nr			0.00
K10	Particle density by small or large pycnometer, or gas jar	nr			0.00
K11	Particle size distribution by sieving	nr	5		0.00
K12	Sedimentation by pipette	nr	5		0.00
K13	Sedimentation by hydrometer	nr			0.00
	Chemical and electrochemical				
K14	Organic matter content	nr			0.00
K15	Mass loss on ignition	nr			0.00
K16	Sulfate content of acid extract from soil	nr			0.00
K17	Sulfate content of water extract from soil	nr			0.00
K18	Sulfate content of groundwater	nr			0.00
K19	Carbonate content by rapid titration	nr			0.00
K20	Carbonate content by gravimetric method	nr			0.00
K21	Water-soluble chloride content	nr			0.00
K22	Acid-soluble chloride content	nr			0.00
K23	Total sulfur content	nr			0.00
K24	Total dissolved solids	nr			0.00
K25	pH value	nr			0.00
K26	Electrical resistivity	nr			0.00
K27	Thermal resistivity	nr			0.00
K28	Extra over Items K26 and K27 for specimen remoulding or recompaction	nr			0.00
K29	Redox potential	nr			0.00
	Compaction-related	nr			
K30	Dry density/water content relationship using 2.5 kg rammer	nr	1		0.00
K31	Dry density/water content relationship using 4.5 kg rammer	nr			0.00
K32	Dry density/water content relationship using vibrating rammer	nr			0.00
K33	Extra over Items K30, K31 and K32 for use of a California bearing ratio (CBR) mould	nr			0.00
K34	Maximum and minimum dry density for granular soils	nr			0.00
K35	Moisture condition value at natural water content	nr			0.00
K36	Moisture condition value/water content relationship	nr			0.00
K37	Chalk crushing value	nr			0.00
K38	California bearing ratio (CBR) on recompacted disturbed sample	nr			0.00
K39	Extra over Item K38 for soaking	day			0.00
	Consolidation				
K40	One-dimensional consolidation, test period not exceeding 7 days	nr	1		0.00
K41	Extra over Item K40 for test period exceeding 7 days	day			0.00
K42	Measurements of swelling pressure, test period not exceeding 2 days	nr			0.00
K43	Measurement of swelling, test period not exceeding 2 days	nr			0.00
K44	Measurement of settlement on saturation, test period not exceeding 1 day	nr			0.00
K45	Extra over Items K42 to K44 for test period exceeding 1 or 2 days	day			0.00
K46	Consolidation of a specimen up to 100 mm diameter in a hydraulic cell, test period 4 days	nr			0.00
K47	As Item K46 but using a 150 mm diameter specimen	nr			0.00
K48	As Item K46 but using a 250 mm diameter specimen	nr			0.00
K49	Extra over Items K46 to K48 for test period exceeding 4 days	day			0.00
K50	Extra over Items K46 to K48 for specimen remoulding or recompaction	nr			0.00
K51	Consolidation in a triaxial cell, test period 4 days	nr			0.00
K52	Extra over Item K51 for test periods exceeding 4 days	day			0.00
K53	Extra over Items K51 for specimen remoulding or recompaction, or specimen diameter reduction	nr			0.00
	Permeability				
K54	Permeability of soil in a rigid or flexible wall permeameter by the constant head or falling head method, test duration not exceeding 4 days	nr			0.00
K55	Extra over Item K54 for test period exceeding 4 days	day			0.00
K56	Permeability of soil in an oedometer ring permeameter, test duration not exceeding 1 day per loading or unloading stage	day			0.00
K57	Extra over Items K56 for test period exceeding 1 day per stage	day			0.00
K58	Permeability of a smaller than 100 mm diameter specimen in a hydraulic cell, test period 4 days	nr			0.00
K59	As Item K58 but using a 100 mm diameter specimen	nr			0.00
K60	As Item K58 but using a 150 mm diameter specimen	nr			0.00
K61	As Item K58 but using a 250 mm diameter specimen	nr			0.00
K62	Extra over Items K58 to K61 for measuring permeability in the horizontal direction	nr			0.00
K63	Extra over Items K58 to K61 for test period exceeding 4 days	day			0.00
K64	Extra over Items K58 to K61 for specimen remoulding, or reconstitution, or recompaction	nr			0.00
K65	Permeability in a triaxial cell, test period 4 days	nr			0.00
K66	Extra over Item K65 for test period exceeding 4 days	day			0.00
K67	Extra over Item K65 for specimen remoulding or reconstitution, or recompaction, or specimen diameter reduction	nr			0.00
	Durability				
K68	Dispersibility by the pinhole method	nr			0.00
K69	Dispersibility by the crumb method	nr			0.00
K70	Dispersibility by the dispersion method	nr			0.00
K71	Frost heave of soil	nr			0.00
	Shear strength (total stress)				
K72	Undrained shear strength by the laboratory vane method (set of 3)	nr			0.00
K73	Undrained shear strength by hand/torsion vane (set of 3)	nr			0.00
K74	Undrained shear strength by hand penetrometer (set of 3)	nr			0.00
K75	Undrained shear strength by the fall cone method	nr			0.00
K76	Extra over Items K72 to K75 for specimen remoulding or recompaction	nr			0.00
K77	Consolidated drained shear strength by direct shear of a set of three specimens in a small shear box (up to 25 mm in height), test duration not exceeding 1 day per specimen	nr			0.00
K78	Extra over Item K77 for test duration exceeding 1 day per specimen	sp.day			0.00
K79	Residual shear strength by direct shear of a set of 3 specimens in a small shear box (up to 25 mm in height), test duration not exceeding 4 days per specimen	nr			0.00
K80	Extra over Item K79 for test duration exceeding 4 days per specimen	sp.day			0.00
K81	Extra over Items K79 and K80 for specimen remoulding or recompaction	nr			0.00

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Number	Item description	Unit	Quantity	Rate	Amount £
Notes					
All	Items for laboratory testing on soil and rock are listed to correspond with the appropriate BS EN ISO/IEC 17982:2020, BS 1377, BS EN 933, BS EN 1097, BS EN 1367 and International Society for Rock Mechanics (ISRM) suggested methods or American Society for Testing and Materials (ASTM) international standard test methods.				
K5	For the purposes of preparation, the following types of soil specimens are considered: disturbed, undisturbed, recompacted, remoulded and reconstituted. To determine the strength properties of clay, silt and organic soil, undisturbed samples should be used. Alternatively, for certain soils (e.g. coarse silt or sand) or special purposes, tests can be carried out on reconstituted or remoulded specimens. Item K5 may be scheduled to assess fine-grained soil (i.e. BS EN 16907-2:2018).				
K94- K108	The deformation of soil specimens in Items K94 to K107 can be measured with on-specimen transducers placed horizontally and axially to measure the radial and axial strain, respectively. Somewhat similarly, three pairs of bender elements (Item K108) can be placed on the soil specimen horizontally and axially to measure the shear wave velocity in three orientations. Measurements of shear wave velocity can be scheduled after specimen saturation or consolidation, or both.				
K127- K153	In Items K127 to K153, tests such as the magnesium sulfate test and resistance to fragmentation or wear may require crushing to obtain the appropriate fraction, typically between 10 mm and 14 mm.				
K40, K93, K107, K126, K153	Items K40, K93, K107, K126 and K153 cover the cost of preparation of specimens that prove unsuitable for testing after preparation owing to sample deficiencies (e.g. not readily identified interval voids or fractures in intact samples, or excessive amount of gravel in bulk samples). See Clause 15.1.				
Where significant quantities of geotechnical testing of contaminated ground samples are also anticipated, consideration may be given to the inclusion of an additional bill that repeats the relevant geotechnical tests to enable the Contractor to better identify any additional costs involved.					
K16- K23	Items K16 to K23 are combined by many testing laboratories due to the potential aggressivity of the ground and groundwater, but the same chemical tests are listed individually in Bill K to permit separate selection of required tests. Test suites in respect of the potential aggressivity of ground and groundwater are provided in Bill L, as these are more often completed by the geoenvironmental laboratories.				

SECTION L

Number	Item description	Unit	Quantity	Rate	Amount £
L	Geoenvironmental laboratory testing				
	Ground/groundwater aggressivity				
L1	Suite A (Greenfield site – pyrite absent)	nr			0.00
L2	Suite B (Greenfield site – pyrite present)	nr			0.00
L3	Suite C (Brownfield site – pyrite absent, including dependent options)	nr			0.00
L4	Suite D (Brownfield site – pyrite present, including dependent options)	nr	2		0.00
	Geoenvironmental laboratory testing				
L5	Suite E (Soil samples)	nr			0.00
L6	Suite F (Water samples)	nr			0.00
L7	Suite G (Perfluoroalkyl and polyfluoroalkyl substances (PFAS) samples)	nr			0.00
L8	Suite H (Permanent gases)	nr			0.00
L9	Suite I (Vapour samples)	nr			0.00
	Waste acceptance criteria (WAC) testing				
L10	Suite J (Inert waste landfill)	nr	2		0.00
L11	Suite K (Stable, non-reactive hazardous waste in non-hazardous waste landfill)	nr			0.00
L12	Suite L (Hazardous waste landfill)	nr			0.00
L13	Contract specific additional bill items				
L14	Mott MacDonald Comprehensive Soil Suite (Specification Appendix B)	nr	8		0.00
L15	Mott MacDonald Comprehensive Soil Leachate Suite (Specification Appendix B)	nr	4		0.00
L16	Mott MacDonald Groundwater Suite (Specification Appendix B)	nr	1		0.00
L17	Mott MacDonald WAC Suite (Specification Appendix B)	nr	Rate only.		#VALUE!
			Total Bill L carried to Summary		#VALUE!

Notes

L1-L4 It is unlikely to be possible to accurately determine the quantities of optional determinands specified in the BRE SD1 suites for the assessment of potentially aggressive ground and groundwater. Therefore, the rates for Items L1 to L4 should include for all optional determinands, as listed in the guidance.

L5, L6 The tests included in each of Test Suites E and F, under Items L5 and L6, respectively, should be reviewed and, if necessary, amended in light of the results of the site-specific Desk Study. When other determinands are required to be included, these can be added as extra over sub-items to the typical suites where only a small number of additional determinands are required, or, alternatively, added as contract-specific determinand items or suites.

SECTION M

Number	Item description	Unit	Quantity	Rate	Amount £
M	Ground practitioners				
M1	(a) Registered ground engineering technician/technician	h			0.00
M2	(b) Graduate geotechnical practitioner/graduate geoenvironmental practitioner	h	x		#VALUE!
M3	(c) Registered ground engineering practitioner/experienced geotechnical practitioner/experienced geoenvironmental practitioner	h			0.00
M4	(d) Registered ground engineering professional	h			0.00
M5	(e) Registered ground engineering specialist	h			0.00
M6	(f) Registered ground engineering adviser	h			0.00
M7	(g) Chartered practitioner	h			0.00
M8	(h) Registered Specialist in Land Condition (SiLC)	h			0.00
M9	(i) Registered risk assessor (RSoBRA or ASoBRA)	h			0.00
M10	Level 3 Drilling Supervisor	h			0.00
	Expenses				
M11	Expenses incurred by staff on site visits or who are resident by agreement with the Investigation Supervisor	day	x		#VALUE!
M12	Rate per mile* from Contractor's premises, and return	mile	x		#VALUE!
M13	All other expenses incurred in conjunction with a site visit where a return journey is made on the same day	visit	x		#VALUE!
M14	All other expenses incurred in connection with visit where an overnight stay is necessary	overnight	x		#VALUE!
M15	Contract specific additional bill items				
			Total Bill M carried to Summary		#VALUE!

Notes

Rates should be entered for the various grades of resources listed. These resources will provide technical support to the Investigation Supervisor in accordance with Clause 4.4.7 and Schedule S1.8.4. When this is unknown at the time of tender, 'Rate only' should be used.

The technical support may comprise advice or assistance during the investigation and/or the preparation of the Ground Investigation Report and/or the Geotechnical Design Report, all in accordance with Specification Clauses 17.3.3 and 17.3.4. Where such support is required, it will either be detailed in Schedule S1.24.9 or S1.24.10 or may be instructed by the Investigation Supervisor.

The resources identified in Bill M exclude resource for the project management, supervision, technical direction and execution required from the Contractor under the Conditions of Contract and the requirements of Specification Clauses 4.4.2, 4.4.3 and 4.4.6 and Schedule S1.8.3, which should be included in the relevant items within Bill A of the Bill of Quantities (see Clause 1 of the Preamble to the Bill of Quantities).

The disciplines and/or grades of ground practitioners and other personnel required to assist or advise the Investigation Supervisor should be determined by the Designer or Investigation Supervisor on a site-specific basis. The list may be subdivided or repeated for the main services required, where due consideration is to be given to the separate costs of the advisory services or report preparation.

SECTION N

Number	Item description	Unit	Quantity	Rate	Amount £
N	Long-term storage of samples				
	Geotechnical samples				
N1	Small disturbed sample	nr	x		#VALUE!
N2	Bulk disturbed sample	nr	x		#VALUE!
N3	Groundwater/surface water sample	nr	x		#VALUE!
N4	Open-tube sample (thick-wall sampler) (e.g. U100)	nr			0.00
N5	Open-tube sample (thin-wall sampler) (e.g. UT100)	nr	x		#VALUE!
N6	Dynamic sampling liner sample	nr			0.00
N7	Rotary drilling core box with core	nr	x		#VALUE!
N8	Rotary drilling core subsample	nr	x		#VALUE!
N9	Block sample	nr			0.00
N10	Mostap sample	nr			0.00
N11	Continuous push/piston sample	nr			0.00
	Geoenvironmental samples				
N12	Soil sample in plastic tubs	nr	x		#VALUE!
N13	Soil sample in glass containers	nr	x		#VALUE!
N14	Groundwater/surface water sample	nr	x		#VALUE!
N15	Gas sample	nr			0.00
N16	Vapour sample	nr			0.00
N17	Contract specific additional bill items				
			Total Bill N carried to Summary		#VALUE!

Notes

AllLong term storage shall mean storage of samples for a period of one year after the submission and acceptance of of the final Factual Investigation report.

Tender Summary

Section	Title	£
A.	General items, amenities and additional items	#VALUE!
B.	Cable Percussion boring and Dynamic Sampling	£0.00
C.	Rotary drilling	£0.00
D.	Pitting and trenching	#VALUE!
E.	Sampling and monitoring during intrusive investigation	£0.00
F.	Dynamic probing and cone penetration testing	£0.00
G.	Geophysical surveys	£0.00
H.	Field Testing	£0.00
I.	Instrumentation	£0.00
J.	Installation monitoring and sampling	£0.00
K.	Geotechnical laboratory testing	#VALUE!
L.	Geoenvironmental laboratory testing	#VALUE!
M.	Technical support from ground practitioners and other personnel	#VALUE!
N.	Long-term storage of samples	#VALUE!
Total Tender		#VALUE!

G. DHEMR

Project title	The Northern Pathology Development
Project Manager	Calum Smith
Project Safety Advisor	Lloyd Edmonds

Project number	100124912
Division/ unit	NTH/HEA
Form number/ revision	NTHPAT-MMD-XX-XX- HS-C-000001

Scope of design

The existing Derek Crowther building at The Christie Hospital is formed of two storey modular units and is to be demolished. A new three storey building, the Proposed Northern Pathology Development, is to be constructed in its place to accommodate laboratory spaces, staff offices and plant space.

A link bridge is to be provided between the the new and existing building that will cantilever from the proposed. The existing liquid nitrogen tank which is external to the existing Derek Crowther building is to be relocated to a different part of the wider Christie Hospital site as part of the works.

This DHEMR covers the geotechnical risks associated with ground investigation works.

Haz ref	Activity/ process/ material/ element – what is being undertaken?	Hazard ¹	Stage of work	Designer risk control measures: ² Design action taken, record of decision process including options considered, design constraints and justification for options/ actions not having been taken. <u>E - eliminate, R - reduce, I - isolate, C - control</u>	Is there a 'significant' or 'particular' ³ residual risk to be passed on? ⁴	If the answer to the previous question is 'yes', information flow: D/ P/ F ⁵	Status within Mott MacDonald
Ground Investiagation							
001	Excavation during ground investigation	Existing basement may be present.	Ground Investigation	Possibility of encountering buried structures or voids in ground. Risk to be managed through Contractors method statement.	Yes	D	Active
002	Excavation during ground investigation	Clash with existing services	Ground Investigation	GPR survey shows multiple buried services within vicinity of the works. Borehole positioned in area away from majority of buried services. Sub-contractor to position borehole to suit utilities plans and site constraints. No GPR information in area for hand dug trial pit investigations. CAT scan and hand dig to 1.2m bgl. Sub-contractor to take full responsibility for utility plans and verify position of uncharted drainage prior to commencement of works. Cat & Genny scanning to be utilised to identify any unseen utilities on plans.	Yes	D	Active

Project title	The Northern Pathology Development
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003	Working near live traffic on Wilmslow road.	Risk of injury or death from coming into contact with live traffic. Applies to all site staff and site visitors.	Ground Investigation	Appropriate segregation to be used and agreed with Trust/council.	Yes	D	Active
004	Excavation during ground investigation in a contaminated area	Asbestos and other contaminants may be present in the ground.	Ground Investigation	For all exploratory holes Contractor to be vigilant on site for potential asbestos or other contaminants in ground.	Yes	D	Active
005	Working in a live hospital	Noise/vibration and general disruption.	Ground Investigation	Noise/vibration and general disruption to be kept to a minimum and agreed with the NHS Trust prior to commencing works. Appropriate segregation to be used around investigations.	Yes	D	Active

Project title	The Northern Pathology Development
Project Manager	Calum Smith
Project Safety Advisor	Lloyd Edmonds

Project number	100124912
Division/ unit	NTH/HEA
Form number/ revision	NTHPAT-MMD-XX-XX- HS-C-000001

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Haz ref	Activity/ process/ material/ element – what is being undertaken?	Hazard ¹	Stage of work	Designer risk control measures: ² Design action taken, record of decision process including options considered, design constraints and justification for options/ actions not having been taken. <u>E - eliminate, R - reduce, I - isolate, C - control</u>	Is there a ‘significant’ or ‘particular’ ³ residual risk to be passed on? ⁴	If the answer to the previous question is ‘yes’, information flow: D/ P/ F ⁵	Status within Mott MacDonald
006	Working near the Liquid Nitrogen Storage Tank	Risk of injury or death of ground workers from contact with liquid nitrogen.	Ground Investigation	Intrusive investigations to be located away from Liquid Nitrogen storage tank. Care to be taken when moving any equipment through the site extents.	Yes	D	Active

1. A hazard is something with the potential to cause harm, such as: working near live traffic, working at height, falling object etc.

2. Designer risk control measures are to be based upon the principles of prevention: - eliminate, reduce, inform/ isolate, control.

3. ‘Significant risk’ is the UK terminology; ‘particular risk’ is the EU terminology.

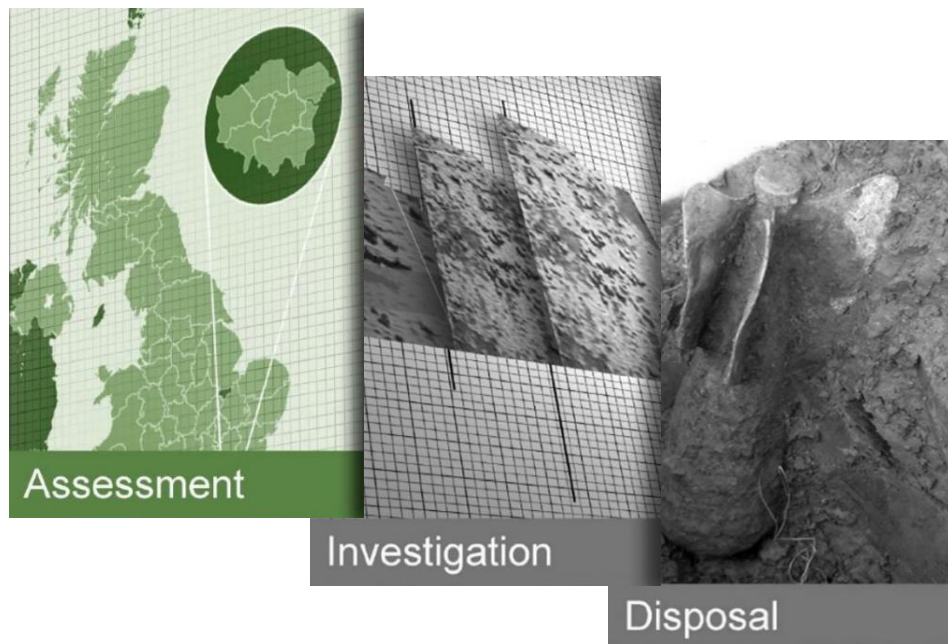
4. Significant/ particular risks are not necessarily those that involve the greatest risks, but those, including health risks that are: (a) not likely to be obvious to a competent contractor or other designers; (b) unusual; or (c) likely to be difficult to manage effectively.

5. Please note that this information may also be relevant to specifications and/ or reports. D - Information detailed on drawings (add drawing numbers); P - Information to be communicated via pre-construction information;
F - Information for the health and safety file

H. Phase 1 Geotechnical and Geoenvironmental Desktop Study

Not included within this document due to the size of the document.

I. UXO Risk Assessment (Zetica)



UXO Desk Study & Risk Assessment

Document Ref. P14466-24-R1

Revision A

Project Title Christie NHS Foundation Trust

Client Mott MacDonald

Date 20th May 2024

Drafted by Ross Sykes
Checked by James Major
Authorised by Stefan Lang

UXO DESK STUDY & RISK ASSESSMENT

EXECUTIVE SUMMARY

Key findings: No significant sources of Unexploded Ordnance (UXO) hazard have been identified.

Key actions: Proceed with works. An UXO awareness briefing is prudent for staff involved in excavations.

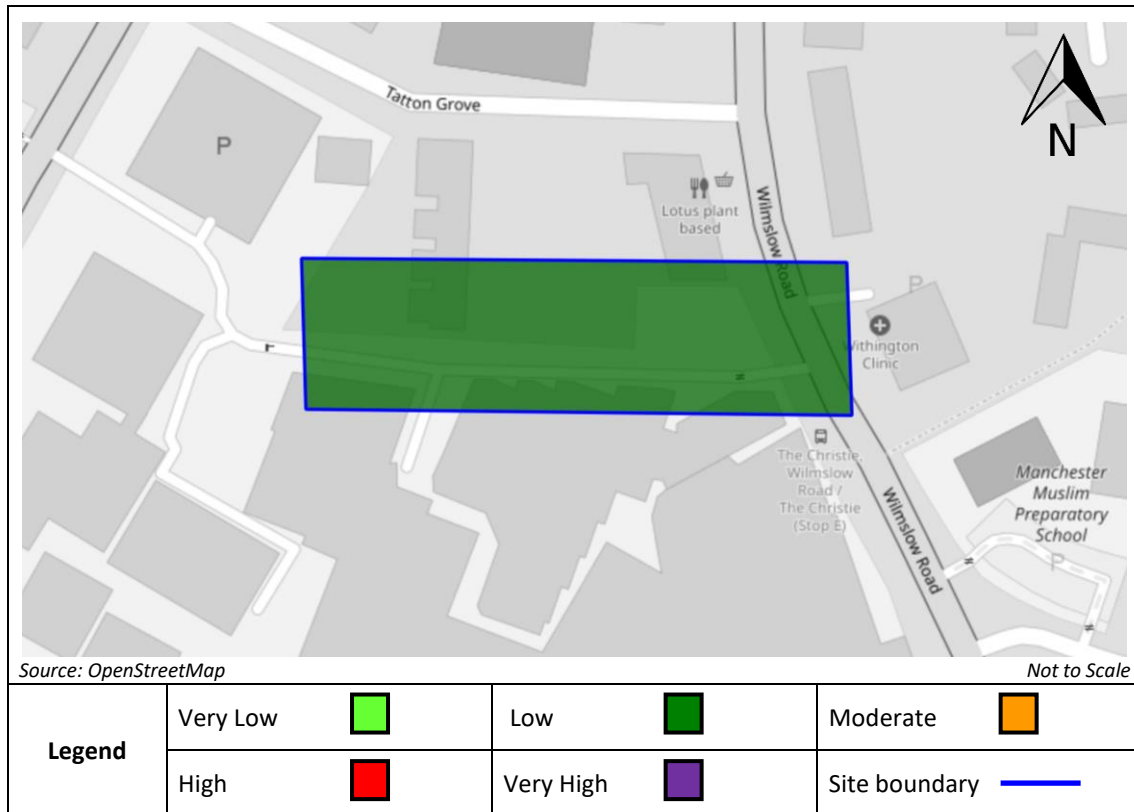
UXO hazard assessment

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in the following Figure, reproduced as Figure 3 in the main report.

The UXO hazard zone plan of the Site is also given in the accompanying P14466-24-R1-MAP01-A.

UXO hazard zone plan of the Site



The main findings of the report are summarised below.

- No records of military activity on the Site during World War One (WWI) or World War Two (WWII) have been found.
- During WWII the main strategic targets in the vicinity of the Site included Salford Docks, warehouses and wharves along the Manchester Ship Canal, the Fairey Aviation aircraft works, and Crosley Brothers Ltd engine works.
- No records have been found indicating that the Site was bombed during WWII. Records indicate that the nearest bomb was an Oil Bomb (OB) which fell approximately 50m south of the Site on the 1st October 1940.

- There were 29 No. Heavy Anti-Aircraft (HAA) and Rocket AA (ZAA) batteries within 10km of the Site during WWII. The potential for an Unexploded AA (UXAA) shell to have fallen on the Site cannot be discounted.

Proposed works

It is understood works are associated with the construction of a new 3-storey building. Works will comprise demolitions of the existing modular building, removal of its foundations, and the removal of tree roots encroaching onto the Site.

Future works on the Site may also include excavations, boreholes, and piling.

Risk assessment

The Table below, reproduced as Table 3 in the main report, provides a UXO risk assessment for the proposed works on the Site.

Further details on the risk assessment methodology are given in Section 7.2 of the main report.

UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Excavations	1	1	1	1	5	5	Low
	Boreholes/Piling	1	1	1	1	4	4	Low
Other UXO	Excavations	1	1	1	1	4	4	Low
	Boreholes/Piling	1	1	1	1	3	3	Low
PE = Probability of Encounter; PD = Probability of Detonation; P = Likelihood								

Risk mitigation plan

The Table below, reproduced as Table 4 in the main report, summarises the UXO risk for proposed works on the Site and recommended actions.

Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		Proceed with works – an UXO awareness briefing is prudent for staff involved in excavations.
Boreholes/Piling		Proceed with works

In summary, no additional measures are considered essential to reduce the UXO risk on the Site to As Low As Reasonably Practicable (ALARP). An UXO awareness briefing for staff involved in excavations is always prudent.

What do I do next?

If you have any comments or require further assistance, contact us and we can help.

	01993 886682		<u>uxo@zetica.com</u>		<u>zeticauxo.com</u>
---	---------------------	---	---	---	---

If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

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Accompanying GIS data

P14466-24-R1-MAP01-A (UXO Desk Study)

ABBREVIATIONS

AA	Anti-Aircraft
AAP	Aircraft Acceptance Park
AFEE	Airborne Forces Experimental Establishment
ALARP	As Low As Reasonably Practicable
AOP	Air Observation Post
AP	Anti-Personnel
ARP	Air Raid Precaution
AXO	Abandoned Explosive Ordnance
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
CLE	Central Landing Establishment
CLS	Central Landing School
DCLG	Department of Communities and Local Government
EO	Explosive Ordnance
EOC	Explosive Ordnance Clearance
EOR	Explosive Ordnance Reconnaissance
ERW	Explosive Remnants of War
ESA	Explosive Substances and Articles
FPP	Ferry Pilots Pool
HAA	Heavy Anti-Aircraft
HE	High Explosive
HER	Historic Environment Record
IB	Incendiary Bomb
IWM	Imperial War Museum
LAA	Light Anti-Aircraft
MoD	Ministry of Defence
NAF	National Aircraft Factory
NARA	National Archives & Records Administration
NCAP	National Collection of Aerial Photography
OB	Oil Bomb
OSNGR	Ordnance Survey National Grid Reference
PM	Parachute Mine
RAF	Royal Air Force
RAuxAF	Royal Auxiliary Air Force
RE	Royal Engineers
RFC	Royal Flying Corps
UK	United Kingdom
UXAA	Unexploded Anti-Aircraft
UXB	Unexploded Bomb
UXO	Unexploded Ordnance
UXPM	Unexploded Parachute Mine
WO	War Office
WWI	World War One
WWII	World War Two
ZAA	Rocket Anti-Aircraft

UXO DESK STUDY & RISK ASSESSMENT

Please read: Zetica has colour coded each paragraph. Paragraphs with black text on a white background provide site-specific information or information specifically researched as part of this project.

Boxed paragraphs in a dark green text with a green background provide general information and, where appropriate, links to online resources giving further detail. These are all available at www.zeticauxo.com. If you cannot gain access to these resources, Zetica can forward them on request.

1 INTRODUCTION

1.1 Project outline

Zetica Ltd was commissioned by Mott MacDonald to carry out a detailed Unexploded Ordnance (UXO) Desk Study and Risk Assessment for an area of approximately 0.5 hectares (ha) off Wilmslow Road, in Manchester, Greater Manchester (the 'Site').

The aim of this report is to gain a fair and representative view of the potential UXO hazard on or affecting the Site in accordance with the Construction Industry Research and Information Association (CIRIA) C681 'Unexploded Ordnance (UXO), a Guide for the Construction Industry'.

Where appropriate, this hazard assessment includes:

- Likelihood of ordnance being present.
- Type of ordnance (size, filling, fuze mechanisms).
- Quantity of ordnance.
- Potential for live ordnance.
- Probable location.
- Ordnance condition.

It should be noted that some military activity providing a source of UXO hazard may not be recorded and therefore there cannot be any guarantee that all UXO hazards affecting the Site have been identified in this report.

1.2 Sources of information

Zetica Ltd researched the World War One (WWI)/World War Two (WWII) bombing and military history of the Site and its surrounding area using a range of information sources. The main sources of information are detailed in the following sections and referenced at the end of this report.

1.2.1 Zetica Ltd records

Zetica Ltd's in-house records were consulted, including the Zetica Ltd bomb risk maps (<https://zeticauxo.com/guidance/risk-maps/>), previous requests for information from government bodies, reference books, and archive materials from past work in the region.

Relevant documents have been cited in the bibliography of this report.

1.2.2 Historical records, maps, and drawings

Numerous reference documents including historical maps, aerial photographs and drawings have been consulted from sources such as the National Archives, the US National Archives & Records Administration (NARA), the Imperial War Museum (IWM), Historic England, National Collection of Aerial Photography (NCAP), the Defence of Britain Project, and relevant archaeological bodies.

The British Geological Survey (BGS) was consulted for borehole information.

1.2.3 Local records

Manchester City Council, the Greater Manchester County Record Office, Manchester Central Library Archive, Manchester University, local historical groups, and the Greater Manchester Historic Environment Record (HER) were consulted for records.

1.3 Data confidence level

In general, there is a high level of confidence in the researched information sources used for this report. Further detail is given in the text of the report where appropriate.

Definitions of data confidence level		
Data Confidence Level		Definition
	Low	There are very few sources of information, and/or those available are lacking in detail.
	Moderate	There is a limited range of available sources of information, a key source of information is missing, and/or some sources may be contradictory or lacking in detail.
✓	High	There is a wide range of available sources of information, which are detailed and corroborate each other.

2 THE SITE

2.1 Site location

The Site is centred on Ordnance Survey National Grid Reference (OSNGR) SJ 848926. It is located approximately 5.3km south-southeast of central Manchester.

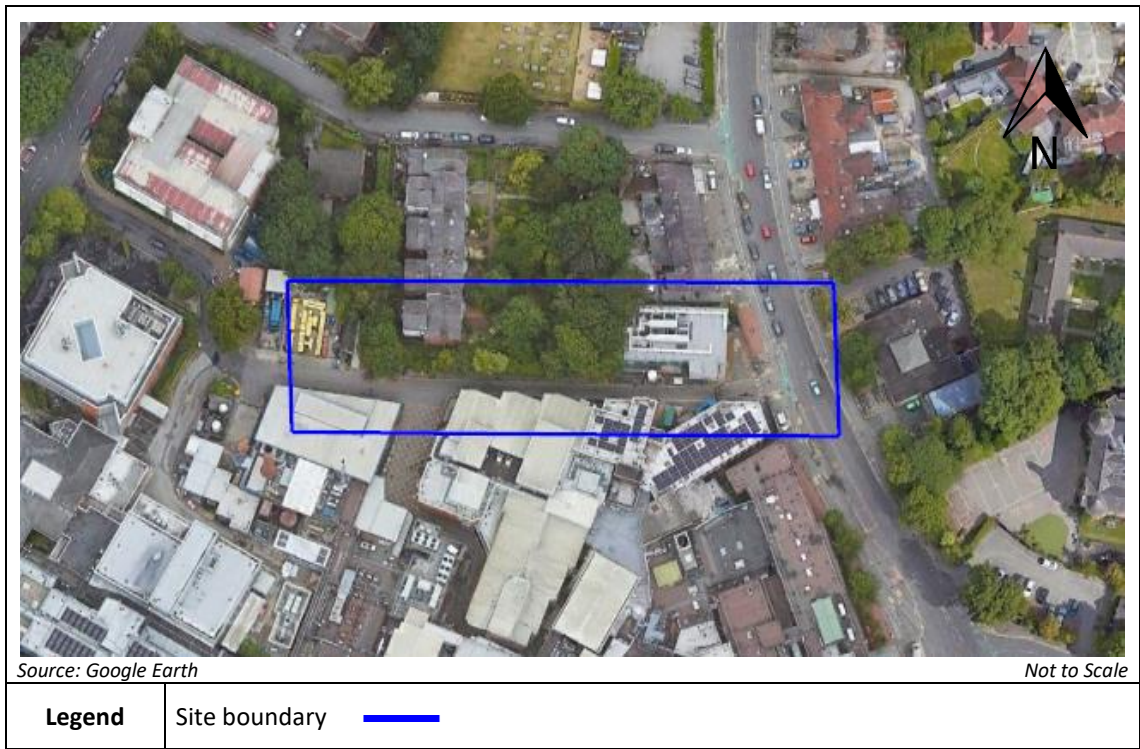
The Site comprises hardstanding, open ground, residential buildings, buildings associated with Christie Hospital, and is crossed by Wilmslow Road. It is bounded to the north by residential and commercial buildings, open ground and hardstanding, and Wilmslow Road, to the east by Withington Dental Care Centre and Wilmslow Road, to the south by Christie Hospital and Wilmslow Road, and to the west by Christie Hospital.

Figure 1 is a Site location map and Plate 1 is a recent aerial photograph of the Site.

Figure 1 Site location map



Plate 1 Recent aerial photograph of the Site



3 MILITARY ACTIVITY

The following sections outline the recorded military activity in the vicinity of the Site. The potential UXO hazard from WWI and WWII bombing is detailed in Section 4.

3.1 Defences

For further information on military defences, and the potential UXO hazards associated with them, follow the links below:

- [Anti-Aircraft Guns](#)
- [Anti-Invasion Defences](#)
- [Barrage Balloons](#)
- [Bombing Decoys](#)
- [Home Guard](#)
- [Mined Locations](#)
- [Mortar & Gun Emplacements](#)
- [Pillboxes](#)

No military defences have been identified on the Site. The nearest are described below.

3.1.1 Anti-Aircraft (AA) guns

During WWI there were 9No. AA batteries recorded within 10km of the Site. The nearest was located at Hough End (SD 825935), approximately 2.4km west-northwest of the Site. It was armed with 1No. 6-pdr gun.

During WWII there were 29No. Heavy AA (HAA) and Rocket AA (ZAA) batteries recorded within 10km of the Site. The nearest was located at Hough Ends Playing Fields (SJ 831934), approximately 1.8km northwest of the Site. It was initially armed with 4No. 4.5" guns.

Potential UXO hazard

Given the number of AA gun batteries in the surrounding area, the potential for an Unexploded AA (UXAA) shell to have fallen on the Site unnoticed, whilst unlikely, cannot be totally discounted.

3.2 Military airfields

For further information on military airfields, and the potential UXO hazards associated with them, follow the link below:

- [Military Airfields](#)

No records of any military airfields on or in close proximity to the Site have been found.

During WWI, the nearest operational airfield was Alexandra Park Aerodrome, approximately 0.8km northwest of the Site.

Alexandra Park Aerodrome operated as an Aircraft Acceptance Park (AAP) and was used for the testing and delivery of Royal Flying Corps (RFC) aircraft manufactured at works in Manchester, such as the Avro Works at Trafford Park, approximately 6.4km northwest of the Site, and National Aircraft Factory (NAF) No.2 at Heaton Chapel, approximately 2.3km east of the Site.

After WWI Alexandra Park Aerodrome reverted to civilian use.

During WWII, the nearest operational airfield was Royal Air Force (RAF) Ringway, approximately 7.3km southwest of the Site.

RAF Ringway was home to the Central Landing School (CLS), later Central Landing Establishment (CLE), focused on parachute training, glider training, and developmental work. In 1942 the CLE was renamed the Airborne Forces Experimental Establishment (AFEE).

In June 1942 the AFEE departed RAF Ringway and the Parachute Training School, formed in February 1942, remained at RAF Ringway for the duration of WWII.

The Fairey Aviation Company and Avro, established aircraft production facilities at RAF Ringway and used the airfield for testing. RAF Ringway was also home to No. 3 (later No. 13) Ferry Pilots Pool (FPP), responsible for delivering aircraft to facilities around the United Kingdom (UK).

After WWII, Ringway airport re-opened for civil use, whilst also accommodating 2No. Royal Auxiliary Air Force (RAuxAF) squadrons and 1No. Air Observation Post (AOP) flight. In 1957, all military activity ceased at RAF Ringway.

RAF Ringway is now known as Manchester International Airport.

Military airfields are not considered to provide a source of UXO hazard to the Site.

3.3 Aircraft crashes

For further information on military aircraft crashes, and the potential UXO hazards associated with them, follow the link below:

- [Aircraft Crashes](#)

No records of any aircraft crashes on or in close proximity to the Site have been found.

3.4 Explosives factories, munitions depots, and disposal areas

For further information on explosives factories, munitions depots and disposal areas, and the potential UXO hazards associated with them, follow the links below:

- [Explosives Factories](#)
- [Munitions Depots](#)
- [Munitions Disposal Areas](#)

No records of any explosives factories, munitions depots or munitions disposal areas on or in close proximity to the Site have been found.

3.5 Firing ranges and military training areas

For further information on firing ranges and military training areas, and the potential UXO hazards associated with them, follow the links below:

- [Artillery Ranges](#)
- [Bombing Ranges](#)
- [Military Training Areas](#)
- [Small Arms Ranges](#)

No records of any firing ranges or military training areas on or in close proximity to the Site have been found.

4 BOMBING

4.1 WWI bombing

For further information on WWI bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.1 or use the following link.

- [WWI Bombing](#)

No records have been found indicating that the Site was bombed during WWI.

4.2 WWII bombing

For further information on WWII bombing in the UK, and the potential UXO hazard associated with it, see Appendix 2.2 or use the following link.

- [WWII Bombing](#)

No records have been found indicating that the Site was bombed during WWII. Details of WWII bombing in the vicinity of the Site are provided in the following sections.

4.2.1 Bombing in Manchester

Air raids on Manchester began in August 1940 and continued until 1945. The heaviest raid on the city occurred between the 22nd and 24th December 1940, the 'Manchester Blitz', during which more than 400No. High Explosive (HE) bombs and 30,000No. Incendiary Bombs (IB) fell on the city, approximately 5.3km north of the Site.

More than 1,710No. HE bombs and 115No. Parachute Mines (PM) fell across the Manchester region during WWII. Bombing was concentrated on central Manchester, approximately 5.3km north-northwest of the Site, Salford Docks, and major industrial works at Trafford Park, approximately 5.3km northwest of the Site.

Bombing densities generally decreased away from the city centre and far less damage was sustained by properties in these areas.

4.2.2 Strategic targets

From prior to the declaration of war in 1939, Britain was subjected to reconnaissance flights by the Luftwaffe which was building up a photographic record of potential targets.

The Site was located in an area which contained numerous strategic targets, including Salford Docks, warehouses and wharves along the Manchester Ship Canal, the Fairey Aviation aircraft works, and Crosley Brothers Ltd engine works.

The nearest identified Luftwaffe target was the Fairey Aviation aircraft works and the Crosley Brothers Ltd engine works, approximately 2.3km east of the Site.

4.2.3 Bombing densities and incidents

Table 1 gives details of the overall bombing statistics recorded for the Local Authority Districts of the Site (highlighted by bold text) and surrounding districts. These were categorised as Rural Districts (RD), Urban Districts (UD), Municipal Boroughs (MB), Metropolitan Boroughs (MetB), and County Boroughs (CB). WWII bomb density levels are defined below:

<5 bombs per 405ha is a Very Low regional bombing density.

5-15 bombs per 405ha is Low.

15-50 bombs per 405ha is Moderate.

50-250 bombs per 405ha is High.

>250 bombs per 405ha is Very High.

Official UK bombing statistics have been compiled from both British and German sources. There were differences in the way the figures were originally reported and collated which has led to discrepancies in the summary data.

Note that Table 1 excludes the figures for IBs. Discrepancies between the below list and other records, such as bomb clearance records, demonstrate that this data is likely to under-represent actual bombing.

Table 1 Bombing statistics

Area	Bombs Recorded				Bombs per 405ha (1000 acres)
	High Explosive	Parachute Mines	Other	Total	
Manchester CB	712	18	7	737	27.0
Stretford MB	456	64	0	520	147.3
Stockport CB	76	1	3	80	10.0

It should be noted that during WWII, many Unexploded Bombs (UXBs) were mapped and subsequently removed as and when conditions and demands on Bomb Disposal teams allowed. Their removal was not always accurately recorded and sometimes records were later destroyed. In practice, most UXBs were probably removed and only a much smaller number were actually registered as officially abandoned bombs.

Details of the nearest recorded bombing incidents to the Site are given in the following section.

1st October 1940

1No. Oil Bomb (OB) fell on the forecourt of Christie Hospital & Holt Radium Institute, approximately 50m south of the Site.

1No. HE bomb fell on land off Wilmslow Road, approximately 80m north-northeast of the Site.

3No. HE bombs fell on Wilmslow Road, between approximately 0.1km and 0.3km north of the Site.

1No. HE bomb fell on Morris Street, approximately 0.4km north of the Site.

1No. OB fell on land south of Withington Cottage, approximately 0.4km south of the Site.

1No. HE bomb fell on Moorfield Street, approximately 0.4km north of the Site.

1No. HE bomb fell on Oak Bank Avenue, approximately 0.5km north of the Site.

2nd January 1941

1No. PM fell on the ground of St Paul's Church, approximately 0.2km north of the Site. This was recorded as an Unexploded Parachute Mine (UXPM).

10th September 1941

1No. HE bomb fell on Danesmoor Road, approximately 0.6km southwest of the Site.

1st February 1941

1No. PM fell Burton Road, approximately 0.3km west-northwest of the Site.

11th – 12th March 1941

1No. IB fell on Fairholme Road, approximately 0.5km east-northeast of the Site.

Figure 2 is a map showing the approximate location of recorded bomb impacts in the immediate vicinity of the Site. IBs shown are indicative of larger numbers of similar devices that fell within the given area.

The map has been compiled from different sources, including air raid incident reports, historical aerial photographs, and bomb census maps.

The bomb map is also given in the accompanying P14466-24-R1-MAP01-A.

Figure 2 Compiled bomb impact map for the vicinity of the Site

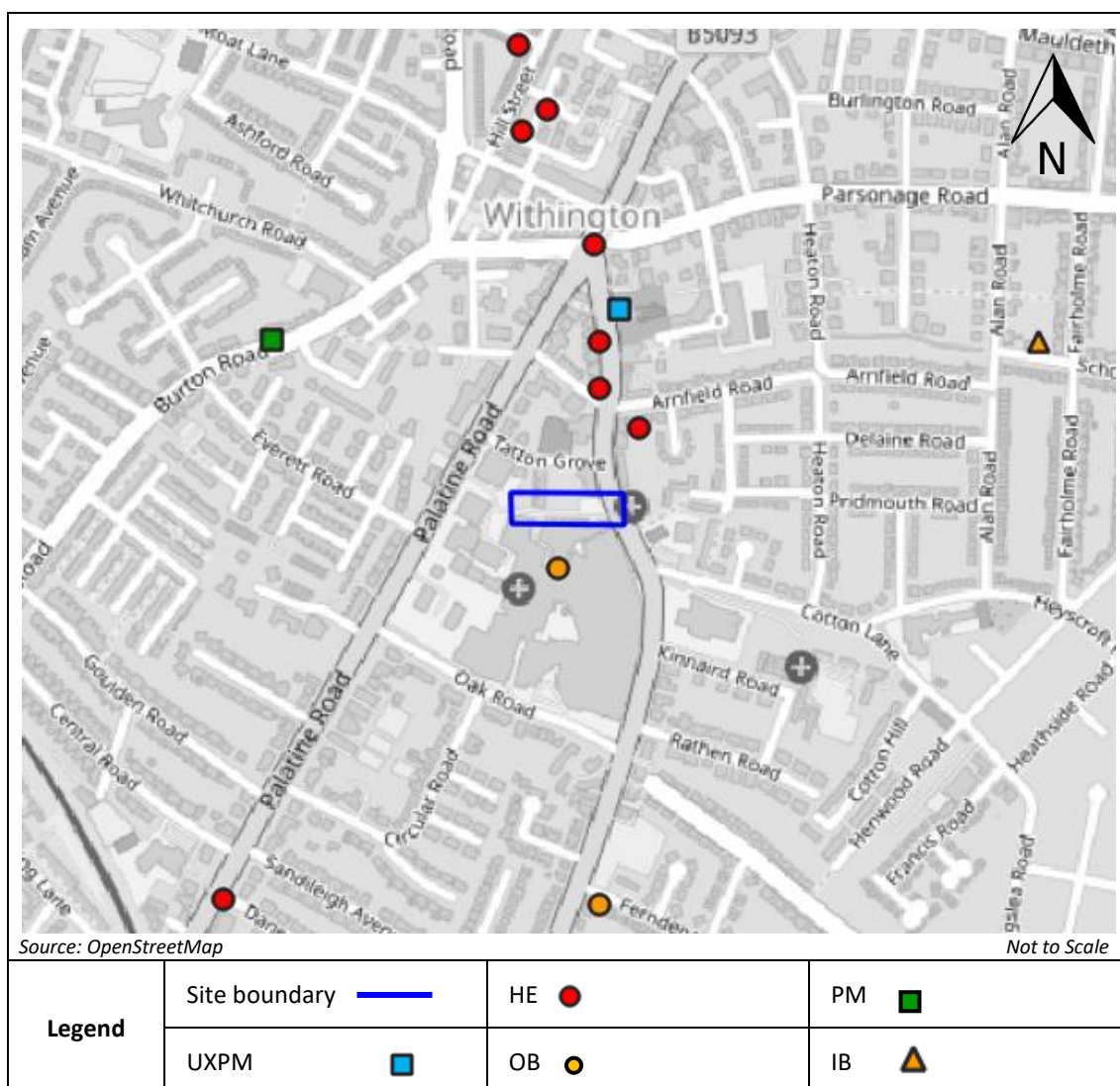
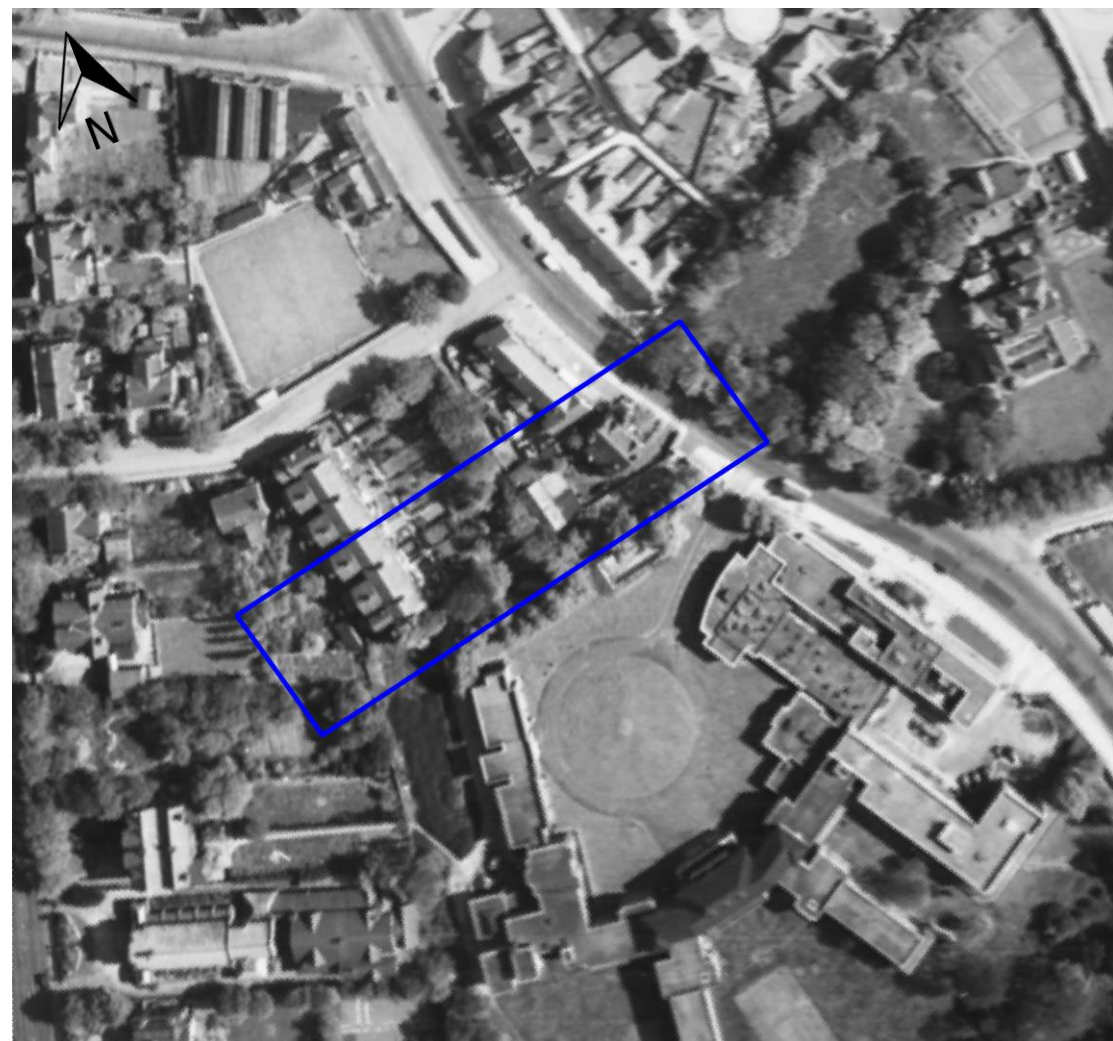


Plate 2 is an aerial photograph dated the 7th May 1946. No bomb damage has been identified on or in the vicinity of the Site.

Plate 2 Aerial photograph, 7th May 1946



Source: Historic England

Not to Scale

Legend

Site boundary —

Potential UXO hazard

No records have been found indicating that the Site was bombed and no bomb damage has been identified on the Site on historical aerial photography.

WWII bombing is not considered to provide a significant source of UXO hazard to the Site.

4.2.4 Abandoned bombs

No records have been found indicating that any officially abandoned bombs are located on the Site.

4.2.5 Bomb penetration depths

At the time of writing, no Site-specific ground investigation data was provided.

Information provided by the Client, BGS 1:50,000 Sheet 98 Stockport (Solid & Drift) and BGS borehole records from nearby investigations have been consulted to get an indicative overview of the Site geology.

The WWII geology of the Site is understood to consist of Made Ground, over Devensian Till, overlying sandstone of the Chester Formation.

Table 2 provides an estimate of average maximum bomb penetration depths for the Site assuming WWII ground conditions of 1m of Made Ground (modelled as gravel), over 1.5m of sand, overlying more than 20m of sandstone (modelled as soft rock).

Table 2 Estimated average maximum bomb penetration depths

Estimated average bomb penetration depths for anticipated geology		
Bomb Weight	50kg	2.4m
	250kg	5.0m
	500kg	10.5m

These calculations can be refined on receipt of Site-specific information.

The estimated bomb penetration depths given in Table 2 are from the WWII ground level and are based on the following assumptions:

- a) High-level release of the bomb resulting in an impact velocity of 260m/s (>5,000m altitude).
- b) A strike angle of 10 to 15° to the vertical.
- c) That the bomb is stable, both in flight and on penetration.
- d) That no retarding units are fitted to the bomb.
- e) That the soil type is homogenous.

Assuming the above, a bomb will enter the ground and travel on the same trajectory until momentum is nearly lost. The bomb will then turn abruptly to the horizontal before coming to rest. The horizontal distance between the centre of the entry hole and the centre of the bomb at rest is known as the 'offset'. A marked horizontal movement from the original line of entry is common.

Low-level attacks may have an impact angle of 45° or more, which will frequently lead to a much greater amount of offset movement during soil penetration.

The average offset is one third of the penetration depth. If hardstanding or Made Ground were present during WWII, bomb penetration depths would have been significantly reduced but offset distances may have been up to four times greater.

5 POST-WWII EXPLOSIVE ORDNANCE CLEARANCE (EOC) ACTIVITIES

Based on data from 1939 to 1945, War Office (WO) statistics indicate that 200,195No. HE bombs exploded within Great Britain. Additionally, 25,195No. HE bombs (approximately 11%) were recorded as UXBs. However, records from the Royal Engineers (RE) who were responsible for bomb disposal at the time indicate that by 27th February 1946, more than 45,000No. UXBs were disposed of.

On average, 8.5% of UXBs later self-exploded. In some cases, the bombs had delayed action fuzes or were never intended to explode, their purpose being to cause inconvenience and fear. Given the discrepancy in records and the fact that UXBs are still being found unexpectedly, it is clear that the original figures are understated and provide only an approximation of the number of potential UXBs in the UK.

WO statistics also show that between October 1940 and May 1941 most UXBs (93%) were either 50kg or 250kg. It should be noted that details of the recovery and size of the UXB were not always accurately reported.

The larger WWII UXBs are often difficult to recover due to both penetration depths and the presence of two or more fuzes, combined with more sensitive fillings of explosive mixtures including Amatol and Trialen.

5.1 EOC tasks

Zetica holds the following records of post-WWII EOC tasks having taken place in the vicinity of the Site.

31st October 2012

1No. WWI shell was discovered at a property on Burton Road, approximately 0.6km west of the Site. It was made safe and removed.

6 UXO HAZARD ASSESSMENT

6.1 UXO hazard level

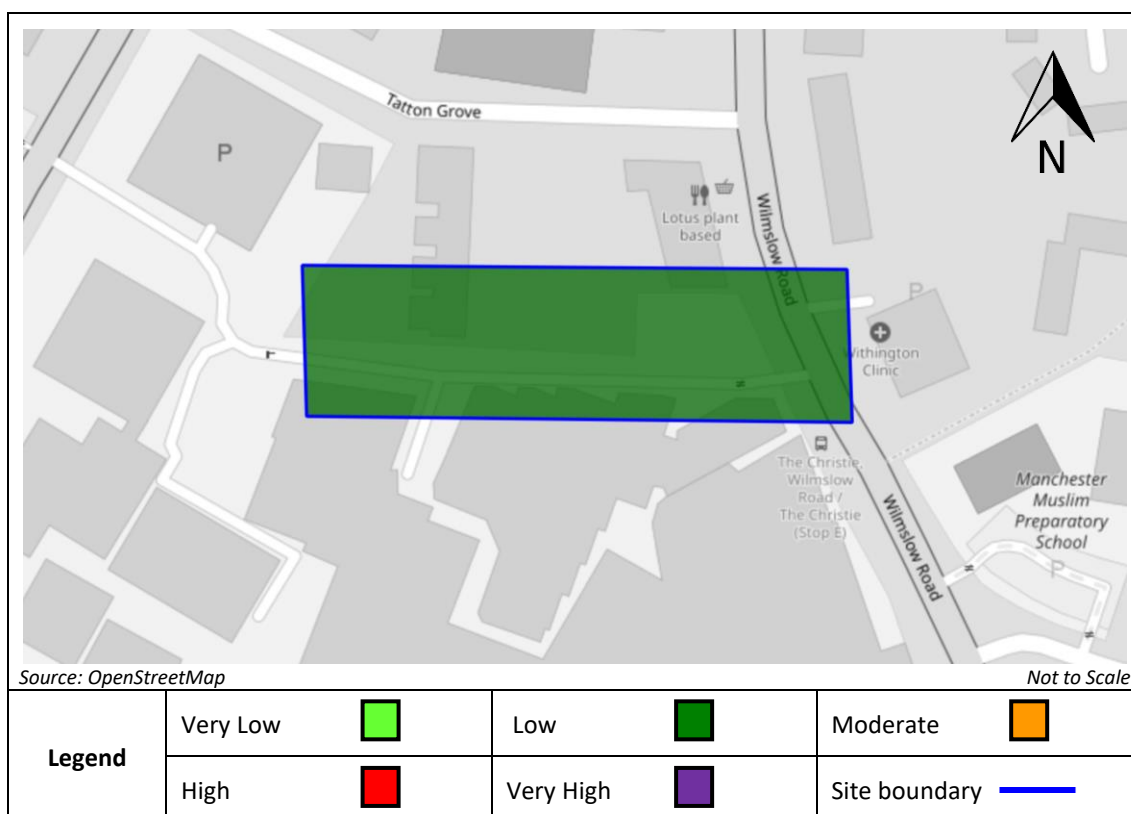
Definitions of UXO Hazard Level for a Site	
Hazard Level	Definition
Very Low	There is positive evidence that UXO is not present, e.g. through physical constraints or removal.
Low	There is no positive evidence that UXO is present, but its occurrence cannot be totally discounted.
Moderate	There is positive evidence that ordnance was present or that other uncharted ordnance may be present as UXO.
High	There is positive evidence that UXO is present.
Very High	As high, but requires immediate or special attention due to the potential hazard.

No records have been found indicating that the Site was bombed and no other significant sources of UXO hazard have been identified on the Site.

Given this, it is considered that the Site has a low UXO hazard level, as shown in Figure 3.

The UXO hazard zone plan of the Site is also given in the accompanying P14466-24-R1-MAP01-A.

Figure 3 UXO hazard zone plan of the Site



7 UXO RISK ASSESSMENT

7.1 Proposed works

It is understood works are associated with the construction of a new 3-storey building. Works will comprise demolitions of the existing modular building, removal of its foundations, and the removal of tree roots encroaching onto the Site.

Future works on the Site may also include excavations, boreholes, and piling.

7.2 Risk assessment methodology

A UXO risk assessment has been undertaken for the proposed works, taking into consideration the identified UXO hazard(s).

Firstly, the probability of encountering UXO (PE) has been considered and rated for the proposed construction techniques, as detailed below.

Probability of Encounter (PE)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Secondly, the probability of detonating an item of UXO (PD) has been considered and rated for the proposed construction techniques, as detailed below.

Probability of Detonation (PD)	Rating
Frequent, highly likely, almost certain.	5
Probable, more likely to happen than not.	4
Occasional, increased chance or probability.	3
Remote, unlikely to happen but could.	2
Improbable, highly unlikely.	1
Impossible	0

Next, the probability of encountering and detonating the UXO (PE x PD) have been used to generate an overall likelihood rating (P).

P = PE x PD	LIKELIHOOD of Encounter and Detonation	Rating
21 to 25	Frequent, highly likely, almost certain.	5
16 to 20	Probable, more likely to happen than not.	4
6 to 15	Occasional, increased chance or probability.	3
2 to 5	Remote, unlikely to happen but could.	2
1	Improbable, highly unlikely.	1
0	Impossible	0

P ranges from 25, a certainty of UXO being encountered and detonated on the Site by engineering activity, to 0, a certainty that UXO does not occur on the Site and will not be detonated by engineering activity.

The likelihood of encountering and detonating UXO during site works (P) is multiplied by the severity (S) of such an event occurring (P x S), to provide a risk level using the following matrix.

Severity (S)	Rating
Multiple fatalities	5
Major injury, long term health issues, single fatality.	4
Minor injury, short term health issues, no fatalities.	3
First aid case but no lost time or ill health.	2
Minor injuries, no first aid.	1
No injuries.	0

UXO Risk Matrix							
LIKELIHOOD (P)	SEVERITY (S)						
		5	4	3	2	1	0
	5	25	20	15	10	5	0
	4	20	16	12	8	4	0
	3	15	12	9	6	3	0
	2	10	8	6	4	2	0
	1	5	4	3	2	1	0
	0	0	0	0	0	0	0

7.3 UXO risk level

The UXO risk assessment for proposed works on the Site is given in Table 3.

Table 3 UXO risk assessment for the Site

Potential UXO Hazard	Anticipated Works	PE	PD	P = PE x PD	Likelihood	Severity	Risk Rating	UXO Risk
UXB	Excavations	1	1	1	1	5	5	Low
	Boreholes/Piling	1	1	1	1	4	4	Low
Other UXO	Excavations	1	1	1	1	4	4	Low
	Boreholes/Piling	1	1	1	1	3	3	Low

PE = Probability of Encounter; PD = Probability of Detonation; P = Likelihood

8 RISK MITIGATION PLAN

Key findings: No significant sources of UXO hazard have been identified.

Key actions: Proceed with works. An UXO awareness briefing is prudent for staff involved in excavations.

8.1 UXO risk summary

Table 4 summarises the UXO risk for proposed works on the Site and recommended actions.

Table 4 Summary of UXO risk and mitigation recommendations

Proposed Works	UXO Risk	Recommended Mitigation
Excavations		Proceed with works – an UXO awareness briefing is prudent for staff involved in excavations.
Boreholes/Piling		Proceed with works

In summary, no additional measures are considered essential to reduce the UXO risk on the Site to As Low As Reasonably Practicable (ALARP). An UXO awareness briefing for staff involved in excavations is always prudent.

8.2 Risk mitigation techniques

8.2.1 UXO awareness briefing

It is prudent that all staff involved in intrusive works are provided with a formal UXO awareness briefing.

The briefing should offer some recognition skills for typical UXO, and suitably sensitise staff to be vigilant during site works.

An UXO awareness briefing ensures that in the unlikely event that UXO is encountered:

- All site staff take appropriate action.
- A support mechanism and points of contact are established.
- The likelihood of harm to people or property is reduced.
- Significant delays to site work are prevented.

8.3 What do I do next?

If you have any comments or require further assistance, contact us and we can help.

	01993 886682		uxo@zetica.com		zeticauxo.com
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If you have requirements to identify other buried hazards (such as mapping utilities or obstructions) we can provide these surveys.

If proposed works on the Site change, or additional works are planned, contact Zetica for a re-assessment of the UXO risk and the risk mitigation requirements.

APPENDICES

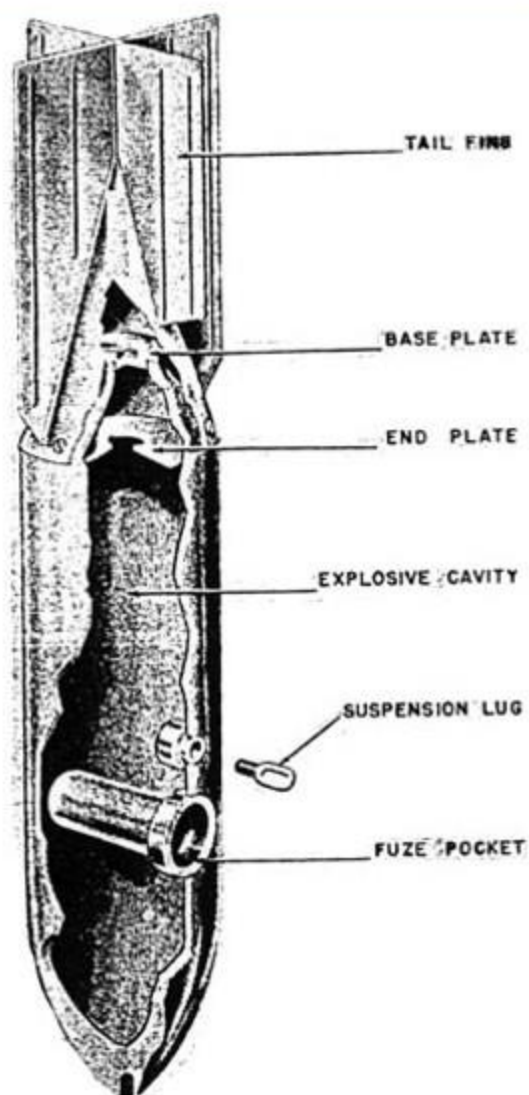
Appendix 1 Anticipated ordnance types

For a more comprehensive set of ordnance data sheets, see <https://zeticauxo.com/guidance/ordnance-data-sheets/>.

Information Data Sheet

zeticauxo

50kg High Explosive Bomb



Specifications

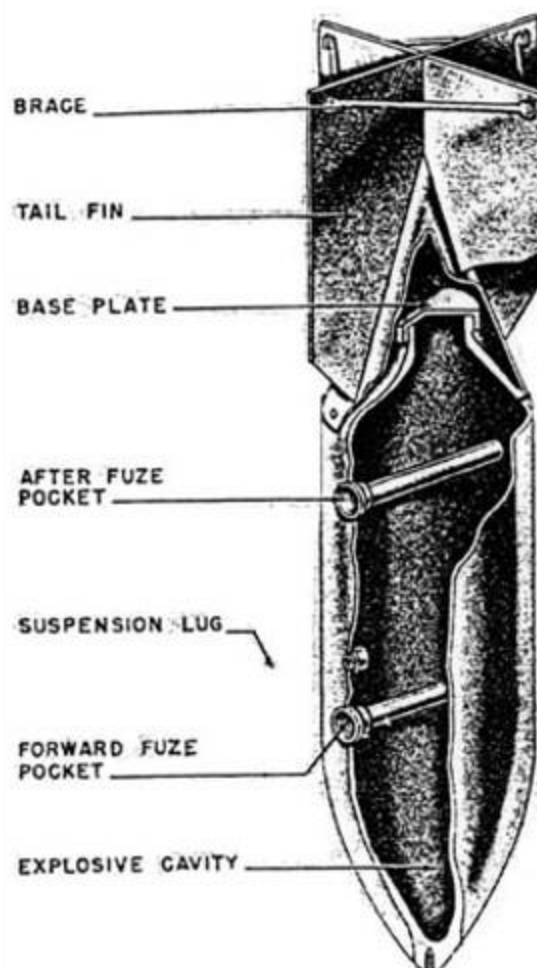
Description	Cylindrical with pointed nose and four-fin tail	Function	General Purpose (Blast and Fragmentation)
Dimensions	Total 1090mm x 280mm (42.9" x 11") Body 765mm x 200mm (30.2" x 7.9")	Activation by	Impact, Time, or Tamper fuze
Material	Steel	Variations	Minor variations in length

Information is accurate for indicative purposes. Photographs used are in the public domain. Any use of copyrighted © material is unintentional.

Information Data Sheet

zetica^{uxo}

250kg High Explosive Bomb



Specifications

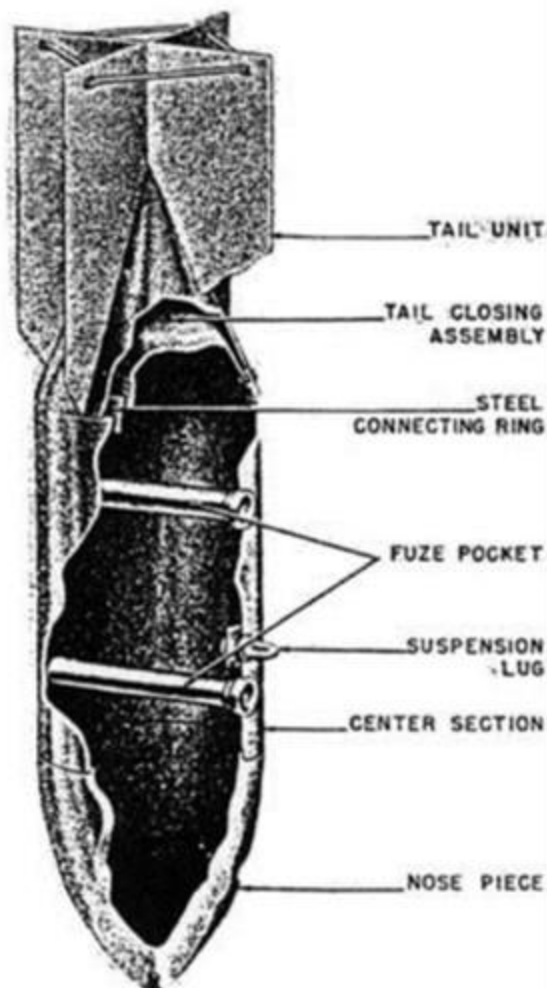
Description	Cylindrical with pointed nose and braced four-fin tail	Function	General Purpose (Blast and Fragmentation)
Dimensions	Total 1640mm x 512mm (64.6" x 20.2")	Activation by	Impact, Time, or Tamper fuze
	Body 1172mm x 368mm (46" x 14.5")		
Material	Steel	Variations	Minor variations in length

Information is accurate for indicative purposes. Photographs used are in the public domain. Any use of copyrighted © material is unintentional.

Information Data Sheet

zetica^{uxo}

500kg High Explosive Bomb



Specifications

Description	Cylindrical with pointed nose and braced or ring-bound four-fin tail	Function	General Purpose (Blast and Fragmentation)
Dimensions	Total 1957mm x 640mm (77" x 25.2") Body 1423mm x 470mm (56" x 18.5")	Activation by	Impact, Time, or Tamper fuze
Material	Steel body, Steel or Magnesium Alloy tail	Variations	Minor variations in length

Information is accurate for indicative purposes. Photographs used are in the public domain. Any use of copyrighted © material is unintentional.

Information Data Sheet



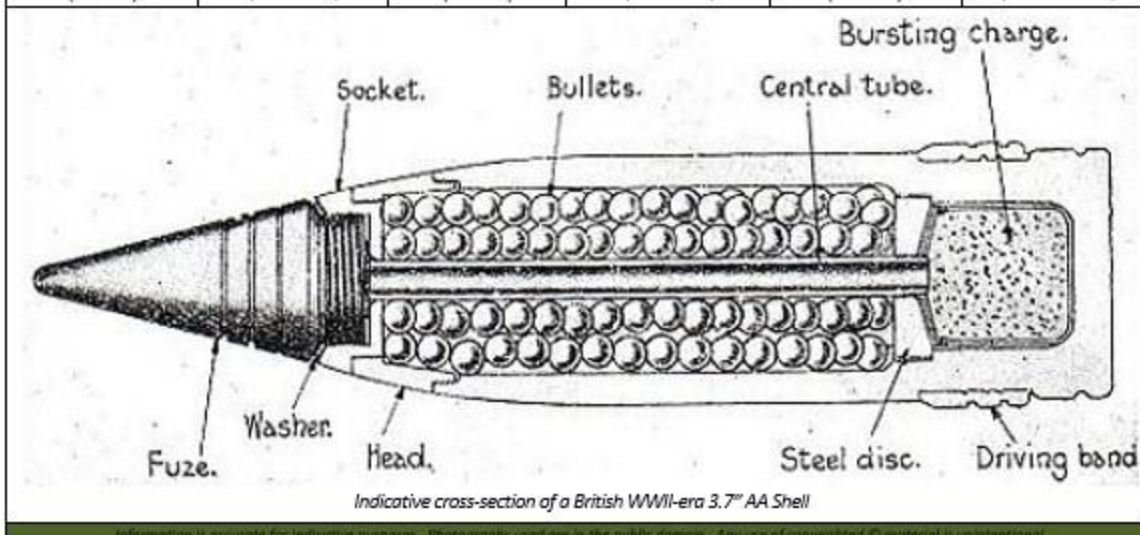
Anti-Aircraft Shells



Anti-Aircraft (AA) guns are artillery pieces designed to engage aircraft. They may be classed as Heavy AA (HAA) or Light AA (LAA). HAA shells are typically streamlined, made of steel, and equipped with driving bands. They usually carry a High Explosive (HE) or shrapnel filling and use time or proximity fuzes. LAA guns are often autocannons. Indicative specifications for common British HAA shells are given below.

Specifications

Shell	Dimensions	Shell	Dimensions	Shell	Dimensions
6-pdr (c. WWI)	307mm x 57mm (12.1" x 2.2")	13-pdr (c. WWI)	294mm x 76mm (11.6" x 3")	3.7" (c. WWII)	675mm x 94mm (26.6" x 3.7")
75mm (c. WWI)	350mm x 75mm (13.8" x 3")	3" (c. WWI)	420mm x 76mm (16.5" x 3")	4.5" (c. WWII)	695mm x 113mm (27.4" x 4.5")
12-pdr (c. WWI)	445mm x 102mm (17.5" x 4")	4" (c. WWI)	445mm x 102mm (17.5" x 4")	5.25" (c. WWII)	782mm x 133mm (30.8" x 5.25")



Information is accurate for indicative purposes. Photographs used are in the public domain. Any use of copyrighted © material is unintentional.

Appendix 2 Sources of UXO hazard

The sections below provide background information on the potential sources of UXO hazard affecting the Site. For a more comprehensive set of UXO information sheets, see <https://zeticauxo.com/guidance/uxo-hazard-sources/>.

Appendix 2.1 WWI bombing

Information Data Sheet

Category World War One (WWI) Bombing

Description:

During WWI, significant bombing took place across some areas of the UK. An estimated 9,000No. German bombs were dropped on Britain during the course of 51No. airship and 52No. aircraft raids. It was the first time that strategic aerial bombardment had been used.

Nearly 100No. air raids were carried out on London and Southeast England, over 40No. of which were by Zeppelin airships. Areas along the East Coast was also targeted regularly due to their proximity to the European continent. Bombing raids further inland were rare and West England and Wales were out of reach for German aircraft of the time.

Aerial bombing during WWI initially relied on visual aiming, with bombsights not developed until later in the war. The inaccuracy inherent in this method meant that bombs often fell some way from their intended targets.

The first recorded raid against England occurred on the 21st December 1914 when 2No. High Explosive (HE) bombs fell near the Admiralty Pier at Dover. Zeppelin raids intensified during 1915 and 1916, with aircraft raids becoming more frequent after 1917. The last raid of WWI took place on the 19th May 1918, when 38 Gotha and 3 Giant aircraft bombed London and surrounding districts, dropping a total of more than 2,500lbs of bombs.



A variety of WWI German bombs

Hazard:

The potential of coming across an Unexploded Bomb (UXB) from WWI is far less likely than an UXB from World War Two (WWII), given the lower bombing densities during raids in WWI.

Some areas which were subjected to sustained bombing raids recorded a higher number of UXBs. In these areas, where there has been no significant development for the last century, the potential of a UXB remaining from WWI cannot be totally discounted.

Appendix 2.2 WWII bombing**Information Data Sheet****Category** World War Two (WWII) Bombing**Description:**

Bombing raids began in summer 1940 and continued until the end of WWII. Bombing densities generally increased towards major cities, such as London, Birmingham, Coventry, and Hull, or strategic targets such as docks, harbours, industrial areas, and airfields. Coastal towns, such as Eastbourne, and cathedral cities, such as Canterbury were also heavily targeted.

The German bombing campaign saw the extensive use of both High Explosive (HE) bombs and Incendiary Bombs (IBs). 50kg and 250kg HE bombs were most commonly used, although 500kg were also used to a lesser extent. More rarely 1,000kg, 1,400kg and 1,800kg bombs were dropped. HE bombs tended to contain about half of their weight in explosives and were fitted with one or two fuzes. Not all HE bombs were intended to explode on impact and some contained timing mechanisms where detonation could occur more than 70 hours after impact.

Incendiary devices ranged from small 1kg thermite filled, magnesium bodied IBs, to 250kg and 500kg Oil Bombs (OB). Occasionally IBs were fitted with a bursting charge which exploded after the bomb had been alight for a few minutes, causing burning debris to be scattered over a greater area. Large OBs were similar in appearance to HE bombs, although their design was sufficiently different to warrant a specially trained unit of the Royal Engineer (RE) to deal with their disposal.



Variety of WWII bombs

Anti-Personnel (AP) bombs and Parachute Mines (PMs) were also deployed. The most common AP bombs were 1kg and 2kg, which could inflict injury across an area up to 150m away from the impact. PMs could be up to 4m in length and were typically detonated either magnetically or by noise/vibration. Anti-shipping PMs were commonly dropped over navigable rivers, dockland areas, and coastlines. Whilst the Royal Navy (RN) was responsible for ensuring that anti-shipping PMs were made safe, their removal and disposal was still the responsibility of the RE.

In 1944, new offensive weapons were introduced. The Flying Bomb (V1), a pilotless guided missile, exploded on impact and could cause significant damage. The Long Range Rocket (V2), a ballistic missile rocket, travelled at such speed that no one could see or hear its approach.

WWII bomb targeting was inaccurate, especially in the first year of the war. A typical bomb load of 50kg HE bombs mixed with IBs aimed at a specific location might not just miss the intended target but could fall a considerable distance away.

Local Civil Defence authorities in urban areas typically had a comprehensive system for reporting bomb incidents and dealing with Unexploded Bombs (UXB). In more rural and coastal areas where fewer bombing raids occurred, it is known that Air Raid Precaution (ARP) records under-represent the number and frequency of bombs falling. Bombs could be released as part of 'tip and run' raids where bomber crews would drop their bombs to avoid Anti-Aircraft (AA) fire or Allied fighter aircraft, on route to and from other strategic targets. Bombs dropped as a result of poor targeting or 'tip and run' raids often went unrecorded or were recorded as 'fell in open country' or 'fell in the sea'. The Luftwaffe are thought to have dropped approximately 75,000 tons of bombs on Britain throughout WWII and an estimated 11% of all bombs dropped during the war failed to detonate.



Removal of an UXB

Hazard:

The potential for a UXB hazard to exist on a site depends on a variety of factors:

- Were their strategic targets in the surrounding area?
- Was the site bombed and how heavy were the raids?
- Could an UXB impact have been missed, masked by rubble or debris?

Even in rural areas, the potential for UXBs cannot be totally discounted and therefore it is essential that detailed local bombing records are obtained when assessing the UXB hazard on any site.

Appendix 2.3 Anti-Aircraft defences**Information Data Sheet****Category** Anti-Aircraft (AA) Defences**Description:**

As aerial bombardment first began during World War One (WWI), AA gun batteries were gradually established throughout much of England to counter German bombing raids. By June 1916, there were approximately 271No. AA guns and 258No. searchlight installations defending London alone.

Common WWI AA defences included 3", 75mm, 6-pounder (pdr), and 1pdr guns. Many of these guns were mobile and would follow the course of an airship, firing from areas of open land.

During WWI, Unexploded AA (UXAA) shells, could land up to 13km from the firing point, although they more typically fell within 10km.



WWI 3-pdr mobile Vickers AA gun



WWII 3.7" static AA gun

During World War Two (WWII), AA gun batteries were used extensively to counter the threat posed by enemy aircraft. AA shells could be distributed over a wide area and could land up to 27km from the firing point, although they more typically fell within 15km.

3No. types of AA batteries existed:

- Heavy AA (HAA) – typically 3.7", 4.5", and 5.25" calibre guns designed to engage high flying bomber aircraft. These tended to be permanent gun emplacements.
- Light AA (LAA) – typically used 40mm shells and machine gun ammunition and designed to counter low flying aircraft. These were often mobile and were moved periodically.
- Rocket AA (ZAA) – fired 3" or 3.7" AA rockets with a maximum altitude of 5,800m and a ground range of 9km. These tended to be permanent gun emplacements.

Hazard:

AA batteries had munitions stores which stored shells for the batteries and Small Arms Ammunition (SAA) for troops manning the position. Such stores were typically removed at the end of WWII, although some disposal may have occurred in the immediate vicinity of the gun battery.

In areas heavily protected by AA batteries, it is prudent to consider the potential for UXAA shells in the area surrounding a battery, taking into consideration the likely extent within which shells would have fallen. Finding an UXAA shell immediately adjacent to a former gun battery is less likely.

Appendix 3 Recent UXO finds

Information Data Sheet

Category Recent UXO Finds

UXO finds in the UK are a regular occurrence, although they almost never result in an accidental detonation.

Explosives rarely lose effectiveness with age. In some instances, mechanisms such as fuzes and gaines can become more sensitive and more prone to detonation, regardless of whether the device has been submersed in water or embedded in silt, clay, or similar materials.

Zetica Ltd, and other commercial EOD companies, uncover and make safe thousands of items of UXO each year, though details are rarely made public knowledge.

Publicly recorded discoveries also occur regularly, as shown by the list of recent significant UXO finds in the UK below. Click [here](#) to keep up to date with the latest UXO finds.

On the 26th February 2021, a 1,000kg German "Hermann" UXB was discovered by builders at Exeter University campus (see below). It was investigated and detonated in-situ following the evacuation of nearby properties and University halls of residence.



1,000kg German UXB discovered in Exeter, 2021

On the 29th March 2021, 1No. 250lb UXB was discovered on the seabed near Hinkley Point C harbour, Bristol. A maritime exclusion was imposed while the item was investigated and then destroyed in a controlled explosion.

On the 1st June 2021, a cache of approximately 100No. WWII-era hand grenades were found in a Nottinghamshire forest, a possible relic from nearby WWII camps. They were destroyed.

On the 24th July 2021, 1No. 500lb British UXB was uncovered during construction works in Goole, East Yorkshire. Reports indicated that the UXB had been jettisoned by a Lancaster bomber aircraft prior to crashing nearby in WWII. The item was investigated and destroyed.

On the 18th August 2021, 1No. UXB was found by construction workers on a Site in Earl Sterndale, Derbyshire. Upon inspection the UXB was deemed to be dangerous, and a controlled detonation was undertaken.

On the 10th September 2021, EOD teams destroyed 25No. mortar bombs which had been washed up onto beaches around Nairn and Ardersier in Morayshire. These beaches had been used during WWII for training prior to the D-Day landings in Normandy.



Mortar bombs found on beaches in Nairn and Ardersier, 2021

On the 15th December 2021, approximately 200No. artillery shells were discovered at a construction site located within the former Royal Ordnance Factory at Swynnerton in Staffordshire. The shells were removed and destroyed.

On the 2nd January 2022, 1No. heavily deteriorated 105mm artillery shell was discovered by dogwalkers on a beach in Cumbria. This may have originated on one of the several offshore ranges which have been operational along the nearby coastline since WWII.

Between the 24th and 27th January 2022, 5No. empty artillery shells were uncovered at a construction site in Manchester. These were likely linked to a shell-production factory which had been active on the site during WWII.

On the 14th July 2022, 1No. 2" mortar bomb and several Small Arms Ammunition rounds were discovered on a beach near Ardnamurchan. An EOD team disposed of the items.

On the 28th November 2022, 45No. Self-Igniting Phosphorus grenades were discovered during construction works at a school in Swindon. They were disposed of by an EOD team.

On the 5th December 2022, 1No. UXB was discovered during construction at Biggin Hill Airport. An EOD team removed the UXB for safe disposal.

On the 7th February 2023 1No. 250kg bomb was found during dredging works in the River Yare, Great Yarmouth. It detonated unplanned whilst being disarmed by an Army EOD team.

On the 17th April 2023, 1No. unexploded mortar bomb was discovered at Cavenham Heath Nature Reserve. It was destroyed in a controlled explosion by an EOD team. This followed 2No. other similar discoveries on the 7th March and 12th March in the same stretch of canal.

On the 27th July 2023, 1No. 250kg WWII bomb was discovered off the coast of Guernsey by a recreational diver. It was detonated in situ by a Royal Navy EOD diver team.

Appendix 4 Glossary and definitions

Abandoned Explosive Ordnance (AXO)	Explosive ordnance that has not been used during an armed conflict, that has been left behind or disposed of by a party to an armed conflict, and which is no longer under control of that party. Abandoned explosive ordnance may or may not have been primed, fuzed, armed or otherwise prepared for use.
Demil	Derived from the term 'Demilitarisation', demil refers to the break down and the recycling or disposal of ordnance components.
Detonation	The high-speed chemical breakdown of an energetic material producing heat, pressure, flame, and a shock wave.
Device	Any component, sub-assembly or completed ordnance, which may or may not have an explosive risk. It can apply to detonators, primers, gaines, fuzes, shells, or bombs.
Explosive	Compounds forming energetic materials that under certain conditions chemically react, rapidly producing gas, heat, and pressure. These are extremely dangerous and should only be handled by qualified professionals.
Explosive Ordnance (EO)	All munitions containing explosives, nuclear fission or fusion materials, and biological and chemical agents. This includes bombs and warheads, missiles, artillery, mortar, rocket, Small Arms Ammunition, mines, torpedoes, depth charges, pyrotechnics, cluster bombs and dispensers, cartridge and propellant devices, electro-explosive devices, clandestine and improvised explosive devices, and all related items/components which are explosive in nature.
Explosive Ordnance Clearance (EOC)	The operation of ordnance detection, investigation, identification, and removal, with Explosive Ordnance Disposal being a separate operation.
Explosive Ordnance Disposal (EOD)	The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of Unexploded Ordnance.
Explosive Ordnance Reconnaissance (EOR)	The detection, identification, and on-site evaluation of Unexploded Ordnance before Explosive Ordnance Disposal.
Explosive Remnants of War (ERW)	Unexploded Ordnance and Abandoned Explosive Ordnance, excluding landmines.
Explosive Substances & Articles (ESA)	Explosive substances are solid or liquid substances (or a mixture) which are either: capable by a chemical reaction of producing gas at a speed, temperature, and pressure to cause damage to the surroundings; or designed to produce an effect by heat, light, sound, gas, or smoke (or a combination) as a result of a non-detonative, self-sustaining, exothermic reaction. One or more explosive substances form an explosive article.

Fuze	The part of an explosive device that initiates the main explosive charge to function. In common usage, the word fuze is used indiscriminately, but when being specific (and especially in a military context), fuze is used to mean a more complicated device, such as a device within military ordnance.
Gaine	Small explosive charge that is sometimes placed between the detonator and the main charge to ensure ignition.
Geophysical survey	A range of methods that can be used to detect objects or identify ground conditions without the need for intrusive methods (such as excavation or drilling). This is particularly suited to ordnance, as disturbance of ordnance is to be avoided where possible.
High Explosive (HE)	Secondary explosives (commonly known as HE) make up the main charge or filling of an ordnance device. They are usually less sensitive than primary explosives. Examples of secondary explosives are Nitro-glycerine (NG), Trinitrotoluene (TNT), Amatol (Ammonium nitrate and TNT), gunpowder, and Cyclotrimethylenetrinitramine (RDX).
Land Service Ammunition (LSA)	Items of ordnance thrown, propelled, or placed during land warfare, to include grenades, mortar bombs, projectiles, rockets, and landmines.
Munition	The complete device charged with explosives, propellants, pyrotechnics, initiating composition, or nuclear, biological, or chemical material for use in military operations, including demolitions. This includes those munitions that have been modified for use in training, ceremonial, or non-operational purposes. These fall into three distinct categories: inert (contain no explosives), live (contain explosives and have not been fired), and blind (have fired but failed to function as intended.)
Primary Explosive	Explosives used to initiate less sensitive explosives and usually extremely sensitive to friction, heat, and pressure. Primary explosives are commonly found in detonators. Examples of primary explosives are lead azide, lead styphnate, and mercury fulminate.
Propellants	Provide ordnance with the ability to travel in a controlled manner and deliver the ordnance to a predetermined target. Propellants burn rapidly producing gas, pressure, and flame. Although usually in solid form they can be produced in liquid form. Examples of propellants are ballistite, often in flake form, and cordite, often in string form.
Pyrotechnic	An explosive article or substance designed to produce an effect by heat, light, sound, gas, or smoke (or a combination), as a result of non-detonative, self-sustaining, exothermic chemical reactions.
Small Arms Ammunition (SAA)	Projectiles around 12mm or less in calibre and no longer than approximately 100mm. They are fired from a variety of weapons, including rifles, pistols, shotguns, and machine guns.

Unexploded Anti-Aircraft (UXAA) Shell	Ordnance containing High Explosives, although they can also contain pyrotechnic compounds that produce smoke. They ranged from 2" to 5.25" calibre, although most common were 3.7" and 4.5" HE shells.
Unexploded Bomb (UXB)	A common term for unexploded air-dropped munitions.
Unexploded Ordnance (UXO)	Explosive ordnance that has been primed, fuzed, armed, or prepared for use and subsequently fired, dropped, launched, projected, or placed in such a manner as to present a hazard to operations, persons, or objects, and remains unexploded either by malfunction or design.
V1	The Vergeltungswaffe-1, also designated Fieseler Fi 103/FZG-76, known colloquially in English as the Flying Bomb, Pilotless Aircraft, Buzz Bomb, or Doodlebug, was the first guided missile used in WWII and the forerunner of today's cruise missile.
V2	The Vergeltungswaffe 2 ('Reprisal Weapon 2') was the first ballistic missile. It was used primarily against Belgian and British targets during the later stages of WWII. It was also the first man-made object launched into space, during test flights in 1944.

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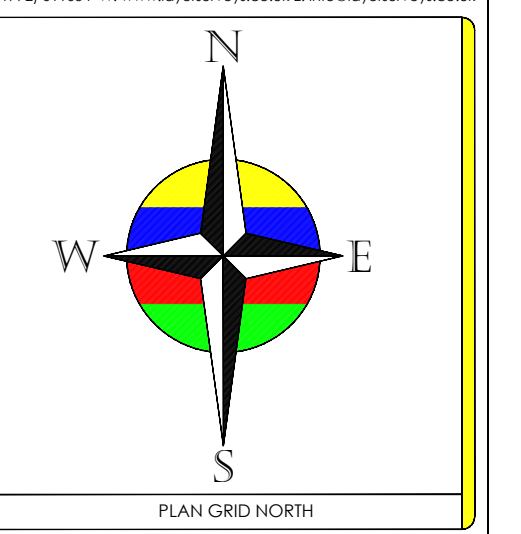
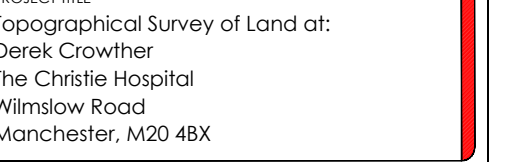
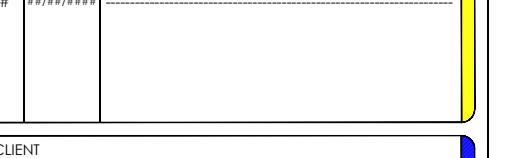
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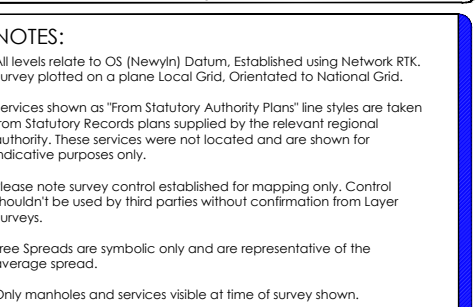
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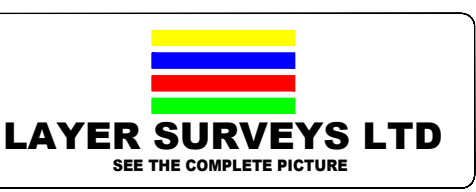
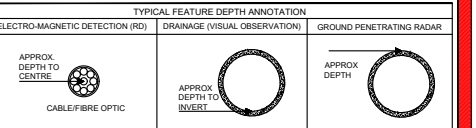
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K. GPR Survey



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