BURO HAPPOLD

London Resort

Specification for Phase 1 Ground Investigation

0042936-BHE-XX-XX-SP-CYG-0001

0042936

28 May 2021

Revision P01

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Revision	Description	Issued by	Date	Checked
P01	Phase 1 Ground Investigation	JH/NS	28/05/21	JY/HM

[redacted]

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author	**Justin Hobkirk**
date	**28/05/21**
approved	**S H Mallett**
signature	[redacted]
date	**28/05/21**

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Contents

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Glossary

Term	Definition
ALARP	'As low as it is reasonably practical to achieve'
BH	Borehole
CAT	Cable Avoidance Tool
BTEX	Benzene, Toluene, Ethyl Benzene and Xylenes
CLEA	Contaminated Land Exposure Assessment
CPT	Cone Penetration Test
CPTU	Piezo-cone Penetration Test
DPR	Drilling Parameter Recording
EOD	Explosive Ordnance Disposal
GPR	Ground Penetrating Radar
EPH	Extractable Petroleum Hydrocarbons
MCERTS	Environment Agency's Monitoring Certification Scheme
MOLA	Museum of London Archaeology
PAH	Polycyclic (or Polynuclear) Aromatic Hydrocarbons
PRO	Petrol Range Organic
SCA	Waste Acceptance Criteria
SCPT	Seismic Cone Penetration Test
SPT	Standard Penetration Test
UXO	Unexploded Ordnance

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1 Instructions to Tenderer

1.1 Queries at the Tender Stage

Any queries regarding the Tender documents or other related matters are to be addressed to the following at the office of Buro Happold, 17 Newman Street, London, W1T 1PD.

[redacted]

[redacted]

The Client's name is London Resort Company Holdings Limited (the 'Client').

1.2 Starting date

The Contractor shall include with the Tender an indication of mobilisation period required to meet the Commencement Date stated in the Form of Tender.

1.3 Form of Tender

The Contractor shall complete and sign the Form of Tender in Section 3.0 of this document.

1.4 Return of Tender

Tenderers must comply with the following requirements:

a) The Tender shall be submitted before 1200hrs on **25th June 2021**, or such later date and time as may be notified in writing.
b) The Tender shall be on the official Form of Tender which shall be signed by the Tenderer with the Tender Total inserted therein.
c) Tenders shall not be qualified and shall be submitted strictly in accordance with these Instructions.
d) Tenders shall not be accompanied by statements which could be construed as rendering the Tender equivocal or placing it on a different footing from other tenders.

The Contractor shall return this document fully completed to arrive at the offices detailed below

Attn: Justin Hobkirk

Buro Happold Limited

17 Newman Street

London

W1T 1PD

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1.5 Suitability of Tender

TENDERERS are required to fully comply with these Instructions to Tenderers when preparing their Tenders. Tenderers' particular attention is drawn to the fact that non compliance with such instructions may, and in stated circumstances shall, invalidate their Tender.

1.6 Contract award criteria

The Employer does not bind itself to accept the Tender with the lowest stated Tender Total or any Tender, and will not pay any compensation whatsoever in connection therewith. The Contract, if awarded, shall be awarded on the basis of the criteria set out below to the Tenderer who has submitted a Tender in compliance with these Instructions:

Returned Costs

Proposed Methodology

Understanding of proposed works

Availability

Completeness of tender submission

1.7 General

The Employer, Engineer, Contractor are as defined in the Form of Tender (Section 3.2). All correspondence in relation to this Contract Documents when placed shall be in the English language. The rates and extensions in the Bill of Quantities and all other sums leading to and including the Tender Total shall be in Pounds Sterling (£) and should be completed to two decimal places.

1.7.1 Notice from Employer

Up to 5 working days prior to the latest date for receipt of Tenders (As stated in 1.4) the Engineer acting on behalf of the Employer may issue a Notice by circular letter or fax to all persons or firms who have received the Tender Documents, deleting, varying or extending any item to these documents. Tenderers shall immediately acknowledge the receipt of each such Notice by letter or fax addressed to the Engineer. Any such Notice shall then form part of the Tender Documents and shall be treated as such by the Tenderer.

1.7.2 Communications

Any communications in connection with the Tender should be forwarded to Justin Hobkirk [redacted]). The Tenderer may examine the site prior to submitting the Tender. However, the Tenderer must be satisfied as to the feasibility of carrying out the works required under the Contract regardless of if they choose to visit the site or not.

A site visit will be conducted during the tender period (date and timings to be confirmed). However, Tenderers should note that permission to enter private land or tenanted areas during the Tender period cannot be guaranteed.

The latest date for receipt of communication from a Tenderer in connection with the Tender shall be 5 working days before the latest date for receipt of tenders stated in 1.4. All queries and resulting replies given will be circulated to all Tenderers, not later than five working days before the latest date set for receipt of Tenders.

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1.7.3 Ambiguity, Discrepancy, Error and Omission

Should the Tenderer become aware of any ambiguity, discrepancy, error or omission in or between Tender Documents, the Engineer shall be immediately notified. The Engineer, upon receipt of such notification, shall notify all Tenderers in respect of any such ambiguity, discrepancy, error or omission. Such ruling shall be issued in writing by the Engineer and shall form part of the Tender Documents.

1.7.5 Checklist of Documents

The Tender Documents provided for the use of Tenderers are as follows:

a. Instructions to Tenderers
b. Form of Tender
c. Conditions of Contract
d. Specification (Including a FTP link to the documents listed in S1.7)
e. Bill of Quantities

The Tenderer must carefully check and acknowledge by PDF letter via email that they have received one complete set of Tender Documents items (a) to (e) inclusive using the proforma appended to the invitation letter and must inform the Engineer within 3 days. Any drawings and other documents not returned with the Tender, or in the event of any Tenderer not wishing to tender shall be sent to the Engineer.

1.7.6 Contract Price Fluctuations Clause

Tenderers should note that the Contract WILL NOT include a Contract Price Fluctuations Clause.

1.7.7 Confidentiality

All documents issued and information given to the Tenderer shall be treated by him as confidential.

1.7.4 Submitting a tender

- The rates quoted in the Bill of Quantities shall be exclusive of Value Added Tax.
- The Tender Total is to be stated in writing and in figures. In case of conflict the written entry shall rule.

1.7.5 Validity of Tender

Tenders will be deemed to be valid for 12 calendar weeks from the date of submission. The acceptance of a Tender will be by a notice in writing signed by the duly authorised representative of the Employer.

1.8 Tender Evaluation

All priced Bills of Quantities will be inspected and examined for errors which might invalidate the Tender or alter the Tender placing determined from the figures in the Form of Tender. FOR THE PURPOSE OF THE ASSESSMENT OF TENDERS and in order to determine the Tender Total of a Tender, the following steps shall be undertaken, without reference to the Tenderer, and the Tender Total shall form the basis for comparison with other tenders:

a) If, on receipt of any Tender, any errors shall be apparent in the extension of any item in the Bill of Quantities, the extension shall be adjusted so as to be a product of the quantity and the rate set against the item and the Tender Total shall be adjusted accordingly.

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b) If, on receipt of any Tender, any error in addition shall be apparent, it shall be corrected and the total amount of the Tender Total altered accordingly.
c) If, on receipt of any Tender, it shall be discovered that there is a discrepancy between the Bill of Quantities and the Contract Specifications or the Contract Drawings the said documents shall be applied in the following order of precedence:
    I. Contract Specifications;
    II. Contract Drawings;
    III. Bill of Quantities.

If any discrepancy is discovered between the quantities stated in the Bill of Quantities and the quantities as described in or determined from the Contract Specifications and Contract Drawings, the latter quantities shall be applied to the rates and prices stated by the Tenderer in the Tender and the Tender Total shall be corrected accordingly.

Instruction 1.8.c shall be applied by the Engineer only to discrepancies which can be clearly demonstrated to be the result of an error in the computation of quantities in the Bill of Quantities.

In the event that, prior to any corrections being made as referred to above, a Tenderer is in contention for the award of the Contract the Tenderer shall be notified of the corrections made in accordance with the provisions of sub-paragraphs 1.8.a to 1.8.c above and agreement sought to the Tender Total.

The Employer's decision as to the corrections required to be made shall be binding. If the Tenderer rejects the corrections to the Tender, the Tender shall be excluded from further consideration. If the Tenderer accepts the corrections, the Tenderer shall be bound by the corrected Tender Total.

1.9 Additional Information

The Tenderer is required to submit information necessary to assess the suitability of the Tenderer in accordance with this specification and shall include:

- A brief capability statement with respect to the ground investigation. This is to include relevant corporate and individual personnel accreditation, qualifications, and experience. Curriculum Vitae for each member of management and supervisory staff as defined by S1.8.2 in the Specification
- Recent Safety and Environmental performance history.
- Details of current Employer's liability, Public Liability, All Risk Insurance and any other insurance required under the Contract.
- Notice, mobilisation period and the earliest date on which the site works could commence
- The names of the proposed subcontractors and their relevant experience, if the Tenderer intends to sublet any major element of the Works.
- Proposals for laboratory testing (geotechnical and geochemical).

Failure to submit the requested information within the time limit specified with the request from the Engineer or extended time limit as may be agreed with the Engineer, may exclude the Tender from further consideration.

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2 Conditions of Contract

The Conditions of Contract shall be the **ICC Conditions of Contract for Ground Investigation, Version August 2011** by the Association for Consultancy and Engineering Civil Engineering Contractors Association with amendments as follows:

CLAUSE 72	
Sub-clause (1) is amended as such:-	CDM regulations 1994 Reference to the 2007 CDM Regulations is superseded by reference to the 2015 CDM Regulations. Reference to the role of "CDM Co-ordinator" is superseded by reference to the "Principal Designer".

CLAUSE 74	
The following Special Conditions form part of the Conditions of Contract.	Intellectual Properties Rights The Contractor acknowledges that any and all of the copyright, trade marks and other intellectual property rights including all multimedia, audio-visual material and any software developed for Client or its associated companies hereunder ("IP Rights") and with respect to all source code, documentation, flowcharts, drawings, specifications, manuals and other data or material of any nature which are created as a result of this Agreement are owned by and will be the sole property of Client. The Contractor shall not during or at any time after the completion, expiry or termination of this Agreement in any way question or dispute the Client's ownership thereof. The Contractor shall forthwith deliver to Client upon request a copy of such source code, documentation, flowcharts, drawings, specifications, manuals and such source and object code (if any) together with other documentation relating thereto. The Contractor shall, with the written consent of Client be allowed to hold a copy of the same for support purpose only, and if so instructed by Client in writing, shall forthwith destroy its copy of all such information and materials above mentioned. In the event that any third party IP Rights are used by the Contractor in the product and/ or services under this agreement, the Contractor warrants that it has obtained for itself all necessary consents, approvals and licenses for use of the same.

CLAUSE 75	
Use of Client's Name and Confidentiality	Employer's Confidentiality The Contractor undertakes not to use or make any reference to Client's name, directly or indirectly, in any product, Website, document, media, publication or publicity material of any kind without the prior written consent of Client. For avoidance of doubt, the Contractor shall have the right to quote Client's name only without details in relation to job reference for the Contractor and the proper conduct of business development of the Contractor. The Contractor further undertakes not to disclose or make available in any form to any third party or to use any confidential or proprietary information of trade secrets and/or materials concerning the business of Client. or any of its dealings, transactions or affairs or those of any holding company, subsidiary or associated company of Client (other than such information and/ or materials which become part of the public domain by lawful means) acquired by the Contractor in connection with or in the course of its performance of this Agreement expect as authorized in writing by Client (or by the relevant associated company of Client as appropriate). The provisions of this Clause 75 shall survive and continue to bind the Contractor notwithstanding termination of this Agreement or this Agreement ceasing to be effective.

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CLAUSE 76	
The following clause is added:	Privacy Information The Contractor shall not give information concerning any Investigation for publication in the Press or on radio, television, screen or any other medium without the written consent of the Employer.

CLAUSE 77	
The following clause is added:	Anti-bribery provisions (1) The Contractor shall, and shall procure that its agents, directors, employees, officers and sub-contractors shall (i) comply with all applicable laws, regulations, codes and sanctions relating to anti-bribery and anti-corruption ("the Anti-Bribery Laws"), (ii) not engage in any activity, practice or conduct which would constitute an offence under the Anti-Bribery Laws, (iii) have and maintain in place throughout the term of this Contract adequate policies and procedures to ensure compliance with the Anti-Bribery Laws. (2) The Contractor shall keep full and accurate records relating to performance of this Contract by it and its sub-contractors ("the Records"). The Contractor shall grant to the Employer and its authorised agents the right of access at all reasonable times to inspect and take copies of the Records and any part of them and shall allow the Employer to obtain such information as the Employer considers necessary to monitor and verify the Contractor's performance provided that any such inspection is carried out with reasonable prior notice and so as not to have any material adverse effect on the performance of this Contract or other business of the Contractor.

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3 Form of Tender and Form of Agreement

3.1 Short Description of Investigation

Exploratory hole site investigation to include boreholes, windowless samples, trial pits (including soakaway tests) and static cone penetration tests. All site operations, laboratory testing and report preparation/submission in connection with the London Resort Ground Investigation.

3.2 Form of Tender

(NOTE: The Appendix forms part of the Tender)

to

London Resort Company Holdings Limited

7th Floor,

20 Berkeley Square,

London,

W1J 6EQ

Having examined the Drawings, Conditions of Contract, Specification, Schedules and Bill of Quantities for the above-mentioned Investigation (and the matters set out in the Appendix hereto), we offer to carry out the whole of the said Investigation in conformity with the said Drawings, Conditions of Contract, Specification and Bill of Quantities for the VAT exclusive Tender Sum of

£……(in figures)

……(in words)

The Tender shall remain open for a period of 12 calendar weeks from the date hereon. The Tender sum is subject to adjustment in accordance with the Conditions of Contract.

We undertake to commence the said Investigation on site within ……calendar weeks of receiving a written order to commence.

We undertake to complete and deliver the whole of the Site Operations and Investigation comprised in the Contract within the times stated in the Appendix hereto.

If our Tender is accepted we will, if required, provide parent company guarantee security for the due performance of the Contract as stipulated in the Conditions of Contract and the Appendix hereto and out parent company is…… We will not charge for this parent company guarantee and the wording shall be as appended to the Tender Documents. Unless and until a formal Agreement is prepared and executed this tender, together with your written acceptance thereof, shall constitute a binding Contract between us.

We understand that you are not bound to accept the lowest or any tender you may receive.

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Yours faithfully,

Signature Date

Address

In the capacity of

.....

On behalf of

.....

Company Stamp

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3.3 Form of Tender (Appendix)

3.3.1 Appendix Part 1

NOTE: Relevant Clause numbers are shown in brackets following the description

1. Name of Employer (Clause 1(1) (a))

   London Resort Company Holdings Limited

   Contact**: TBC**

2. Name of Engineer (Clause 1(1) (c))

   Buro Happold Ltd

   17 Newman Street

   London

   W1T 1PD

3. Defects Correction Period (Clause 1(1)(w)) **26** Weeks

4. Parts or Sections of the Investigation which shall not be sub-contracted without the Engineer's prior written approval (Clause 4(2))

   n/a

5. Number and type of copies of Drawings to be provided (Clause 6(1)(b))

   Drawings and Documents are issued as part of tender in electronic format only (as detailed in S1.7).

6. Form of Agreement (Clause 9) **Required by the Employer**
   If required **Signed**

7. Performance Bond (Clause 10(1)) **Not Required**

8. Minimum amount of third party insurance (persons and property) (Clause 23 (3)) **£5,000,000** for each and every occurrence

9. Commencement Date (Clause 41(1) (a))

   09th August 2021 (subject to further confirmation)

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10. Time for completion calculated from the Commencement Date (Clause 43)[a]

Section of Investigation (Clause 1 (1) (y))[b]	**Details (Duration)**	**Completion time from commencement date**
Section A	Field work as defined by Schedule 1 and Schedule 2 of the specification	16 weeks
Section B	100% of the Laboratory Testing (5 weeks)	21 weeks
Section C	Post Fieldwork monitoring (8 weeks)	24 weeks
Section D	Final Factual Report*(1 week)	25 weeks

** Draft Report to be delivered in accordance with S1.21.12 of this Specification.*

11. Liquidated damages for delay (Clause 47)

    N/A

12. Vesting of materials not on Site (Clauses 54(4) and 60(1)(c)) (if required by the Employer) [d]

    Not Required

13. Method of measurement adopted in preparation of Bills of Quantities (Clause 57) [e]

    ICE Specification for Ground Investigation, Second Edition, 2012, with amendments to selected bill items and additional bill items where necessary.

14. Percentage of the value of goods and materials to be included in Interim Certificates (Clause 60(2)(b))

    N/A

15. Minimum amount of Interim Certificates (Clause 60(3))

    N/A

16. Rate of retention (Clause 60(5)) i.e. **5%**

17. Limit of retention (% of Tender Total) (Clause 60(5)) i.e. **5%**

18. Bank whose Base Lending rate is to be used (Clause 60(7)) i.e. **HSBC Plc**

19. Requirement for prior approval by the Employer before the Engineer can act (Clause 2(1) (b))[f]

    Engineer to advise and obtain approval from the Employer as soon as issues arise which affect cost of works.

20. Name of Principal Designer (Clause 71(1)(b))

    NAME: [TBC]

    Contact: **[TBC]**

21. Name of Principal Contractor (if appointed) (Clause 71(1)(b))

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The Contractor to be appointed in this Contract

22. Period for Approval (14(7))

Testing Schedule	i.e. **1 week**
Draft Report	i.e. **2 week**
Final Report	i.e. **1 week**

23. Maximum sum for the Contractor to make changes without instructions (Clause 13(4))

£500

24. The arbitration procedure to be used is (Clause 66(11)(a))

a) The Institution of Civil Engineers' Arbitration Procedure (1997)

~~b) The Construction Industry Model Arbitration Rules[g]~~

If no deletion is made The Institution of Civil Engineers' Arbitration Procedure (1997) shall be used.

a If not stated is to be completed by Contractor in Part 2 of the Appendix.
b To be completed with brief description. The item for "the Remainder of the Investigation" must be used to cover the balance of the investigation if the Sections described do not in total comprise the whole of the Investigation.
c Delete where not required.
d (If used) Materials to which the Clauses apply must be listed in Part 1 of the Appendix to the Form of Tender (Employer's option) or in Part 2 (Contractor's option).
e Insert here any amendments or modification adopted if different from that stated in Clause 57.
f If there is any requirement that the Engineer has to obtain prior approval from the Employer before he can act full particulars of such requirements must be set out above.
g Delete one as appropriate.

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3.3.2 Appendix Part 2

(To be completed by Contractor)

1. Insurance Policy Excesses (Clause 25(2))

   Insurance of the Investigation (Clause 21(1)) £……

   Third party (property damage) (Clause 23(1)) £……

2. Time for completion calculated from the Commencement Date (Clause 43**) (if not completed in Part 1 of the Appendix)**

Sections of the Investigation (Clause 1(1) (y)) (as detailed in Part I of the Appendix)

Section A the whole of the Site Operations…….. ……..weeks

Section B …… ……..weeks

Section C …… ……..weeks

Section D …… ……..weeks

the Remainder of the Investigation ……..weeks

3. Vesting of materials not on site (Clauses 54(4) and 60(1)(c)) (at the option of the Contractor --- see [d] in Part 1)

1 …… 4 ……

2 …… 5 ……

3 …… 6 ……

4. Sub-Contractors to be used by the Contractor (Clause 4(3))

……

……

5. Percentage(s) for adjustment of PC sums (Clauses 59(5)(c)) (with details if required)

……

……

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3.3.3 Form of Agreement

THIS AGREEMENT made the ……day of …… 20…….

BETWEEN **London Resort Company Holdings Limited**

of 7th Floor, 20 Berkeley Square, London, W1J 6EQ.

in the County of …… (hereinafter called "the Employer")

and ……

of ……

in the County of …… (hereinafter called "the Contractor").

WHEREAS the Employer is desirous that certain Investigations should be carried out in connection with:

London Resort

and has accepted a Tender by the Contractor for the carrying out of the Investigation. In accordance with the Employer's letter of award dated ……and subject to appropriate measurement of the final quantities in accordance with the Conditions of Contract, Specification and Bill of Quantities, the Contract Sum for the works as stated above is:

In words……

In figures……

NOW THIS AGREEMENT WITNESSETH as follows

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, namely

    a) the said Tender and the written acceptance thereof (including the Form of Tender, Appendix Part 1 and Appendix Part 2).
    b) the Drawings (as outlined in S1.7)
    c) the Conditions of Contract (Including amendments in Section 2: Conditions of Contract)
    d) the Specification as in the Contract Documents
    e) the priced Bill of Quantities, including amendments, additions and omissions to the scope as detailed in the Contract Documents.

3. In consideration of the payments to be made by the Employer to the Contractor as hereinafter mentioned the Contractor hereby covenants with the Employer to carry out the Investigation in conformity in all respects with the provisions of the Contract.

4. The Employer hereby covenants to pay to the Contractor in consideration of the carrying out of the Investigation the Contract Price at the times and in the manner prescribed by the Contract.

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IN WITNESS whereof the parties hereto have caused this Agreement to be executed the day and year first above written.

[*SIGNED on behalf of the said …… ……Ltd/plc (the Employer)

*SIGNED on behalf of the said ……Ltd/plc (the Contractor)]

[*or if Agreement required under Deed:

SIGNED [and SEALED*] AS A DEED by the said ……

…… Ltd/plc (the Employer)

In the presence of ……

SIGNED [and SEALED*] AS A DEED by the said ……

…… Ltd/plc (the Contractor)

In the presence of ……]

* Delete as appropriate

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4 Schedules

4.1 Specification

The specification shall be the UK Specification for Ground Investigation by the Site Investigation Steering Group (SISG) Specification published by ICE Publishing 2012 with information, amendments and additions as described in the Schedules.

The following schedules are included in this specification:

Table 4-1: List of Schedules included in this Specification.

Schedule	Name	Status/Comment
S1.1 to S1.8	Information and site specific requirements	**Included**
S1.9	Percussion Boring (Specification Section 4) Particular restrictions / relaxations	**Included**
S.10	Rotary Drilling (Specification Section 5) Particular restrictions / relaxations	**Included**
S1.11	Pitting and trenching (Specification Section 6) Particular restrictions / relaxations	**Included**
S1.12	Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions / relaxations	**Included**
S1.13	Probing and cone penetration testing (Specification Section 8) Particular restrictions/ relaxations	**Included**
~~S1.14~~	~~Geophysical testing (Specification Section 9) Particular restrictions/relaxations~~	Not Used
S1.15	In situ testing (Specification Section 10) Particular restrictions/relaxations	**Included**
S1.16	Instrumentation (Section 11) Particular restrictions/relaxations	**Included**
S1.17	Installation monitoring and sampling (Specification Section 12) Particular restrictions/relaxations	**Included**
S1.18	Daily records (Specification Section 13)	**Included**
S1.19	Geotechnical laboratory testing (Specification Section 14)	**Included**
S1.20	Geoenvironmental laboratory testing (Specification Section 15) Particular restrictions/relaxations	**Included**
S1.21	Reporting (Specification Section 16) Particular restrictions/relaxations	**Included**
S2	Exploratory Holes	**Included**
S3	Investigation Supervisor's Facilities	**Included**
~~S4~~	~~Specification Amendments~~	Not Used
~~S5~~	~~Specification Additions~~	Not Used

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SCHEDULE 1: Information and site specific requirements

S1.1 Name of Contract

London Resort Phase 1 Ground Investigation

S1.2 Investigation Supervisor

The Investigation Supervisor is:

Buro Happold Ltd.

17 Newman Street,

London,

W1T 1PD

Tel: 020 7927 9700

S1.3 Description of site

The site is located on the Swanscombe Peninsula, Kent, on the south bank of the River Thames, and is approximately centred on National Grid Reference TQ 60657 76055. To facilitate assessment, the site is divided into five zones based on location, land use patterns and current ownership provided (Figure 4-1) and briefly described in

Table 4-2 overleaf.

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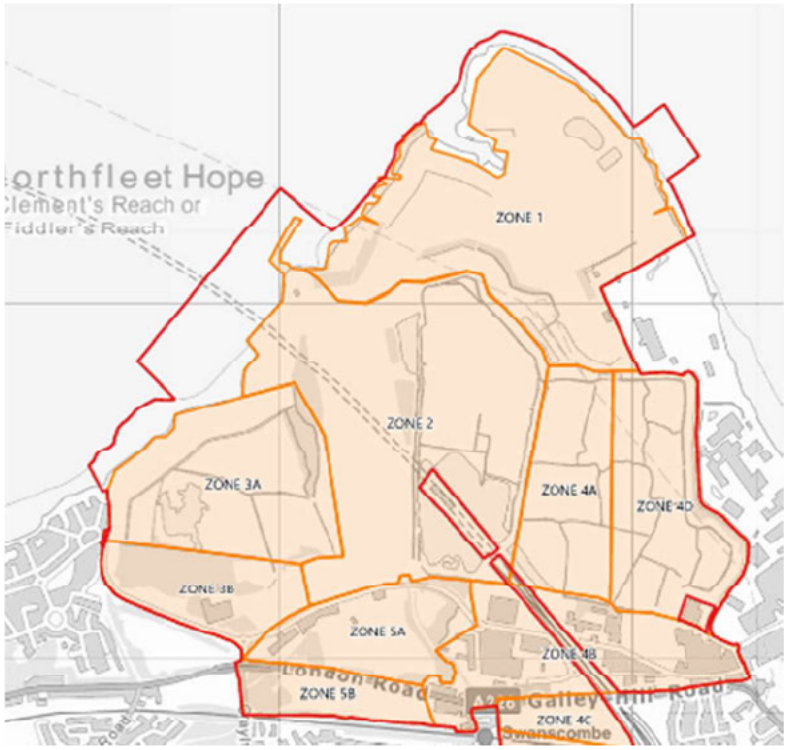

Figure 4-1. The Site Zones

Table 4-2 Site summary Description

Zone	Area	Description
Zone 1	48ha	Broadness Marsh. Forms the northernmost part of the Swanscombe Peninsula. River Thames adjacent to the north, north-west and north-east. Of undulating topography due to the historical infilling of Cement Kiln Dust (CKD). Generally covered with scrub vegetation.
Zone 2	54ha	North-western section of Swanscombe Peninsula. Highly varying topography due to presence of licensed CKD landfills. Vegetated with shrubs and trees.
Zone 3	35ha	Western part of the Peninsula east of Ingress Park residential development. Northern part (Zone 3A) is Blackduck Marsh. Zone 3B to the south comprises a more developed area with light commercial / industrial uses.
Zone 4	41ha	Eastern part of the Peninsula. Zones 4A and 4D currently marshland. Zone 4B is dissected by HS1 and is occupied by a series of industrial/commercial units, (Northfleet Industrial Estate, Kent Kraft Industrial Estate and eastern part of Manor Way Business Park).
Zone 5	18ha	Located in middle of the Peninsula immediately north of North Kent Line railway and west of HS1. Northern half (Zone 5A) includes the western part of Manor Way Business Park. Southern part (Zone 5B) is an open area part in-filled former chalk quarry (Craylands Lane Pit).

This specification should be read in conjunction with the Buro Happold Ground Investigation Scoping report (Ref: 047730-BHE-XX-XX-RP-CG-0009) which will be provided to tenderers.

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S1.4 Main works proposed and purpose of this contract

This programme of ground investigation is targeted to both the built elements of the Resort and also to other particular areas of the site (e.g. areas of particular constraint or sensitivity – such as landfills, chalk spines and areas of particular ecological and archaeological interest). The investigations therefore have combined geotechnical, geoenvironmental, ecological and archaeological objectives and will include a suitable number of exploratory holes to appropriate depths and with adequate sampling / testing and duration / frequency of monitoring to enable the characterisation of soils, rocks and the groundwater, surface water and ground gas regimes. The ground investigation will include measures appropriate to mitigate the potential health, safety and hygiene risks associated with ground contamination, including unexploded ordnance (UXO).

The combined objectives of the ground investigation are to:

- Determine the stratigraphy & groundwater regime and associated geotechnical parameters to inform the geotechnical design of retaining walls and foundations to support the proposed development.
- Determine the presence and nature of the Made Ground/Alluvial Deposits (including peat and former land surfaces) /River Terrace Deposits and the London Clay and Upper Chalk to inform their behaviour towards the loading/unloading.
- Determine the strength and stiffness parameters of the superficial deposits, London Clay and Upper Chalk.
- Determine the elevation of the perched water table within the superficial deposits.
- To determine the potential for infiltration drainage at relevant locations
- Determine the pore water pressure distribution within the London Clay and Chalk
- Identify the potential location, nature and extent of contamination within the Made Ground (including its waste characterisation and potential for re-use) and groundwater.
- Define the ground gas regime and enable assessment of potential risks associated with hazardous gases.
- Identify particular below ground obstructions and infrastructure (e.g. shallow foundations, pile caps, ground bearing slabs, basements etc.)
- Assess the geoarchaeological and archaeological significance of deposits
- To define the presence, location and nature of soils/ strata at locations of existing flood defences
- To define the presence, location and nature of soils/ strata at locations of new earth embankment flood defences
- To determine the condition of existing river walls (in vicinity of jetty) and suitability for use during construction
- To define the physical characteristics and geotechnical parameters of these strata sufficient to inform suitability / design.

S1.5 Scope of Investigation

This scope of investigation should be read in conjunction with Schedule 1 within the Buro Happold Ground Investigation Scoping report (Ref: 047730-BHE-XX-XX-RP-CG-0009). The following scope of works is proposed for the scheme:

- 24no. cable percussion boreholes to depths between 10 and 50m bgl (labelled WS on plan and schedule);
- 46no. cable percussion boreholes with rotary follow on to depths between 25 and 75m bgl;
- 77no. windowless samples to depths of 5m bgl;
- 95no. trial pits to 4m bgl;
- 22no. static cone penetration tests using piezocones with dissipation testing to depths of up to 20m bgl to confirm ground conditions;

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- Geotechnical sampling and subsequent classification and strength testing;
- Geo-environmental sampling and testing;
- Soil infiltration testing;
- 50no. standpipes/standpipe piezometers installed in 50 boreholes to determine the elevation of the water table(s) and for groundwater sampling;
- 70no. piezometers installed in all CP boreholes to determine the pore water pressure distribution within the Alluvium/Sands and Gravels and Chalk;
- 40no. gas standpipe installed at shallow depth in each 5m cable percussive borehole (labelled WS);
- Groundwater level and gas monitoring during site work;
- Permeability testing in standpipe/standpipe piezometers;
- 3 rounds of groundwater sampling from standpipe/standpipe piezometers for chemical testing; and
- 6 return visits for groundwater level and gas monitoring following completion of site work at approximate weekly intervals.

S1.6 Geology and Ground Conditions

The following general assumptions of the geology of the site and ground conditions has been inferred from the available information. No assurance is given to its accuracy.

Table 4-3: Anticipated Geology and Ground Conditions

Stratum	Description	Observed Stratigraphy	
		Elevation of Top of Stratum (m OD)	Stratum Thickness (m)
Made Ground	Landfill comprising variable cement kiln dust, clayey gravel, and cobble-sized brick and concrete fragments	+12.5 to +0.0	7.5 to 17.5
Alluvium	Variable soft to firm clay and soft amorphous peat	+6.0 to -5.0	5.0 to 15.0
River Terrace Deposits	Medium dense sandy gravel	-10.0 to -15.0	1.0 to 7.5
Upper Chalk	Chalk with flints	-16.0 to -20	Not proven

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S1.7 Schedule of drawing(s) and documents

The Figures and Drawings list in the Table 4-5respectively are available in Appendix A of this specification. The documents listed in Table 4-5 are available from the "Box" FTP Site. A link will be provided upon request.

Table 4-4: List of Drawings/Figures

Figure/Drawing Number	Title
Figure 1	Site Location Plan
Figure 2	Proposed Exploratory Hole Location Plan
Figure 3	GPR Survey
Figure 4	Schematic Drawing of a Standpipe Installation
Figure 5	Schematic Drawing of a Standpipe Piezometer Installation
Figure 6	Schematic Drawing of a Ground Gas Monitoring Installation

Table 4-5: List of relevant documents

Document reference	Title
047730-BHE-XX-XX-RP-CG-0009	Buro Happold Ground Investigation Scoping Report, date April 2021
0042936-BHE-XX-XX-RP-YG-0009	Buro Happold Desk Study Report entitled London Resort, Desk Study – Kent Project Site (Swanscombe Peninsula) dated November 2020.
30766, Revision B	Geotechnical Engineering Limited entitled London Paramount Entertainment Resort, Factual Report on Ground Investigation, dated January 2016
5134008/Phase 1/FinalRev3.0	Atkins Desk Study Report entitled Paramount Park Entertainment Resort, Phase 1 Geo-Environmental and Geotechnical Risk Assessment, dated December 2014

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

S1.8.1 Quality management system (Clause 3.3 and 3.14.3)

All work shall be carried out in accordance with relevant quality management systems in the fieldwork, laboratory testing and reporting (BS EN ISO, UKAS/NAMAS and MCERTS).

All boring and drilling operatives, including Lead Drillers and Drillers (Drilling Support Operatives), employed on the contract shall hold an NVQ in Land Drilling and hold a valid and current audit card of competence, for example as issued by the British Drilling Association Ltd or an equivalent body in a State of the European Union. This shall be applicable to the work and specific drilling operation on which they are engaged. They shall also hold a CSCS blue skilled Land Drilling card.

The Contractor shall give written instructions to the site staff on all relevant aspects in the Specification such as sampling frequency, groundwater records and the procedure required for dealing with obstructions

S1.8.2 Professional Attendance (Clauses 3.5.1 and 3.5.2)

The Contractor shall provide sufficient site management and superintendence and Professional Attendance to perform those tasks detailed in Specification Notes for Guidance 3.5.1 and 3.5.2 respectively which are relevant to this investigation. The Contractor shall detail in the tender the number, names and experience (and include detailed career CVs) of all the proposed staff. The Contractor shall include an estimate of the length of time each grade of technical

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staff will attend site. Time spent in preparing the Factual Report or other office tasks shall be included in the rates of those items. The Investigation Supervisor may accept or reject staff proposed at this time or later in the Contract or request that the Contractor provide additional or fewer technical staff.

The Contractor shall ensure that the site management and superintendence staff be contactable on a mobile phone at all times during the working day, and shall report at an agreed time each day if the Investigation Supervisor has not been on site.

The Specification for the on-site management (Clause 3.5.1) and technical staff (Clause 3.5.2) shall be as follows:

Site Contract Manager - The Contractor shall provide a full-time Site Manager who will be responsible for the overall day to day running of the site including obtaining the necessary permits, record keeping, HSE requirements and programming and liaising with the Investigation Supervisor in these matters. The Site Manager will have overall responsibility of the Health and Safety matters of the site, and ensure that all aspects of the running of the site are being completed in accordance with the Specification. The costs of the Site Manager and any administrative assistance will be provided within the overhead costs of the works and not as a specific Bill Item. The Site Manager should have a minimum of 5 years of relevant experience.

Technical Supervisor - The Contractor shall appoint an Experienced Ground Engineer as full-time Technical Supervisor who shall have overall responsibility of the technical output of the investigation. This person will be expected to lead the onsite Quality Assurance procedures and will have a lead role in the preparation of subsequent factual report. It is envisaged that this person will perform regular logging and check logging of the recovered samples, core and excavated trial pits, on-site review of any sub-contractor works and have input to the Quality Assurance of the site in-situ testing, monitoring installations construction/reading, laboratory testing and reporting. The Technical Supervisor should have a minimum of 5 years of relevant experience.

The Site Manager or the Technical Supervisor must be on site at all times during the site works. The role of Site Manager and Technical Supervisor may be combined, if the Contractor deems that this is required.

Geotechnical Engineers/Engineering Geologists - The Contractor shall provide suitably qualified and experienced engineering geologists and / or geotechnical engineers (Ground Engineer) to supervise the geotechnical investigations and undertake the required geotechnical logging on the site and subsequent factual reporting. The geotechnical engineers/engineering geologists shall have a minimum of 3 years of relevant experience on major projects.

Geotechnical/Geo-Environmental Monitoring Technicians - The Contractor shall provide suitably qualified and experienced monitoring technicians to undertake the required geotechnical and geo-environmental monitoring of new and existing borehole installations and subsequent factual reporting. The monitoring technician shall have a minimum of 3 years of relevant experience. The role of Geotechnical Engineer and Monitoring Technician may be combined, if the Contractor deems that this is required.

S1.8.4 Hazardous ground, land affected by contamination and notifiable and invasive weeds (Clauses 3.7.1 and 3.22)

The Contractor shall be required to make his own judgement as to the contamination status of the site for protection of workers, the general public and surrounding environment.

The site is given a preliminary RED classification owing to its historical use and the recorded presence of contamination of soils and groundwater.

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The results of the current UXO risk assessments have indicated that there are potential risks related to UXO on the Site. These risks can be mitigated by one or a number from a range of measures as appropriate, that will reflect both the location and the nature and extent of the below ground works. This range of measures includes:

- The preparation of a ground investigation operational UXO risk management plan
- UXO safety and awareness briefing for all personnel involved in below ground works;
- The availability/ presence of an "on call" explosive ordnance disposal (EOD) engineer Information requirements
- Magnetometer survey ahead of intrusive boreholes to a depth of 14m (estimated maximum bomb penetration depth).

The Contractor shall ensure that all equipment is free from flora and fauna before being brought onto or removed from the site. The same checks must be made when transferring any equipment from one area to another. No other notifiable and invasive plant species (as defined by the Wildlife and Countryside Act, 1981) or their relevant exclusion zones are known to be present at the time of writing this Specification. If identified within the working area by the Contractor during the course of the works, their presence of these plants shall be notified immediately to the Investigation Supervisor.

S1.8.5 Additional information on services not shown on Contract drawings (Clauses 3.7.2 and 3.8.3)

Available service information is included (see Figure 3). Local services and service connections may also be present at the site. It is the responsibility of the contractor to ensure that they have collated all available service information and that no known services exist beneath exploratory hole locations.

The Contractor is expected to take reasonable measures to ensure that damage to underground and overhead services do not occur during the ground investigation. Such measures will include but not be limited to:

- A hand dug inspection pit to 1.20m bgl before commencing borehole from ground level.
- The scanning of every exploratory hole position with a Cable Avoidance Tool (CAT) or Ground Penetrating Radar (GPR) as deemed necessary.
- A visual check of each exploratory hole location to ensure that it is of sufficient distance from any overhead cables.

S1.8.6 Known/suspected mine workings, mineral extractions etc. (Clause 3.7.3)

Historical land use records the site to have been quarried for Chalk at numerous locations across the site. Refer to document 0042936-BHE-XX-XX-RP-YG-0009.

S1.8.7 Protected Species (Clause 3.7.4)

The Contractor is to ensure that no harm comes to any flora or fauna. The exception is necessary clearance of flora for access to complete the works as shall be agreed between the Contractor and the Investigation Supervisor.

S1.8.8 Archaeological remains (Clause 3.7.5)

Due to the various historical and current land use on site the chances of encountering Archaeological remains are medium risk. Should Archaeological remains be encountered during the investigation that all work should stop in this area of the site and the contractor inform the consultant engineers.

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S1.8.9 Security of site (Clause 3.11)

Once an exploratory hole has commenced, it shall be completed continuously and without undue delay. Leaving exploratory holes open overnight should be avoided where possible, and should not occur without confirmation from the Investigation Supervisor. Any exploratory hole remaining open overnight shall be adequately temporarily protected and covered in a safe manner to ensure no risks to site visitors.

Security on the site, including all offices, stores, plant, equipment, exploratory holes etc., is the responsibility of the Contractor; this includes but is not limited to theft and vandalism. The Contactor shall provide temporary clean, steel non-mesh fencing/hoarding around his individual working areas. As a minimum, all individual worksites shall be kept secure at all times.

S1.8.10 Traffic management measures (Clause 3.12)

As Clause 3.12 access routes must be safely maintained at all times. Access routes are defined in S1.8.20. The Contractor shall be responsible for all liaisons with the local authority highways department, and other site users and shall obtain all required consents and permits and shall provide all necessary traffic management measures.

S1.8.11 Restricted working hours (Clause 3.13)

The working hours are to be 08:00am to 17:00pm weekdays. Work outside these hours and work on Saturdays may take place only with the prior agreement of the Employer and Investigation Supervisor.

S1.8.12 Trainee site operatives (Clause 3.14.1)

Trainee operatives may be employed provided that they are adequately supervised by suitably trained/qualified Contractor's staff.

S1.8.13 Contamination avoidance and/or aquifer protection measures required (Clauses 3.15.2 and 3.15.3)

To minimise contamination the Contractor shall provide spill kits (minimum 1 per drill rig/excavator /other plant) and train personnel in their use. Drip trays shall be located beneath any static plant, such as generators, hydraulic power packs etc. Any contamination shall be contained and reported to the Investigation Supervisor immediately. Ground protection sheets shall be used at each exploratory hole location to prevent cross contamination.

All drilling and excavation plant and equipment should be clean and jet-washed before commencing an exploratory hole to avoid cross-contamination. The Contractor should take all reasonable precautions to minimise the risk of causing the migration of contaminants, the contamination of groundwater or the creation of pollution pathways. The Environment Agency, and the Investigation Supervisor shall be informed if there is a risk of drilling through contaminated ground into the Chalk aquifer, and the Contractor should comply with any special mitigation measures that they require.

The Contractor shall be responsible for disposal of excess material in accordance with waste management regulations and schedule S5.9 of this specification. The Contractor shall supply their chain of custody records for the disposal of all materials off site as part of their factual report.

If any signs (visual and/or olfactory) of significant contamination are encountered, particularly Non-Aqueous Phase Liquid (NAPL), the Contractor shall inform the Investigation Supervisor immediately.

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The Contractor shall provide details of the drilling method in his method statement. Aquifer protection measures are required where boreholes penetrate into the Upper Chalk Formation - Principal Aquifer.

S1.8.14 Maximum period for boring, pitting or trenching through hard material, hard stratum or obstruction (Clauses 2.8, 4.3 and 6.4)

The maximum period for boring or pitting through a hard stratum, hard material or an obstruction shall be 1 hour for boring and 0.5hr for pitting. After this time the Contractor should seek further instructions from the Investigation Supervisor.

S1.8.15 Reinstatement requirements (Clause 3.16)

The condition of each individual work site/exploratory hole location should be agreed by the Contractor and Investigation Supervisor using a photographic record prior to and subsequent to the work to ensure the any damage resulting from the work is made good to a condition similar to that observed prior to commencement of the site works.

In bituminous/concrete public hardstanding or highways areas (e.g. roads, car parking spaces, pavements, etc.), reinstatement shall take place in accordance with the New Roads and Streetworks Act (NRSWA) 1991 and HAUC SWP 163 Specification for Reinstatement of Openings in Highways, as agreed by the Contractor with the Local Authority.

S1.8.16 Hygiene facilities required (Clauses 2.20 and 3.16.1)

Suitable welfare facilities, including a place to consume food from the live work environment, toilet, washing and changing facilities with a supply of warm washing water as a minimum shall be available to all personnel. Further measures may become necessary if significant or anomalous contamination is encountered, as indicated in S1.8.4. If any part of the site is reclassified as RED, the Contractor will be required to provide a Decontamination Unit for that part of the site. The facilities provided for all investigations must meet the minimum requirements set by the Health and Safety Executive (HSE) and CDM 2015.

S1.8.17 Unavoidable damage to be reinstated by Contractor (Clause 3.16.1)

Unavoidable damage caused by the Contractor shall be reinstated unless otherwise instructed by the Investigation Supervisor.

S1.8.18 Accuracy of exploratory hole locations (Clauses 3.19 and 3.20)

Due to the logistics of the site the attached plan shows indicative locations and these are to be cleared for services and set out (in agreement with the Investigation Supervisor). Special consideration is required in case of exploratory holes that are located in close proximity to the HS1 tunnel and exclusion zones. The locations are therefore flexible to a reasonable extent to ensure that the objectives of the SI are met. All locations should be agreed on site with the Investigation Supervisor on the first day of works.

The Contractor shall determine the as built co-ordinates of the exploratory hole to an accuracy of 0.1m horizontally and 10mm in elevation. The accuracy of the exploratory hole locations shall be +/-75mm in plan & 1:75 vertically. The Contractor shall survey the top of all exploratory locations using Ordnance Survey (OS) benchmark. OS datum used shall be Newlyn.

The Contractor shall determine the coordinates of all exploratory holes with reference to the UK OS National Grid. In the case of trial pits the Contractor shall survey opposite corners and reference these on the exploratory hole location plan. The Contractor shall ensure that measurements of features or services within trial pits are tied into the survey.

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S1.8.19 Photography requirements (Clause 3.25)

The Contractor shall take colour photographs of all samples and triaxial samples (before and after testing), split cores in the laboratory and of at least one representative side and the spoil heap of all trial or observation pits. In addition, the Contractor shall take photographs of potential reinstatement, damage and safety issues.

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S1.8.20 Notice of entry and Access routes (Clauses 3.9 and 3.10)

The Employer will obtain permissions for the Contractor to enter private land and carry out the required investigations. The Contractor shall notify landowners, occupiers and/or tenants of their planned occupation of a site/ or part thereof, agree detailed access arrangements and ensure that all works are carried out to the satisfaction of the landowner. Any outstanding issues should be referred to the Investigation Supervisor as soon as they are known.

S1.8.21 Logging of exploratory holes (Clause 3.2)

All logging shall be carried out in accordance Clause 3.2 and in particular EC7 and derivative standards. The following details are to be included:

- Description and classification of chalk given by Lord, J.A., Clayton, C.R.I. & Mortimore R.N., (2002) "Engineering in Chalk" CIRIA Publication C574, CIRIA, London, pp91-94.

When a detailed fracture log is required the form of presentation shall accord with Figure 3 of the Geological Society Working Party Report: Anon (1970), The logging of rock cores for engineering purposes, Q. J. Eng. Geol., Special Publication 3. All fractures shall be explicitly identified by reference to dip, tightness/infill, roughness and spacing.

Selected UT100 and U100 of cohesive materials or chalk that are not required for testing shall be split and photographed prior to describing.

Contractor engineer's logs will contain details of any visual and/or olfactory evidence of contamination in accordance with BS 10175:2001.

S1.8.22 Anomalous conditions (Clause 3.23)

Where anomalous or unexpected features are revealed during the site works (such as underground obstructions, visual or olfactory evidence of significant contamination, artesian water pressures etc.), the Contractor shall immediately inform the Investigation Supervisor.

S1.8.23 Disposal of Arisings (Clause 3.26)

The Contractor will be required to produce and maintain a SWMP for the Ground Investigation Contract. The contractor shall be responsible for removal and correct disposal of all excess materials and arisings (in accordance with WM3). It is recommended that arisings are removed from site daily awaiting proper disposal due to access restrictions.

S1.8.24 Complaints and interaction with the local community and/ or site users (Clause 3.17)

The Contractor shall maintain a record of all complaints received regarding the Site Operations, and shall promptly notify the Investigation Supervisor of any such complaints. The Contractor shall take all necessary measures to prevent damage loss injury or nuisance caused by:

1) Mud dirt stones or other material used or generated whilst carrying out the Investigation. This shall include but not be limited to ensuring that no fuel or lubricant mud dirt stones or other material is spilled or deposited on the highway, railway or pathway whether or not it is open to traffic.
2) Smoke or dust generated whilst carrying out the Investigation.

S1.8.25 British Standards and equivalent (Clause 3.2)

At tender time, the Contractor shall indicate which standards he will be following during the course of the works, particularly those associated with the implementation of BS EN 1997, BS EN or BS EN ISOs.

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S1.8.26 Risk assessments and method statements

(1) All method statements shall be submitted to the Investigation Supervisor for review and approval. The period for approval by the Investigation Supervisor is two weeks.

(2) Method statements will be required for the following activities as appropriate to the particular work package:

a. Erection and dismantling of hoarding at exploratory hole locations

b. Excavations including inspection pits, observational trenches etc.

c. Reinstatement of excavations

d. Cable percussion boring

e. Rotary drilling

f. Static cone penetration test

g. In-situ testing

h. Installation of piezometers (including grouting)

i. Sampling of ground water

j. Core preparation, sampling, photography and logging

k. Transportation of samples

l. Ground water and gas monitoring

m. UXO mitigation

n. Other activities required as part of the particular work package

(3) A site specific risk assessment based on the available information concerning the site, taking into account the nature of all works proposed and any issues arising from the site walkover.

S1.9 Percussion Boring (Specification Section 4) Particular restrictions / relaxations

S1.9.1 Permitted methods and restrictions (Clauses 4.1 to 4.2)

Boring shall normally be carried out using a cable percussion rig and attachments, where permitted by the Engineer, such as shells, clay cutters or corers, augers, chisels and sinker bars. The minimum diameter of borings or internal diameter of casing shall be 150mm. The Contractor shall be responsible for selecting the appropriate diameter casing at the start of boring/drilling to account for any necessary reduction in casing size to achieve the minimum diameter required at the base of the borehole.

The Contractor shall be responsible for selecting the appropriate diameter casing at the start of boring/drilling to account for any necessary reduction in casing size to achieve the minimum diameter required at the base of the borehole.

Clay Cutters - Clay cutters shall be of a pattern approved by the Engineer and shall not be used for advancing boring in soft alluvial soils with an undrained shear strength of less than 40kN/m^2.

Shell and Casing - Care shall be taken at all times to avoid disturbing or loosening of the soil or loss of ground. When using a shell and casing in order to keep disturbance of the ground to a minimum, the Contractor shall operate the

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equipment in such a way as to allow the shell to proceed before the casing only the minimum distance necessary to advance the boring. The casing shall not be advanced by reciprocating action of the cable, but by driving, rotation or self-weight. In ground where even the careful withdrawal of close fitting shells causes ingress of soil into the borehole, the Contractor shall not only maintain a positive head of water, but shall also use a shell of diameter at least 25mm less than that of the borehole.

Where soft alluvial clays and silts or saturated sands are encountered, a head of water shall be maintained in the borehole during drilling equal to the piezometric pressure in the stratum. The addition of water shall be noted on the driller's logs and on the final engineer's logs.

S1.9.2 Backfilling (Clause 4.5)

Boreholes shall not be backfilled without prior approval of the Investigation Supervisor. Holes without monitoring installations shall be grouted with cement/bentonite grout or bentonite pellets on completion as directed by the Investigation Supervisor.

S1.9.3 Dynamic Sampling (Clause 4.6)

Not applicable.

S1.9.5 Obstructions

The Contractor shall inform the Investigation Supervisor immediately if any difficulty in achieving the required depths of investigation is experienced. Notification shall be made prior to leaving the exploratory hole location and works shall not recommence until instructions are received from the Investigation Supervisor.

S1.10 Rotary Drilling (Specification Section 5) Particular restrictions / relaxations

S1.10.1 Augering requirements and restrictions (Clause 5.1)

Not applicable.

S1.10.2 Particular rotary drilling techniques (Clause 5.2)

In 46no. boreholes the rotary core drilling shall be carried out from the base of specified cable percussion boreholes. The Contractor shall allow for leaving casings in the ground to seal groundwater and maintain stability on completion of the cable percussion borehole and removing them on completion of the rotary borehole. The Contractor may request the permission of the Investigation Supervisor to install required instrumentation or backfill a cable percussion borehole with cement-bentonite grout or pellets and drill the rotary hole open hole to the depth of the cable percussion borehole. In this case, the backfilling of the cable percussion borehole and the open hole drilling will be at his own cost (i.e. there will be no additional costs than that of the single hole).

Rotary drilling shall normally be carried out with diamond or tungsten carbide tipped bits. All bits, core barrels and casing shall normally conform to BS4019: Part 3 or Part 4. Other equipment shall only be used with the approval of the Investigation Supervisor.

S1.10.3 Drilling fluid type and collection (Clause 5.3)

Air mist or alternative drilling fluids that maintain the in situ moisture content as much as possible should be adopted. As Clause 5.3. In addition, records on the flush, returns and core losses shall be made during the drilling works and noted both on the driller's logs and on the final logs.

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S1.10.4 Rotary core drilling equipment, core diameter and drill runs (Clauses 5.4.1, 5.4.2 and 5.4.3)

The equipment used shall be a core drilling system incorporating triple tube core barrels in which the innermost barrel comprises a one piece cylindrical semi-rigid plastic liner of minimum 1mm wall thickness. The equipment shall be capable of providing cores of at least 100 mm diameter of Class 1 standard in accordance with EC7 requirements. The minimum core diameter is to be met after the sub-sampling procedure has been followed (See S1.10.6).

Rotary core drilling shall produce continuous cylindrical cores within the London Clay and the Chalk strata of at least 100 mm diameter throughout the length of each core run. Drill runs shall not exceed 1.5 m in length in any deposit unless approved by the Investigation Supervisor. The core barrel shall be removed from the drill holes as often as may be required in order to get the best possible core recovery.

A minimum core recovery of 95% is expected. The Contractor is required to make every endeavour to achieve this, adjusting the drilling technique as appropriate e.g. using a different drill bit, changing the flushing medium, increasing/decreasing rate of rotation and penetration etc. If these adjustments fail to consistently achieve in excess of 95% core recovery the Investigation Supervisor shall be informed and any revised procedures agreed upon. Failure to address any issue of inadequate core recovery whilst on site could result in payment not being made and a potential requirement to re-drill.

Standard penetration tests (SPT) should be carried out the end of each core run where the total core recovery in that run is less than 85%.

All equipment brought onto site shall be in good working condition, have adequate power to undertake all the work given in this Specification, and properly maintained throughout the Contract. All equipment shall arrive on site in a clean condition and no standing time shall be charged to the contract as a result of the requirement to clean the equipment prior to commencing works.

S1.10.5 Core logging (Clause 5.4.6)

Selected core shall be photographed and sub sampled on site immediately on completion of each drill run for the rotary coring.

The recovered core shall be removed from the core barrel and treated as described below:

- Slightly angle the core liner to allow water from the drilling process to drain from the liner. Split the core liner immediately following draining.
- Wipe or scrape off all drilling fluid and debris from the core (to a depth of up to 5mm).
- Attach a label to the core. Mark the top and bottom of the core on the label or, if possible, on the core itself.
- Take a full colour photograph of the exposed core in accordance with Clause 5.8 of the Specification.
- Identify suitable core sub samples of nominal length 400mm, and at a frequency of one per 2 metre length of core or as otherwise instructed by the Investigation Supervisor. The sub samples shall be carefully wiped or scraped to remove all drilling fluid and debris.
- Attach a label to the sub sample. Mark the top and bottom of the sample on the label or, if possible, on the sample itself.

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- Wrap the sub sample in cling film, or similar approved material to retain moisture. This should be undertaken to ensure that as little air as possible is trapped between the sub sample and the wrapping. The completed wrapping should be both air and moisture tight.
- Wrap the sub sample in aluminium foil with the shiny side outwards to protect the sub sample from heat.
- Wrap the sub sample in hessian, muslin cloth or similar approved material to provide an adequate bond for the wax.
- Cover the sub sample in wax by either dipping the sub sample directly into the wax or applying with a paintbrush. The temperature of the wax should be in the range 60 to 70 degrees Celsius to ensure that the sub sample is not damaged.
- Place a label on the outer surface of the sub sample held in place with wax and/or heavy-duty tape. As for above the label should indicate the top and bottom of the sub sample.
- In granular soils, where an intact core sub sample cannot be obtained, the core sub sample should be placed and sealed in a plastic bag as a bulk sample.

The purpose of this treatment is to ensure that the natural moisture content of the sub sample is maintained. The wrapped sub samples shall be treated with care and adequately protected during transport to avoid any disturbance.

Where rotary coring is used to recover Class 1 samples of cohesive materials, the drilling fluid and technique used is to have a minimal impact on natural moisture content. Any excessive wetting or drying of the samples will result in payment not normally being made and a potential requirement to re-drill.

S1.10.12 Backfilling (Clause 5.7)

Boreholes shall not be backfilled without prior approval of the Investigation Supervisor. Holes without monitoring installations shall be grouted with cement/bentonite grout or bentonite pellets on completion as directed by the Investigation Supervisor.

S1.10.13 Core photographic requirements (Clauses 5.4.6 and 5.8)

Core and core sub sample photographs are required. Prior to wrapping each core sub sample, a photograph shall be taken of it length ways and of each end.

The core photograph images shall be made available to the Investigation Supervisor on site for inspection and shall be provided with the preliminary logs.

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S1.11 Pitting and trenching (Specification Section 6) Particular restrictions / relaxations

Contract specific restrictions/relaxations, are detailed in the following schedules. Information should be obtained without personnel entering the pit. Pits are classified as confined spaces and personnel entering pits will require appropriate training.

S1.11.1 Indirect detection of buried services and inspection pits (Clauses 3.8.3 and 6.1)

A hand dug inspection pit (to a minimum depth of 1.2m bgl) shall be excavated before commencing borehole from ground level and any trial pit/observation trench. In addition, the position of every exploratory hole shall be scanned with a Cable Avoidance Tool (CAT) and Genny (in accordance with HSG47, 3rd Edition, 2014) (and Ground Probing Radar if deemed necessary).

The Contractor should be prepared and state within their Method Statement submission if obstructions are encountered within the Made Ground how they plan to break through or pass these anomalies, safely. Trial pits and observation trenches shall be excavated under the supervision of and logged by a suitably qualified and experienced geotechnical / geo-environmental specialist. Trial pits and observation trenches shall be backfilled with arisings, compacted and the surface reinstated to Investigation Supervisors satisfaction.

S1.11.2 Restrictions on plant or pitting / trenching methods (Clause 6.2 and 6.3)

Foundation observational trenches are to be excavated either by machine excavator as deemed appropriate by the Contractor. A machine excavator appropriate to the site and the requirements for the trial pits should be chosen. A breaker is likely to be required in order to break out surface hardstanding and existing obstructions with the ground.

S1.11.3 Entry of personnel (Clause 6.5)

Entry will not be permitted into trial pits.

S1.11.4 Alternative pit and trench dimensions (Clause 6.7)

As Clause 6.7.

The dimensions of the observation trenches in plan are to be approximately 1m wide and up to 6m in length.

S1.11.5 Abstracted groundwater from land affected by contamination (Clause 6.9.2)

As Clause 6.9.2. As specified.

S1.11.6 Backfilling (Clause 6.10)

Pits shall not be backfilled without prior approval of the Investigation Supervisor. Upon completion of each pit or trench to the Investigation Supervisor's satisfaction, the pit is to be backfilled, using arisings. These shall be placed in even layers not exceeding 200mm in depth and well compacted to minimise the risk of subsequent surface settlement. The contractor shall make allowance to return to the site 1 month after completion of the works to rectify any additional settlement of the ground surface. Contaminated ground should not be used for backfilling.

S1.11.7 Photographic requirements (Clause 6.12)

Photographs of the trial pits and observation pits are required. At least one photograph shall be taken of each representative pit side, the plan view and any encountered features. Photographs should also be taken of the spoil heap.

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S1.11.10 Material arising

All soil arisings shall be placed on plastic sheeting and not on Natural Ground, in order to prevent contamination of clean areas. Separate stockpiles shall be formed for Made Ground and Natural Ground.

S1.11.11 Description

The Contractor shall ensure that fully dimensioned sketches are provided (both vertical and horizontal 1:1 scale), which shall include a plan (with orientation) and sections detailing the locations, depths and dimensions of features within each face of the observation trench and any services encountered within it. The locations of these sections shall be clearly identified on a plan and related to survey information (see Schedule S1.8.18). Trial Pits and Observation Trenches shall be excavated under the supervision of, and logged by, a suitably qualified and experienced specialist contractor.

S1.11.12 Excavation details of pits and trenches

90no. trial pits mechanically dug to a depth of 4.0m bgl. Each of these trial pits must be undertaken separately and completed and backfilled prior to the commencement of the next. Observation trenches are to be mechanically dug to a depth of 4.5m bgl and should be a minimum of 10m in length or as directed by an engineer if required to be greater than 10m. Each of the observation trenches shall be backfilled on approval of the Investigation Supervisor. The number of trenches are TBC.

Suitable temporary support should be provided to allow trial pits to be excavated to the required depths if directed by the engineer. Groundwater entry into the excavated pit or trench should be removed from the pit by a suitable pump. The Tenderer shall be responsible for identifying a suitable disposal method and/or storage point for the discharged water. Pits or trenches shall be excavated under the supervision of and logged by a suitably qualified and experienced specialist. If a proposed Trial Pit or Observation Trench location is blocked or there is limited space to excavate in proximity to the proposed location, the Contractor shall inform the Principal Contractor immediately to arrange access.

S1.12 Sampling and monitoring during intrusive investigation (Specification Section 7) Particular restrictions / relaxations

The sample size for geotechnical and contamination testing shall be commensurate with the range of analyses to be carried out.

S1.12.2 Retention and disposal of geotechnical samples (Clause 7.6.2)

As specified.

S1.12.3 Frequency of sampling for geotechnical purposes (Clause 7.6.3 to 7.6.11)

BOREHOLES (including dynamic (multi-purpose rig) sampling)

Inspection Pits

Depth	Sampling Frequency
• Existing ground level to bottom of inspection pit • Sampling shall start within 0.1m of existing ground level	• **Disturbed** samples shall be taken every **0.5m** or at every change of strata whichever is more frequent • A representative **bulk** disturbed sample shall be taken of each mixed or granular stratum encountered.

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Note 1: Hand vane and hand penetrometer tests are not required in boreholes but may be used to assist the logger in the assessment of soil strength.

Cohesive and Mixed Natural Strata or Fills

Depth	Sampling Frequency
• From base of inspection pit to 5m below existing ground level	• **Disturbed** samples at each change of stratum.
• From 5m below existing ground level to top of bedrock	• **Disturbed** samples at each change of stratum.
Depth	**Testing Frequency**
• From base of inspection pit to 5m below existing ground level	• Alternate **UT100** and **SPTs** at **0.5m centres** (the first SPT shall be undertaken at the bottom of the inspection pit)
• From 5m below existing ground level to top of bedrock	• Alternate **UT100** and **SPTs** at **1.0m** centres

Note 1: A small disturbed sample shall be taken and included in the rate for SPTs.

Note 2: Hand vane and hand penetrometer tests are not required in boreholes but may be used to assist the logger in the assessment of soil strength.

Granular Natural Strata of Fills

Depth	Sampling and Testing Frequency
• From base of inspection pit to 5m below existing ground level	• **SPTs** at **0.5m centres** (the first SPT shall be undertaken at the bottom of the inspection pit). • **Bulk** samples at **1.0m centres**
• From 5m below existing ground level to top of bedrock	• **SPTs** at **1.0m centres** • **Bulk** samples at **1.0m centres**

Note 1: A small disturbed sample shall be taken and included in the rate for SPTs.

Note 2: Hand vane and hand penetrometer tests are not required in boreholes but may be used to assist the logger in the assessment of soil strength.

Note 3: If cohesive material is encountered during the SPT, follow with a UT100 then repeat every 1.0m until granular material.

Bedrock

Depth	Sampling and Testing Frequency
• Top of bedrock to bottom of borehole	• **1 SPT** at top of rock. 1 SPT every 1.5m for first 10m and then 1 SPT every 3m to end of borehole. • Core subsample to be taken at the rate of **1 sample per 1.5m** of core for the first 10m and then **1 sample per 3.0m**. Core sub-samples should also be taken at each change of strata.

Note 1: When core recovery falls below 85%, prior to the next core run, an SPT shall be taken

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TRIAL PITS

Depth	Sampling and Testing Frequency
• Existing ground level to bottom of pit • Sampling shall start within 0.1m of existing ground level	• **Disturbed** samples in cohesive material every **1.0m** or every change in strata. Hand vanes every 0.5m. • **Bulk** samples in granular material every **1.0m** or every change in strata. • Measurement of in situ density in granular material* • **1 large bulk** sample per location (the Contractor is responsible for ensuring large bulk samples are undertaken at a range of depths and strata across the site).

* See Table 11 of BS 5930:2015

DYNAMIC (WINDOW OR WINDOWLESS) SAMPLES

Inspection Pits

Depth	Sampling Frequency
• Existing ground level to bottom of inspection pit • Sampling shall start within 0.1m of existing ground level	• **Disturbed** samples shall be taken every **0.5m** or at every change of strata whichever is more frequent • A representative **bulk** disturbed sample shall be taken of each mixed or granular stratum encountered.

Note 1: Hand vane and hand penetrometer tests are not required in boreholes but may be used to assist the logger in the assessment of soil strength.

Dynamic sampling drive

Depth	Sampling and Testing Frequency
• From base of inspection pit to bottom of exploratory hole • Sampling shall start within 0.1m of existing ground level	• **Disturbed** and **bulk** samples in cohesive material every **1.0m** or every change in strata. • **Bulk** samples in granular material every **1.0m** or every change in strata. • **SPTs** at **1.0m centres** (the first SPT shall be undertaken at the bottom of the inspection pit)

Note 1: Hand vane and hand penetrometer tests are not required during dynamic sampling but may be used to assist the logger in the assessment of soil strength.

Note 2: If cohesive material is encountered during the SPT, follow with a U100 / U70 then repeat every 1.0m until granular material.

Note 3: Provision for waxing U samples should be made for all undisturbed samples taken in dynamic (window or windowless) samples and boreholes.

S1.12.4 Open-tube and piston sample diameters (Clause 7.6.5)

Open tube sampling should normally be carried out in cable percussion boreholes using pushed thin wall samplers (UT100 or Type OS-T/W) generally in accordance with Clause 7.6.5. Aluminium or steel tubes shall be adopted for all UT100/U100 sampling in cable percussion boreholes.

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The tubes shall have a minimum length of 700mm and shall be circular in section along their full length. The tubes should be completely new and made from stainless steel. They shall be clean, free from dents, rust, burrs and pitting. They shall be lightly greased on the inside and outside with petroleum jelly. They shall conform to the following criteria:

i) The wall thickness shall be such that the cross sectional area is less than 10% of the total area of the closed tube.

(ii) The inside of the tube shall be straight with no lip or inside clearance at the bottom end.

(iii) The outside bottom end of the tube shall be tapered to a sharp cutting edge with a concentrically machined face at between 15° and 20° to the axis of the tube.

(iv) The inside diameter of the tube shall be between 100mm and 105mm. Prior to use of the tube, at least three diameters at the base of the tube shall be measured using callipers to an accuracy of 0.1mm and recorded. If the tube is found to be non-circular (>0.5mm difference between maximum and minimum readings), the tube shall be rejected.

They shall be pushed in a minimum distance of 100mm less than the length of the tube to obtain a sample of at least 600mm length using not more than two, and preferably only one, continuous push.

The rate of penetration shall be approximately 10mm per second. The equipment provided shall be capable of applying a thrust of at least 10t.

The rods providing the thrust shall be straight and aligned centrally in the borehole in order to prevent eccentricity of loading. The base of the borehole should be clean and horizontal before pushing begins.

After pushing the tube to the full depth it shall be left in position for a minimum of 5 minutes before being withdrawn from the hole using a steady pull.

Immediately after being withdrawn from the hole, a sample length of 175mm shall be extruded from the sampling tube. A 75mm length (corresponding to the end of the sampling tube) should be trimmed from this sample and discarded. The remaining 100mm long sample should be carefully trimmed around its curved surface using a soil lathe, removing a 5mm thickness of material in preparation for laboratory testing. The sample shall then be sealed following the procedures described for rotary core samples (Clause S1.10.6 (4) onwards). The remaining material left inside the sample tube shall be carefully preserved within the tube using standard techniques, for extrusion in the laboratory.

(8) At least three diameters at the base of the tube shall be measured and recorded as a check on any change in circularity of the tube. A check on damage along the length of the tube shall be made and recorded as type of damage and position along the tube.

The equipment shall be capable of sampling clays with shear strength of up to 250kN/m2. The Contractor shall propose appropriate methods for obtaining Class 1 undisturbed samples (UT100) in accordance with BS EN ISO 22475-1 and BS 5930. If the Contractor is unable to obtain Class 1 UT100 samples of at least 350mm in length, U100 (Type OS-TK/W) samples shall be taken instead. If it is not possible to obtain U100 samples, a bulk sample should be taken with an alternating SPT and bulk sample taken over the depth of the SPT.

A recovery of at least 350mm length is expected after trimming off the disturbed soil. If recovery falls below 300mm then the hole shall be cleaned out for the full depth to which the sampling tube has penetrated and a fresh attempt to recover the undisturbed sample shall then be made. If this second attempt is unsuccessful the Contractor shall inform

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the Investigation Supervisor. Under normal circumstances the hole shall be cleaned out for the full depth to which the second sampling tube has penetrated and an SPT shall be carried out.

Note that payment may not be made for undisturbed samples with recovery less than 300mm without good reason, and re-drilling may be required. Payment may also not be made if there is evidence of alteration in the natural moisture content of the undisturbed samples.

S1.12.5 Retention of cutting shoe samples (Clause 7.6.5)

To be retained as a jar or tub samples.

S1.12.7 Groundwater level measurements during exploratory hole construction (Clause 7.7)

As Clause 7.7.

The Contractor is to ensure that, at each groundwater strike, boring is suspended and the depth from ground level to water level recorded at 5 minute intervals for a period of 20 minutes. If the groundwater level is still raising after 20 minutes the Contractor shall immediately notify the Investigation Supervisor and continue recording the groundwater level until:

(a) The water level stops rising

(b) The Investigation Supervisor instructs that further water level recording is not required at that time or

(c) A period of 60 minutes has elapsed.

S1.12.8 Special geotechnical sampling (Clause 7.8)

As specified.

S1.12.10 Retention and disposal of contamination/WAC samples (Clause 7.9.3)

As Clause 7.9.3.

S1.12.11 Frequency of sampling (Contamination) (Clause 7.9.4)

Contamination sampling will be required, in addition to those required above for geotechnical purposes, from inspection pits, trial pits, trial trenches and boreholes as follows:

Samples shall be taken immediately below the surface at 0.5m, 1.0m and 1.2m bgl from the inspection pit and then at 0.5m intervals throughout the Made Ground. Samples shall also be taken at the top of the natural ground and in any natural ground where suspected ground contamination (e.g. exhibiting visual or olfactory evidence) is first encountered and then at 0.5m intervals until at least 1m below any such evidence or as instructed by the engineer.

Each contamination sample shall consist of a 2x1 litre plastic tub with secure lid, 250g amber glass jar and 60g amber glass jar. Each container shall be filled to the top and the lid securely fitted. Samples shall be placed immediately into a cool box for despatch to the laboratory.

Trial Pits, Trial Trenches, Boreholes and Window Sample Holes.

- Where inspection pits are not undertaken: The first contamination sample shall be taken just below the surface (0.1 – 0.2m BGL) or, where hard standing is present, just below the base of the hard standing. The second sample shall be taken at 0.5mbgl.

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- Subsequent samples from 0.5m shall be taken at 1m intervals or at the change of strata type to a maximum depth of 5mbgl (a total of 6 contamination samples per borehole / window sample hole). No contamination samples are to be taken below 5mbgl, unless instructed by the Investigation Supervisor.
- Samples taken from window samples will have to be taken across a depth range in order to achieve the volume of sample required, this depth range should be noted e.g. 1.5m – 1.65m.

Additional samples are to be collected where there is any evidence of contamination (i.e. staining, odours etc.) or on the instruction from the Investigation Supervisor. Evidence of contamination is to be noted on the contract engineer's log. If significant contamination is found/suspected, work shall stop and the Contractor shall contact the Investigation Supervisor.

S1.12.12 Sampling method (Clause 7.9.5)

Samples are to be taken in accordance with BS 10175:2001 Clause 8.3.2.

At each sampling location (e.g. BH-depth) soil samples shall be taken into 2 x 1kg plastic tub, 2 x 250g amber glass jars and 2 x 60g volatiles vials. These should always as far as practicable be filled to the brim. The rate for a single contamination sample shall include for all soil jars or tubs collected at that depth.

Samples shall be taken using a stainless steel trowel or similar stainless steel sampling tool which has been thoroughly cleaned before each sampling event. Clean gloves should be worn for collection of each separate sampling event.

Samples are to be stored in accordance with protocols agreed with the Investigation Supervisor within a cool box, and will generally be collected each day from site by a courier provided by the analytical laboratory. Alternatively the contamination samples may be collected from the Contractor's main depot, within 24hrs of being taken, if agreed with the Investigation Supervisor. All glass jars and volatiles jars need to be stored with ice or in a freezer pack to reduce the loss of volatile organic compounds.

It should be noted that sample jars, particularly volatiles vials, are often fragile. Cool boxes will be packed with care and with sufficient padding/bubble wrap to ensure that the samples arrive at the analytical laboratory in an intact state. The Investigation Supervisor may require re-sampling at no additional cost if a significant number of samples are un-testable due to damage in transit.

The Contractor shall take such measures, including those given in Clauses 7.5 and 7.9.1 of the Specification and these Schedules to ensure that samples and cores are protected from damage and changes in their physical and chemical properties at all times and in particular during handling, transport and storage.

S1.12.13 Headspace testing (Clause 7.9.8)

A calibrated Photo- or Flame- Ionisation Detector (PID or FID) meter shall be used to screen each sample of the Made Ground/Fills, Mixed Soils and upper part of the Natural Strata (particularly where there is visual or olfactory evidence of suspected Volatile Organic Compounds or hydrocarbon contamination).

This portable equipment shall be calibrated in accordance with the manufacturers' instructions and their calibration records shall be submitted to the Investigation Supervisor for approval prior to use on site. Prior to commencing any measurements on site, the Contractor shall demonstrate, to the satisfaction of the Investigation Supervisor, their familiarity of using such equipment and recording of the resulting data. Regular calibration checks of all the monitoring equipment shall also be undertaken to confirm that they are functioning correctly. All vapour measurements shall be to an accuracy of 1ppm.

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Field results shall be supplied to the Investigation Supervisor within 24hrs of this field screen testing being carried out.

S1.12.14 Specific requirements for contamination samples

Sample analysis for both inorganic and organic, including volatile, parameters is anticipated. Sample containers for contaminated materials shall be provided by the Contractor with necessary preservatives provided by the laboratory to undertake the analysis. The sample containers and preservatives shall reflect the anticipated contamination and associated determinands.

The Contractor shall liaise with the Investigation Supervisor and the analytical laboratory to ensure that the correct sample containers or bottles are used to store the collected samples and the correct volume of soil is obtained. Where cool boxes and cool packs are used for sample storage and transportation, the Contractor shall ensure that cool packs are frozen in preparation for sampling and for that all cool boxes have frozen cool packs. The Contractor shall maintain a stock of frozen cool packs.

The Contractor is to ensure that all samples are kept at a temperature of between 2°C and 4°C and are collected from site at the end of each working day and transported to the analytical testing laboratory within 24 hours of sampling (Clause 7.9.1).

All samples shall be accompanied by Chain of Custody forms, duly signed off, copies of which shall be sent to the Investigation Supervisor. The laboratory should be informed by the Contractor of the potential contaminants on the site.

S1.13 Probing and cone penetration testing (Specification Section 8) Particular restrictions/ relaxations

CPTs shall be undertaken at the locations specified in using an electrical piezocone in accordance with BS 1377-9:1990. The Contractor is to propose a sequence of works and liaise pre-drilling with the CPT contractor. The CPTs shall be carried out to refusal, which is likely to occur by 30m depth.

Testing shall be in general accordance with BS1377 (1990) Part 9 Method 3.1 and Appendix A of the 'Report of the Sub-Committee on the Penetration Test for Use in Europe' published by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE).

Cone resistance, sleeve friction and pore pressure shall be electronically measured at intervals no greater than 20mm for the duration of all tests. Electronic records of each test shall be supplied to the Investigation Supervisor within 24 hours of the completion of the test.

Calibration of the CPT shall be based on the results of the site specific laboratory test results.

Dissipation tests are to be carried out within the natural strata at the depths and test locations specified in Schedule 2.

Printouts of cone resistance, sleeve friction, pore pressure and friction ratio shall be provided with the factual report. An interpretation of soil type shall also be provided for each test.

S1.13.3 Reporting of cone penetration testing parameters (Clause 8.2.4)

Cone resistance, sleeve friction and pore pressure shall be electronically measured at intervals no greater than 20mm for the duration of all tests. Electronic records of each test shall be supplied to the Investigation Supervisor within 24 hours of the completion of the test.

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Calibration of the CPT shall be based on the results of the site specific laboratory test results.

Printouts of cone resistance, sleeve friction, pore pressure and friction ratio shall be provided with the factual report. An interpretation of soil type shall also be provided for each test.

S1.14 Geophysical testing (Specification Section 9) Particular restrictions/relaxations

S1.14.1 Geophysical survey objectives (Clause 9.1.1)

Not required.

S1.14.2 Requirement for Ground Specialist geophysicist (Clause 9.1.1)

Not required.

S1.15 In situ testing (Specification Section 10) Particular restrictions/relaxations

Not required.

S1.15.1 Soil Infiltration Test (clause 10.6)

Soakaway Test

10no. soakaway tests shall be carried out across the site in proposed trial pit locations – TBC and shall be advised by the engineer. Soakaway testing shall be carried out in accordance with BRE 365. Gravel shall not be required to support the sides of the trial pit and the strata in which to carry out the soakaway will be advised by the engineer. Interpretation of the soakaway testing data shall be provided within the Factual Report.

Falling Head Test

10no. falling head tests are to be carried out in a number of boreholes which will be specified by the engineer. The tests will be carried out in each of the envisaged strata on the site (i.e. within the alluvium, gravels and chalk).

S1.16 Instrumentation (Section 11) Particular restrictions/relaxations

S1.16.1 Protective covers for installations (Clause 11.2)

Flush covers will generally be required. The Contractor should also ensure that the head of the borehole is constructed in a way to ensure the piezometer/standpipe can be dipped.

The tops of all instruments (standpipes, standpipe piezometers and gas monitoring wells) shall be protected by lockable stopcock covers (or similar), installed in concrete Grade C10P in accordance with Clause 2602 of the Specification for Highway Works (1986), with provision of a drainage channel and appropriate ventilation. The lockable covers shall be installed immediately after installation of the monitoring point. Two sets of keys for the covers are to be provided to the Investigation Supervisor. These covers shall be equipped with suitable gaskets/seals to prevent the ingress of surface water.

Each instrument (standpipes, standpipe piezometers and gas monitoring wells) shall be permanently labelled with a metal stamp or tag indicating the exploratory hole number and, if there are two instruments in one exploratory hole, the tags shall clearly distinguish between the two instruments.

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S1.16.2 Protective fencing (Clause 11.3)

Permanent protective fencing is not required.

S1.16.3 Standpipe and standpipe piezometer installations (Clause 11.4.1 and 11.4.2)

Groundwater monitoring devices including 50mm groundwater standpipes, 19mm standpipe piezometers shall be used in boreholes. 50mm gas standpipes shall be used in the window sample holes and these shall be fitted with gas taps.

(1) Prior to the commencement of the site works, the Contractor shall submit a method statement for the mixing of cement-bentonite grout. A trial mix shall be made on site to the satisfaction of the Investigation Supervisor using materials from the same sources, and the same mixing techniques as will be used for the actual grouting works, before any boreholes are grouted. The water content of this mix shall be kept to a practicable minimum to reduce the risk of bleeding and subsequent shrinkage of the grout mix in the ground. Once a grout mix is approved, it shall be the Contractor's responsibility to ensure that subsequent mixes conform to the approved mix proportions and that the method of mixing produces a smooth well-mixed grout with consistent properties. It is anticipated that this will therefore require the use of a mechanical grout mixer on site. The Investigation Supervisor may require the Contractor to take sample cubes/cylinders of the grout for laboratory testing, to determine the engineering properties of the grout. In certain circumstances, bentonite pellets may be used in place of cement-bentonite grout but only with the approval of the Investigation Supervisor.

Requirements for standpipes:

(2) & (3) Standpipes shall have a 0.4mm slot width and manufactured from UPVC or polypropylene. Use of geotextile wrapped sections will not be permitted, unless specifically instructed by the Investigation Supervisor.

(4) The slotted section shall be surrounded by a filter consisting of washed graded fine gravel (2 - 6mm diameter, unless otherwise instructed by the Investigation Supervisor) and shall be sealed into the ground with plain sections above to ground level. The length of the slotted section (and surrounding filter) for each installation will be determined on site by the Engineer.

(5) Where the depth of the borehole is greater than the depth to which the filter is to be installed, then the hole shall be backfilled with cement/bentonite grout. The grout mix used shall comply with Clause S1.16.3(1). The filter shall not be placed until the underlying grout is sufficiently hardened to prevent the gravel sinking into it.

(6) The groundwater levels shall be recorded immediately before and after installation of the standpipe. Weekly readings shall then be undertaken for the remainder of the site works period.

Requirements for standpipe piezometers:

(7) The level of the piezometer tip and the length of the surrounding filter will be determined on site by the Investigation Supervisor.

(8) Standpipe piezometer tips shall be of the Casagrande type and the porous ceramic tips are to be soaked in water for a minimum of 48 hours before installation.

(9) The uPVC tubing shall be of 19mm minimum internal diameter.

(10) Where the depth of the borehole is greater than the depth to which the filter is to be installed, then the hole shall be backfilled with cement/bentonite grout. The grout mix used shall comply with Clause S1.16.3 (1) The grout shall be

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tremied into the borehole to a level at least 1m below the interface with the sand filter. Bentonite pellets shall then be used to form a seal beneath the filter zone which shall not be less than 1m thick. The pellets shall not be placed until the underlying grout is sufficiently hardened to prevent the pellets sinking into it. Bentonite pellets shall then be used to form a seal at least 1m thick above the filter seal before completing the grouting using the cement/bentonite grout in accordance with Clause S1.16.3(1).

(11) Sand filters will generally be 1m long, but this may be varied on site by the Investigation Supervisor.

(12) The groundwater levels shall be recorded immediately before and after installation of the standpipe. Weekly readings shall then be undertaken for the remainder of the site works period.

(13) Falling, rising or constant head tests may be required in piezometers. These should be performed as described in Section 25.4 of BS5930: 1999.

S1.16.5 Development of standpipes and standpipe piezometers (Clause 11.4.5)

All groundwater monitoring wells shall be developed by the Contractor in accordance with Sections 8.3.3.3 and 8.3.3.4 of the BS10175:2011. The Contractor shall provide details of the method for well development and the disposal of arisings in his method statement.

S1.16.6 Ground gas standpipes (Clause 11.5)

Refer to S1.16.3

S1.17 Installation monitoring and sampling (Specification Section 12) Particular restrictions/relaxations

S1.17.2 Groundwater sampling from installations (Clause 12.3.1)

Where sampling of groundwater and ground gas for contamination laboratory analysis is specified, the monitoring and sampling visits shall be carried out by an appropriately trained and experienced member of the Contractor's staff. Sample bottles and containers shall be supplied by the analytical laboratory as clean, free from any cracks, chips or fractures and appropriate for the proposed analyses.

At each monitoring visit, the Contractor shall measure the gas/vapour concentrations and flow, groundwater level, determine whether free phase is present and take a sample of the groundwater, at each borehole location. Permeability tests may be carried out in the standpipes, as directed by the Investigation Supervisor. The Contractor shall also record the atmospheric pressure during monitoring.

S1.17.3 Purging/micro-purging (Clause 12.3.2)

Groundwater monitoring wells shall be purged as described in S1.16. 5. If free phase is present, purging must not be carried out. The Investigation Supervisor shall be contacted to discuss and agree a revised sampling procedure.

S1.17.4 Ground gas monitoring (Clause 12.4)

Unless otherwise specified by the Investigation Supervisor, the frequency of gas monitoring in installations shall be at weekly intervals for six weeks after completion of the field works.

Gas monitoring will be carried out and recorded in accordance with guidance and protocols presented in CIRIA C665 (2007). At each monitoring visit, the Contractor shall measure the gas/vapour concentrations, groundwater level,

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determine whether free phase is present and take a sample of the groundwater at each borehole location. Ground gasses analysed for shall be: carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), oxygen (O) and hydrogen sulphide. In addition, gas flow rates from the borehole shall be recorded in l/hr and atmospheric pressure during monitoring will be recorded.

All gas monitoring equipment shall be properly calibrated and evidence of calibration provided to the Investigation Supervisor on request, prior to works commencing on site. Measurements of the differential pressure between ambient and within the installation together with atmospheric barometric pressure shall be made to an accuracy of 1mBar. All vapour measurements shall be to an accuracy of 1ppm.

At least one monitoring round shall be undertaken during a period of falling atmospheric pressure or during a period when atmospheric pressure is below 1000mb. (Atmospheric pressure and ambient air temperature for the area on the days of the site visit plus five days before and three days after can be obtained from the Meteorological Office, [redacted]

S1.18 Daily records (Specification Section 13)

As Clause 13.1, but in addition:

The depth at which any water is added to a cable percussion borehole, the volume added and the reason for its addition shall be recorded on the driller's daily log. This information shall also be transferred to the final-issue logs prepared by the Contractor's engineer.

Report sheets for post-fieldwork monitoring visits shall be submitted to the Investigation Supervisor within 48 hours of the visit. The following information shall be presented on the proforma, as a minimum:

- Location and Purpose of the Monitoring Visit
- Dates and Duration of the Monitoring Visit
- Types, Levels of Detection and Calibration Details of the Equipment Used
- "As-built" details of the Monitoring Installation (i.e. well slotted response zone, base of installation, etc.)
- Other pertinent site information (eg. weather conditions, ambient air temperature, ground surface conditions – wet or dry, damage or access problems, etc.)

The factual data shall also to be provided at the same time electronically, in a suitable spreadsheet format.

S1.18.2 Special in situ tests and instrumentation records (Clause 13.4)

Records are to be submitted within 24 hours of the tests.

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S1.19 Geotechnical laboratory testing (Specification Section 14)

S1.19.1 Investigation Supervisor or Contractor to schedule testing (Clause 14.1.1)

The Contractor should provide a list of the samples that have been taken with the preliminary logs. The Investigation Supervisor will prepare a Schedule of Tests to be carried out within **48hrs** of completion of the borehole. The format of the list should be agreed with the Investigation Supervisor to minimise the work required by both parties.

Prior to testing of all the scheduled samples, the Investigation Supervisor shall be notified as soon as possible in writing by the relevant laboratory if the materials or recovered sample size are not suitable to complete the scheduled tests, or cannot be reported in accordance with the appropriate testing standard.

S1.19.2 Tests required (Clause 14.1.2)

Tests to be carried out will include (but not limited to):

Classification
a. Moisture content
b. Liquid limit (definitive method),
c. Plastic limit
d. Plasticity index
e. Dry density and saturation moisture content of chalk
f. Particle Size distribution
g. Sedimentation by hydrometer

Chemical and electrochemical
h. Mass loss on ignition
i. Organic matter content
j. Determination of SD1 basic determinands in accordance with Clause S1.19.6
k. Determination of SD1 additional determinands in accordance with Clause S1.19.6
l. Sulphate content of groundwater
m. pH value of groundwater
n. Resistivity

Compressibility, permeability, durability
o. One-dimensional consolidation properties
p. Measurement of swelling

Shear strength (total stress)
q. Shear strength of a single 300mm × 300mm square specimen by direct shear.
r. Undrained strength of a single 100mm diameter specimen in triaxial compression without the measurement of pore pressure.
s. Unconfined compressive strength for chalk with measurement of deformability
t. Point load tests for chalk

Detailed Sample Description

On completion of the scheduled laboratory testing of UT100, U100 and core sub-samples, the Contractor shall prepare a draft schedule of untested UT100, U100 and core sub-samples and submit this to the Investigation Supervisor.

Within 48hrs of its receipt, the Investigation Supervisor will complete the schedule detailing any final tests required and of those samples that he requires to describe in detail. The Contractor shall arrange for these samples to be split, photographed and described in detail by an approved engineering geologist/ geotechnical engineer in accordance with current Eurocode standards and this Specification.

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The Contractor will split the nominated UT100 or U100 samples and core sub samples, photograph, and provide detailed visual description on completion of testing programme using the naked eye and/or hand lenses. This will involve measurements, photographing and geological logging of the following different macro-fabric features which define the shape, arrangement and size of solid particles or voids that may affect the swelling characteristics of the clay soil mass:

- Fissures
- Joints
- Bedding Planes
- Laminations
- Sand layers, partings and pockets

In addition, the Investigation Supervisor may instruct detailed sample description on a limited number of samples during the testing programme.

S1.19.3 Specifications for tests not covered by BS 1377 and options under BS 1377 (Clauses 14.2.1 and 14.4)

Not required.

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S1.19.4 UKAS accreditation to be adopted (Clause 14.3)

UKAS/NAMAS accreditation is required. Details of the scheme and the tests that are accredited should also be provided at the time of Tender.

S1.19.5 Rock testing requirements (Clause 14.5)

Natural moisture content, chalk crushing value, point load tests, uniaxial compressive strength and deformability under uniaxial compression tests shall be conducted on Chalk samples.

S1.19.6 Chemical testing for aggressive ground/groundwater for concrete (Clause 14.6) (Test suites A-D are overleaf)

Sulphate testing:

BRE SD1 on soil and water, results required:

- pH, water soluble sulfate (mg/l), total sulphur (%), acid soluble sulfate (%);
- where pH<5.5, additional parameters shall be tested: water soluble nitrate (mg/l), water soluble chloride (mg/l);
- where water soluble sulfate >3000mg/l, additional parameter shall be tested: water soluble magnesium (mg/l).

Reference to SD1 basic determinands in the bill of quantities.

S1.20 Geoenvironmental laboratory testing (Specification Section 15) Particular restrictions/relaxations

S1.20.1 Investigation Supervisor or Contractor to schedule testing (Clause 15.1)

Geoenvironmental testing is to be scheduled by the Investigation Supervisor.

S1.20.2 Accreditation required (Clause 15.2)

The laboratory shall hold relevant UKAS and NAMAS accreditation, and participate in appropriate proficiency testing schemes such as the LGC's CONTEST scheme. The following details for the proposed laboratory will be provided to the Investigation Supervisor with this tender:

- Laboratory name and account contact;
- Confirmation of whether the Investigation Supervisor is authorised by the Contractor to discuss samples and results with the laboratory direct to minimise delays with queries;
- Analytical methodologies and accreditations;
- Quality Assurance and Detection Limit details for all tests.

S1.20.3 Chemical testing for contamination (Clause 15.3) (Test suites E-G)

All analysis and reporting of analytical results shall comply with relevant MCERTS requirements and in particular with the latest version requirements of the Environment Agency's "Performance Standard for Laboratories Undertaking Chemical Testing of Soils". Air dried soil samples are to be prepared and pre-treated to BS7755: Section 3.5 or BS ISO 14570:2003 as appropriate.

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At the time of tender time, the Contractor shall inform the Employer which sub-contract laboratory will be appointed. Contamination testing shall be carried out on samples of soil in accordance with the suites detailed below. The Investigation Supervisor may also instruct additional contaminants for analysis if required or adopt the standard suites E to G as detailed in Schedule 1.20.3 of the UK Specification for Ground Investigation, 2nd Edition (2012)

The following sections overleaf give analytical suites and guidance on test methods considered suitable by Buro Happold. Testing laboratories may submit for consideration other methods, accompanied by appropriate validation data to demonstrate that the alternative methods are at least as sensitive and precise as those shown, at no significant increase in cost.

Chemical analysis suites

A. SOIL

Suite 1 – Made Ground

Made Ground soil analysis suite – pH, Asbestos screen, CLEA metals suite, total cyanide, total mercury, speciated PAHs, EPH, PRO including BTEX, Soil Organic Matter.

Suite 2 – Natural ground

Natural Ground soil analysis suite – pH, CLEA metals suite, total cyanide, total mercury, speciated PAHs, EPH, PRO including BTEX.

Suite 3 – Waste analysis

WAC analysis - Full Waste suite

B. GROUNDWATER

Groundwater analysis suite

pH, Hardness, CLEA metals suite, total cyanide, speciated PAHs, EPH, PRO including BTEX.

S1.21 Reporting (Specification Section 16) Particular restrictions/relaxations

S1.21.2 Information on exploratory hole logs (Clause 16.2.2)

As Clauses 16.2 and 5.4.6, and S1.8.21.

In addition, the depth at which any water is added, together with the volume added and the reason for its addition shall be recorded on log.

The following rock core fracture state parameters shall also be reported:

- Rock Quality Designation (RQD)
- Fracture Index (FI)

S1.21.3 Variations to final digital data supply requirements (Clause 16.5.1)

The final AGS data is required in one file to 4.1 version only. The AGS data version offered shall be stated by the Contractor, but not within a ZIP file. The AGS file should be compatible with Holebase SI (Keynetix). If not, the Contractor should advice the Investigation Supervisor during submission of their tender. A DWG file of the exploratory

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hole location plan, including the as-built survey positions of the exploratory hole positions, shall be provide with the final submission.

S1.21.4 Preliminary digital data (Clause 16.5.3)

1. Preliminary AGS data in AGS 4.1 shall be submitted at the time the preliminary borehole logs are issued (within 48hrs on completion of the borehole). Further issue of preliminary AGS data shall be submitted within 48hrs on completion of laboratory testing operations.
2. Preliminary monitoring data shall be submitted in Excel format on a weekly basis during the course of the monitoring operations. An alternative frequency may be possible if agreed with the Investigation Supervisor prior to the works beginning.
3. The Contractor shall issue paper and digital copies of all preliminary data as given below. The Investigation Supervisor may relax the requirement for the Contractor to provide some or all of the paper or digital copies.
    a) Preliminary logs shall be typed and not hand written and should include all information available on completion of the exploratory hole.
    b) List of Samples taken from exploratory holes (Blank laboratory test schedule): With Preliminary Log.
    c) Chain of Custody Records (contamination samples): 24hrs after collection from site.
    d) Fieldwork groundwater monitoring records: Weekly.
    e) In situ/field test records: on daily records, preliminary logs and otherwise within 7 working days of carrying out the tests.
    f) Post fieldwork monitoring and test records: Within 48 hours of the site visit.

S1.21.5 Type(s) of report required (Clause 16.6)

A Ground Investigation Report (Factual Report) is required. The Contractor shall provide one paper master copy of the final factual report for the Employer and an electronic copy.

S1.21.6 Electronic report requirements (Clause 16.6.3)

In addition to the AGS data, Excel files of in-situ tests and laboratory tests are required upon request.

S1.21.10 Report approval (Clause 16.11)

A Ground Investigation Report (Factual Report) is required. The Contractor shall provide one paper master copy of the final factual report for the Employer and an electronic copy.

The Contractor shall present a draft factual after four weeks of completion of the field works. The draft factual report is to comprise the following as a minimum:

- All contract borehole, drill hole and trial pit logs;
- All photographs from the investigation;
- 85% of laboratory test results (geotechnical and contamination);
- 100% of results of groundwater and ground gas monitoring undertaken during site works;
- 85% of post-fieldwork monitoring results.

The Contractor may provide the Investigation Supervisor completed draft sections of the report (e.g. borehole logs) for comment before formal submission of the draft report.

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The Investigation Supervisor will provide the Contractor with comments within 2 week of receiving the draft report.

The Contractor shall present a final factual report within 1 weeks of receiving comments from the Investigation Supervisor on the draft factual report.

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SCHEDULE 2 EXPLORATORY WORKS

A detailed schedule of the exploratory works is provided in the Buro Happold Ground Investigation Scoping Report (Ref: 047730-BHE-XX-XX-RP-CG-0009).

An excel file format of the exploratory hole locations can be provided upon request.

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5 Bill of Quantities

The preamble to the Bill of Quantities shall be as that given in the Specification for Ground Investigation published by ICE Publishing in 2012

The following pages constitute the Bill of Quantities. Where bill items have been added, amended or substituted this is indicated in the bill of quantities by 'add', 'amd' or 'sub' respectively.

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Number	Item description	Unit	Quantity	Rate	Amount £
A	**General items, provisional services and additional items**				
A1	Offices and stores for the Contractor	sum	1		
A2	Establish on site all plant, equipment and services for a Green Category site	sum	1		
A3	Extra over Item A2 for a Yellow Category site	sum	1		
A4	Maintain on site all site safety equipment for a Yellow Category site	week	16		
A5	Decontamination of equipment during and at end of intrusive investigation for a Yellow Category site	sum	1		
A6	Appropriate storage, transport and off-site disposal of contaminated arisings and any PPE equipment, excluding laboratory testing	sum	1		
A7	Provide professional attendance in accordance with Clause 3.5.2	sum	1		
A8	Establish the location and elevation of the ground at each exploratory hole	sum	1		
A9	Preparation of Health and Safety documentation and Safety Risk Assessment.	sum	1		
A10	Facilities for the Investigation Supervisor	sum	1		
A14	Deliver selected cores and samples to the specified address	provisional sum	1		
A16	Traffic safety and management	provisional sum	1		
A21	Electronic copy of Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS 4.1 transfer format	sum	1		
A29	Long-term storage of geoenvironmental samples (Appendix B)	provisional sum	1		
<u>Contract specific additional bill items</u>					
A3.1	Extra over Item A3 for a Red Category site	sum	1		
A4.1	Extra over Item A4 for a Red Category site	sum	1		
A5.1	Extra over Item A5 for a Red Category site	sum	1		
A30.1	UXO technician and equipment - mobilisation and attendance	sum	1		
	Total section A carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
B	**Percussion boring**				
B1	Move boring plant and equipment to the site of each exploratory hole and set up	nr	70		
B3	Break out surface obstruction where present at exploratory borehole	h	70		
B4	Advance borehole between existing ground level and 10 m depth	m	700		
B5	As Item B4 but between 10 m and 20 m depth	m	240		
B6	As Item B4 but between 20 m and 30 m depth	m	60		
B7	As Item B4 but between 30 m and 40 m depth	m	40		
B8	As Item B4 but between 40 m and 50 m depth	m	40		
B9	Advance borehole through hard stratum or obstruction	h	70		
B10	Provide aquifer protection measures at a single aquiclude/aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr	70		
B12	Standing time for borehole plant, equipment and crew	h	35.0		
	Dynamic (Window or Windowless) sampling				
B13	Move dynamic sampling equipment to the site of each exploratory hole and set up	nr	77		
B15	Advance dynamic sample hole between existing ground level and 5 m depth	m	385		
B16	As Item B15 but between 5 and 10 m depth	r/o	0		
B18	Standing time for dynamic sampling equipment and crew	hr	38.5		
Contract specific additional bill items					
B19	Contractor to input ALL standing time due to UXO detection	sum	1		
	Total section B carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
C	**Rotary drilling**				
	Rotary drilling with and without core recovery				
C15	Move rotary drilling plant and equipment to the site of each exploratory drillhole and set up	nr	46		
C19	Standing time for rotary drilling plant, equipment and crew	h	46		
	Drilling to obtain cores		0		
C41	Rotary drill in hard strata to obtain cores of the specified diameter between existing ground level and 10m depth	r/o	0		
C42	As Item C41 but between 10 and 20m depth	m	460		
C43	As Item C41 but between 20 and 30m depth	m	440		
C44	As Item C41 but between 30 and 40m depth	m	420		
C45	As Item C41 but between 40 and 50m depth	m	360		
C46	As Item C41 but between 50 and 60m depth	m	130		
C47	As Item C41 but between 60 and 70m depth	m	70		
C48	As Item C41 but between 70 and 80m depth	m	30		
C49	Extra over Items C41 to C45 for use of semi-rigid liner	r/o	1910		
	Total section C carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
D	**Pitting and trenching**				
	Inspection pits				
D1	Excavate inspection pit by hand to 1.2m depth	nr	169		
D2	Extra over Item D1 for breaking out surface obstructions	h	80		
	Trial pits and trenches				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.5m depth	nr	95		
	Daily provision of pitting crew and equipment		0		
D29	Provision of excavation plant equipment and crew for machine dug trial pits or trenches as directed by the Investigation Supervisor, maximum depth 3.0m	day	80		
D36	Extra over Items D32 to D34 for breaking out hard strata or obstructions	h	95		
	General		0		
D37	Bring pump to the position of each exploratory pit or trench	sum	1		
Contract specific additional bill items					
D38	E/O temporary support and equipment for trial pitting as necessary (refer to section S1.11.12) this should including logging and sampling by an engineer. Rate must include for moving equipment into position.	r/o			
	Total section D carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
E	**Sampling and monitoring during intrusive investigation**				
	Samples for geotechnical purposes				
E1	Small disturbed sample	nr	2620		
E2	Bulk disturbed sample	nr	1080		
E3	Large bulk disturbed sample	nr	95		
E4.2	Open tube sample using thin walled (OS-T/W) sampler	nr	300		
E5	Piston sample	nr	40		
E6	Groundwater sample	nr	170		
E7	Ground gas sample	nr	50		
E8	Cut, prepare and protect core sub sample	nr	637		
	Continuous or semi-continuous sampling				
E9	Move Delft continuous or Mostap semi-continuous sampling plant and equipment to the site of each exploratory hole and set up	nr	0		
E10	Extra over Item E9 for setting up on a slope of gradient greater than 20%	nr	0		
E11	Break out surface obstruction where present at exploratory hole	h	0		
E12	Advance sampler between existing ground level and 10m depth	m	0		
E13	As Item E12 but between 10 and 20m depth	m	0		
	Containers for contamination assessment and WAC testing				
E14.1	Provision of containers and collection of samples for contamination Suite E (S1.20.3)	nr	1200		
E14.2	Provision of containers and collection of samples for contamination Suite F (S1.20.3)	nr	300		
E14.3	Provision of containers and collection of samples for contamination Suite G (S1.20.3)	nr	40		
E15.1	Provision of containers and collection of samples for WAC Suite H (S1.20.5)	nr	100		
E15.2	Provision of containers and collection of samples for WAC Suite I (S1.20.5)	nr	100		
E15.3	Provision of containers and collection of samples for WAC Suite J (S1.20.5)	nr	100		
Contract specific additional bill items					
E15.4	Provision of containers and collection of samples for Waste Classification and Full WAC Suite	nr	100		
E15.5	Provision of containers and collection of samples for TPH CWG	nr	240		
E15.6	Provision of containers and collection of samples for VOC	nr	120		
E15.7	Provision of containers and collection of samples for SVOC	nr	120		
	Total section E carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
F	**Probing and cone penetration testing** Dynamic probing Cone penetration testing				
F8	Bring static cone penetration test equipment to the site of each test location	nr	22		
F10	Carry out static cone penetration test measuring both cone and sleeve resistance from existing ground level to 10m depth	m	220		
F11	As Item F10 but between 10 and 20m depth	m	220		
F12	As Item F10 but between 20 and 30m depth	m	0		
F14	Extra over Items F10 to F13 for use of piezocone	m	440		
F15	Extra over Items F10 to F13 for interpretation of CPT/CPTU data	m	440		
F16	Carry out dissipation test up to 1 hour duration	nr	66		
F18	Standing time for static cone penetration test equipment and crew	h	22		
Contract specific additional bill items					
F23 (add)	Pre-drilling of CPT locations from ground surface to top of natural strata	nr	22		
F24	Contractor to input ALL standing time due to UXO detection	sum	1		
	Total section F carried to summary:				0.00

Number	Item description	Unit	Quantity	Rate	Amount £
G	**Geophysical testing** Not Required				
	Total section G carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
H	**In situ testing**				
H1	Standard penetration test in borehole	nr	1820		
H2	Standard penetration test in rotary drillhole	nr	800		
	Other tests				
	Permeability testing				
H14	Set up and dismantle falling head permeability test in standpipe/standpipe piezometer	nr	10		
H16	Carry out permeability test in standpipe/standpipe piezometer	h	10		
	Soil infiltration test				
H81	Provide equipment and carry out set of 3 infiltration tests at selected location up to 1 day, including hire of excavation equipment	nr	10		
H82	Extra over Item H81 for additional days	r/o	0		
H83	Calculation of infiltration rate for each tested location	nr	10		
	Miscellaneous site testing				
H84	Reading of free product level in borehole using an interface probe	nr	Rate Only		
H85	Provide contamination screening test kits per sample	r/o	0		
H86	Carry out headspace testing by FID/PID	sum	Rate Only		
	Total section H carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
I	**Instrumentation**				
	Standpipes and piezometers				
I1	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer	m	895		
I3	Provide and install standpipe piezometer (19mm)	m	2000		
I7	Provide and install ground gas monitoring standpipe (50mm)	m	735		
I9	Provide and install headworks for ground gas monitoring standpipe, standpipe or standpipe piezometer	nr	147		
I10	Provide and install protective cover (flush)	nr	147		
I14	Supply and erect 1.5m high marker post	nr	147		
I15	Standpipe and piezometer development				
I15.1	Supply equipment and personnel to carry out development by surging	nr	147		
I15.2	Develop standpipe or piezometer by surging (bailing 3 x well volume for max 3 hrs)	nr	147		
I15.9	Disposal of development water, not including chemical testing	Provisional sum	Rate Only		
	Total section I carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
J	**Installation monitoring and sampling** (during Fieldwork Period)				
J1	Reading of water level in standpipe or standpipe piezometer during fieldwork period	sum	1		
J5	Water sample from standpipe or standpipe piezometer during fieldwork period, including purging or micro-purging up to 3.0 hours	nr	70		
J7	Ground gas sample from gas monitoring standpipe during fieldwork period	nr	10		
	Installation monitoring and sampling (post Fieldwork Period)				
J9	Return visit to site following completion of fieldwork to take readings in, or recover samples from, installations	nr	6		
J10	Extra over Item J9 for reading of water level and temperature in standpipe or standpipe piezometer during return visit	nr	882		
J11	Extra over Item J9 for ground gas measurement in ground gas monitoring standpipe during return visit	nr	882		
J14	Extra over Item J9 for water sample from standpipe or standpipe piezometer during return visit to site, including purging or micro-purging up to 3.0 hours	nr	140		
J16	Extra over Item J9 for ground gas sample from gas monitoring standpipe during return visit to site	nr	30		
J18	Surface water body sample taken during fieldwork period	r/o			
	Total section J carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
K	**Geotechnical laboratory testing**				
K1	Classification				
K1.1	Moisture content	nr	700		
K1.2	Liquid limit, plastic limit and plasticity index	nr	700		
K1.7	Dry density and saturation moisture content for chalk	nr	210		
K1.9	Particle size distribution by wet sieving	nr	700		
K1.11	Sedimentation by pipette	nr	700		
K3	Compaction related				
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr	250		
K3.8	Chalk crushing value	nr	200		
K4	Compressibility, permeability and durability				
K4.1	One-dimensional consolidation properties, test period 5 days	nr	40		
K4.2	Extra over Item K4.1 for test period in excess of 5 days	day	200		
K6	Shear strength (total stress)		0		
K6.6	Shear strength of a single 300mm × 300mm square specimen by direct shear, test duration not exceeding 1 day	nr	40		
K6.16	Undrained strength of a single 100mm diameter specimen in triaxial compression without the measurement of pore pressure	nr	100		
K8	Rock testing		0		
K8.1	Natural water content of rock sample	nr	210		
K8.3	Porosity/density using saturation and buoyancy	nr	210		
K8.14	Uniaxial compressive strength	nr	210		
K8.15	Deformability in uniaxial compression	nr	140		
K8.22	Single measurement of point load strength on irregular rock lump or core sample (either axial or diametral test)	nr	210		
Contract specific additional bill items					
K9	Chemical testing for aggressive ground/groundwater		0		
K9.1	SD1 basic determinands suite on soil/rock sample (See S1.19.6)	nr	210		
K9.4	SD1 additional determinands suite on water sample (See S1.19.6)	rate only	70		
	Total section K carried to summary:				

Number	Item description	Unit	Quantity	Rate	Amount £
L	**Geoenvironmental laboratory testing**				
	Contamination testing				
L1.1	Suite E (Soil samples - Suite 1. Schedule S1.20.3)	nr	900		
L1.2	Suite E (Soil samples - Suite 2. Schedule S1.20.3)	nr	120		
L1.3	Suite F (Water samples Schedule S1.20.3)	nr	270		
L1.4	Suite G (Gas samples Schedule S1.20.3)	nr	40		
	Waste acceptance criteria testing				
L2.1	Suite H (Inert waste landfill Schedule S1.20.5)	nr	100		
L2.2	Suite I (Stable, non-reactive hazardous waste in non-hazardous waste landfill Schedule S1.20.5)	nr	100		
L2.3	Suite J (Hazardous waste landfill Schedule S1.20.5)	nr	100		
Contract specific additional bill items					
L2.4	Waste classification suite (including full WAC)	nr	100		
L2.5	Asbestos quantification	nr	240		
L2.6	TPH CWG	nr	240		
L2.7	Cyanide (free)	nr	120		
L2.8	Chromium (hexavalent)	nr	120		
L2.9	VOC	nr	120		
L2.9	SVOC	nr	120		
	Total section L carried to summary:				

Summary of Bill of Quantities

Section	Description	Total (£)
A.	General items, provisional services and additional items	
B.	Percussion boring	
C.	Rotary drilling	
D.	Pitting and trenching	
E.	Sampling and monitoring during intrusive investigation	
F.	Probing and cone penetration testing	0.00
G.	Geophysical testing	Not Required
H.	In situ testing	
I.	Instrumentation	
J.	Installation monitoring and sampling	
K.	Geotechnical laboratory testing	
L.	Geoenvironmental laboratory testing	
	Total tender:	

Justin Hobkirk
Buro Happold Limited
Camden Mill
Lower Bristol Road
Bath
BA2 3DQ
UK

[redacted]