



Appendix C

WYG Phase II Designed Specification and BoQ



Tidal Lagoon (Swansea Bay) Plc

Tidal Lagoon Swansea Bay

Ground Investigation Specification

19th August 2016



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Preamble to Specification

The Specification shall be the UK Specification for Ground Investigation, ICE Site Investigation Steering Group, Second edition, published by Thomas Telford Ltd in 2012, with information, amendments and additions as detailed in the following Schedules, Appendices and Drawings:

- Schedule 1: Information and site specific requirements
- Schedule 2: Exploratory Holes
- Schedule 3: Investigation Supervisor's facilities
- Schedule 4: Specification amendments
- Schedule 5: Specification additions



Schedule 1: Information and site-specific requirements

General comments

S1.1 Name of Contract

Tidal Lagoon Swansea Bay – Onshore Site Investigation Phase II

S1.2 Investigation Supervisor

Not Required. The Contractor shall be responsible for implementing the site investigation works in accordance with this specification and in a manner so as to satisfy regulatory requirements.

S1.3 Description of site

The site comprises land adjacent to Kings Dock and Queens Dock in Swansea Bay and an elongated route (circa 4.5km) for a proposed high voltage electricity cable extending to Baglan near Port Talbot. The majority of the site is currently vacant land and is largely covered by hardstanding. The proposed cable route portion of the site extends along the footpath to Fabian Way before passing through the sand dunes at Crymlyn Burrows and then running under the River Neath and connecting into Baglan Energy Park.

The site has an extensive history of industrial development since the construction of the docks circa 1918. Land uses on the site have included a timber yard, fish meal works, oil storage tanks, various industrial works, gasworks and railway sidings. Adjacent land uses have comprised further industrial processes including a large chemical works and power station at Baglan.

The geology underlying the site comprises Made Ground deposits in the vicinity of the western docks and around the Baglan Bay end of the cable route. The underlying superficial geology comprises Marine Beach Deposits with Tidal Flat Deposits and alluvium around the River Neath and some Blown Sand deposits along the central portion of the cable route. The underlying bedrock comprises Coal Measures. The Coal Measures and superficial deposits are classed as Secondary Aquifers. There is no appreciable risk currently identified from radon gas or coal mining for the site.

Significant sources of contamination have been identified based upon the extensive historic industrialisation of the site and surrounding area and in view of information in existing site investigation reports. Key contaminants of concern include heavy metals, asbestos, petroleum hydrocarbons, BTEX and PAHs. There is also a plausible risk of sulphate, cyanide, PCBs, VOCs and SVOCs being present in some areas.

Risks to human health and controlled waters have been identified. These risks are predominantly low to moderate; however, some elevated high level risks have also been identified.



S1.4 Main works proposed and purpose of this contract

The site is to be developed as part of the land based elements of the proposed Tidal Lagoon Swansea Bay. This will include requirements for temporary offices and haul road during the construction phase, a high voltage cable route extending into Baglan Energy Park with a cable crossing beneath the River Neath, new access road, car parking, public realm landscaping and a new employment use building at the western extremity of the site. The main objectives of the ground investigation are to identify potential geotechnical and geoenvironmental issues that may represent a constraint to the proposed construction.

S1.5 Scope of investigation

In summary the investigation is to comprise:

- Establishment of temporary site offices and welfare facilities
- Provide safe working access to exploratory hole positions
- 24 No. machine excavated trial pits
- 10 no. hand excavated pits
- 14 no. cable percussive boreholes
- 44 no. dynamic window sample boreholes
- 25 no. CBRs
- 25 no. stockpile / bund samples (to be obtained using hand tools)
- *in-situ* testing (SPT's, hand vane tests, PID readings)
- Installation of ground gas and groundwater monitoring wells
- Monitoring of groundwater levels and free phase product if present
- Sampling and laboratory analysis of soil, groundwater and ground gas samples for chemical parameters
- Sampling and laboratory analysis of soil samples for geotechnical parameters
- Factual reporting
- Interpretative reporting
- Remediation options appraisal and remediation strategy

The investigation works are expected to be instructed and undertaken in four distinct stages, namely:

- Part A – Western landfall area, access road and Morrisey Land
- Part B – Central contractors laydown area
- Part C – Transport hub and access road
- Part D – HV export cable route

In view of the phased approach separate bill of quantities are proposed for each of the four stages.

The Contractor is to undertake the investigation and subsequent reporting in a manner so as to satisfy the requirements of the Regulatory Authorities with regard to discharge of planning conditions and to provide the requisite information to the Client for purposes of finalising design works. If, in order to fulfil these



obligations, the Contractor encounters ground conditions that require additional assessment or analysis not included within this specification then they are to identify this issue to the Client as soon as possible and to provide a recommended (and costed) scope for further works. Subject to the agreement of the Client the scope of further works will be discussed and agreed with the Regulatory Authorities prior to commencement of any additional works.

S1.6 Geology and ground conditions

The following general assessment of the geology of the site and ground conditions has been inferred from available information, no assurance is given to its accuracy. The site is covered by British Geological Survey (BGS) 1:50,000 (solid and drift) map number 247, Swansea. The online version of GeoIndex has been consulted. Further details of the site geology and ground conditions are presented in the desk study report referenced in S1.7 below.

Made Ground

According to BGS mapping, the western area of the site and the adjacent former BP transit site is underlain by Made Ground comprising both artificial deposits and artificially modified ground. BGS borehole logs indicate that Made Ground extends to depths of up to 3.9 to 7.1m and comprise various types of Made Ground including ashy deposits, gravel and cobbles of slag, clinker, firebrick and concrete.

Superficial Geology

The west of the site is underlain by Marine Beach Deposits comprising mainly sands. Blown Sand Deposits are recorded along the central section of the site and the far east below the former BP power station. Tidal Flat Deposits and alluvium consisting of clay, silt and sand are indicated across the River Neath.

Solid Geology

The bedrock consists of the South Wales Middle Coal Measures Formation in the north and Lower Coal Measure Formation in the south. Both formations consist of mudstone, siltstone and sandstone.

Historical BGS Borehole logs

A number of historical BGS boreholes records in the vicinity of the site are available. Five records are summarised in Table 1 below

Table 1 Summary of Historical Borehole Logs

Borehole BGS Reference (year drilled)	Location	Strata	Depths (m bgl)	Description
SS69SE138-142 (1993)	NGR: 268805, 192895 to 269140, 192945 Port of Swansea road, south-	Made Ground	0-3.9	Loose to medium dense clayey silty GRAVEL and COBBLES of sandstone, clinker, coal, coke, brick and slag
		Upper Alluvium	3.9-7.7	Medium dense to dense silty SAND and GRAVEL with occasional shell fragments



Borehole BGS Reference (year drilled)	Location	Strata	Depths (m bgl)	Description
	west of A483 Fabian Way	Alluvium	7.7->30	Interbedded soft to firm occasionally stiff silty CLAY with fibrous peat and medium dense to dense clayey SILT and SAND with peaty fibres. Bands between 0.45 and 0.7m thick of compact fibrous peat recorded
SS69SE316 (1978)	NGR: 269410, 192960 A483 Fabian Way	Made Ground	0-7.1	Ash, chippings and cobbles
		Sand and Gravel	7.1-9.0	Sand and Gravel
SS79SW106 (1979)	NGR: 272770, 193525	Topsoil	0.0-0.2	Topsoil and turf
		Alluvial Blown Sand	0.2-4.0	Medium dense brown fine to medium grained sand with little shell fragments Lense of grey silty clay with some peat debris at 3.60m bgl
		Alluvium	4.0-6.0	Firm grey slightly peaty clay
		Alluvium	6.0-10.4	Very soft grey brown slightly silty clay with a trace of plant remains
		Alluvium	10.4-12.0	Moderately compact grey brown slightly clayey very fine-grained sandy silt with a trace of plant remains
		Alluvium	12.0-15.0	Medium dense grey brown very silty fine to medium grained sand with a trace of shell fragments and a trace of plant remains
		Alluvium	15.0-20.5	Medium dense grey brown silty fine to medium grained sand with occasional layers and packets of grey silty clay and trace of shell fragments and a trace of plant fragments.
		Alluvium	20.5-23.0	Medium dense grey brown silty angular to sub-rounded fine to coarse grained sand with some shell fragments and sub-angular to sub-rounded fine to coarse grained gravel with some cobbles and occasional layers of clayey silt
		Glacial Deposits	23.0-26.5	Medium dense grey brown sub-angular to rounded fine to coarse grained gravel and cobbles with some very silty angular to sub-rounded fine to coarse grained sand and occasional layers of grey silty clay
		Glacial Deposits	26.5-29.5	Dense to very dense grey brown clayey silty angular to sub-angular fine to coarse grained sand and sub-angular to rounded fine to coarse grained gravel with some cobbles
		Sandstone	29.5-29.7	Angular coarse grained gravel and cobble sized fragments of grey sandstone



Borehole BGS Reference (year drilled)	Location	Strata	Depths (m bgl)	Description
SS79SW562 (1998)	NGR: 272351, 192725 Baglan Burrows – adjacent to River Neath	Topsoil	0.0-0.2	Loose gravelly sandy topsoil
		Made Ground	0.2-0.5	Loose orange brown medium grained sand with some cobbles of broken concrete
		Made Ground	0.5-1.1	Dense cobbles and boulders of cementitious brown fines with fire bricks and some blue grey vesicular slag
		Made Ground	1.1-2.1	Loose gravel of black ash with clinker and some cobbles of dark blue grey slag with some carbonation
		Made Ground	2.1-3.0	Loose gravel and cobbles of blue grey vesicular slag. Distinct area of this material with high degree of carbonation.
		Made Ground	3.0-4.3	Medium density gravel to boulders of dark grey vesicular slag with a little carbonation and a few fire bricks.
		Made Ground	4.3-4.4	Firm silty black sand with vegetation. Sulphurous odour
		Sand	4.4-4.9	Loose grey brown medium grained sand
SS79SW619 (1998)	NGR: 273121, 193069 Baglan Burrows, adjacent to River Neath	Topsoil (Made Ground)	0.0-0.2	Loose sand, some gravel of ash and slag rich soil
		Made Ground	0.2-2.2	Loose sand, some gravel and occasional firebrick and shells
		Made Ground	2.2-2.8	Medium dense cobbles and gravel of slag, brown ash and firebrick
		Made Ground	2.8-4.0	Loose dark grey brown clinker and ash, sand and gravel. Little visible slag.
		Made Ground	4.0-5.0	Loose gravel of brown clinker
		Made Ground	5.0-5.7	Loose cobbles/gravel of clinker with minor cobbles of slag
		Sand	5.7-5.9	Loose light brown medium grained sand

S1.7 Schedule of drawing(s) and documents

- Annex A - Figure 1 : Site Location
- Annex B - Figure 2 : Exploratory Hole Layout Plan
- Annex C – Bill of Quantities
- Tidal Lagoon Swansea Bay – Onshore Works, Ground Conditions Desk Study, WYG, 19th April 2016

Utility Service Plans will be provided prior to commencement of the ground investigation (issued by the client).



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

S1.8.1 Quality management system (Clause 3.3)

The Contractor is required to work to a Quality Management system in accordance with clause 3.3. Details of suitable accreditation shall be provided prior to commencement of any work on site.

Laboratory analysis shall be carried out by MCERTS and UKAS accredited laboratories.

S1.8.2 Professional Attendance (Clause 3.5.2)

Professional attendance will be provided by the Contractor to perform the tasks detailed in Specification Note for Guidance 3.5.2. The Contractor is to provide an experienced Ground Engineer/Geologist, with at least 5 years' experience of site investigation works of a comparable nature, to supervise all site activities. The Ground Engineer must be on site during all times whilst intrusive works are underway in order to supervise the investigation activities and to undertake or supervise logging of exploratory holes, taking of samples and in-situ tests, taking of photographic records and the completion of daily records / field notes.

The Contractor is to provide names, contact details, CV's and evidence of relevant certification for all site personnel. All site staff are to hold a valid CSCS card relevant to their role.

S1.8.3 Provision of ground practitioners and other personnel (Clauses 3.6.1 and 3.6.2)

Not required

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

Significant sources of contamination have been identified based upon the extensive historic industrialisation of the site and surrounding area and in view of information in existing site investigation reports. Key contaminants of concern include heavy metals, asbestos, petroleum hydrocarbons, BTEX and PAHs. There is also a plausible risk of sulphate, cyanide, PCBs, VOCs and SVOCs being present in some areas.

The site is categorised as a Yellow Site in accordance with the Site Investigation Steering Group (SISG) guidance. This is considered to apply to the majority of the ground conditions anticipated across the site. The Contractor shall immediately advise the Client if any ground conditions are encountered which are indicative of Red Site working conditions.

The Contractor shall be responsible for providing any necessary precautions or complying with any specified procedures required to address the risk of unexploded ordnance (UXO). This will be in accordance with specialist UXO reports to be supplied by the Client.



There is the potential for Japanese Knotweed or Sea Buckthorn to be present on the site as these invasive plants are known to have been encountered during works on the adjacent former BP Transit site. An appropriate methodology will be required within the Contractor's method statement to prevent disturbance or spreading of these invasive plants as a result of the site investigation works.

S1.8.5 Additional information on services not shown on Contract drawings (Clause 3.7.2)

Available service drawings will be provided to the Contractor for guidance purposes. The Contractor shall make all necessary enquiries and undertake all necessary assessments and surveys to check for the presence of utility services prior to commencing intrusive works. The Contractor shall be responsible for making due consideration as to the likely accuracy of any service plans and shall be responsible for adopting suitable safe distances from any recorded or suspected service locations.

Local services not recorded on statutory undertakers plans or abandoned and redundant services may be present. This may include relic pipelines associated with the BP transit site / oil terminal and the BP Chemical works at Baglan Bay. Any such pipelines may be a potential source of contamination and due care should be taken to avoid disturbance that may result in a release of contamination.

All exploratory locations must be visually checked for evidence of nearby service infrastructure (including overhead cables, manholes, grids, service trenches, transformers and junction boxes or similar) and then must be surveyed using a suitable Cable Avoidance Tool (CAT) and Genny system, operated by a trained member of staff. Evidence of suitable CAT and Genny training must be provided prior to commencement of works.

A permit to dig system must be operated and this must record the details of any surveys and checks undertaken prior to intrusive works at each exploratory hole. The works shall be carried out in accordance with the latest version of the Health and Safety Executive publication HSG47 Avoiding Danger from Underground Services.

Hand dug inspection pits to 1.2m shall be undertaken at all borehole and dynamic sample positions with regular re-scanning of the pit at 0.3m intervals using the CAT and genny system.

The Contractor shall accept full responsibility of the location, avoidance, protection and if necessary the repair of all underground and overground services regardless of whether these are shown on any available plans or drawings.

Intrusive works shall only commence once the Contractor is satisfied that no services are present in the vicinity of the exploratory hole.



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

The site is underlain by Coal Measures; however, a Coal Mining Report included within the site desk study does not identify any coal mining risks to the site.

S1.8.7 Protected species (Clause 3.7.4)

The Client will provide any available information to the Contractor regarding protected species prior to commencement of the works.

Crymlyn Burrows is a site of special scientific interest (SSSI) covering the area between the River Neath to the east and the BP transit site to the west. Any works that occur in this area will need to be undertaken in a sensitive manner using a methodology to be agreed between the Contractor and the Biodiversity Officer for Neath and Port Talbot Council. This may also need to include liaison with National Resources Wales.

S1.8.8 Archaeological remains (Clause 3.7.5)

Intrusive works in the Crymlyn Burrows part of the site will require an archaeological watching brief in accordance with the Written Scheme of investigation - Terrestrial Heritage Assets, Tidal Lagoon Swansea Bay, prepared by Aecom, September 2015.

S1.8.9 Security of site (Clause 3.11)

The Contractor is responsible for keeping all of their working areas, access routes and site compounds safe and secure at all times.

All working areas must be secured during both the working day and at the end of each working shift as well as overnight. The Contractor will be responsible for the provision, installation and maintenance of any additional security measures, fencing and signage as is required to keep the site safe.

S1.8.10 Traffic management measures (Clause 3.12)

Exploratory holes are to be located in the footpaths to the public highways (A483 Fabian Way). The Contractor shall be responsible for liaising with the Local Authority and agreeing suitable working procedures. It is not anticipated that there will be any works required in the roads at this stage.

The Contractor shall provide appropriate signage for pedestrians / footpath users in accordance with Chapter 8 of the Traffic Signs Manual 2006.

S1.8.11 Restricted working hours (Clause 3.13)

Working hours shall be 08:00 to 18:00 Monday to Friday inclusive (excluding UK public holidays) unless agreed otherwise.



S1.8.12 Trainee site operatives (Clause 3.14.1)

Trainee operatives are not permitted without prior approval from the Client.

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

Exploratory holes shall be advanced in a manner suitable to minimise the risk of lateral or vertical contamination migration within either the soils or groundwater. Drilling methods should ensure that any drilling flush does not enter local drainage networks or cause impacts to the land or surface waters.

Aquifer protection as defined in 3.15.3 is required if significant mobile contamination is. The contractor shall confirm details of proposed aquifer protection measures with their tender

In accordance with BS10175:2013 all boreholes should be backfilled with clean, low permeability material (e.g. bentonite) unless monitoring wells are installed. Areas of clearly contaminated soils, such as free phase oil, shall be plugged using bentonite seals to avoid vertical migration of contaminants.

All excess spoil shall be removed from site by the Contractor to a suitable, licensed facility. All temporary storage of spoil arisings shall be in a manner suitable to prevent contamination or discolouration of the ground or impacts to controlled waters. Non-contaminated arisings shall be stored separately to contaminated materials.

Care shall be taken to avoid cross contamination between exploratory hole positions. Equipment and sampling tools shall be washed down as necessary to avoid the risk of cross contamination. The Contractor shall provide the necessary facilities and sufficient time for this purpose.

Emergency spill kits shall be available on site at all times. No discharge of cement slurry, drilling flush, purged groundwater or other liquids shall be permitted to controlled waters or drainage systems without prior approval of the relevant authority.

In the event of any contamination occurring to land, drainage or controlled waters then the Contractor shall immediately inform the relevant authority and the Client.

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)

1 hour unless otherwise agreed with the Client.

S1.8.15 Reinstatement requirements (Clause 3.16)

All working areas, access routes and exploratory holes without monitoring wells (including trial pits) are to be reinstated to their original condition. Monitoring wells are to be left in a suitable condition for future use.



All highways / public pavement areas are to be reinstated as per the New Roads and Street Work Act (NRSWA) 1991.

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

The Contractor shall provide and maintain site welfare facilities suitable for a Yellow Site and suitable for the proposed number of workers likely to be present in accordance with CDM regulations. This shall include washing facilities, toilets, decontamination, boot wash facilities, equipment storage, rest and changing facilities and a supply of potable water.

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

Any damage caused by the Contractor shall be reported to the Client and shall be made good.

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

Preliminary locations for exploratory holes are provided and these are to be agreed with the regulatory authorities (Swansea Council, Neath and Port Talbot Council and Natural Resources Wales).

Upon completion of works the Contractor shall survey the location and level of all exploratory holes (including any abandoned at shallow depth) to National Grid coordinates and Ordnance Datum.

S1.8.19 Photography requirements (Clause 3.25)

Photographs shall be taken to show the condition of all exploratory hole positions and all access routes before and after completion of the works.

All dynamic window sample and rotary cores shall be photographed prior to splitting the core for logging or sampling. Trial pits shall be photographed such that a record of all excavation faces is obtained and a photograph shall be obtained of the arisings.

Photographs should be of at least 3 mega pixels and shall include a suitable scale and reference board which includes the project name, exploratory hole location, date and depth.

Photographs shall be obtained of any services encountered or any damage caused during the works. All photographs are to be provided in the Factual Report.

S1.8.20 Risk Assessments and Method Statements

The Contractor shall provide site specific risk assessments and method statements at least 1 week prior to site works commencing.

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

S1.9.1 Permitted methods and restrictions (Clauses 4.1 to 4.4)

The contractor may use only vegetable oil based lubricants.



S1.9.2 Backfilling (Clause 4.5)

In accordance with BS10175:2013 all boreholes should be backfilled with clean, low permeability material (e.g. bentonite) unless monitoring wells are installed. Trial pits are to be backfilled using the arisings.

A provisional estimate of installation requirements is provided in Schedule 2.

S1.9.3 Dynamic sampling (Clause 4.6)

Percussion boreholes and dynamic window sample holes shall follow on from the base of the hand dug starter pit which shall be a minimum depth of 1.2m below ground level (bgl).

Windowless sampling shall be carried out using hollow line steel tubes of maximum 1m length and a cutting shoe in order to recover a nominally continuous soil sample for examinations/sub-sampling. Clear plastic tubing shall be used inside the steel tubes to facilitate environmental and geotechnical sample recovery, sample protection and sample logging. The range of sampling tube diameters brought to site and those used at the start of the hole shall be compatible with achieving the scheduled depths and quality of sample in the expected ground conditions. The Contractor shall be responsible for selecting the appropriate diameter casing at the start of drilling to account for any necessary reduction in casing size to achieve the minimum diameter required at the base of the borehole and any requirements for forming bentonite plugs.

All boreholes shall be continued to the depth specified in Schedule 2 or refusal. Where necessary to maintain hole stability, suitable casing shall be used to the full depth of the hole.

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

S1.10.1 Augering requirements and restrictions (Clauses 5.1)

Not used.

S1.10.2 Particular rotary drilling techniques (Clause 5.2)

Not used.

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

Not used.

S1.10.4 Rotary core drilling equipment and core diameter (Clauses 5.4.1 and 5.4.2)

Not used.

S1.10.5 Core logging (Clause 5.4.6)

Not used.



S1.10.6 Core sub-samples for laboratory testing (Clause 5.4.7)

Not used.

S1.10.7 Address for delivery of selected cores (Clauses 5.4.8 and 5.4.9)

Not used.

S1.10.8 Rotary open-hole drilling general requirements (Clause 5.5.1)

Not used.

S1.10.9 Rotary open-hole drilling for locating mineral seams, mine workings, etc. (Clause 5.5.2)

Not used.

S1.10.10 Open-hole resonance (sonic) drilling (Clause 5.6.1)

Not used.

S1.10.11 Resonance (sonic) drilling with sampling or continuous coring (Clause 5.6.2)

Not used.

S1.10.12 Backfilling (Clause 5.7)

Not used.

S1.10.13 Core photographic requirements (Clause 5.8)

Not used.

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

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

All trial pits must be visually checked for evidence of nearby service infrastructure (including overhead cables, manholes, grids, service trenches, transformers and junction boxes or similar) and then must be surveyed using a suitable Cable Avoidance Tool (CAT) and Genny system, operated by a trained member of staff. Evidence of suitable CAT and Genny training must be provided prior to commencement of works.

A permit to dig system must be operated and this must record the details of any surveys and checks undertaken prior to intrusive works at each exploratory hole. The works shall be carried out in accordance with the latest version of the Health and Safety Executive publication HSG47 Avoiding Danger from Underground Services.



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

None

S1.11.3 Entry of personnel (Clause 6.5)

No personnel shall be permitted to enter pits or trenches.

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

Variations to pit dimensions are permitted as required to accommodate ground conditions, ground stability and obstructions.

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

Any groundwater abstracted from the site shall be assumed to be potentially contaminated until proven otherwise. The Contractor shall be responsible for storing and disposing of the groundwater at a suitable licensed facility.

S1.11.6 Backfilling (Clause 6.10)

Pits and trenches shall be backfilled as soon as practicable with arisings being placed in reverse order to excavation. The arisings shall be compacted using the excavator bucket.

S1.11.7 Photographic requirements (Clause 6.12)

Photographs shall be taken of the trial pit arisings and of all faces of the excavation.

S1.11.8 Artificial lighting (Clause 6.12.2)

Not required

S1.11.9 Provision of pitting equipment and crew for Investigation Supervisor's use (Clause 6.13)

Not required

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

S1.12.1 Address for delivery of selected geotechnical samples (Clause 7.6.1)

The Contractor is to propose a suitable geotechnical laboratory for the works.

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

Samples are to be retained, at the Contractors' cost, for a period of at least 28 days after submission of the approved final report.

S1.12.3 Frequency of sampling for geotechnical purposes (Clauses 7.6.3-7.6.11)



All types of boreholes shall, in general, implement the following sampling regime:

- Start at base of an inspection pit with an in situ SPT followed by a dynamic drive of 1m length to obtain a lined sample. This sequence shall be repeated at 1m centres to 5m depth and at 1.5m intervals thereafter;
- Small disturbed samples will be taken at 1m intervals and at each change in soil type or consistency.
- On refusal of a drive, an in situ SPT shall be undertaken prior to completion of the exploratory hole;

Trial Pits and Inspection Pits shall, in general, implement the following sampling regime:

Small disturbed samples shall be taken and sealed against moisture loss:

- Of the topsoil;
- At 1m intervals; and
- At each change in soil type or consistency

Bulk disturbed samples shall be taken:

- At 1m intervals; and
- At each change in soil type or consistency

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

Only the use of UT100 or OS-TW thin wall samples is permitted.

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

None.

S1.12.6 Delft and Mostap sampling (Clause 7.6.12)

Not used

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

Water within an exploratory hole shall be measured, as a minimum:

- At start of day;
- At start of any down time (e.g. lunch breaks, other rest period breakdowns etc);
- At recommencement of work (e.g. following lunch break, other rest periods, breakdowns etc); and
- At end of day.

When groundwater is encountered in exploratory holes:

- The depth from the ground level of the point of entry shall be recorded together with depth of any casing;
- Exploratory hole operations shall be stopped and the depth from ground level to water level recorded with an approved instrument at 5 minute intervals for a period of 20 minutes.



- If after 20 minutes the water level is still rising, this shall be recorded together with the depth to water below ground level. The exploratory hole operations shall then be continued.
- If casing is used and this forms a seal against the entry of groundwater, the Contractor shall record the depth of casing at which no further entry or only insignificant infiltration of water occurred.

Where applicable, every effort shall be made to seal off each water strike post monitoring. On each occasion when groundwater is recorded, the depth of the exploratory hole, the depth of any casing and the time shall be recorded.

S1.12.8 Special geotechnical sampling (Clause 7.8)

None.

S1.12.9 Address for delivery of selected samples (Clause 7.9.2)

The Contractor is to propose a suitable laboratory for the proposed suites of chemical analysis.

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

Samples are to be retained, at the Contractors' cost, for a period of at least 28 days after submission of the approved final report.

S1.12.11 Frequency of sampling (Clause 7.9.4)

Samples shall be taken as follows:

- Of the topsoil / Granular surface cover if present
- At 0.5m and 1m depth
- Thereafter at 1m intervals to 5m, thereafter at 2m intervals
- At each change in soil type or consistency and
- At any soil strata displaying evidence, visual or olfactory, of potential contamination impacts.

S1.12.12 Sampling method (Clause 7.9.5)

Appropriate measures should be taken to avoid cross contamination in accordance with BS1075.

Samples shall be placed into suitable containers clearly labelled with the project title, exploratory hole location, depth and date. Samples shall be kept at an appropriate temperature (ideally 4-5 deg C) and shall be securely packaged for safe transport to the laboratory.

For purposes of selecting sample containers it should be assumed that any sample may be potentially tested for the full range of determinants specified and a suitable volume of sample should be obtained for this purpose.

Any samples thought to potentially contain significant hazards (e.g. asbestos) shall be clearly labelled as such to avoid unnecessary risks to laboratory staff.



S1.12.13 Headspace testing (Clause 7.9.8)

Readings of the headspace volatile organic compounds (VOCs) using a photo-ionisation detector (PID) or similar shall be recorded on site during sampling at the frequency detailed in S1.12.11. The Contractor shall ensure daily calibration of the PID or similar is carried out to ensure accuracy of the readings.

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

S1.13.1 Type(s) and reporting of dynamic probing (Clauses 8.1.1 and 8.1.2)

Not used

S1.13.2 Capacity and equipment requirements for cone penetration testing (Clause 8.2.1)

Not used

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

Not used

S1.13.4 Seismic cone equipment requirements (Clause 8.3.1)

Not used

S1.13.5 Interpretation of seismic cone tests (Clause 8.3.4)

Not used

S1.13.6 Other cone or specialist probes (Clause 8.4)

Not used

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

Not used

S1.14.1 Geophysical survey objectives (Clause 9.1.1)

Not used

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

Not used

S1.14.3 Trials of geophysical methods (Clause 9.1.1)

Not used



S1.14.4 Types of geophysics requirement (Clause 9.1.1)

Not used

S1.14.5 Information provided (Clause 9.2)

Not used

S1.14.6 Horizontal data density (Clause 9.3)

Not used

S1.14.7 Level datum (Clause 9.4)

Not used

S1.14.8 Geophysical survey report (Clause 9.7)

Not used

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

S1.15.1 Tests in accordance with British Standards (Clause 10.3)

- Standard Penetration Tests (SPTs)
- Hand Shear Vane
- California Bearing Ratio

S1.15.2 Hand penetrometer and hand vane for shear strength (Clause 10.4.1)

Hand shear vane tests shall be carried out on suitable samples of cohesive materials at 1m depth intervals. Where possible a set of three tests should be undertaken in close proximity. Tests shall be permitted from large block type bucket samples.

S1.15.3 Self-boring pressuremeter and high-pressure dilatometer testing and reporting (Clause 10.5.1)

Not used

S1.15.4 Driven or push-in pressuremeter testing and reporting requirements (Clause 10.5.2)

Not used

S1.15.5 Menard pressuremeter tests (Clause 10.5.3)

Not used

S1.15.6 Soil infiltration test (Clause 10.6)

Not used



S1.15.7 Special in situ testing and reporting requirements (Clause 10.7)

Not used

S1.15.8 Interface probes (Clause 10.8)

Interface probes / dipmeters are required to be available at all times during the intrusive works and monitoring works in order to monitor for the possible presence of LNAPL or DNAPL products in the groundwater.

S1.15.9 Contamination screening tests (Clause 10.9)

Any soils considered to show potential evidence of organic contamination shall be screened using a PID as per S1.12.13.

S1.15.10 Metal detection (Clause 10.10)

Not used

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

S1.16.1 Protective covers for installations (Clause 11.2)

Flush well covers are required except in Crymlyn Burrows as many parts of the site are in active use. Raised protective covers shall be used in the Crymlyn Burrows area.

S1.16.2 Protective fencing (Clause 11.3)

Subject to the agreement of the regulatory authorities, the location of all monitoring wells in Crymlyn Burrows is to be marked with a 1m high post labelled with the exploratory hole number.

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

Standpipe piezometers will be required in selected exploratory holes, as detailed in Schedule 2 of this Specification.

Ground gas standpipes will be required in selected exploratory holes, as detailed in Schedule 2 of this Specification. The typical well construction shall entail a 50mm diameter HDPE or UPVC well screen and plain casing. Filter pack comprising clean washed non-calcareous 10mm shingle shall be placed around the well screen. A 1m thick bentonite (or equivalent) seal shall be placed immediately above and below the response zone of the well.

All exploratory holes identified for instrumentation, and depths of installation detailed within Schedule 2 are currently provisional and may be revised depending subject to liaison with the regulatory authorities and subject to actual ground conditions encountered.



S1.16.4 Other piezometer installations (Clause 11.4.3)

Not used

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

Standpipes shall be developed by the Contractor by using a suitable submersible pump prior to any subsequent sampling. Well development to be achieved either by removing 3 well volumes of water or by measuring the chemical quality of the pumped water until electrical conductivity, pH, temperature and dissolved oxygen parameters stabilise. Development shall take place at least two weeks prior to sampling.

S1.16.6 Ground gas standpipes (Clause 11.5)

Ground gas standpipes will be required in selected exploratory holes, as detailed in Schedule 2 of this Specification. The typical well construction shall entail a 50mm diameter HDPE or UPVC well screen and plain casing. Filter pack comprising clean washed non-calcareous 10mm shingle shall be placed around the well screen. A 1m thick bentonite (or equivalent) seal shall be placed immediately above and below the response zone of the well.

S1.16.7 Inclinator installations (Clause 11.6)

Not used

S1.16.8 Slip indicators (Clause 11.7)

Not used

S1.16.9 Extensometers and settlement gauges (Clause 11.8)

Not used

S1.16.10 Settlement monuments (Clause 11.9)

Not used

S1.16.11 Removal of installations (Clause 11.10)

Not used

S1.16.12 Other instrumentation (Clause 11.11)

Not used

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

S1.17.1 Groundwater level readings in installations (Clause 12.2)



The Contractor shall read groundwater levels in all installed standpipes daily during the fieldwork period once installed and operational. Where sampling of gas or groundwater is required, each standpipe shall be read after gas sampling, but before water sampling.

Each installation reading shall include as a minimum:

- Presence and thickness of any free phase LNAPL or DNAPL
- Depth to base of standpipe; and
- Water level.

A total of six return visits are required on a fortnightly basis.

To measure possible tidal influences downhole water level loggers will be required for the first visit within at least eight of the boreholes. The level loggers should record water levels at 30 minute intervals for a two week period.

S1.17.2 Groundwater sampling from installations (Clause 12.3.1)

Groundwater sampling shall only be undertaken following borehole development, after which there shall be a period of at least two weeks to allow aquifer conditions to equilibrate.

Well development shall require the purging of groundwater (to include a minimum of 3 well volumes) to be undertaken until such time as on-going field measurements of groundwater quality parameters (to include pH value, redox potential, conductivity, dissolved oxygen and total suspended solids) stabilise at levels that are considered to indicate sufficient well development has been achieved. Pre and post purging groundwater levels shall be recorded along with details of any LNAPL or DNAPL product that may be present.

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

Low flow sample techniques shall be used with field parameters (conductivity, pH, temperature, dissolved oxygen, redox) monitored until stable. The Contractor is responsible for arranging disposal of purged groundwater.

S1.17.4 Ground gas monitoring (Clause 12.4)

Ground gas monitoring shall be undertaken on all monitoring wells on at least six occasions on an approximate fortnightly basis. Ideally the monitoring should be undertaken during a range of climatic conditions including at least one period of falling pressure.

At each location the following shall be recorded:

- Carbon dioxide (% volume) – peak and steady concentrations
- Methane (% volume) – peak and steady concentrations
- Oxygen (% volume) – peak and steady concentrations
- Hydrogen sulphide (to at least 1ppm) – peak and steady concentrations



- Carbon monoxide (to at least 1ppm) – peak and steady concentrations
- Total VOCs (to at least 1ppm) – peak and steady concentrations
- Flow rate (to at least 0.1 l/hr) – peak and steady concentrations
- Pressure differential and atmospheric pressure
- Time of monitoring and time taken for readings to stabilise for each gas type
- Depth to groundwater

Pre and post monitoring readings should also be taken of the ambient atmospheric conditions and weather observations for each visit. All equipment used should be suitably calibrated and evidence of this shall be provided in the Factual Report.

S1.17.5 Sampling from ground gas installations (Clause 12.5)

Subject to the initial rounds of gas monitoring results gas samples to be obtained and analysed using tedlar bags. Two tedlar bags may be required per sample to allow for analysis of a bulk gas suite and a VOC gas suite.

The process for sampling into tedlar bags requires that the gas is pumped into the bag using a suitable gas meter or separate pump. The bags should not be overinflated. All tedlar bag samples should be suitably preserved and packaged so as to protect the sample in transit. The samples should be transported to the analytical laboratory within no more than 24hrs. Any samples damaged in transit or not received at the laboratory within 24hrs will be deemed to be non-compliant and a replacement sample shall be obtained by the Contractor at their own cost.

S1.17.6 Other monitoring (Clause 12.8)

Not required

S1.17.7 Sampling and testing of surface water bodies (Clause 12.9)

Not required

S1.18 Daily records (Specification Section 13) Particular restrictions/relaxations

S1.18.1 Information for daily records (Clause 13.1)

The Contractor's site engineer shall maintain daily records of progress on site, any delays or obstructions and details of any incidents which may have occurred.

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

The Contractor shall include the details (including type, number and results etc) of all in situ testing and sampling undertaken.

S1.19 Geotechnical laboratory testing (Specification Section 14) Particular restrictions/relaxations



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

The Contractor shall schedule the testing.

S1.19.2 Tests required (Clause 14.1.2)

The following geotechnical testing shall be carried out and reported in accordance with the Specification:

- moisture content, liquid limit, plastic limit, plasticity index;
- particle size distribution (both wet sieve and sedimentation by pipette)
- Dry density vs moisture content relationship
- Chemical testing for concrete classification (BRE SD1 suite)
- Organic matter content
- California bearing ratio
- One dimensional consolidation test, 5 days (Oedometer)
- Undrained shear strength single 100mm diameter in triaxial compression
- Compaction test using 2.5kg and 4.5kg rammer

S1.19.3 Specifications for tests not covered by BS 1377 and options under BS 137 (Clauses 14.2.1 and 14.4)

BRE SD1 suites for concrete design

S1.19.4 UKAS accreditation to be adopted (Clause 13.3)

All tests are to be UKAS accredited.

S1.19.5 Rock testing requirements (Clause 14.5)

Rock testing is likely to include:

- point load tests
- Uniaxial compressive strength

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

pH and sulphate as per BRE SD1

S1.19.7 Laboratory testing on site (Clause 14.7)

Not required.

S1.19.8 Special laboratory testing (Clause 14.8)

Not required.



Schedule 1.19.6 (Derived from BRE Special Digest SD1)

CHEMICAL TESTS ON POTENTIALLY AGGRESSIVE GROUND/GROUNDWATER

SUITE A Greenfield site (pyrite absent)			
Sample type	Determinand	Recommended test methods	Test method offered¹
Soil	pH in 2:5:1 water/soil extract	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄ in 2:1 water/soil extract	BS 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.3 + 5.5	
Groundwater	pH	BR279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄	BR 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.4 + 5.5	
	Commercial lab in-house procedure – determination of sulphur by ICP-AES ²		
SUITE B Greenfield site (pyrite present)			
Soil	pH in 2:5:1 water/soil extract	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄ in 2:1 water/soil extract	BS 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.3 + 5.5	
		TRL 447 Test 1	
	Acid soluble SO ₄	BR 279 Gravimetric method	
		BS 1377 Part 3 Method 5.2 + 5.5	
		TRL 447 Test 2	
Total sulphur	BR 279 Ignition in oxygen		
	TRL 447 Test 4A		
	TRL 447 Test 4B		
Groundwater	pH	BR279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄	BR 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.4 + 5.5	
		Commercial lab in-house procedure – determination of sulphur by ICP-AES ²	

¹ Contractor to detail method(s) offered.

² ICP-AES: inductively coupled plasma atomic emission spectroscopy.



Schedule 1.19.6 (Derived from BRE Special Digest SD1)

CHEMICAL TESTS ON POTENTIALLY AGGRESSIVE GROUND/GROUNDWATER

SUITE C Brownfield(pyrite absent)			
Sample type	Determinand	Recommended test methods	Test method offered¹
Soil	pH in 2:5:1 water/soil extract	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄ in 2:1 water/soil extract	BS 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.3+ 5.5	
		TRL 447 Test 1	
	Mg (only required if water soluble SO ₄ >3000mg/1)	BR 279 AAS ² method	
		Commercial lab in-house procedure – variant of BR 279 using ISP-AES ³	
NO ₃ in 2:1 water/soil extract (only required if pH<5.5)	BR 279		
C1 in 2:1 water/soil extract (only required if pH <5.5)	BR 279		
	BS 1377 Part 3, Method 7.2		
Groundwater	pH	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄	BR 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.4 + 5.5	
		Commercial lab in-house procedure – determination of sulphur by ICP-AES ³	
	Mg (only required if water soluble SO ₄ ≥3000 mg/1)	BR 279 AAS method ²	
		Commercial lab in-house procedure – Mg in solution by ICP-AES ³	
	NO ₃ (only required if pH <5.5)	BR 279	
C1 (only required if pH <5.5)	BR 279		
	BS 1377 Part 3, Method 7.2		

¹ Contractor to indicate method(s) offered.



Schedule 1.19.6 (Derived from BRE Special Digest SD1)

CHEMICAL TESTS ON POTENTIALLY AGGRESSIVE GROUND/GROUNDWATER

SUITE D Brownfield(pyrite absent)			
Sample type	Determinand	Recommended test methods	Test method offered ¹
Soil	pH in 2:5:1 water/soil extract	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄ in 2:1 water/soil extract	BS 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.3 + 5.5	
		TRL 447 Test 1	
	Acid soluble SO ₄	BR 279 Gravimetric method	
		BS 1377 Part 3, Method 5.2 + 5.5	
		TRL 447 Test 2	
	Total sulphur	BR 279 Ignition in oxygen	
		TRL 447 Test 4A	
TRL 447 Test 4B			
Mg (only required if water soluble SO ₄ >3000 mg/l)	BR 279 AAS ² method		
	Commercial lab in-house procedure – variant of BR 279 using ISP-AES ³		
	NO ₃ in 2:1 water/soil extract (only required if pH <5.5)	BS 279	
	C1 in 2:1 water/soil extract (only required if pH <5.5)	BS 1377 Part 3, Method 7.2	
Groundwater	pH	BR 279 Electrometric	
		BS 1377 Part 3, Method 9	
	SO ₄	BR 279 Gravimetric method, cation exchange or ion chromatography	
		BS 1377 Part 3 Method 5.4 + 5.5	
		Commercial lab in-house procedure – determination of sulphur by ICP-AES ³	
	Mg (only required if water soluble SO ₄ ≥3000 mg/l)	BR 279 AAS method ²	
		Commercial lab in-house procedure – Mg in solution by ICP-AES ³	
	NO ₃ (only required if pH <5.5)	BR 279	
C1 (only required if pH <5.5)	BR 279		
	BS 1377 Part 3, Method 7.2		



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

S.1.20.1 Investigation Supervisor or Contractor to schedule testing (Clause 15.1)

The Contractor shall schedule the geo-environmental testing.

S1.20.2 Accreditation required (Clause 15.2)

UKAS and MCERTS accreditation is required where feasible.

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

Required as detailed below. The Contractor is to propose the limit of detection and test method offered, taking into consideration the proposed commercial nature of the development scheme.

It is anticipated that an average of two samples per exploratory hole will be schedule for the core contaminant suite (E1) with further samples and suites being scheduled according to the historical activities within the area and in view of any field observations of potential contamination such as PID headspace analysis, visual or olfactory evidence.

The Contractor shall provide details of the limit of detection required and these limits should be suitable for the proposed commercial end use proposed for the site.



SCHEDULE 1.20.3 CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory _to be proposed by Contractor for approval_____

Required testing turnaround times __10 days_____

SUITE E1 – Soil samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Arsenic			
Boron			
Cadmium			
Chromium (total)			
Hexavalent Chromium			
Copper			
Lead			
Mercury			
Nickel			
Zinc			
Selenium			
pH			
Water soluble sulphate (SO ₄)			
Fraction Organic Carbon			
Total petroleum hydrocarbons			
Speciated PAHs (USEPA 16)			
Phenol			
Cyanide (free)			
Cyanide (total)			
Asbestos screen and ID			



SUITE E2 – Soil samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
TPH-CWG			
BTEX			
SUITE E3 – Soil samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Volatile Organic Compounds (VOCs)			
Semi-Volatile Organic Compounds (SVOCs)			
SUITE E4 – Soil samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Polychlorinated Biphenyls (PCBs)			
SUITE E5 – Soil samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Asbestos Quantification			



SCHEDULE 1.20.3 CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory _to be proposed by Contractor for approval_____

Required testing turnaround times __10 days_____

SUITE F1 – Water samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Arsenic			
Boron			
Cadmium			
Chromium (total)			
Hexavalent Chromium			
Copper			
Lead			
Mercury			
Nickel			
Zinc			
Selenium			
pH			
Sulphate (as SO ₄)			
Ammoniacal Nitrogen			
Total Alkalinity			
Total petroleum hydrocarbons			
Speciated polyaromatic hydrocarbons (USEPA 16)			
Phenol			
Cyanide (total)			
Chloride			



SUITE F2 – Water samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
TPH-CWG			
BTEX			
SUITE F3 – Water samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Volatile Organic Compounds (VOCs)			
Semi-Volatile Organic Compounds (SVOCs)			
SUITE F4 – Water samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Polychlorinated Biphenyls (PCBs)			



SCHEDULE 1.20.3 CHEMICAL LABORATORY TESTING FOR CONTAMINATION

Nominated test laboratory _to be proposed by Contractor for approval_____

Required testing turnaround times ___10 days_____

SUITE G1 – Ground gas samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
Oxygen			
Nitrogen			
Carbon dioxide			
Carbon monoxide			
Hydrogen sulphide			
Methane			
SUITE G2 – Ground gas samples			
Determinand	Limit of detection offered¹	Test method offered¹	Accreditation offered¹
VOCs			
TPH (C4-C12)			



S1.20.4 Waste characterisation (Clause 15.4)

The Contractor shall carry out any necessary assessment of wastes derived from the works prior to disposal or removal from site. All waste water and waste soils resulting from the site investigation are to be removed from site on completion of the works.

S.10.5 Waste Acceptance Criteria testing (Clause 15.5) (Test Suites H-J are overleaf)

To be scheduled by the Contractor.

S1.20.6 Laboratory testing (Clause 15.6)

Not required

S1.20.7 Special laboratory testing (Clause 15.7)

Not required



SCHEDULE 1.20.5 CHEMICAL TESTING FOR WASTE ACCEPTANCE CRITERIA TESTING

SUITE H – Inert waste landfill			
Determinand	Limit of detection required/offered¹	Test method required/offered¹	Accreditation required/offered¹
Total organic carbon			
BTEX			
PCBs (7 congeners)			
Mineral oil (C ₁₀ -C ₄₀)			
PAHs			
Leachate analyses			
Arsenic			
Barium			
Cadmium			
Chromium (total)			
Copper			
Mercury			
Molybdenum			
Nickel			
Lead			
Antimony			
Selenium			
Zinc			
Chloride			
Fluoride			
Sulphate (as SO ₄)			
Total dissolved solids			
Phenol Index			
Dissolved organic carbon at own pH or pH 7-5-8.0			



SCHEDULE 1.20.5

CHEMICAL TESTING FOR WASTE ACCEPTANCE CRITERIA TESTING

SUITE I – Stable non-reactive hazardous waste in non-hazardous landfill			
Determinand	Limit of detection required/offered¹	Test method required/offered¹	Accreditation required/offered¹
Total organic carbon			
pH			
Leachate analyses			
Arsenic			
Barium			
Cadmium			
Chromium (total)			
Copper			
Mercury			
Molybdenum			
Nickel			
Lead			
Antimony			
Selenium			
Zinc			
Chloride			
Fluoride			
Sulphate (as SO ₄)			
Total dissolved solids			
Phenol Index			
Dissolved organic carbon			



SCHEDULE 1.20.5

CHEMICAL TESTING FOR WASTE ACCEPTANCE CRITERIA TESTING

SUITE J – Stable non-reactive hazardous waste in non-hazardous landfill			
Determinand	Limit of detection required/offered¹	Test method required/offered¹	Accreditation required/offered¹
Soil analyses			
Total organic carbon			
Loss of ignition			
Leachate analyses			
Arsenic			
Barium			
Cadmium			
Chromium (total)			
Copper			
Mercury			
Molybdenum			
Nickel			
Lead			
Antimony			
Selenium			
Zinc			
Chloride			
Flouride			
Sulphate (as SO ₄)			
Total dissolved solids			
Phenol Index			
Dissolved organic carbon			



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

S1.21.1 Form of exploratory hole logs (Clauses 16.1 and 16.2.1)

The Contractor shall confirm and provide an example at tender stage of the proposed reporting format of each type of exploratory hole logs.

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

As specified. These are to include details of samples taken for geotechnical or contamination analysis and details of visual or olfactory evidence of potential contamination.

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

Laboratory data and exploratory hole survey data is also to be provided in XLS / Excel format.

Photographs are to be in Jpeg format and can be supplied on a CD or DVD. Photographs are to be plated with details of the location and date.

S1.21.4 Preliminary digital data (Clause 16.5.3)

Required as specified.

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

The Contractor shall provide a combined factual and interpretative report. This shall include assessment and interpretation of ground conditions, geology, hydrogeology, contamination observations, in-ground features and obstructions, geotechnical assessment and environmental risk assessment. The risk assessment shall include screening of laboratory data against appropriate generic assessment criteria in accordance with current guidance. A full risk assessment, adopting the source-pathway-receptor model, shall be included with full evaluation of all contaminant sources.

Subsequently, the Contractor shall liaise with the Client and prepare a Remediation Options Appraisal and Remediation Strategy to address all significant environmental risks.

Reports shall be prepared separately for each stage of investigation works unless otherwise agreed by the Client.

S1.21.6 Electronic report requirements (Clause 16.6.3)

The final report shall be provided in a single file pdf format

S1.21.7 Format and contents of Desk Study Report (Clause 16.7)

Not required



S1.21.8 Contents of Ground Investigation Report (or specified part thereof) (Clause 16.8)

The Report shall include:

- Details of the works undertaken and dates
- Exploratory hole logs
- Laboratory test results
- Photographs as per S1.21.3
- Tabulated details of any contamination observations (visual or olfactory) and any headspace PID readings
- Tabulated details of any below ground services or obstructions encountered
- Exploratory hole survey data
- Exploratory hole location plans
- Calibration certificates for equipment used (including gas monitors)
- Groundwater and ground gas monitoring records
- Details of all wastes removed from site

S1.21.9 Contents of Geotechnical Design Report (or specified part thereof) (Clause 16.9)

Not required

S1.21.10 Times for supply of electronic information (Clause 16.10.1)

A draft Factual Report shall be issued within four weeks of completion of the monitoring visits.

S1.21.11 Electronic information transmission media (Clause 16.10.2)

The final Factual Report is to be submitted in the form of three hardcopy and six CD or DVD copies, clearly labelled with the project title and the report title.

Interim information and draft reports can be provided by email or download file sharing systems.

S1.21.12 Report approval (Clause 16.11)

The Client will provide comments upon or approve each version of the report within three weeks of receipt.



Schedule 2: Exploratory Holes

The following abbreviations are used within the Schedule of Exploratory Holes:

- TP = Machine dug Trial Pit
- HP = Hand Dug trial pit
- WS = Dynamic Window Sample
- BH = Cable percussive borehole
- BHR = Cable percussive borehole with Rotary follow on drilling
- GW = Groundwater monitoring installation, to target saturated zone
- GS = Gas monitoring installation, to target unsaturated zone

Final positions of exploratory holes are to be agreed with the regulatory authorities and are subject to review of utility services information including a service subscan survey to be commissioned by the Client. The following schedule of exploratory holes is therefore preliminary at this stage and subject to final confirmation.

The site can be broadly split into seven distinct areas based upon the proposed nature of redevelopment, historical site activities and current site conditions. These areas are considered separately below.

S2.1 Hole number

Holes shall not be renumbered unless they have been relocated to avoid in-ground features.

S2.2 Type

The proposed type of exploratory hole may not be varied on site unless agreement is obtained from the Client and the regulatory authorities beforehand.

S2.3 Scheduled depth

The scheduled depth given is the anticipated depth, which may be varied on site depending on the ground conditions encountered.

S2.4 National grid reference

The final positions must be determined by accurate survey upon completion of the intrusive works.

S2.5 Approximate ground level

The actual ground level must be determined by accurate survey upon completion of the intrusive works.

S2.6 Remarks

The remarks column gives an indication of any in situ tests or instrument installations, together with any further controlling detail, where these are known in advance, including:



- Known or suspected constraints
- Reason for exploratory hole

Proposed Schedule of Exploratory Holes

Part A - Western Landfall Area				
Historic Uses: Former Fish meal works and oil storage tanks				
Number	Type	Depth	Installation	Remarks
BH01	BH	15	GW	Assess ground and groundwater (inc. tidal effects) conditions; and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
BH02	BH	15	GW	
WS01	WS	5	GS	Assess ground conditions, shallow / perched groundwater, ground gas and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS02	WS	5	GS	
WS03	WS	5	GS	
WS04	WS	5	GS	
TP01	TP	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
TP02	TP	3		
TP03	TP	3		
TP04	TP	3		
TP05	TP	3		
TP06	TP	3		
TP07	TP	3		
TP08	TP	3		
CBR01	CBR	0.5		Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
CBR02	CBR	0.5		
CBR03	CBR	0.5		
CBR04	CBR	0.5		
SP01- SP20	Stockpile			Allowance for 20no. samples to be obtained from various stockpiles (possible ship ballast and construction arisings) for analysis (suite E1, with suites E2 and E3 subject to PID headspace analysis and suite E5 subject to asbestos screening).
Part A - Western Landfall Access Road				
Historic Uses: Oil tanks, timber yard and rail sidings				
Number	Type	Depth	Installation	Remarks
BH03	BH	15	GW	Assess ground and groundwater (inc. tidal effects) conditions; and obtain samples for geotechnical and geo-environmental analysis (suites E1, with suites E2, E3 F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
BH04	BH	15	GW	
BH05	BH	15	GW	
BH06	BH	15	GW	
WS05	WS	5	GS	Assess ground conditions, shallow / perched groundwater, ground gas and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS06	WS	5	GS	
WS07	WS	5	GS	
WS08	WS	5	GS	



TP09	TP	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
TP10	TP	3		
TP11	TP	3		
TP12	TP	3		
TP13	TP	3		
TP14	TP	3		
TP15	TP	3		
TP16	TP	3		
CBR05	CBR	0.5		Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
CBR06	CBR	0.5		
CBR07	CBR	0.5		
CBR08	CBR	0.5		
CBR09	CBR	0.5		
CBR10	CBR	0.5		
CBR11	CBR	0.5		
CBR12	CBR	0.5		
CBR13	CBR	0.5		
CBR14	CBR	0.5		
SP21-25	stockpile			Allowance for 5no. samples to be obtained from various stockpiles (possible ship ballast and construction arisings) for analysis (suite E1, with suites E2 and E3 subject to PID headspace analysis and suite E5 subject to asbestos screening).

Part A – Morrisey Land

Historic Uses: Oil depot and tanks in south and east, various industrial works and rail sidings in north

BH07	BH	20	GW	Assess ground and groundwater (inc. tidal effects) conditions; and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
BH08	BH	20	GW	
WS09	WS	5	GS	Assess ground conditions, shallow / perched groundwater, ground gas and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS10	WS	5	GS	
WS11	WS	5	GS	
WS12	WS	5	GS	
TP17	TP	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
TP18	TP	3		
CBR15	CBR	0.5		Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
CBR16	CBR	0.5		

Part B – Contractor Laydown Area

Historic Uses: Oil depot and tanks in south and east, various industrial works and rail sidings in north

Number	Type	Depth	Installation	Remarks
BH09	BH	15	GW	Assess ground and groundwater (inc. tidal effects) conditions;



BH10	BH	15	GW	and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
BH11	BH	10	GW	
BH12	BH	10	GW	
WS13	WS	5	GS	Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS14	WS	5	GS	
WS15	WS	5		Assess ground conditions in areas of hardstanding and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS16	WS	5		
WS17	WS	5		
TP19	TP	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
TP20	TP	3		
TP21	TP	3		
TP22	TP	3		
TP23	TP	3		
TP24	TP	3		
CBR17	CBR	0.5		Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
CBR18	CBR	0.5		
CBR19	CBR	0.5		
CBR20	CBR	0.5		

Part C – Transport Hub

Historic Uses: tank farm for BP Transit site

Number	Type	Depth	Installation	Remarks
WS18	WS	5		Assess ground conditions in areas of hardstanding and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS19	WS	5		
WS20	WS	5		
WS21	WS	5	GW	Assess ground conditions, groundwater, ground gas and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS22	WS	5	GW	
WS23	WS	5	GW	
WS24	WS	5	GS	
WS25	WS	5	GS	
CBR21	CBR	0.5		Assess CBR values for roads / pavement design. Obtain near surface samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
CBR22	CBR	0.5		
CBR23	CBR	0.5		
CBR34	CBR	0.5		
CBR25	CBR	0.5		

Part D - Cable Route along Fabian Way / Crymlyn Burrows

Historic Uses: adjacent to BP Transit site on western half

Number	Type	Depth	Installation	Remarks
WS26	WS	5	GS	Assess ground conditions, shallow / perched groundwater, ground gas and obtain samples for geotechnical and geo-environmental analysis (suites E1, E2, F1 and F2, with suites E3 and F3 subject to PID headspace analysis, suite E5 subject to
WS27	WS	5	GS	
WS28	WS	5	GS	
WS29	WS	5	GS	



WS30	WS	5	GS	asbestos screening).
WS31	WS	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS32	WS	3		
WS33	WS	3		
WS34	WS	3		
WS35	WS	3		
HP01	HP	1.2		Provisional allowance of 4 hand pits to investigate relic buried services (inc. possible former BP oil pipelines) at shallow depths. Obtain samples for geo-environmental analysis (suites E1 and E2, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
HP02	HP	1.2		
HP03	HP	1.2		
HP04	HP	1.2		

Part D - Cable Route along Crymlyn Burrows

Historic Uses: Possible relic BP pipelines, SSSI, military training, AA gun position, disturbed ground.

Number	Type	Depth	Installation	Remarks
BH13	BH	30	GW	Assess ground conditions and groundwater levels to inform horizontal directional drilling under River Neath. Obtain samples for geotechnical analysis. To be confirmed with directional drilling contractor.
WS36	WS	3		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suite E1, with suites E2 and E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS37	WS	3		
WS38	WS	3		
WS39	WS	3		
WS40	WS	3		
WS41	WS	3		
HP05	HP	1.2		Provisional allowance of 4 hand pits to investigate relic buried services (inc. possible former BP oil pipelines) at shallow depths. Obtain samples for geo-environmental analysis (suite E1, with suites E2 and E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
HP06	HP	1.2		
HP07	HP	1.2		
HP08	HP	1.2		

Part D - Cable Connection at Baglan Bay

Historic Uses: former power station, adjacent to BP chemical works.

Number	Type	Depth	Installation	Remarks
BH14	BH	30	GW	Assess ground conditions and groundwater levels to inform horizontal directional drilling under River Neath. Obtain samples for geotechnical analysis. To be confirmed with directional drilling contractor.
WS42	WS	5		Assess ground conditions and obtain samples for geotechnical and geo-environmental analysis (suite E1, E2, E45, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
WS43	WS	5		
WS44	WS	5		
HP09	HP	1.2		Provisional allowance of 4 hand pits to investigate relic buried services (inc. possible former BP oil pipelines) at shallow
HP10	HP	1.2		



				depths. Obtain samples for geo-environmental analysis (suite E1, E2, E45, with suite E3 subject to PID headspace analysis, suite E5 subject to asbestos screening).
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Schedule 3: Investigation Supervisor's Facilities

General comments

S3.1 Accommodation

Not required.

S3.2 Furnishings

Not required.

S3.3 Services

Not required.

S3.3 Equipment

Not required.

S3.3 Transport

Not required.

S3.3 Personal Protective Equipment for Investigation Supervisor

Not required.



Annexes



Annex A – Site Location Plan



Annex B – Exploratory Hole Layout Plan



Annex C – Bill of Quantities



Annex D – Desk Study

Part A Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
A	General items and provisional sums				
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	E/O over item A2 for a Yellow Category site	sum	1		
A4	Maintain on site all site safety equipment for a Yellow Category site	week	2		
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	provisional sum	1	£250.00	£250.00
A7	Provide professional attendance in accordance with Clause 3.5.2	sum			
A7.1	Provide Technician	p.day	r/o		
A7.2	Provide graduate Ground Engineer	p.day	14		
A7.3	Provide experienced Ground Engineer	p.day	14		
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 Assessments	sum	1		
A10	Facilities for the Investigation Supervisor	sum	0		
A16	Traffic safety and management	provisional sum	0		
A19	One master copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A20	Additional copies of the Ground Investigation Report (or specified part thereof)	nr	3		
A21	Electronic copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS transfer format	sum	1		
A40	Archaeological watching brief - works in Crymlyn Burrows	sum	0		
A41	Unexploded Ordnance Safety Briefings and Site Instructions	sum	1		
A41.1	EOD Engineer site supervision of shallow excavations in high risk areas	day	14		
A41.2	Intrusive magnetometer survey of borehole locations in high risk areas	nr	20		
A41.3	Non-intrusive magnetometer survey for UXO in high risk greenfield areas	sum	1		
A42	Provision and use of track mats to protect ground at Crymlyn Burrows	provisional sum	0		
A43	Liaison and approvals from regulatory authorities	Sum	1		
A44	Liaison and approvals from Landowners	Sum	1		
A45	One master copy of the Remediation Options Appraisal and Remediation Strategy (or specified part thereof)	sum	1		
Total section A carried to summary					£250.00

Part A Bill of Quantities

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	8		
B3	Break out surface obstruction where present at exploratory borehole	h	12		
B4	Advance borehole between existing ground level and 10 m depth	m	80		
B5	As Item B4 but between 10 m and 20 m depth	m	20		
B6	As Item B4 but between 20 m and 30 m depth	m	r/o		
B9	Advance borehole through hard stratum or obstruction	h	8		
B10	Provision of equipment, personnel and crew to measure aquiclude/aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr	8		
B11	Backfill borehole with cement/bentonite grout or bentonite pellets	m	25		
B12	Standing time for borehole plant, equipment and crew	h	r/o		
	Dynamic sampling				
B13	Move dynamic sampling equipment to the site of each exploratory hole and set up	nr	12		
B15	Advance dynamic sampling hole between existing ground level and 5m depth	m	60		
B18	Standing time for dynamic sampling equipment and crew	h	r/o		
B19	Provision of dynamic sampling equipment and crew for sampling as directed by the Investigation Supervisor; maximum depth 5m	day	r/o		
B20	Backfill dynamic sampling hole with cement/bentonite grout or bentonite pellets	m	12		
Total section B carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
D	Pits and trenches				
	<u>Inspection pits</u>				
D1	Excavate inspection pit or sample stockpile by hand to 1.2 m depth	nr	45		
D2	Extra over Item D1 for breaking out surface obstructions	h	20		
	<u>Trial pits and trenches</u>				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.50m depth	nr	18		
D5	Extra over Item D3 for trial pit or trench between 4.50m and 6.0m depth	m	r/o		
D6	Excavate trial pit between existing ground level and 3.0m depth	m	54		
D12	Extra over Item D6 for breaking out hard material or surface obstructions	h	18		
D13	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench	h	r/o		
	<u>Observation pits and trenches</u>				
D14	Move equipment to the site of each observation pit or trench of not greater than 4.50m depth	nr			
D15	Extra over item D14 for setting up on a slope of gradient greater than 20%	m			
D16	Extra over Item D14 for trial pit or trench between 4.50m and 6.0m depth	m			
D17	Excavate observation pit between existing ground level and 3.0 m depth	m			
D18	As Item D17 but between 3.0 m and 4.5 m depth	m			
D19	As Item D17 but between 4.5 m and 6 m depth	m			
D20	Extra over item D17 for hand excavation	m			
D21	Excavate observation trench between existing ground level and 3.0 m depth	m3			
D22	As Item D21 but between 3.0 m and 4.5 m depth	m3			
D23	As Item D21 but between 4.5 m and 6 m depth	m3			
D24	Extra over Items D21 for hand excavation	m3			
D25	Extra over Items D17 to D19 and D21 to D23 for breaking out hard strata or obstructions	h			
D26	Extra over Items D17 and D21 for breaking out hard strata or obstructions by hand	h			
D27	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench	h			
D28	Standing time for excavation plant, equipment and crew for hand observation pit or trench	h			
	<u>Daily provision of pitting crew and equipment</u>				
D29	Provision of excavation plant equipment and crew for machine dug trial pits or trenches, maximum depth 3.0 m	day	r/o		
Total section D carried to summary					

Part A Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
E	Sampling				
	<u>Samples for geotechnical purposes</u>				
E1	Small disturbed sample	nr	100		
E2	Bulk disturbed sample	nr	100		
E3	Large bulk disturbed sample	nr	r/o		
E4.1	Large bulk disturbed sample (1000mm), sampler	nr	35		
	<u>Containers for contamination assessment and WAC testing</u>				
E14.1	Provision of containers and collection of samples for contamination Suite E1, E2, E3, E4 and E5 (S1.20.3)	nr	300		
E14.2	Provision of containers and collection of samples for contamination Suites F1, F2, F3 and F4 (S1.20.3)	nr	20		
E14.3	Provision of containers and collection of samples for contamination Suite G1 and G2 (S1.20.3)	nr	3		
E15.1	Provision of containers and collection of samples for WAC Suite H (S1.20.5)	nr	10		
E15.2	Provision of containers and collection of samples for WAC Suite I (S1.20.5)	nr	10		
E15.3	Provision of containers and collection of samples for WAC Suite J (S1.20.5)	nr	10		
Total section E carried to summary					

Part A Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
H	In situ testing				
H1	Standard penetration test in borehole	nr	50		
H4	California Bearing Ratio test	nr	16		
H8	Hand vane test (set of 3 readings)	nr	50		
Total section H carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
I	Instrumentation				
	<u>Standpipes and piezometers</u>				
	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer				
I1		m	30		
I4	Provide and install standpipe piezometer (50mm)	m	100		
	Provide and install ground gas monitoring standpipe (50mm)				
I7		m	50		
	Provide and install headworks for monitoring standpipe, standpipe or standpipe piezometer				
I9		m	20		
I10	Provide and install protective cover (flush)	nr	20		
I11	Provide and install protective cover (raised)	nr	r/o		
	Extra over item I10 for heavy duty cover in highways				
I12		nr	r/o		
Total section I carried to summary					

Part A Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
J	Installation monitoring and sampling (during fieldwork period)				
J1	Reading of water level in standpipe/standpipe piezometer during field work period	nr	20		
J8	Reading of free product level in standpipe using an interface probe during fieldwork period	nr	20		
	Installation monitoring and sampling (post fieldwork period)				
J9	Return visit to site following completion of fieldworks to take readings in, or recover samples from, installations	nr	6		
J10	Extra over Item J9 for reading of water level in standpipe/standpipe piezometer during return visit	nr	120		
J11	Extra over Item J9 for ground gas measurement in ground gas monitoring standpipe during return visit	nr	120		
J14	Extra over item J9 for water sample from standpipe/standpipe piezometer during return visit, including purging or micro-purging up to 3 hours	nr	25		
J15	Extra over Item J14 for purging or micro-purging in excess of 3 hours	h	r/o		
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit	nr	3		
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit	nr	120		
J40	Provide PID Meter during field works and monitoring period	Sum	1		
			Total section J carried to summary		

Number	Item description	Unit	Quantity	Rate	Amount (£)
K	Geotechnical Laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content	nr	15		
K1.2	Liquid limit, plastic limit and plasticity index	nr	15		
K1.9	Particle size distribution by wet sieving	nr	15		
K1.10	Particle size distribution by dry sieving	nr	15		
K1.12	Sedimentation by hydrometer	nr	5		
K2	<u>Chemical and electrochemical</u>				
K2.1	Organic matter content	nr	10		
K3.1	Dry density/moisture content relationship using 2.5 kg rammer	nr	5		
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr	5		
K3.9	California Bearing Ratio on recompacted disturbed sample	nr	5		
K4	<u>Compressibility, permeability, durability</u>	nr			
K4.1	One-dimensional consolidation properties, test period 5 days	nr	3		
K4.2	Extra over Item K4.1 for test period in excess of 5 days	day	r/o		
K6	<u>Shear strength (total stress)</u>				
K6.17	Undrained shear strength of single 100 mm diameter specimen in triaxial compression with multistage loading and without measurement of pore pressure	nr	5		
K40	<u>Contract Specific Items</u> BRE SD1 suite	nr	5		
Total section K, carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
L	Geoenvironmental laboratory testing				
	<u>Contamination testing</u>				
L1.1.1	Suite E1 (soil samples Schedule S1.20.3)	nr	100		
L1.1.2	Suite E2 (soil samples Schedule S1.20.3)	nr	25		
L1.1.3	Suite E3 (soil samples Schedule S1.20.3)	nr	25		
L1.1.4	Suite E4 (soil samples Schedule S1.20.3)	nr	5		
L1.1.5	Suite E5 (soil samples Schedule S1.20.3)	nr	10		
L1.2.1	Suite F1 (water samples Schedule S1.20.3)	nr	25		
L1.2.2	Suite F2 (water samples Schedule S1.20.3)	nr	25		
L1.2.3	Suite F3 (water samples Schedule S1.20.3)	nr	25		
L1.2.4	Suite F4 (water samples Schedule S1.20.3)	nr	3		
L1.3.1	Suite G1 (gas samples Schedule S1.20.3)	nr	3		
L1.3.2	Suite G2 (gas samples Schedule S1.20.3)	nr	3		
	<u>Waste acceptance criteria testing</u>				
L2.1	Suite H (Inert waste landfill Schedule S1.20.5)	nr	3		
L2.2	Suite I (Stable, non-reactive hazardous waste in non-hazardous waste landfill Schedule S1.20.5)	nr	3		
L2.3	Suite J (Hazardous waste landfill Schedule S1.20.5)	nr	3		
Total section L carried to summary					

Summary of Bill of Quantities		
A.	General items, provisional services and additional items	£250.00
B.	Percussion boring	
C.	Rotary drilling	
D.	Pitting and trenching	
E.	Sampling, monitoring during intrusive investigation	
F.	Probing and cone penetration testing	
G.	Geophysical testing	
H.	In situ testing	
I.	Instrumentation	
J.	Installation monitoring and sampling	
K.	Geotechnical laboratory testing	
L.	Geoenvironmental laboratory testing	
	Total tender	£250.00

Part B Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
A	General items and provisional sums				
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	E/O over item A2 for a Yellow Category site	sum	1		
A4	Maintain on site all site safety equipment for a Yellow Category site	week	1		
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	provisional sum	1	£250.00	£250.00
A7	Provide professional attendance in accordance with Clause 3.5.2	sum			
A7.1	Provide Technician	p.day	r/o		
A7.2	Provide graduate Ground Engineer	p.day	3		
A7.3	Provide experienced Ground Engineer	p.day	6		
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 Assessments	sum	1		
A10	Facilities for the Investigation Supervisor	sum	0		
A16	Traffic safety and management	provisional sum	0		
A19	One master copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A20	Additional copies of the Ground Investigation Report (or specified part thereof)	nr	3		
A21	Electronic copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS transfer format	sum	1		
A40	Archaeological watching brief - works in Crymlyn Burrows	sum	0		
A41	Unexploded Ordnance Safety Briefings and Site Instructions	sum	1		
A41.1	EOD Engineer site supervision of shallow excavations in high risk areas	day	6		
A41.2	Intrusive magnetometer survey of borehole locations in high risk areas	nr	9		
A41.3	Non-intrusive magnetometer survey for UXO in high risk greenfield areas	sum	1		
A42	Provision and use of track mats to protect ground at Crymlyn Burrows	provisional sum	0		
A43	Liaison and approvals from regulatory authorities	Sum	1		
A44	Liaison and approvals from Landowners	Sum	1		
A45	One master copy of the Remediation Options Appraisal and Remediation Strategy (or specified part thereof)	sum	1		
Total section A carried to summary					£250.00

Part B Bill of Quantities

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	4		
B3	Break out surface obstruction where present at exploratory borehole	h	4		
B4	Advance borehole between existing ground level and 10 m depth	m	40		
B5	As Item B4 but between 10 m and 20 m depth	m	10		
B6	As Item B4 but between 20 m and 30 m depth	m	r/o		
B9	Advance borehole through hard stratum or obstruction	h	4		
B10	Provision of equipment, personnel and control measures at a single aquiclude/aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr	4		
B11	Backfill borehole with cement/bentonite grout or bentonite pellets	m	10		
B12	Standing time for borehole plant, equipment and crew	h	r/o		
	Dynamic sampling				
B13	Move dynamic sampling equipment to the site of each exploratory hole and set up	nr	5		
B15	Advance dynamic sampling hole between existing ground level and 5m depth	m	25		
B18	Standing time for dynamic sampling equipment and crew	h	r/o		
B19	Provision of dynamic sampling equipment and crew for sampling as directed by the Investigation Supervisor; maximum depth 5m	day	r/o		
B20	Backfill dynamic sampling hole with cement/bentonite grout or bentonite pellets	m	5		
Total section B carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
D	Pits and trenches				
	<u>Inspection pits</u>				
D1	Excavate inspection pit or sample stockpile by hand to 1.2 m depth	nr	9		
D2	Extra over Item D1 for breaking out surface obstructions	h	9		
	<u>Trial pits and trenches</u>				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.50m depth	nr	6		
D5	Extra over Item D3 for trial pit or trench between 4.50m and 6.0m depth	m	r/o		
D6	Excavate trial pit between existing ground level and 3.0m depth	m	18		
D12	Extra over Item D6 for breaking out hard material or surface obstructions	h	6		
D13	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench	h	r/o		
	<u>Observation pits and trenches</u>				
D14	Move equipment to the site of each observation pit or trench of not greater than 4.50m depth	nr			
D15	Extra over item D14 for setting up on a slope of gradient greater than 20%	m			
D16	Extra over Item D14 for trial pit or trench between 4.50m and 6.0m depth	m			
D17	Excavate observation pit between existing ground level and 3.0 m depth	m			
D18	As Item D17 but between 3.0 m and 4.5 m depth	m			
D19	As Item D17 but between 4.5 m and 6 m depth	m			
D20	Extra over item D17 for hand excavation	m			
D21	Excavate observation trench between existing ground level and 3.0 m depth	m3			
D22	As Item D21 but between 3.0 m and 4.5 m depth	m3			
D23	As Item D21 but between 4.5 m and 6 m depth	m3			
D24	Extra over Items D21 for hand excavation	m3			
D25	Extra over Items D17 to D19 and D21 to D23 for breaking out hard strata or obstructions	h			
D26	Extra over Items D17 and D21 for breaking out hard strata or obstructions by hand	h			
D27	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench	h			
D28	Standing time for excavation plant, equipment and crew for hand observation pit or trench	h			
	<u>Daily provision of pitting crew and equipment</u>				
D29	Provision of excavation plant equipment and crew for machine dug trial pits or trenches, maximum depth 3.0 m	day			
Total section D carried to summary					

Part B Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
E	Sampling				
	<u>Samples for geotechnical purposes</u>				
E1	Small disturbed sample	nr	50		
E2	Bulk disturbed sample	nr	50		
E3	Large bulk disturbed sample	nr	r/o		
E4.1	Large bulk disturbed sample (S1.20.3), sampler	nr	15		
	<u>Containers for contamination assessment and WAC testing</u>				
E14.1	Provision of containers and collection of samples for contamination Suite E1, E2, E3, E4 and E5 (S1.20.3)	nr	150		
E14.2	Provision of containers and collection of samples for contamination Suites F1, F2, F3 and F4 (S1.20.3)	nr	15		
E14.3	Provision of containers and collection of samples for contamination Suite G1 and G2 (S1.20.3)	nr	3		
E15.1	Provision of containers and collection of samples for WAC Suite H (S1.20.5)	nr	5		
E15.2	Provision of containers and collection of samples for WAC Suite I (S1.20.5)	nr	5		
E15.3	Provision of containers and collection of samples for WAC Suite J (S1.20.5)	nr	5		
Total section E carried to summary					

Part B Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
H	In situ testing				
H1	Standard penetration test in borehole	nr	20		
H4	California Bearing Ratio test	nr	4		
H8	Hand vane test (set of 3 readings)	nr	20		
Total section H carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
I	Instrumentation				
	<u>Standpipes and piezometers</u>				
	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer				
I1		m	5		
I4	Provide and install standpipe piezometer (50mm)	m	50		
	Provide and install ground gas monitoring standpipe (50mm)				
I7		m	12		
	Provide and install headworks for monitoring standpipe, standpipe or standpipe piezometer				
I9		m	6		
I10	Provide and install protective cover (flush)	nr	6		
I11	Provide and install protective cover (raised)	nr	r/o		
	Extra over item I10 for heavy duty cover in highways				
I12		nr	r/o		
Total section I carried to summary					

Part B Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
J	Installation monitoring and sampling (during fieldwork period)				
J1	Reading of water level in standpipe/standpipe piezometer during field work period	nr	6		
J8	Reading of free product level in standpipe using an interface probe during fieldwork period	nr	6		
	Installation monitoring and sampling (post fieldwork period)				
J9	Return visit to site following completion of fieldworks to take readings in, or recover samples from, installations	nr	6		
J10	Extra over Item J9 for reading of water level in standpipe/standpipe piezometer during return visit	nr	36		
J11	Extra over Item J9 for ground gas measurement in ground gas monitoring standpipe during return visit	nr	36		
J14	Extra over item J9 for water sample from standpipe/standpipe piezometer during return visit, including purging or micro-purging up to 3 hours	nr	12		
J15	Extra over Item J14 for purging or micro-purging in excess of 3 hours	h	r/o		
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit	nr	3		
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit	nr	36		
J40	Provide PID Meter during field works and monitoring period	Sum	1		
			Total section J carried to summary		

Number	Item description	Unit	Quantity	Rate	Amount (£)
K	Geotechnical Laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content	nr	5		
K1.2	Liquid limit, plastic limit and plasticity index	nr	5		
K1.9	Particle size distribution by wet sieving	nr	5		
K1.10	Particle size distribution by dry sieving	nr	5		
K1.12	Sedimentation by hydrometer	nr	5		
K2	<u>Chemical and electrochemical</u>				
K2.1	Organic matter content	nr	5		
K3.1	Dry density/moisture content relationship using 2.5 kg rammer	nr	2		
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr	2		
K3.9	California Bearing Ratio on recompacted disturbed sample	nr	2		
K4	<u>Compressibility, permeability, durability</u>	nr			
K4.1	One-dimensional consolidation properties, test period 5 days	nr	2		
K4.2	Extra over Item K4.1 for test period in excess of 5 days	day	r/o		
K6	<u>Shear strength (total stress)</u>				
K6.17	Undrained shear strength of single 100 mm diameter specimen in triaxial compression with multistage loading and without measurement of pore pressure	nr	5		
K40	<u>Contract Specific Items</u> BRE SD1 suite	nr	5		
Total section K, carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
L	Geoenvironmental laboratory testing				
	<u>Contamination testing</u>				
L1.1.1	Suite E1 (soil samples Schedule S1.20.3)	nr	50		
L1.1.2	Suite E2 (soil samples Schedule S1.20.3)	nr	15		
L1.1.3	Suite E3 (soil samples Schedule S1.20.3)	nr	15		
L1.1.4	Suite E4 (soil samples Schedule S1.20.3)	nr	5		
L1.1.5	Suite E5 (soil samples Schedule S1.20.3)	nr	10		
L1.2.1	Suite F1 (water samples Schedule S1.20.3)	nr	12		
L1.2.2	Suite F2 (water samples Schedule S1.20.3)	nr	12		
L1.2.3	Suite F3 (water samples Schedule S1.20.3)	nr	12		
L1.2.4	Suite F4 (water samples Schedule S1.20.3)	nr	3		
L1.3.1	Suite G1 (gas samples Schedule S1.20.3)	nr	3		
L1.3.2	Suite G2 (gas samples Schedule S1.20.3)	nr	3		
	<u>Waste acceptance criteria testing</u>				
L2.1	Suite H (Inert waste landfill Schedule S1.20.5)	nr	3		
L2.2	Suite I (Stable, non-reactive hazardous waste in non-hazardous waste landfill Schedule S1.20.5)	nr	3		
L2.3	Suite J (Hazardous waste landfill Schedule S1.20.5)	nr	3		
Total section L carried to summary					

Summary of Bill of Quantities		
A.	General items, provisional services and additional items	£250.00
B.	Percussion boring	
C.	Rotary drilling	
D.	Pitting and trenching	
E.	Sampling, monitoring during intrusive investigation	
F.	Probing and cone penetration testing	
G.	Geophysical testing	
H.	In situ testing	
I.	Instrumentation	
J.	Installation monitoring and sampling	
K.	Geotechnical laboratory testing	
L.	Geoenvironmental laboratory testing	
	Total tender	£250.00

Part C Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
A	General items and provisional sums				
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	E/O over item A2 for a Yellow Category site	sum	1		
A4	Maintain on site all site safety equipment for a Yellow Category site	week	1		
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	provisional sum	1	£250.00	£250.00
A7	Provide professional attendance in accordance with Clause 3.5.2	sum			
A7.1	Provide Technician	p.day	r/o		
A7.2	Provide graduate Ground Engineer	p.day			
A7.3	Provide experienced Ground Engineer	p.day	3		
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 Assessments	sum	1		
A10	Facilities for the Investigation Supervisor	sum	0		
A16	Traffic safety and management	provisional sum	0		
A19	One master copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A20	Additional copies of the Ground Investigation Report (or specified part thereof)	nr	3		
A21	Electronic copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS transfer format	sum	1		
A40	Archaeological watching brief - works in Crymlyn Burrows	sum	0		
A41	Unexploded Ordnance Safety Briefings and Site Instructions	sum	1		
A41.1	EOD Engineer site supervision of shallow excavations in high risk areas	day	3		
A41.2	Intrusive magnetometer survey of borehole locations in high risk areas	nr	8		
A41.3	Non-intrusive magnetometer survey for UXO in high risk greenfield areas	sum	1		
A42	Provision and use of track mats to protect ground at Crymlyn Burrows	provisional sum	0		
A43	Liaison and approvals from regulatory authorities	Sum	1		
A44	Liaison and approvals from Landowners	Sum	1		
A45	One master copy of the Remediation Options Appraisal and Remediation Strategy (or specified part thereof)	sum	1		
Total section A carried to summary					£250.00

Part C Bill of Quantities

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	0		
B3	Break out surface obstruction where present at exploratory borehole	h	0		
B4	Advance borehole between existing ground level and 10 m depth	m	0		
B5	As Item B4 but between 10 m and 20 m depth	m	0		
B6	As Item B4 but between 20 m and 30 m depth	m	0		
B9	Advance borehole through hard stratum or obstruction	h	0		
B10	Provision of equipment, personnel and control measures at a single aquiclude/aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr	0		
B11	Backfill borehole with cement/bentonite grout or bentonite pellets	m	0		
B12	Standing time for borehole plant, equipment and crew	h	0		
	Dynamic sampling				
B13	Move dynamic sampling equipment to the site of each exploratory hole and set up	nr	8		
B15	Advance dynamic sampling hole between existing ground level and 5m depth	m	40		
B18	Standing time for dynamic sampling equipment and crew	h	r/o		
B19	Provision of dynamic sampling equipment and crew for sampling as directed by the Investigation Supervisor; maximum depth 5m	day	r/o		
B20	Backfill dynamic sampling hole with cement/bentonite grout or bentonite pellets	m	8		
Total section B carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
D	Pits and trenches				
	<u>Inspection pits</u>				
D1	Excavate inspection pit or sample stockpile by hand to 1.2 m depth	nr	8		
D2	Extra over Item D1 for breaking out surface obstructions	h	8		
	<u>Trial pits and trenches</u>				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.50m depth	nr	0		
D5	Extra over Item D3 for trial pit or trench between 4.50m and 6.0m depth	m	0		
D6	Excavate trial pit between existing ground level and 3.0m depth	m	0		
D12	Extra over Item D6 for breaking out hard material or surface obstructions	h	0		
D13	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench	h	0		
	<u>Observation pits and trenches</u>				
D14	Move equipment to the site of each observation pit or trench of not greater than 4.50m depth	nr			
D15	Extra over item D14 for setting up on a slope of gradient greater than 20%	m			
D16	Extra over Item D14 for trial pit or trench between 4.50m and 6.0m depth	m			
D17	Excavate observation pit between existing ground level and 3.0 m depth	m			
D18	As Item D17 but between 3.0 m and 4.5 m depth	m			
D19	As Item D17 but between 4.5 m and 6 m depth	m			
D20	Extra over item D17 for hand excavation	m			
D21	Excavate observation trench between existing ground level and 3.0 m depth	m3			
D22	As Item D21 but between 3.0 m and 4.5 m depth	m3			
D23	As Item D21 but between 4.5 m and 6 m depth	m3			
D24	Extra over Items D21 for hand excavation	m3			
D25	Extra over Items D17 to D19 and D21 to D23 for breaking out hard strata or obstructions	h			
D26	Extra over Items D17 and D21 for breaking out hard strata or obstructions by hand	h			
D27	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench	h			
D28	Standing time for excavation plant, equipment and crew for hand observation pit or trench	h			
	<u>Daily provision of pitting crew and equipment</u>				
D29	Provision of excavation plant equipment and crew for machine dug trial pits or trenches, maximum depth 3.0 m	day			
Total section D carried to summary					

Part C Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
H	In situ testing				
H1	Standard penetration test in borehole	nr	15		
H4	California Bearing Ratio test	nr	6		
H8	Hand vane test (set of 3 readings)	nr	10		
Total section H carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
I	Instrumentation				
	<u>Standpipes and piezometers</u>				
	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer				
I1		m	5		
I4	Provide and install standpipe piezometer (50mm)	m	15		
	Provide and install ground gas monitoring standpipe (50mm)				
I7		m	10		
	Provide and install headworks for monitoring standpipe, standpipe or standpipe piezometer				
I9		m	5		
I10	Provide and install protective cover (flush)	nr	5		
I11	Provide and install protective cover (raised)	nr	r/o		
	Extra over item I10 for heavy duty cover in highways				
I12		nr	r/o		
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/standpipe piezometer during field work period	nr	5		
J8	Reading of free product level in standpipe using an interface probe during fieldwork period	nr	5		
	Installation monitoring and sampling (post fieldwork period)				
J9	Return visit to site following completion of fieldworks to take readings in, or recover samples from, installations	nr	6		
J10	Extra over Item J9 for reading of water level in standpipe/standpipe piezometer during return visit	nr	30		
J11	Extra over Item J9 for ground gas measurement in ground gas monitoring standpipe during return visit	nr	30		
J14	Extra over item J9 for water sample from standpipe/standpipe piezometer during return visit, including purging or micro-purging up to 3 hours	nr	5		
J15	Extra over Item J14 for purging or micro-purging in excess of 3 hours	h	r/o		
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit	nr	3		
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit	nr	30		
J40	Provide PID Meter during field works and monitoring period	Sum	1		
		Total section J carried to summary			

Number	Item description	Unit	Quantity	Rate	Amount (£)
K	Geotechnical Laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content	nr	5		
K1.2	Liquid limit, plastic limit and plasticity index	nr	5		
K1.9	Particle size distribution by wet sieving	nr	5		
K1.10	Particle size distribution by dry sieving	nr	5		
K1.12	Sedimentation by hydrometer	nr			
K2	<u>Chemical and electrochemical</u>				
K2.1	Organic matter content	nr	5		
K3.1	Dry density/moisture content relationship using 2.5 kg rammer	nr	2		
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr	2		
K3.9	California Bearing Ratio on recompacted disturbed sample	nr	2		
K4	<u>Compressibility, permeability, durability</u>	nr			
K4.1	One-dimensional consolidation properties, test period 5 days	nr	2		
K4.2	Extra over Item K4.1 for test period in excess of 5 days	day	r/o		
K6	<u>Shear strength (total stress)</u>				
K6.17	Undrained shear strength of single 100 mm diameter specimen in triaxial compression with multistage loading and without measurement of pore pressure	nr	2		
K40	<u>Contract Specific Items</u> BRE SD1 suite	nr	0		
Total section K, carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
L	Geoenvironmental laboratory testing				
	<u>Contamination testing</u>				
L1.1.1	Suite E1 (soil samples Schedule S1.20.3)	nr	25		
L1.1.2	Suite E2 (soil samples Schedule S1.20.3)	nr	10		
L1.1.3	Suite E3 (soil samples Schedule S1.20.3)	nr	10		
L1.1.4	Suite E4 (soil samples Schedule S1.20.3)	nr	3		
L1.1.5	Suite E5 (soil samples Schedule S1.20.3)	nr	3		
L1.2.1	Suite F1 (water samples Schedule S1.20.3)	nr	5		
L1.2.2	Suite F2 (water samples Schedule S1.20.3)	nr	5		
L1.2.3	Suite F3 (water samples Schedule S1.20.3)	nr	5		
L1.2.4	Suite F4 (water samples Schedule S1.20.3)	nr	r/o		
L1.3.1	Suite G1 (gas samples Schedule S1.20.3)	nr	2		
L1.3.2	Suite G2 (gas samples Schedule S1.20.3)	nr	2		
	<u>Waste acceptance criteria testing</u>				
L2.1	Suite H (Inert waste landfill Schedule S1.20.5)	nr	2		
L2.2	Suite I (Stable, non-reactive hazardous waste in non-hazardous waste landfill Schedule S1.20.5)	nr	2		
L2.3	Suite J (Hazardous waste landfill Schedule S1.20.5)	nr	2		
Total section L carried to summary					

Summary of Bill of Quantities		
A.	General items, provisional services and additional items	£250.00
B.	Percussion boring	
C.	Rotary drilling	
D.	Pitting and trenching	
E.	Sampling, monitoring during intrusive investigation	
F.	Probing and cone penetration testing	
G.	Geophysical testing	
H.	In situ testing	
I.	Instrumentation	
J.	Installation monitoring and sampling	
K.	Geotechnical laboratory testing	
L.	Geoenvironmental laboratory testing	
	Total tender	£250.00

Part D Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
A	General items and provisional sums				
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	E/O over item A2 for a Yellow Category site	sum	1		
A4	Maintain on site all site safety equipment for a Yellow Category site	week	2		
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	provisional sum	1	£250.00	£250.00
A7	Provide professional attendance in accordance with Clause 3.5.2	sum			
A7.1	Provide Technician	p.day	r/o		
A7.2	Provide graduate Ground Engineer	p.day	5		
A7.3	Provide experienced Ground Engineer	p.day	14		
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 Assessments	sum	1		
A10	Facilities for the Investigation Supervisor	sum	0		
A16	Traffic safety and management	provisional sum	1	£2,500.00	£2,500.00
A19	One master copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A20	Additional copies of the Ground Investigation Report (or specified part thereof)	nr	3		
A21	Electronic copy of the Ground Investigation Report (or specified part thereof)	sum	1		
A25	Digital data in AGS transfer format	sum	1		
A40	Archaeological watching brief - works in Crymlyn Burrows	sum	1		
A41	Unexploded Ordnance Safety Briefings and Site Instructions	sum	1		
A41.1	EOD Engineer site supervision of shallow excavations in high risk areas	day	14		
A41.2	Intrusive magnetometer survey of borehole locations in high risk areas	nr	21		
A41.3	Non-intrusive magnetometer survey for UXO in high risk greenfield areas	sum	1		
A42	Provision and use of track mats to protect ground at Crymlyn Burrows	provisional sum	1	£750.00	£750.00
A43	Liaison and approvals from regulatory authorities	Sum	1		
A44	Liaison and approvals from Landowners	Sum	1		
A45	One master copy of the Remediation Options Appraisal and Remediation Strategy (or specified part thereof)	sum	1		
Total section A carried to summary					£3,500.00

Part D Bill of Quantities

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	2		
B3	Break out surface obstruction where present at exploratory borehole	h	2		
B4	Advance borehole between existing ground level and 10 m depth	m	20		
B5	As Item B4 but between 10 m and 20 m depth	m	20		
B6	As Item B4 but between 20 m and 30 m depth	m	20		
B9	Advance borehole through hard stratum or obstruction	h	2		
B10	Provision of equipment, personnel and control measures at a single aquiclude/aquifer boundary or cross-contamination control measures at a single soil boundary in a borehole	nr	2		
B11	Backfill borehole with cement/bentonite grout or bentonite pellets	m	0		
B12	Standing time for borehole plant, equipment and crew	h	0		
	Dynamic sampling				
B13	Move dynamic sampling equipment to the site of each exploratory hole and set up	nr	19		
B15	Advance dynamic sampling hole between existing ground level and 5m depth	m	95		
B18	Standing time for dynamic sampling equipment and crew	h	r/o		
B19	Provision of dynamic sampling equipment and crew for sampling as directed by the Investigation Supervisor; maximum depth 5m	day	r/o		
B20	Backfill dynamic sampling hole with cement/bentonite grout or bentonite pellets	m	19		
			Total section B carried to summary		

Number	Item description	Unit	Quantity	Rate	Amount (£)
D	Pits and trenches				
	<u>Inspection pits</u>				
D1	Excavate inspection pit or sample stockpile by hand to 1.2 m depth	nr	10		
D2	Extra over Item D1 for breaking out surface obstructions	h	10		
	<u>Trial pits and trenches</u>				
D3	Move equipment to the site of each trial pit or trench of not greater than 4.50m depth	nr	0		
D5	Extra over Item D3 for trial pit or trench between 4.50m and 6.0m depth	m	0		
D6	Excavate trial pit between existing ground level and 3.0m depth	m	0		
D12	Extra over Item D6 for breaking out hard material or surface obstructions	h	0		
D13	Standing time for excavation plant, equipment and crew for machine dug trial pit or trench	h	0		
	<u>Observation pits and trenches</u>				
D14	Move equipment to the site of each observation pit or trench of not greater than 4.50m depth	nr			
D15	Extra over item D14 for setting up on a slope of gradient greater than 20%	m			
D16	Extra over Item D14 for trial pit or trench between 4.50m and 6.0m depth	m			
D17	Excavate observation pit between existing ground level and 3.0 m depth	m			
D18	As Item D17 but between 3.0 m and 4.5 m depth	m			
D19	As Item D17 but between 4.5 m and 6 m depth	m			
D20	Extra over item D17 for hand excavation	m			
D21	Excavate observation trench between existing ground level and 3.0 m depth	m3			
D22	As Item D21 but between 3.0 m and 4.5 m depth	m3			
D23	As Item D21 but between 4.5 m and 6 m depth	m3			
D24	Extra over Items D21 for hand excavation	m3			
D25	Extra over Items D17 to D19 and D21 to D23 for breaking out hard strata or obstructions	h			
D26	Extra over Items D17 and D21 for breaking out hard strata or obstructions by hand	h			
D27	Standing time for excavation plant, equipment and crew for machine dug observation pit or trench	h			
D28	Standing time for excavation plant, equipment and crew for hand observation pit or trench	h			
	<u>Daily provision of pitting crew and equipment</u>				
D29	Provision of excavation plant equipment and crew for machine dug trial pits or trenches, maximum depth 3.0 m	day			
Total section D carried to summary					

Part D Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
H	In situ testing				
H1	Standard penetration test in borehole	nr	30		
H4	California Bearing Ratio test	nr	0		
H8	Hand vane test (set of 3 readings)	nr	30		
Total section H carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
I	Instrumentation				
	<u>Standpipes and piezometers</u>				
	Backfill exploratory hole with cement/bentonite grout below standpipe or standpipe piezometer				
I1		m	0		
I4	Provide and install standpipe piezometer (50mm)	m	60		
	Provide and install ground gas monitoring standpipe (50mm)				
I7		m	0		
	Provide and install headworks for monitoring standpipe, standpipe or standpipe piezometer				
I9		m	0		
I10	Provide and install protective cover (flush)	nr	2		
I11	Provide and install protective cover (raised)	nr	r/o		
	Extra over item I10 for heavy duty cover in highways				
I12		nr	r/o		
Total section I carried to summary					

Part D Bill of Quantities

Number	Item description	Unit	Quantity	Rate	Amount (£)
J	Installation monitoring and sampling (during fieldwork period)				
J1	Reading of water level in standpipe/standpipe piezometer during field work period	nr	4		
J8	Reading of free product level in standpipe using an interface probe during fieldwork period	nr	4		
	Installation monitoring and sampling (post fieldwork period)				
J9	Return visit to site following completion of fieldworks to take readings in, or recover samples from, installations	nr	6		
J10	Extra over Item J9 for reading of water level in standpipe/standpipe piezometer during return visit	nr	12		
J11	Extra over Item J9 for ground gas measurement in ground gas monitoring standpipe during return visit	nr	12		
J14	Extra over item J9 for water sample from standpipe/standpipe piezometer during return visit, including purging or micro-purging up to 3 hours	nr	2		
J15	Extra over Item J14 for purging or micro-purging in excess of 3 hours	h	r/o		
J16	Extra over item J9 for ground gas sample from gas monitoring standpipe during return visit	nr	3		
J17	Extra over item J9 for reading of free product level in standpipe using an interface probe during return visit	nr	12		
J40	Provide PID Meter during field works and monitoring period	Sum	1		
			Total section J carried to summary		

Number	Item description	Unit	Quantity	Rate	Amount (£)
K	Geotechnical Laboratory testing				
K1	<u>Classification</u>				
K1.1	Moisture content	nr	5		
K1.2	Liquid limit, plastic limit and plasticity index	nr	5		
K1.9	Particle size distribution by wet sieving	nr	5		
K1.10	Particle size distribution by dry sieving	nr	5		
K1.12	Sedimentation by hydrometer	nr			
K2	<u>Chemical and electrochemical</u>				
K2.1	Organic matter content	nr	5		
K3.1	Dry density/moisture content relationship using 2.5 kg rammer	nr	2		
K3.2	Dry density/moisture content relationship using 4.5 kg rammer	nr	2		
K3.9	California Bearing Ratio on recompacted disturbed sample	nr	r/o		
K4	<u>Compressibility, permeability, durability</u>	nr			
K4.1	One-dimensional consolidation properties, test period 5 days	nr	r/o		
K4.2	Extra over Item K4.1 for test period in excess of 5 days	day	r/o		
K6	<u>Shear strength (total stress)</u>				
K6.17	Undrained shear strength of single 100 mm diameter specimen in triaxial compression with multistage loading and without measurement of pore pressure	nr	r/o		
K40	<u>Contract Specific Items</u> BRE SD1 suite	nr	0		
Total section K, carried to summary					

Number	Item description	Unit	Quantity	Rate	Amount (£)
L	Geoenvironmental laboratory testing				
	<u>Contamination testing</u>				
L1.1.1	Suite E1 (soil samples Schedule S1.20.3)	nr	20		
L1.1.2	Suite E2 (soil samples Schedule S1.20.3)	nr	10		
L1.1.3	Suite E3 (soil samples Schedule S1.20.3)	nr	10		
L1.1.4	Suite E4 (soil samples Schedule S1.20.3)	nr	10		
L1.1.5	Suite E5 (soil samples Schedule S1.20.3)	nr	10		
L1.2.1	Suite F1 (water samples Schedule S1.20.3)	nr	2		
L1.2.2	Suite F2 (water samples Schedule S1.20.3)	nr	2		
L1.2.3	Suite F3 (water samples Schedule S1.20.3)	nr	2		
L1.2.4	Suite F4 (water samples Schedule S1.20.3)	nr	2		
L1.3.1	Suite G1 (gas samples Schedule S1.20.3)	nr	3		
L1.3.2	Suite G2 (gas samples Schedule S1.20.3)	nr	3		
	<u>Waste acceptance criteria testing</u>				
L2.1	Suite H (Inert waste landfill Schedule S1.20.5)	nr	2		
L2.2	Suite I (Stable, non-reactive hazardous waste in non-hazardous waste landfill Schedule S1.20.5)	nr	2		
L2.3	Suite J (Hazardous waste landfill Schedule S1.20.5)	nr	2		
Total section L carried to summary					

Summary of Bill of Quantities		
A.	General items, provisional services and additional items	£3,500.00
B.	Percussion boring	
C.	Rotary drilling	
D.	Pitting and trenching	
E.	Sampling, monitoring during intrusive investigation	
F.	Probing and cone penetration testing	
G.	Geophysical testing	
H.	In situ testing	
I.	Instrumentation	
J.	Installation monitoring and sampling	
K.	Geotechnical laboratory testing	
L.	Geoenvironmental laboratory testing	
	Total tender	£3,500.00