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PHASE 2 GROUND INVESTIGATION REPORT FOR OAKLEY FARM, PRIORS ROAD, CHELTENHAM, GLOS GL52 5AQ

PREPARED FOR ROBERT HITCHINS LIMITED

Report No. 4360/2

Report Production Record		
Report No	4360/2	
Site Name	Oakley Farm, Priors Road, Cheltenham, Gloucestershire GL52 5AQ	
Client	Robert Hitchins Limited	
Report on	Ground Investigation	
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PHASE 2 GROUND INVESTIGATION REPORT FOR OAKLEY FARM, PRIORS ROAD, CHELTENHAM, GLOUCESTERSHIRE GL52 5AQ PREPARED FOR ROBERT HITCHINS LIMITED

1 INTRODUCTION

1.1 The above site in Cheltenham is under consideration for a residential development. A ground investigation was requested in order to assess site suitability in respect of its contamination status and geotechnical conditions for appropriate foundation and ground floor slab design. This report follows on from a Phase 1 desk study (WA Report ref 4360) undertaken by this Practice in June 2018, to which reference should be made when reading this current report.

1.2 The Geo-environmental assessment has been carried out in accordance with BS10175:2011 "Code of Practice for the Investigation of Potentially Contaminated Sites" and EA document CLR 11 "Model Procedures for the Management of Land Contamination".

1.3 The geotechnical investigation has been carried out in general accordance with Eurocode 7 'Geotechnical Design', in particular BS EN 1997-1:2004 and 1997-2:2007 and BS EN ISO 14688-1:2002 and 14688-2:2004. The proposed development is considered to fall into the Geotechnical Category 2 classification, thus routine field and laboratory testing methods have been adopted. Reference has also been made to BS5930:2015 Code of Practice for Ground Investigations, and National House Building Council (NHBC) Standards Chapter 4.2 – 'Building Near Trees'.

1.4 This report has been prepared in accordance with email instruction from Edward Argent of Robert Hitchins Limited received on 18 July 2018. Reliance on this report is presently restricted to Robert Hitchins Limited.

1.5 In summary the previous desk study established that the site has remained undeveloped farmland with no history of industrial or other former usage, thus no no-site contamination sources are anticipated. It is underlain by clay/mudstone bedrock of the Charmouth Mudstone Formation (CMF) with no record of superficial deposits,

although given the sloping nature unrecorded landslip is a possibility. Off-site features may pose a risk of landfill gas migration onto site.

2 PROPOSED DEVELOPMENT

2.1 The site is being considered for a residential end use. No proposed development layout plan was available at the time of writing.

3 GROUND INVESTIGATION REPORT

Site Works

3.1 The Phase 2 intrusive investigation took place on 30-31 July 2018 by way of borehole drilling. The location of all exploratory hole positions were selected by this Practice (in conjunction with the Client) in order to obtain good spatial coverage across the site within the time available, and as requested positions were primarily focused on the southern half of the site. Positions were subsequently marked out on site (again by this Practice) using on and off-site reference points, and are indicated on drawing 4360/2/2. A CAT electrical service scanner was deployed prior to all intrusive works and as an added precaution (in light of recorded water pipework in the vicinity) boreholes WS10-11 were initiated by manually excavated inspection pits up to 1.0m depth. No services (recorded or unrecorded) were physically encountered during the intrusive works.

3.2 A total of eleven windowless sampling (small diameter) boreholes (WS1-11) were drilled to depths of up to 4.45m. Boreholes WS1-9 were drilled using an Archway Competitor Dart 338 windowless-sampling drilling rig and boreholes WS10-11 were drilled using a Terrier 2002 windowless-sampling drilling rig. The boreholes were logged on-site by a suitably qualified engineer from this Practice in accordance with Eurocode 7 (BS EN ISO 14688-1:2002 and 14688-2:2004), and representative disturbed samples taken for geotechnical and contamination testing as appropriate. In-situ cone penetration tests (CPT) or standard penetration tests (SPT) were completed at 1.0m intervals in accordance with BS EN ISO 22476-3:2005 to assess the relative density of the material penetrated and these results are indicated on the respective logs in Appendix 1.

3.3 Insitu percolation testing was undertaken during the works to establish the infiltration potential of the natural ground with 'falling head' percolation tests undertaken in BH's WS1 & 6. Results are presented graphically on the logs in Appendix 1 and soakaway feasibility is discussed in Section 3.21-3.22.

3.4 Following completion of logging and sampling, all boreholes except WS5, 7 and 9 were installed with standpipes and of those monitoring wells, five (WS1-2, WS4, WS6 and WS11) were also fitted with gas valves. Response zones are typically between 1.0m and 4.0m depth (1.0-3.0m depth in WS10), as shown on the respective borehole logs in Appendix 1.

3.5 Gas/water monitoring visits were undertaken on 17 and 24 August and 18 September 2018 and the results are presented in Appendix 6. Water monitoring data is also presented in Figure 1 and discussed in Section 3.17-3.19. Gas monitoring results are summarised in Table 7 and discussed in Section 5.8-5.13.

3.6 Upon completion of logging, sampling and in-situ testing, all boreholes were backfilled with compacted arisings and surface topsoil replaced.

Laboratory Testing - Geotechnical

3.7 The certified geotechnical laboratory test results are presented as Appendix 4.

3.8 A number of disturbed samples were taken for routine geotechnical classification testing, comprising moisture content and plasticity determinations, along with classification to the Unified Soil Classification Scheme (USCS) and NHBC Standards, plus acidity and sulphate analysis to BRE Special Digest 1 requirements. Results are tabulated below.

TABLE 1: INDEX TEST RESULTS AND CLASSIFICATION

BH No	Depth (m)	Sample of	Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Plasticity / USCS	Consistency Index	<425um (%)	Modified Plasticity Index (%)	Volume Change Potential (NHBC)
WS1	2.0	CMF	26	62	23	39	CH	0.92	100	39	Med
WS1	3.5	CMF	24	63	22	41	CH	0.95	100	41	High
WS2	0.7	CMF	25	83	28	55	CV	1.05	100	55	High
WS2	1.0	CMF	26	63	22	41	CH	0.9	100	41	High
WS2	3.0	CMF	27	60	22	38	CH	0.87	100	38	Med
WS3	0.5	CMF	25	49	23	26	CI	0.92	100	26	Med
WS3	3.8	CMF	22	62	24	38	CH	1.11	100	38	Med
WS4	1.5	CMF	27	71	25	46	CV	0.96	100	46	High
WS4	2.5	CMF	25	61	24	37	CH	0.97	100	37	Med
WS5	0.5	CMF	20	50	22	28	CI/H	1.07	100	28	Med
WS5	1.7	CMF	22	61	23	38	CH	1.03	100	38	Med
WS6	0.5	CMF	21.7								
WS6	1.0	CMF	24.3								
WS6	1.5	CMF	24.7								
WS6	2.0	CMF	19.3								
WS6	2.5	CMF	18.8								
WS6	3.0	CMF	19.5								
WS7	1.5	CMF	25	59	24	35	CH	0.97	100	35	Med
WS7	2.5	CMF	20	57	22	35	CH	1.06	100	35	Med
WS8	0.5	CMF	20	44	22	22	CI	1.09	100	22	Med
WS8	2.0	CMF	22	57	21	36	CH	0.97	100	36	Med
WS9	1.3	CMF	23	58	23	45	CH	0.78	100	45	High
WS9	2.3	CMF	21	62	26	36	CH	1.14	100	36	Med
WS10	0.5	CMF	27	51	23	28	CH	0.86	100	28	Med
WS10	1.5	CMF	23	50	24	26	CI/H	1.04	100	26	Med
WS11	0.75	CMF	25	48	23	25	CI	0.92	100	25	Med
WS11	1.75	CMF	18	54	21	33	CH	1.09	100	33	Med

CMF = Charmouth Mudstone Formation

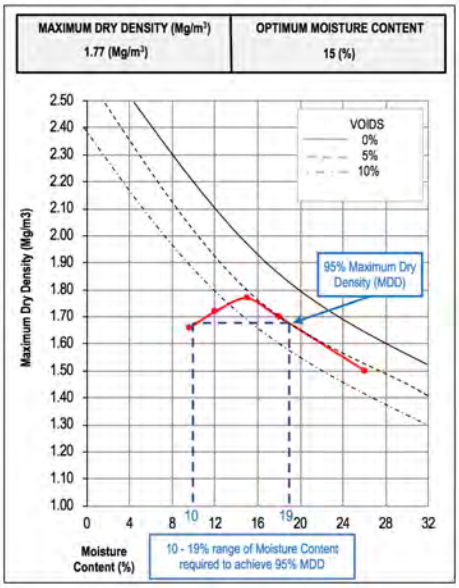
TABLE 2: CHEMICAL TEST RESULTS AND CLASSIFICATION

BH Ref	Depth (m)	Sample of	Total Sulphate SO_4 (%)	Total Sulphur (%)	Total Potential Sulphate SO_4 (%)	Oxidisable Sulphides SO_4 (%)	pH Value in Soil	Water Soluble Sulphate (mg/l) SO_4	Overall Classification According to BRE Special Digest 1 (2005) DS	ACEC
WS1	1.5	CMF	0.04	0.02	0.06	0.02	6.8	50	DS-1	AC-1
WS1	2.5	CMF	0.19	0.07	0.21	0.02	7.9	840	DS-2	AC-2
WS1	3.5	CMF	4.9	1.7	5.1	0.2	7.7	2280	DS-4	AC-4
WS5	1.0	CMF	0.01	0.01	0.03	0.02	6.8	20	DS-1	AC-1
WS5	2.0	CMF	0.03	0.01	0.03	<0.01	7.8	50	DS-1	AC-1
WS5	3.0	CMF	0.03	0.02	0.06	0.03	7.5	70	DS-1	AC-1
WS8	1.3	CMF	<0.01	<0.01	<0.03	<0.02	6.9	<10	DS-1	AC-1
WS8	2.3	CMF	0.03	0.01	0.03	<0.01	7.8	20	DS-1	AC-1
WS8	3.3	CMF	0.03	0.05	0.15	0.12	7.4	20	DS-1	AC-1
WS9	0.7	CMF	0.04	0.02	0.06	0.02	6.0	<10	DS-1	AC-1
WS9	1.7	CMF	0.01	<0.01	<0.03	<0.02	5.8	<10	DS-1	AC-1
WS9	2.7	CMF	0.01	<0.01	<0.03	<0.02	7.4	<10	DS-1	AC-1

CMF = Charmouth Mudstone Formation

3.9 A single representative sample of near surface cohesive material from WS3 was subject to a light hammer compaction test to determine the dry density/moisture content relationship, and the resulting compaction curve is shown in Figure 1 below.

FIG 1: MOISTURE CONTENT -v- DRY DENSITY (WS3/0.5-3.5m)



3.10 Given that suspected shear planes were locally encountered within the near surface weathered clay of the CMF, two disturbed samples were taken for a consolidated drained peak and residual shear box test to determine effective shear strength and effective cohesion soil parameters. The results are presented in Table 3 below.

TABLE 3: PEAK AND RESIDUAL ANGLE OF SHEARING RESISTANCE AND EFFECTIVE COHESION

Borehole No.	Depth	Sample of	Moisture Content (%)	Bulk Density (Mg/m^3)	Dry Density (Mg/m^3)	Peak Angle of Shearing Resistance (ǿ)	Peak Effective Cohesion (c')	Residual Angle of Shearing Resistance (ø'r)	Residual Effective Cohesion (c'r)
WS1	0.85m	CMF	19	1.46	1.23	18.5	6	12.0	3
WS8	0.8m	CMF	14	1.82	1.6	19.8	10	15.8	7

CMF = Charmouth Mudstone Formation

Laboratory Testing - Contamination

3.11 The contamination sampling scheme was conducted in accordance with BS10175:2011. Representative samples of topsoil and natural undisturbed soil were taken from the upper 0.6m of extracted ground. All samples were sent to UKAS accredited Concept Life Sciences laboratories in Manchester under chain of custody labelling where analysis selectively comprised the following:

- Toxic and phytotoxic metals
- pH
- Soil organic matter content
- Speciated polyaromatic hydrocarbons (PAH) (16 most common compounds)
- Asbestos Identification
- Organochlorine and organophosphorous insecticides
- Topsoil BS3882: 2015

3.12 In the absence of groundwater during the short time the boreholes were left open during sitework, the potential risk to groundwater resources was instead determined by leachate analysis on five representative samples of topsoil, made ground and shallow natural material, tested to determine the leachable content of toxic and phytotoxic metals.

3.13 The certified contamination laboratory test results are presented as Appendix 2 and for convenience these have also been summarised to facilitate comparison against assessment criteria. All results and their implications upon the preliminary CSM are further discussed in Sections 8 and 9.

3.14 Three representative samples of topsoil were acquired for BS3882:2015 Topsoil analysis to determine suitability for retention within the proposed development as a multipurpose topsoil. Composite samples were taken from western fields (boreholes WS1-3), central fields (boreholes WS4, 8 and 10) and eastern fields (boreholes WS5-7, WS9 and WS11). The certified laboratory test results are contained within Appendix 2 but for ease of reference are also provided as certificates of analysis within Appendix 3. These results are further discussed in Section 5.15.

Discussion on Ground Conditions

3.15 Ground conditions appear to be commensurate with geological mapping. Beneath a thin mantle of topsoil and/or localised made ground all boreholes encountered undisturbed clay to termination, representing the recorded Charmouth Mudstone Formation. A summary of the observed strata is presented in Table 4 below.

TABLE 4: SUMMARY OF OBSERVED STRATA

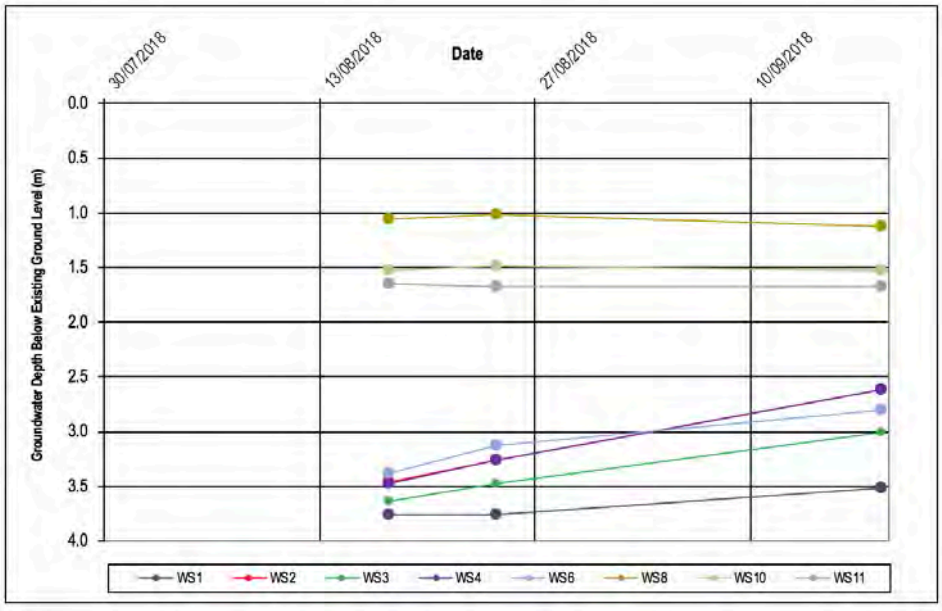
Stratum	Base Depth (m)	Notes
TOPSOIL: generally encountered as probable firm, dark brown, organic CLAY with many roots from overlying grass	0.15 - 0.4	Encountered in all boreholes except WS4
MADE GROUND: probable medium dense, sandy GRAVEL with many roots. Gravel is brick and concrete	0.4	Encountered in borehole WS4 only
MADE GROUND: probable stiff, desiccated, light brown, slightly gravelly CLAY. Gravel is typically charcoal, brick and/or glass	0.35 – 0.5	Encountered in WS1 and WS5 only
CLAY: probable initially firm, mottled light brown and light grey desiccated CLAY. Possible relict shear surfaces identified between 0.65m and 0.85m depth in boreholes WS1-3 and WS5. Below 0.9-1.4m depth appearing normally hydrated. With increasing depth becoming stiff, dark grey, with fossil and shell fragments, localised pockets of gypsum and showing relict mudstone structure. See specific logs for details *(Charmouth Mudstone Formation)*	>4.45	Encountered to terminal depth in all boreholes
Perched/Groundwater	All boreholes	Depth to Water (m) dry

3.16 Based upon on-site visual and olfactory examination of the subsoil, and consistent with the site history there was nothing to suggest the presence of obviously significantly contaminated subsoil, however made ground was locally encountered, which appears to be restricted to the area proximal to existing buildings and access road.

3.17 The near surface soil was identified as entirely cohesive in composition and index testing on the CMF classifies this undisturbed material as inorganic clay of mostly high (locally intermediate or very high) plasticity and medium volume change potential (locally high) in accordance with NHBC Standards. Consistency index (CI) values were recorded between 0.86 and 1.14, with those values at >1.0 suggestive of mild desiccation, and the on-site visual assessment of undisturbed shallow subsoil would appear to confirm this. Given that the site is almost entirely grass and tree covered, the local flora would be expected to continue to desiccate the soil throughout the summer months with worst-case conditions expected at the end of the summer season, so depending upon the time of year of development actual conditions may vary from that reported.

3.18 All boreholes were dry during drilling, which in this Practice's experience is typical of the low-permeability CMF, however subsequent monitoring of those boreholes installed with standpipes (response zones of between 1.0m and 4.0m depth) indicated that groundwater does percolate slowly through the subsoil (most likely through fissures) and standing levels are shown in Figure 2 below.

FIG 2: GROUNDWATER OBSERVATIONS



3.19 Our assessment of Figure 2 indicates that with the exception of WS2 the water level is shallower in those boreholes furthest upslope (WS8 and WS10-11), where levels were all initially recorded at fairly similar depths (1.05-1.65m) and remained constant during the monitoring period. The boreholes located further downslope (WS1, WS3-4 and WS6) including WS2 also initially recorded water at similar but greater depths (3.38-3.76m) and all expressed a similar characteristic gradual rise throughout the monitoring period.

3.20 The above would suggest that whilst in the short-term groundwater is unlikely to be encountered within newly excavated foundation or service trenches, the CMF does allow groundwater permeation, albeit at a slow rate due to the low permeability, therefore it is likely to be encountered within excavations (particularly deeper excavations) that are left open for any great period. As always, the groundwater level is of course subject to seasonal fluctuation according to prevailing weather conditions, and the situation encountered and described above could potentially change in the future, especially in a period of seemingly ever-apparent but unpredictable climate change.

Percolation Testing - Soakaway Feasibility

3.21 Two falling head percolation tests were undertaken separately within boreholes WS1 and WS6 into the undisturbed Charmouth Mudstone Formation, and summary results are shown below in Table 5. Due to negligible recorded drainage/outflow it has not been possible to calculate soil infiltration rates or undertake repeat tests within either of the two test locations.

TABLE 5: SUMMARY OF PERCOLATION TEST RESULT

Borehole No.	Test Zone Depth (m)	Approximate Soil Infiltration Rate (m/sec)	Approximate time to drain to 50% storage (hours)
WS1	0.34-4.45	N/A	>24
WS6	0.24-4.45	N/A	>24

3.22 BRE guidance states that soakaways should be feasible where infiltration rates indicate that water would drain to 50% effective storage capacity within a period of 24 hours. Due to insufficient infiltration this was not achieved within any of the test holes

and the results in Table 5 are considered to be representative of the entire site. The foregoing suggests that the site is not suitable for adoption of a soakaway (SUDS) drainage system and it is therefore recommended that alternative drainage options are sought. It is anticipated that surface-water attenuation pond(s) may already be the favoured option.

4 GEOTECHNICAL DESIGN REPORT

4.1 The site investigation works achieved by the eleven boreholes have proven ground conditions beneath the site to be in accordance with both recorded mapping and previous comparable experience. Beneath a thin surface mantle of topsoil and/or made ground all boreholes encountered undisturbed clay representing a normal weathering profile of the recorded Charmouth Mudstone Formation, which appeared locally affected by landslip.

Slope Stability

4.2 As previously identified during the Phase 1 researches, geological mapping records a swathe of landslipped ground that extends around the western and northern sides of Battledown hill and the conjectured easternmost edge of which extends across the western half of the site. Whilst landslipping is likely to have occurred in geological history our walkover survey revealed no obvious tell-tale signs of historic/ongoing instability (i.e. back scars or hummocky ground) although it is recognised that this assessment was hampered by long grasses growing at surface.

4.3 Subsequent intrusive investigation has identified possible relict shear surfaces at shallow depth only (between 0.65m and 0.85m depth) in boreholes WS1-3 and also WS5, however in all cases the condition of the shear surface was poorly defined.

4.4 Given the gradient of the existing slope it is anticipated that any development proposal will likely require cuts to be made into the slope. The presence of a 'suspected shear surface' suggests that care needs to be taken that any such interfaces are not exposed in bulk excavation as this could leave the overlying mass effectively unsupported. Given that the suspected shear surface was identified between 0.65m and 0.85m depth, this would indicate that this scenario is possible. Given the spacing of the boreholes during the current investigation it may be prudent to undertake

supplementary investigation (once a proposed layout is made available) to clarify those plots potentially affected. Again subject to the proposed development layout, a detailed slope stability assessment may be necessary and this Practice can provide further assistance if required.

4.5 Given the shallow depth of the suspected shear surface, foundation deepening beyond NHBC required depths (as discussed below) will not be necessary, although it may be prudent to reinforce the foundations of those potentially affected plots as a precaution, and upslope walls may need to be designed as retaining structures if they support the upslope ground.

4.6 It is recommended that retaining wall design be based upon residual shear strength values for the clay (suitably factored as per Eurocode guidance) of C'_r=2 kN/m^2 and $Ø'_r$=9.5^o. Please note that water monitoring recorded sub-artesian conditions with the water level locally rising to 1.02m (WS8) below existing ground level so care will need to be taken during excavations.

Foundation Design

4.7 The natural weathered cohesive soils of the CMF classify as of mostly high plasticity and medium volume change potential, however it is recognised that almost 25% of the samples tested recorded as high volume change potential. Given both the lateral and vertical spread of 'high' test results together with the spacing of borehole locations, as a precaution we have provisionally adopted a site-wide high volume change potential for the site, which (following NHBC Standards) means that a minimum founding depth of 1.0m is required, or greater within the radius of influence of trees and obviously subject to those foundations also penetrating through any localised softer, infilled or disturbed deposits to found in competent undisturbed and normally hydrated natural material, below any observed shear planes.

4.8 Consideration has been given as to whether any foundation deepening is required (beyond the above minimum) to account for potential tree root activity. Site observations indicate that there are significant numbers of semi-mature and mature trees along field boundaries, including amongst others hawthorn and oak (of high water demand) and beech and ash (of moderate water demand). Given the high number of trees present it is recommended that a detailed tree identification survey is undertaken; once complete plot-specific foundation depths can be calculated for those plots

affected by future root growth and possible existing desiccation, however it is understood that a final proposed development layout is not yet available.

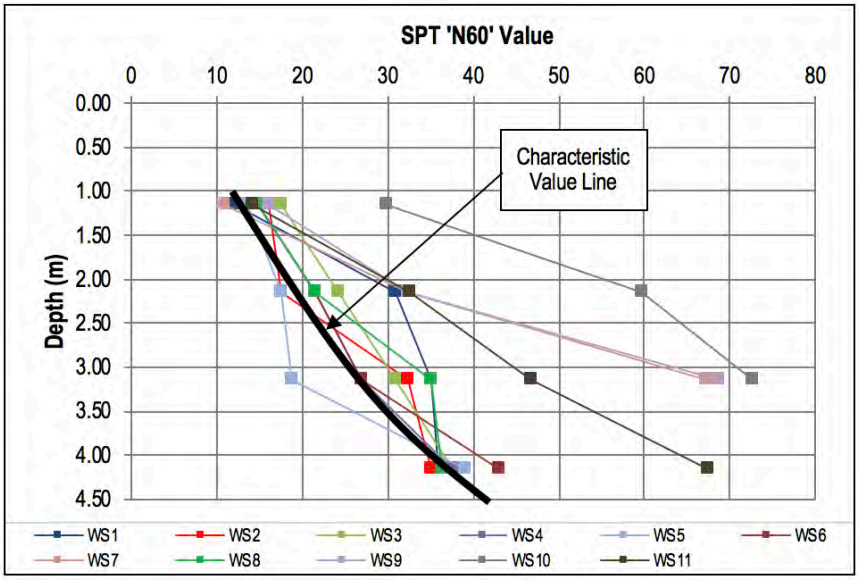
4.9 Those buildings within the zone of influence of trees will require heave protection in the form of a 70mm thick compressible membrane against the inside face of all external foundations deeper than 1.5m in order to overcome potential unbalanced lateral heave forces (unless NHBC is satisfied that the soil is not desiccated). Such protection should be applied on the inner face of external foundation walls only, with the lower 0.5m left unprotected. The same buildings will also require suspended ground floor slabs, which should incorporate a subfloor void of 150mm for insitu concrete or 300mm for pre-cast concrete and timber floors.

4.10 Design calculations in Eurocode 7 (BS EN 1997-1) require the establishment of design values for actions, ground properties and ground resistances, definition of the limits that must not be exceeded (usually a serviceability limit state), the setting up of calculation models for the relevant ultimate or serviceability limit state, and showing by such calculation that these limits will not be exceeded. Design values for such calculations are derived by applying partial factors to characteristic values for actions, ground properties and ground resistances, and based upon the foregoing geotechnical model and following the requirements of Design Approach 1, both Combination 1 and Combination 2 calculations have been undertaken. This Practice has adopted the Combination 2 calculation for foundation design as this applies partial factors to resistances rather than actions and therefore provides a slightly more conservative value. Calculation sheets can be presented upon request.

4.11 BS EN 1997-2:2007 and BS EN ISO 22475-1:2006 require quality class 1 samples for determination of soil shear strength, and such samples can only be obtained by category A sampling methods. To avoid the costly complexities of such sampling in-situ tests can alternatively be undertaken, the borehole standard penetration test (SPT) being the most commonly adopted method. Field results are adjusted or 'normalised' in accordance with Eurocode requirements (BS EN ISO 22476-9:2009), to enable the generation of characteristic values of undrained shear strength that can then be used for determination of bearing resistance as described above.

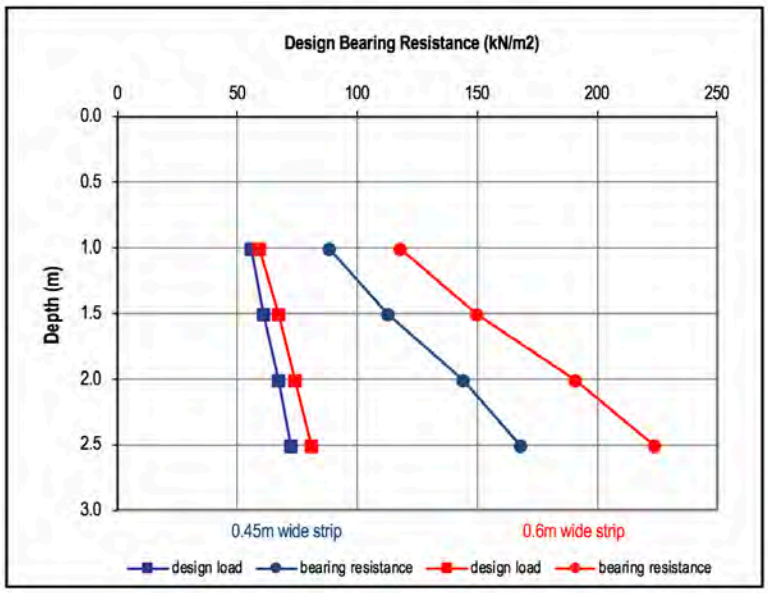
4.12 Uncorrected SPT N-values are shown on the borehole logs and normalised N-values shown are also presented as N_{60} versus depth in Figure 3. Equivalent undrained shear strength has subsequently been calculated which also takes account of plasticity index values.

FIG 3: SPT 'N60' VALUES -v- DEPTH



4.13 Using a characteristic SPT N_{60} value of 12 at 1.0m depth, based on a conventional two-storey residential line load of 45kN/m, the design bearing resistance (bearing capacity) for a standard 0.6m wide strip foundation is estimated to be approximately 118kN/m^2, which exceeds the likely bearing pressure and confirms suitability. Similar calculations demonstrate only marginal suitability for 0.45m wide foundations at this depth (bearing capacity of 88kN/m^2), indeed this continues with greater depth. Design bearing resistance is plotted against depth in Figure 4 below, so that values can be assigned to any other depths as necessary due to tree influence.

FIG 4: DESIGN BEARING RESISTANCE -v- DEPTH



4.14 The results of acidity and sulphate testing presented in Table 2 show that buried concrete associated with foundations and floor slabs constructed up to 2.3m depth can be designed to Design Sulphate Class DS-1 and Aggressive Chemical Environment for Concrete Class ACEC-1 in accordance with BRE Special Digest 1 (2005), i.e. no special measures required. For foundations in excess of 2.3m depth it is recommended that the concrete grade be increased to DS-2, AC-2 and in the unlikely event that foundation trenches will be excavated to 3.5m depth then it is recommended that the concrete grade be increased again to DS-4, AC-4. Similar requirements apply to concrete drainage pipes.

4.15 Shallow excavations should remain stable and as previously discussed in Section 3.19 in the short term it is not anticipated that groundwater will be encountered. As always it is recommended that any excavations are not left open and unsupported for any longer than necessary, and if water is encountered, in order to avoid potential softening of the founding horizon it should not be permitted to sit on the foundation base. As always groundwater levels may vary seasonally, and water may therefore be encountered at levels in variance to those recorded by this investigation.

Pavement Design

4.16 With regard to pavement design for external hardstand, near surface plasticity index values of between 22% and 28% within the near surface cohesive clay suggests a California Bearing Ratio (CBR) of approximately 3-4% at 0.5m depth. As always it is recommended that insitu testing be carried out closer to the time of construction to obtain a more accurate bearing ratio. The clay soil is not considered to be frost-susceptible, however the Local Authority should be able to advise based upon their previous experience in the area.

Material Suitability In Earthworks

4.17 Should the development proposal include surface run-off attenuation or “balancing” ponds, the following gives outline recommendations on material suitability for incorporation into earthworks. As shown in Figure 1 a light hammer compaction test on a sample of clay from WS3 at 0.5-3.5m depth indicates that a maximum dry density of 1.77 Mg/m^3 can be achieved at an optimum moisture content (OMC) of 15%. On the assumption that excavated materials would be recompacted to 95% of the maximum dry density (MDD), the compaction curve gives a moisture content range of

between 10% and 19% to achieve 95% MDD or greater. Review of moisture content test results in Table 1 indicates that arisings will require interim drying within any earthworks in order to achieve the 95% criterion, although if the required density were reduced below 95% MDD then more of the material would become potentially suitable direct from cut to fill. This situation will vary seasonally and also excludes the effects of stockpiling of materials before use.

Recommendations for Monitoring of Ground Conditions During Construction

4.18 In view of the importance of founding on natural ground, a careful watch must be maintained during all foundation excavations to ensure that this requirement has been satisfied.

4.19 Consideration should be given to access into/around the site since the surface soils have the potential to be subject to softening during periods of sustained wet weather.

4.20 Due to the potential for cohesive soils to shrink and swell, inspection during foundation excavations should ensure that no live roots or evidence of desiccation is visible at the founding horizon.

4.21 In the event of any doubt in the above matters, this Practice would be pleased to attend site as instructed.

5 CONTAMINATION RISK ASSESSMENT, TOPSOIL SUITABILITY AND SOIL WASTE CLASSIFICATION

Human Health

5.1 The contamination risk assessment has been carried out in general accordance with the methodology described within Appendix 1. Testing has included samples of the near-surface topsoil and undisturbed clay to assess their suitability for retention within the development proposal. In view of the nature of the proposals Tier 1 risk modelling has adopted the '***residential'*** land use scenario, including the pathway of direct ingestion via vegetables grown for consumption, and the 'critical receptor' is taken as a female child of age class 1-6.

5.2 Laboratory test results are presented in Appendix 3 and have also been summarised in Table 6 below.

TABLE 6: COMPARISON OF SOIL CHEMICAL TEST RESULTS WITH GUIDELINE VALUES

Determinand	Maximum Measured Concentration (mg/kg)	LQM/CIEH S4UL Residential with plant uptake (mg/kg) $	Tests Undertaken (No.)	Exceedances (No.)	Notes
Arsenic	38	37	22	1	WS10/0.2m
Cadmium	1	11	22	0	
Chromium*	66	910	22	0	
Lead	190	200**	22	0	
Mercury	<1	40	22	0	
Selenium	<3	250	22	0	
Nickel	46	180	22	0	
Copper	77	2400	22	0	
Zinc	190	3700	22	0	
Asbestos Fibres	CHR	N/A	1	1	WS4/0.25m
PAH compounds	Various	Various	5	0	
Insecticides	All below LOD	Various	3	0	
Notes:					
* assumed all chromium on site is in trivalent form					
** former C4SL used in absence of S4UL					
$ based on soil organic matter = 2.5%					

5.3 The findings presented in Table 6 indicate that there are no elevations of phytotoxic metals, PAH or insecticide compounds above Tier 1 Generic Assessment Criteria (GAC). It is however noted that loose fibre(s) of ACM were locally identified (Chrysotile) along with a single elevation of the toxic metal arsenic that may pose a risk to the health of future site users and these have been considered in more detail below.

5.4 Firstly considering arsenic, a value of 38mg/kg (WS10/0.2m) was recorded within near surface natural clay which very mildly exceeds the GAC-S4UL of 37mg/kg. Progression has therefore been made to a Tier 2 site-specific assessment which includes statistical analysis using the CIEH Statistical Calculator and assessment using site-specific parameters within CLEA v1.071. The CLEA software has calculated a site-specific assessment criteria (SSAC) value of 36.5mg/kg. All results came from non-targeted investigation so are therefore deemed permissible for

inclusion within statistical analysis, and using such data an Upper Confidence Limit (UCL) of 22.6mg/kg has been determined which does not exceed the SSAC. The isolated elevated value of arsenic is therefore not considered to pose a significant risk to the health of future site users.

5.5 Suspected ACM was identified during the walkover survey being used as corrugated roof sheeting on derelict farm buildings and laboratory testing has identified loose fibre(s) of Chrysotile within a single sample of surface made ground (WS4/0.25m) in the farm yard. – it may be prudent to commission a specialist to undertake a formal asbestos survey prior to any demolition.

5.6 It is current recommended practice to remove all asbestos from residential developments, not only for the protection of future site users but also to protect groundworkers, and all such material will need to be disposed of off-site at a suitably licensed landfill. It is recommended that some further investigation is undertaken once all existing buildings have been demolished to delineate the area surrounding not only WS4 but also the wider farm yard that may be affected, determine the volume of made ground requiring off-site disposal and also clarify whether the subsequent waste stream classifies as hazardous. Note that if only isolated fragments are found rather than free fibres within the soil, then a simplified 'manual pick' strategy may be sufficient to remove the risk. Please note that the submission of a formal remedial strategy may be requested by the relevant authority detailing the method and timescales of such works. Immediately following the remedial works, it will be necessary to undertake validation sampling on the exposed formation to ensure that all contaminated material has been adequately removed with a final verification report produced, again to satisfy the relevant authority. Replacement soil will need to be uncontaminated and suitable for a residential development and ideally come with pre-certification confirming its suitability. This Practice can provide further assistance with the foregoing if required.

Water Supply Pipework

5.7 In addition to the above, consideration has been given to the potential effects of recorded concentrations on new water utility pipework. Given the general absence of made ground and negligible risk from organic contaminants there ought to be no requirement for upgraded barrier pipework and the results of the contamination testing undertaken as part of this investigation would seem to support this. As always it is recommended that advice be sought from the local regulatory authority prior to ordering, since it is possible that their specific in-house thresholds may differ markedly

from those within the most recent guidance by UK Water Industry Research (UKWIR) report "Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites" (2010).

Landfill Gas and Radon Gas

5.8 It was previously established during desk study researches that the site is located within proximity to a single recorded historical landfill site located 180m to the north, as well as a backfilled reservoir to the east and former clay pits to the west, and may therefore be affected by landfill gases migrating from one or more of these sources.

5.9 The landfill gas risk assessment has been undertaken in general accordance with BS8485:2015 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings", and with reference to Construction Industry Research and Information Association (CIRIA) 665 'Assessing risks posed by hazardous ground gases to buildings' (2007).

5.10 As shown in Appendix 7 the recent monitoring has recorded maximum concentrations of methane and carbon dioxide of 0% and 5.3% respectively, with a maximum steady state flow rate of +0.2 l/hr. Worst case low (and falling) atmospheric pressure was recorded during one out of the three monitoring visits.

5.11 On this basis the implied maximum Characteristic Situation (CS) is derived by consideration of the maximum hazardous gas flow rate calculated from each monitoring well during the recent monitoring rounds, as shown in Table 7 below.

TABLE 7: SUMMARY GAS MONITORING RESULTS AND MAXIMUM CHARACTERISTIC SITUATION

BH Ref	Maximum Steady State Flow (l/hr)	Maximum Peak Gas Concentrations (%)		Peak Hazardous Gas Flow Rate (l/hr)		Implied Characteristic Situation		Worst-Case Hazardous Gas Flow Rate (l/hr) Q_{hg}		Worst-Case Characteristic Situation	
		Methane	Carbon Dioxide	$Q_{hg}CH_4$	$Q_{hg}CO_2$	CH_4	CO_2	CH_4	CO_2	CH_4	CO_2
WS1	+0.2	0.0	1.7	0.0	0.0034	1	1				
WS2	0.0	0.0	0.6	0.0	0.006	1	1				
WS4	+0.1	0.0	5.3	0.0	0.0053	1	1	0.0	0.011	1	1
WS6	+0.1	0.0	1.5	0.0	0.0015	1	1				
WS11	+0.1	0.0	1.4	0.0	0.0014	1	1				

NOTES:	
Q_{hg}	= equivalent to GSV in C665
	Implied Characteristic Situation based on individual borehole data
	Worst-case gas flow rate and Characteristic Situation based on maximum observed flow rate and concentrations from any borehole

5.12 As shown in Table 7 above, based on both peak and worst-case monitoring results the overall site classification is 'CS1' indicating a very low hazard potential. It is recognised however that a value of 5.3% was recorded for Carbon Dioxide, which exceeds the "typical maximum" of 5% and further consideration has therefore been given as to whether an increase to CS2 classification may be appropriate. Given the only nominal exceedance of the typical maximum and that subsequent monitoring rounds (during worst-case low and falling atmospheric pressure) did not record any further exceedances the original site classification of CS1 is still considered appropriate. Landfill gas protection measures are not therefore considered necessary within new development.

5.13 Consultation of the BRE Report BR211 "Radon: guidance on protective measures for new buildings" (2015) suggests that no radon gas protection measures are required in new development at this site.

Controlled Waters

5.14 In the absence of groundwater within the boreholes at the time of the intrusive works, the risk to controlled waters has instead been assessed by leachate analysis on five representative soil samples of topsoil, made ground and shallow natural material, each tested to determine the leachable content of toxic and phytotoxic metals. It will be seen within Appendix 2 that there are no recorded elevations above respective Water Framework Directive (WFD) thresholds for groundwater. In view of the foregoing no additional pre-construction remedial measures in respect of controlled waters are considered necessary.

Topsoil Suitability for Retention

5.15 Three composite samples (Western, Central and Eastern Fields) have each been tested in accordance with BS3882:2015 "*Specification for Topsoil*" to determine the suitability of the existing topsoil for retention within the proposed development. As shown in Appendix 3 the Certificates of Analysis classify all three composite samples

as 'silty clay' due to relative sand, silt and clay contents, which unfortunately means that all three samples fall outside the acceptable limits for a multi-purpose topsoil. In addition to the foregoing, the Western Field sample was also noted to have an excessive organic matter content, and both Central and Eastern Field samples had nutrient deficiencies. It may be possible to recover the topsoil to multi-purpose quality and it is recommended that advice be taken from a landscaping/topsoil specialist.

Waste Classification for Off-Site Disposal of Arisings

5.16 In accordance with current legislation all soil arisings generated for disposal as part of this development site are by definition a "commercial waste" and will be classified as both a directive and a controlled waste. Should it be necessary to remove from site any surplus excavation arisings then as per the European Waste Catalogue (EWC) these will be coded 1705, that is "soil (including excavated soil from contaminated sites), stones and dredging spoil".

5.17 Using the HazWasteOnline software and in accordance with Technical Guidance Waste Management 3 (TGWM3) 1st Edition, 2015) the contamination test results obtained for that material have been compared with respective threshold data as set out in TGWM3 in order that this specific waste stream can be classified. As shown in Appendix 6, this material would be classified as a "Non-hazardous Mirror Entry" under EWC Code 170504 (soil and stones that do not contain the tested dangerous substances above the respective threshold value). Such materials can therefore be disposed of at a suitably licensed "non-hazardous" landfill site, which will require the contamination test data undertaken as part of this investigation.

5.18 The presence of chrysotile fibres within localised near surface made ground means that this specific waste stream would currently be classified as a 'Hazardous Mirror Entry' under EWC Code 170503* (soil and stone containing dangerous substances). Unless and until an asbestos quantification test proves a fibre content of <0.1% such material will require disposal at a suitably licensed 'hazardous' landfill site.

5.19 On the assumption that all other non-hazardous arisings are being considered for disposal as inert waste to take advantage of a lower tipping rate, Waste Acceptance Criteria (WAC) testing has been undertaken on three composite samples (one each from Western, Central and Eastern Fields), mostly comprising natural CMF but where appropriate also containing made ground (Central Fields samples only). As shown in Appendix 5, all tested determinands from both the Central and Eastern composite

samples fall within acceptable thresholds for inert waste (EWC code 17-05-04). Considering the Western Fields composite sample, it should be noted that this sample recorded both an elevated 'sulphate' value of 6900mg/kg, which exceeds the threshold of 1000mg/kg and an elevated 'total dissolved solids' value of 8100mg/kg, which exceeds the threshold of 4000mg/kg. The foregoing therefore suggests that the arisings from the Western Fields will not qualify as inert waste. It is recommended that the attached WAC results (Appendix 5) and contamination test data (Appendix 2) are provided to the chosen landfill operator for their own assessment of acceptability in advance of soil arrival.

Caveats

5.20 In line with best industry practice the scope of contamination testing has been based upon the site history, current land usage and actual findings, with reference where necessary to DoE Industry Profiles and DEFRA/EA guidance. To the best of our knowledge information concerning the land quality assessment is accurate at the date of issue, however subsurface conditions including ground contamination may vary spatially and with time. There may be conditions pertaining to the site not disclosed by the above sources of information, which might have a bearing upon the recommendations made, were such conditions known. We have however used our professional judgement in order to limit this during the investigation.

5.21 The conclusions and recommendations made in respect of land quality do not address any potential risks to site operatives or ground workers during the construction stage. These issues should be addressed by the Principal Contractor in accordance with the relevant statutory procedures and regulations (CDM Regulations 2015).

5.22 It is important that these limitations be clearly recognised when the findings and recommendations of this report are being interpreted. Additional assessment may be necessary should a significant delay occur between report date and implementation of the proposed scheme to which it relates.

6 REFINED CONCEPTUAL SITE MODEL

6.1 In view of the above discussions the preliminary conceptual site model has been refined as shown in Figure 5 and Table 8 below.

FIG 5: REFINED CONCEPTUAL SITE MODEL (NTS)

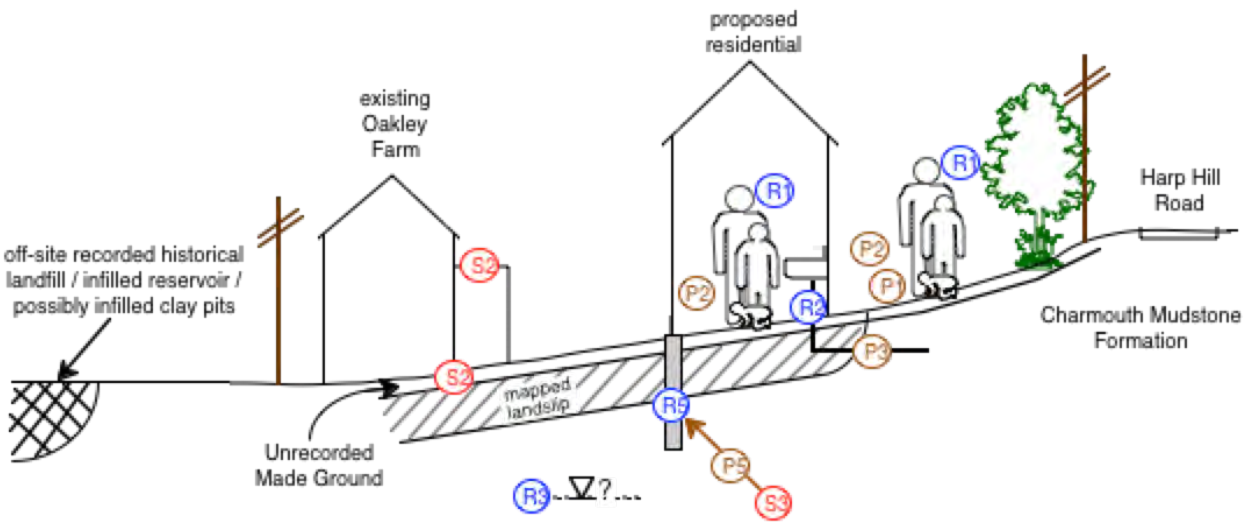


TABLE 8: SUMMARY OF POTENTIAL / IDENTIFIED POLLUTANT LINKAGES

Potential Sources	Pathways	Receptors R1	R2	R3	R4	R5	R6	Comments	Refined Risk Rating	Remedial/Mitigation Requirements
ON-SITE										
S2	P1							Chrysotile asbestos recorded in near surface made ground near Oakley Farm buildings	High	Further investigation recommended following building demolition to delineate affected area requiring excavation and off-site disposal, or simple manual pick to remove ACM fragments. Supplementary quantification testing recommended to help classify waste
	P2	X					X			
	P3									
	P4									
	P5									
	P6									
	P7									
S3	P1							Elevated sulphate/sulphide recorded within Charmouth Mudstone Formation	High	Concrete classification of DS-1/AC-1 suitable for foundations and floor slabs up to 2.3m depth. Below 2.3m depth increase to DS-2/AC-2 required. Below 3.5m depth increase to DS-4/AC-4 required.
	P2									
	P3									
	P4									
	P5					X				
	P6									
	P7									
OFF-SITE										
SOURCES	S2	Chrysotile Asbestos identified within near surface made ground (within vicinity of farm buildings)								
	S3	Natural Charmouth Mudstone Formation								
PATHWAYS	P1	Direct dermal contact or ingestion via soil attached to vegetables								
	P2	Inhalation of dust & vapours								
	P3	Permeation into new water supply pipework								
	P4	Vertical leaching in unsaturated zone and lateral migration in saturated zone								
	P5	Direct contact with high sulphate-bearing clay								
	P6	Landfill gas migration through unsaturated zone and accumulation within confined spaces								
	P7	Radon gas migration through unsaturated zone and accumulation within confined spaces								
RECEPTORS	R1	Future site users (critical residential receptor is female child age class 1-6)								
	R2	Potable water supply								
	R3	Groundwater (CMF is a Secondary Undifferentiated aquifer)								
	R4	Surface waters								
	R5	Concrete Foundations								
	R6	Adjacent site users (residential)								

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 The foregoing discussions and recommendations are based upon the results of an intrusive ground investigation comprising boreholes plus insitu testing and laboratory geotechnical and contamination testing. The boreholes appear to present a consistent pattern of subsoil conditions concordant with recorded geological mapping comprising undisturbed Charmouth Mudstone Formation below a thin surface mantle of topsoil, localised made ground and localised near surface suspected landslip affected strata. As always however a careful watch should be maintained for any anomalous conditions during site stripping and excavation, which should be reported back to this Practice for further investigation and assessment. Some supplementary ground investigation and assessment should be undertaken as the site is broken down into smaller development parcels.

7.2 The intrusive investigation has proven topsoil/made ground up to 0.5m depth, which directly overlies the recorded undisturbed cohesive CMF, proven to terminal depth in all boreholes. The CMF was mostly recovered as probable initially firm, mottled light brown and light grey desiccated CLAY, appearing normally hydrated below 0.9-1.4m depth. With increasing depth becoming stiff, dark grey, with fossil and shell fragments, localised pockets of gypsum and showing relict mudstone structure.

7.3 Possible relict shear surfaces were identified between 0.65m and 0.85m depth in boreholes WS1-3 and WS5. All boreholes remained dry and stable during the time left open while drilling, however subsequent piezometer readings recorded sub-artesian standing water at depths of as shallow as 1.02m from surface. The short-term stability of side walls within open excavations for foundations and services is unlikely to be an issue during construction, however some care will obviously need to be taken within those plots falling within the area affected by landslip as exposing the shallow shear plane in bulk excavation could potential lead to an unsupported slope. Dependent on the proposed development layout it is likely that some slope retention may locally be necessary and it is recommended that retaining wall design be based upon factored residual shear strength values of C'_r=2 kN/m^2 and $Ø'_r$=9.5^o.

7.4 Foundations will need to penetrate any near surface disturbed, softer or desiccated ground to found within normally hydrated soil of the undisturbed CMF at a minimum depth of 1.0m, with foundation deepening and suspended ground floor slabs likely for any buildings located within the zone of influence of trees. Heave protection will only be necessary if desiccation is present within soil beneath building footprints at the time

of construction. At the minimum depth founding horizon the design bearing resistance has been calculated as being suitable for a typical two storey dwelling on 0.6m wide foundations. Narrower 0.45m wide foundations are only marginally suitable so should not be considered without a more detailed assessment.

7.5 Buried concrete in open excavations for conventional strip/trenchfill foundations and floor slabs up to 2.3m depth can be designed to concrete classification DS-1/AC-1. i.e. no special precautions required. Should foundations or concrete drainage infrastructure be required to exceed 2.3m depth then the concrete classification will need to be increased to DS-2/AC2 and for foundations in excess of 3.5m depth this increases again to DS4/AC/4. Deep excavation arisings from >2.3m depth should not be placed as backfill against concrete that is <DS/AC2 classification (or DS/AC4 if from > 3.5m depth)

7.6 In terms of proposed external pavement design a CBR value of 3-4% is considered appropriate (based on correlation from index test results only) and such material is unlikely to be frost susceptible. As always we recommend that in-situ tests be undertaken closer to the time of construction once proposed road layouts are known.

7.7 The soils found beneath the entire site are of inadequate permeability to be suitable for a soakaway (SUDS) drainage system, therefore an alternative method of surface-water removal will be required.

7.8 Contamination risk assessment has shown that the site is mostly uncontaminated in terms of risk to both human health and controlled waters, however Chrysotile asbestos was locally recorded within near surface made ground in proximity to the existing farm yard buildings and further works are recommended following demolition to delineate the affected area and to quantify the waste stream.

7.9 BS3882:2015 Topsoil testing has suggested that the existing topsoil across the entire site is currently unsuitable for reuse as a multi-purpose topsoil within a residential end-use primarily due to a Silty Clay textural class falling outside the required acceptable limits. Additionally, the topsoil was also found to be deficient in nutrients. It is recommended that a landscaping/topsoil specialist be consulted to determine whether the topsoil can be recovered/improved to confirm with BS3882:2015 requirements.

7.10 With regard to the off-site disposal of arisings, the majority of soil classifies as a 'Non-Hazardous Mirror Entry' and therefore can be disposed of at a suitably licensed non-

hazardous landfill site, however the localised near surface made ground containing asbestos fibres currently classifies as a 'Hazardous Mirror Entry' and in the absence of an asbestos quantification test (which might downgrade it to non-hazardous) this material will require disposal at a hazardous landfill site. WAC testing has identified that arisings from Central and Eastern Fields also classify as inert waste, although arisings from Western Fields classify as non-hazardous (stable non-reactive) waste due to exceedances of both sulphate and total dissolved solids.

7.11 There is no requirement for landfill gas protection measures and in line with BGS and HPA records no radon protection measures are necessary within new construction at this site.

7.12 Should planning consent be subject to certain conditions, this report and attachments should be lodged with the local planning authority, such that they can update their records.

7.13 The above recommendations must not be used in respect of any development differing in any way from the proposals described in this report, without reference back to this Practice or to another geotechnical/geo-environmental specialist. This report is subject to our standard terms and conditions.

8 REFERENCES

Geotechnical

BS EN 1997-1:2004 'Geotechnical Design - *General Rules'*

BS EN 1997-2:2007 'Geotechnical Design - *Ground Investigation and Testing'*

British Standards Institute, BS5930:2015 '*Code of Practice for Ground Investigations*'

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BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 1 Identification and Description*' (2002)

BS EN 14688: *'Geotechnical Investigation and Testing - Identification and Classification of Soil Part 2 Principles for a Classification'* (2004)

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The Water Supply (Water Quality) Regulations 2000 (Amendment) Regulations (2007)

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Technical Guidance Waste Management 2 (TGWM2, EA Version 3.0, May 2013)

Building Research Establishment (BRE)- *'Cover Systems for Land Regeneration'* (2004)

Environment Agency (www.environment-agency.gov.uk)

Zetica (www.zetica.com)

Google Earth (current and historical aerial mapping plus street view)

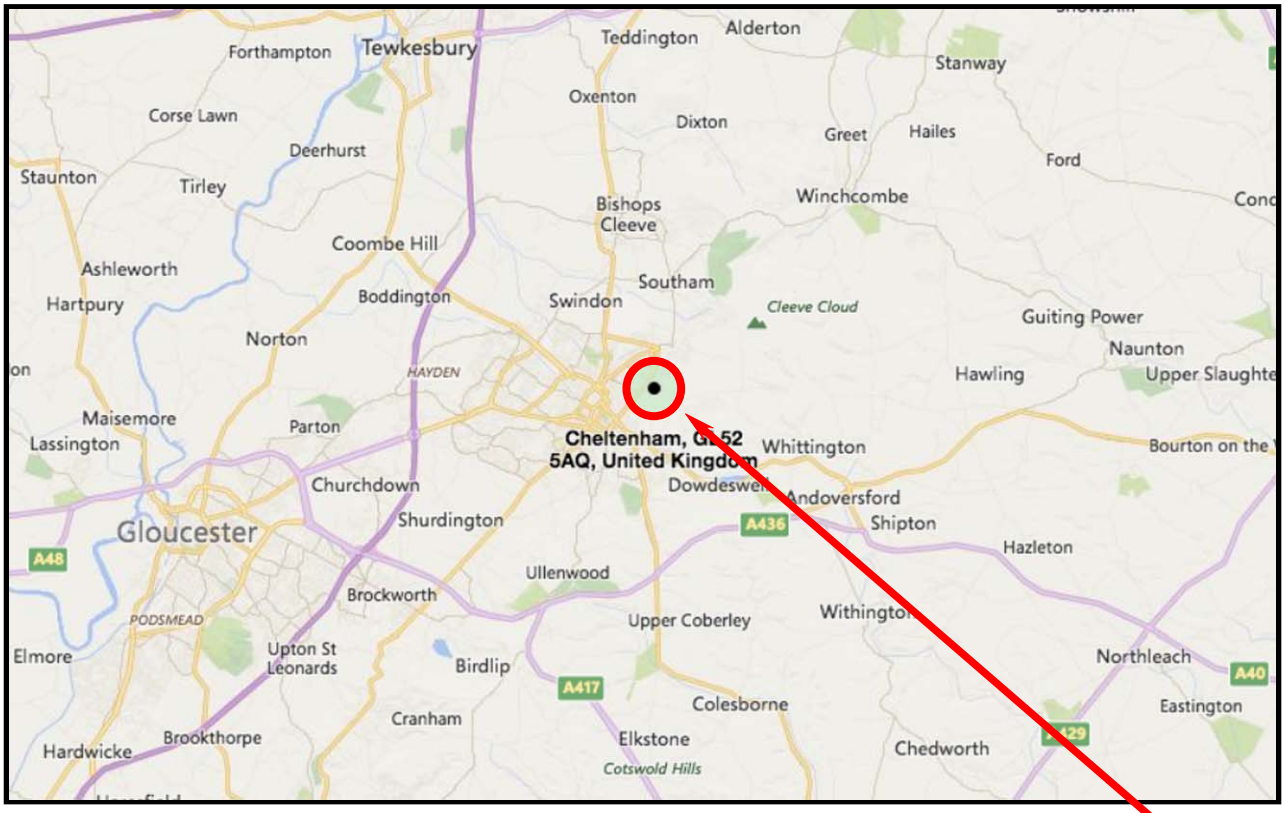
Wilson Associates (Consulting) Limited report ref 4360, dated June 2018

OAKLEY FARM, PRIORS ROAD, CHELTENHAM, GL52 5AQ

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

SITE LOCATION (based on Microsoft Bing Mapping)

Job No.	Drawing No.	Scale:	Date:
4360/2	4360/2/1	NTS	14-11-18



OAKLEY FARM, PRIORS ROAD, CHELTENHAM, GL52 5AQ

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

EXISTING SITE LAYOUT (based on Aerial Image from Google Maps) SHOWING INVESTIGATION LOCATIONS

Job No.	Drawing No.	Scale:	Date:
4360/2	4360/2/2	NTS	14-11-18

APPENDIX 1

BOREHOLE LOGS
(INCLUDING PHOTOGRAPHS)

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

KEY TO BOREHOLE LOG SYMBOLS

Symbol	Explanation
D or J	Small Disturbed Sample (tub or jar sample)
B	Large Disturbed Sample
U	Undisturbed Sample
W	Water Sample
U70	Undisturbed Sample

Undrained Shear Strength Test (HSV)

90	Hand vane - direct reading in kN/m^2

Standard Penetration Test (SPT)

15	SPT 'N' Value (BS EN ISO 22476-3:2005)
125/50	Where full test drive not completed, penetration (125mm) and blow count (50) recorded
NR	No effective penetration

Water

	Water struck
	Water standing

Test/Core Range

TCR	Total Core Recovery - as percentage of core run. Where value significantly exceeds 100%, a note is given on remarks on log
SCR	Solid Core Recovery - as percentage of core run. Note: assessment of solid core is based on full diameter
RQD	Rock Quality Designation - the amount of solid core greater than 100mm expressed as percentage of core run
	Where SPT has been carried out at beginning of core run, disturbed section of core excluded from SCR and RQD assessment

Instrumentation

	Bentonite Seal
	Solid / Perforated Standpipe
	Granular Response Zone

Wilson Associates
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BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS1**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	76.00	E 396,804 N 222,517	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.10	D					0.18	TOPSOIL: probable firm, dull brown, organic, heavily rooted CLAY		
0.30	D					0.35	MADE GROUND: probable stiff, desiccated, light brown, slightly gravelly CLAY (gravel is brick and glass fragments)		
0.50	D						CLAY: probable initially firm, light brown to light grey, desiccated CLAY		
							0.85 - possible relict shear surface (inclined at 45°)		
1.00		N9							
1.50	D						1.40 - becoming normally hydrated, mottled light grey to light brown CLAY, with occasional shell fragments and pockets of gypsum		
2.00	D						2.00 - becoming stiff		
2.00		N23				(4.10)		CMF	
2.50	D								
3.00		N26					3.00 - becoming dark grey CLAY		
3.50	D						3.65 - weathered fissure observed 3.70 - rootlet observed		
4.00		N27							
						4.45			
							Core Recovery: 0.0 - 4.0m 100% All insitu strength testing undertaken using CPT Falling head testing carried out Borehole terminated at 4.45m depth Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations

Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling

From	To	Hours

Water Added

From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

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BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS2**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	91.00	E 396,896 N 222,409	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.30	TOPSOIL: probable firm to stiff, light brown, organic, desiccated, heavily rooted CLAY		
0.30	D						CLAY: probable firm, light brown to light grey, desiccated CLAY		
0.50	D								
0.70	D						0.75 - possible shear surface (inclined at c45°)		
1.00	D						0.90 - becoming normally hydrated, with frequent pockets of gypsum		
1.00		N12							
							1.50 - weathered fissure		
							1.80 - becoming dark grey, locally mottled light brown		
2.00		N13							
						(4.15)		CMF	
							2.90 - becoming stiff, dark bluish-grey, with frequent fossil fragments		
3.00	D								
3.00		N24							
4.00		N26							
						4.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Borehole terminated at 4.45m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS3**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	82.00	E 396,944 N 222,512	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA							
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.20	TOPSOIL: probable firm to stiff, dark brown, organic, heavily rooted CLAY		
							CLAY: probable initially firm, light brown, desiccated CLAY with rare roots		
							0.65 - possible shear surface; rare gravel of rounded medium limestone		
1.00		N13					0.90 - becoming normally hydrated, dark grey to light brown CLAY, with frequent pockets of gypsum		
2.00		N18				(4.25)		CMF	
							2.60 - no more live rootlets observed		
3.00		N23					3.00 - becoming stiff		
							3.50 - frequent fossil fragments		
4.00		N28				4.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Borehole terminated at 4.45m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS4**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	84.00	E 397,042 N 222,516	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(0.40) 0.40	MADE GROUND: grass over probable medium dense, sandy GRAVEL (gravel is brick and concrete)		
1.00		N11					CLAY: probable initially firm, light brown CLAY		
							1.50 - becoming mottled light brown to light grey, with frequent pockets of crystalline gypsum		
2.00		N16							
						(4.05)		CMF	
							2.50 - becoming dark grey CLAY		
3.00		N20					3.00 - becoming stiff		
4.00		N28							
						4.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Borehole terminated at 4.45m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

WS1 – core 0.0 – 4.0m

WS1 – possible shear plane at 0.85m

WS2 – core 0.0 – 4.0m

WS3 – core 0.0 – 4.0m

WS4 – core 0.0 – 4.0m

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BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS5**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	94.00	E 397,178 N 222,509	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.10	D					0.15	TOPSOIL: probable firm, light brown, organic, desiccated, heavily rooted CLAY		
0.25	D					0.40	MADE GROUND (reworked): probable firm to stiff, light brown, desiccated CLAY, with fragments of charcoal		
0.50	D						CLAY: probable initially firm, light brown to light grey, desiccated CLAY, with rare rounded limestone and rare roots		
1.00		N10					0.65 - possible shear surface 0.90 - becoming normally hydrated		
							1.50 - no roots observed below this depth		
2.00	D								
2.00		N13				(4.05)		CMF	
							2.80 - becoming dark grey CLAY, with rare pockets of crystalline gypsum		
3.00		N14							
4.00		N29					4.00 - becoming stiff		
						4.45			
							Core Recovery: 0.0 - 4.0m 100% All insitu strength testing undertaken using CPT Borehole terminated at 4.45m depth; backfilled with arising upon completion of testing and sampling		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
30/07/2018					DRY					

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS6**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	103.00	E 397,299 N 222,490	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						(0.40) 0.40	TOPSOIL: probable stiff, light greyish-brown, organic, desiccated, heavily rooted CLAY		
0.50	D						CLAY: probable initially stiff and friable, light brown, desiccated CLAY		
1.00	D						0.90 - becoming firm, normally hydrated, mottled light brown and grey		
1.00		N11							
1.50	D								
2.00	D								
2.00		N16				(4.05)		CMF	
2.50	D								
3.00	D						3.00 - becoming stiff		
3.00		N20							
4.00		N32				4.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Falling head testing carried out		
							Borehole terminated at 4.45m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
30/07/2018					DRY					

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS7**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	101.00	E 397,140 N 222,423	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
						0.25	TOPSOIL: probable stiff, light brown, organic, desiccated, heavily rooted CLAY		
							CLAY: probable initially firm to stiff, desiccated, light brown to light grey CLAY		
1.00		N8					1.00 - becoming soft to firm, normally hydrated		
						(3.20)		CMF	
2.00		N24					2.00 - becoming stiff		
							2.80 - 10mm band of iron-rich limestone		
3.00		N50							
						3.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Borehole terminated on iron-rich limestone at 3.45m depth; backfilled with arising upon completion of testing and sampling		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
30/07/2018					DRY					

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
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BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS8**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	31-07-18	96.00	E 397,016 N 222,419	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.10	D					0.30	TOPSOIL: probable firm, light brown, organic, desiccated, heavily rooted CLAY		
0.30	D						CLAY: probable initially stiff, desiccated, light brown to light grey CLAY, with occasional gravel of subangular limestone		
0.50	D								
0.80-0.90	D								
1.00		N11					1.00 - becoming firm		
1.30	D						1.30 - appearing normally hydrated		
2.00	D								
2.00		N16							
2.30	D					(4.15)		CMF	
							2.50 - weathered fissure observed; becoming stiff, dark grey, with relict mudstone structure evident		
3.00		N26							
3.30	D								
4.00		N27							
						4.45			
							Core Recovery:		
							0.0 - 4.0m 100%		
							All insitu strength testing undertaken using CPT		
							Borehole terminated at 4.45m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
31/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS9**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	31-07-18	110.00	E 397,239 N 222,402	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.20	D					0.30	TOPSOIL: probable firm to stiff, dull brown, organic, desiccated, heavily rooted CLAY		
0.50	D						CLAY: probable initially stiff, light brown to light grey, desiccated CLAY		
0.70	D								
1.00		N12					1.10 - becoming firm, normally hydrated, light brown to light grey CLAY, with rare gravel of subrounded limestone		
1.30	D								
1.70	D					(3.14)		CMF	
2.00		N24					2.00 - becoming stiff		
2.30	D								
2.70	D								
3.00		N50/ 295 mm					2.90 - grading to dark grey CLAY, with relict mudstone structure evident		
						3.44			
							Core Recovery:		
							0.0 - 3.0m 100%		
							All insitu strength testing undertaken using CPT		
							Falling head testing carried out		
							Borehole terminated on refusal at 3.44m depth; backfilled with arisings upon completion of testing and sampling		

Boring Progress and Water Observations						Chiselling			Water Added	
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt	From	To	Hours	From	To
31/07/2018					DRY					

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Archway Dart 338	Logged By CM

WS5 – core 0.0 – 4.0m

WS5 – possible shear plane at 0.65m

WS6 – core 0.0 – 4.0m

WS7 – core 0.0 – 3.0m

WS8 – core 0.0 – 3.0m

WS9 – core 0.0 – 4.0m

SPT Calibration Report

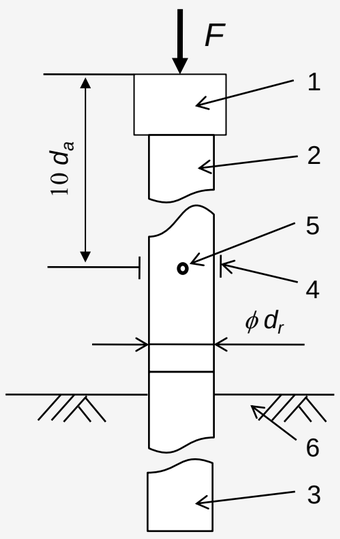
www.equipegroup.com

Hammer Energy Measurement Report

Type of Hammer		DART
Client		COOK GROUND INVESTIGATION
Test No		EQU2109
Test Depth (m)		8.70
Mass of hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J

Characteristics of the instrumented rod

Diameter	d_r =	0.052 m
Length of instrumented rod		0.558 m
Area	A =	11.61 cm²
Modulus	E_a =	206843 MPa



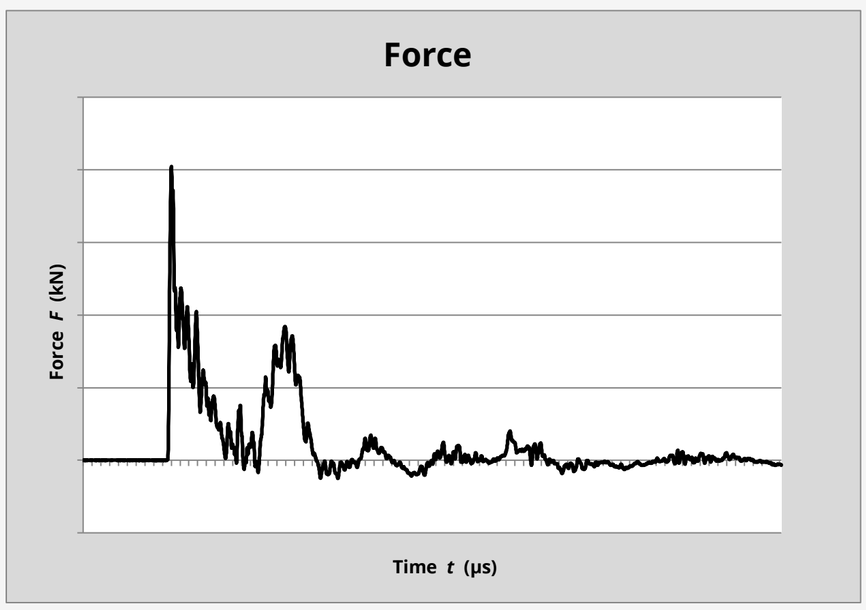
Key

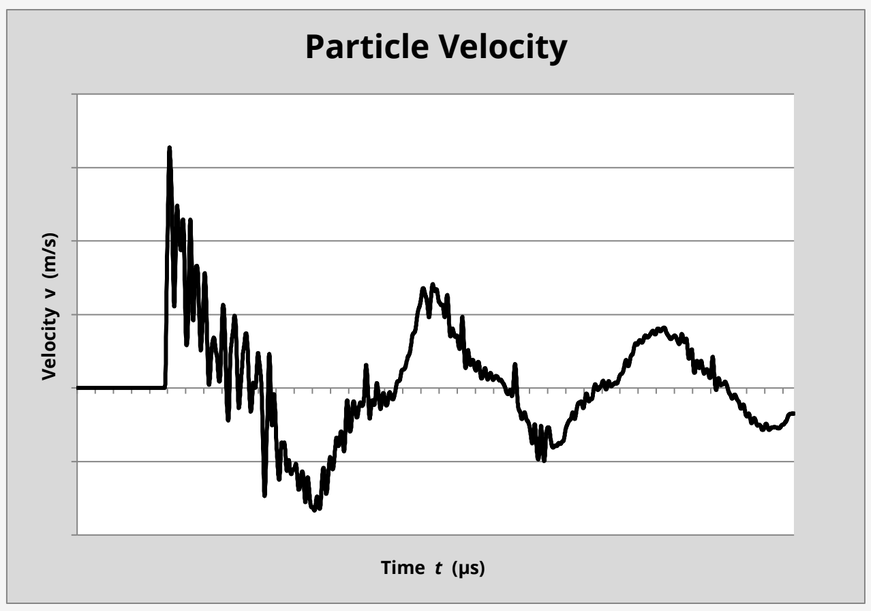
1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

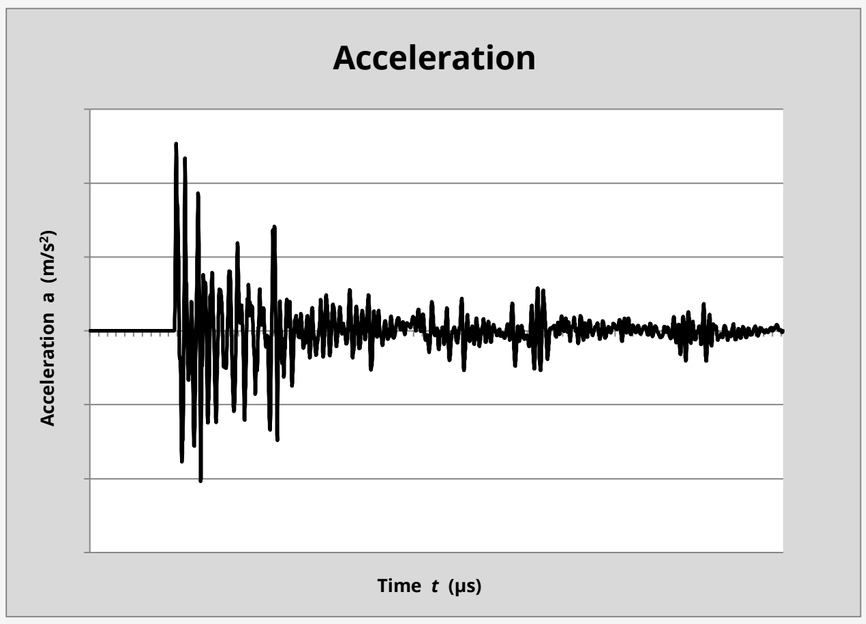
F Force
d_r Diameter of rod

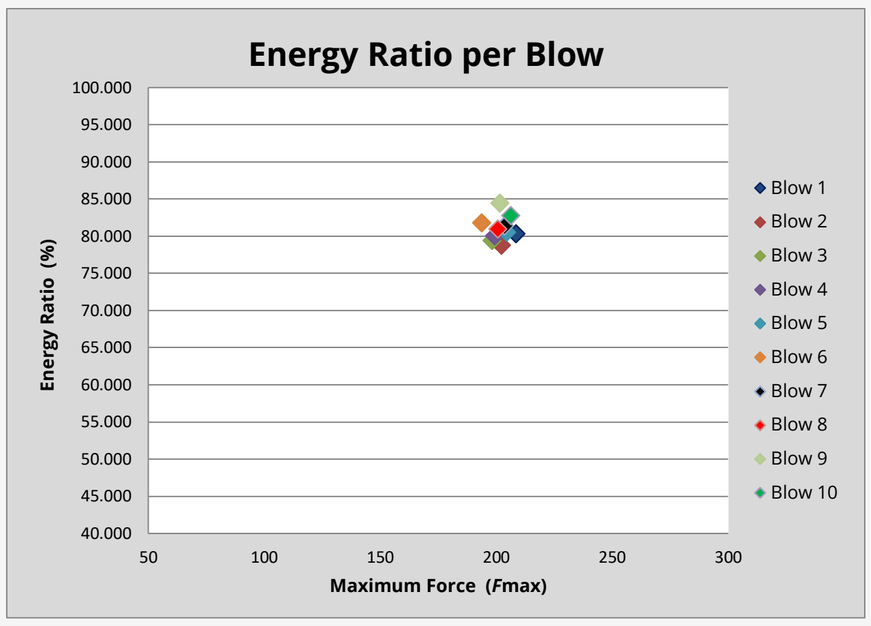
Fig. B.1 and B.2
BS EN ISO 22476-3 : 2005 + A1 : 2011

DATE OF TEST	VALID UNTIL	HAMMER ID
29/06/2018	29/06/2019	338









Observations:
1.

E_{meas} =	**0.382** kN-m	
E_{theor} =	**0.473** kN-m	

Energy Ratio = $\frac{E_{meas}}{E_{theor}}$ (E_r) **80.75%**

Equipe SPT Analyzer Operators: **AF**

Prepared by:	05/07/2018	**Checked by:**	05/07/2018	**Date:** 05/07/2018

 Equipe Group, The Paddocks, Home Farm Offices, The Upton Estate, Banbury, Oxfordshire, OX15 6HU
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Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS10**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	118.00	E 397,090 N 222,249	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.05	D					0.20	TURF over TOPSOIL: probable firm, dark brown, organic, slightly sandy CLAY, with frequent grass rootlets		
0.20	D					0.50	CLAY: probable firm to stiff, brown mottled orange and grey, silty, locally slightly sandy CLAY; occasional grass rootlets, slightly desiccated		
0.50	D					(0.50)		CMF	
						1.00	CLAY: probable firm, orangish-brown and grey, silty locally slightly sandy CLAY		
1.00		N23					CLAY: stiff,grey, thinly laminated, mottled orange silty CLAY		
1.50	D					(1.40)	1.00 - slightly gravelly (gravel is angular to subangular, medium and coarse, extremely weak mudstone) 1.20 - becoming thinly laminated - bands of grey, black, orange and brown, very silty CLAY	CMF	
2.00		N46					1.65 - gravel becoming very weak 1.85 - very thinly bedded, grey, silty CLAY, weathered orangish-brown (iron) on bedded planes		
						2.40	2.00 - becoming very stiff		
						(1.02)	CLAY/MUDSTONE: probable very stiff, dark grey and mottled reddish-brown, silty CLAY/extremely weak MUDSTONE	CMF	
3.00		N50/ 267 mm				3.42			
							Core Recovery: 0.0 - 3.0m 100% All insitu strength testing undertaken using SPT Borehole terminated at 3.42m depth Gas/groundwater monitoring standpipe installed to 3.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Window Sampling / Terrier 2002 (T06)	Logged By AJ

Wilson Associates
Consulting Engineering Geologists & Geo-Environmental Engineers

BOREHOLE LOG

Project				BOREHOLE No
Oakley Farm, Priors Road, Cheltenham GL52 5AQ				**WS11**
Job No	Date	Ground Level (c.m, AOD)	Co-Ordinates (c.)	
4360/2	30-07-18	119.00	E 397,306 N 222,304	
Contractor				Sheet
Cook Ground Investigation Limited				1 of 1

SAMPLES & TESTS			STRATA						
Depth	Type No	Test Result	Water	Undrained Shear Strength	Legend	Depth (Thick-ness)	DESCRIPTION	Geology	Instrument/ Backfill
0.00-0.30	D					0.20	TURF over TOPSOIL: probable firm, brown, organic, sandy, slightly gravelly, desiccated CLAY (gravel is subangular to subrounded, fine to coarse mudstone, chalk, occasional flint, very rare clinker and brick); frequent grass rootlets		
0.10	D					0.55			
0.50	D						CLAY: probable firm, greyish-brown, very sandy, slightly gravelly CLAY (gravel is angular to subrounded, fine to coarse mudstone); occasional roots and rootlets		
0.75	D								
1.00		N11					CLAY: firm, grey mottled orange and brown, silty, slightly sandy, slightly gravelly CLAY (gravel is angular to subrounded, fine to medium mudstone		
						(2.15)	1.35 - becoming grey	CMF	
1.75	D								
2.00		N25					2.00 - becoming stiff		
						2.70			
						(0.65)	CLAY/MUDSTONE: very stiff, orange and greyish-brown mottled red, thinly laminated, silty, slightly gravelly CLAY/extremely weak MUDSTONE	CMF	
3.00		N36				3.35			
							CLAY: very stiff, grey, silty CLAY		
						(1.06)		CMF	
4.00		N50/ 291 mm				4.41			
							Core Recovery:		
							0.0 - 1.2m hand-dug starter pit 1.2 - 4.0m 100%		
							All insitu strength testing undertaken using SPT		
							Borehole terminated upon refusal at 4.41m depth		
							Gas/groundwater monitoring standpipe installed to 4.0m depth; fitted with gas valve and lockable cover		

Boring Progress and Water Observations					
Date	Hole Dia. mm	Depth	Casing Depth	Casing Dia. mm	Water Dpt
30/07/2018					DRY

Chiselling			Water Added	
From	To	Hours	From	To

GENERAL REMARKS

Borehole position scanned using Cable Avoidance Tool (CAT); no services detected

CMF = Charmouth Mudstone Formation

All dimensions in metres Scale 1:50	Client Robert Hitchins Limited	Method/ Plant Used Window Sampling / Terrier 2002 (T06)	Logged By AJ

WS10 – core 1.0 – 3.0m

WS10a

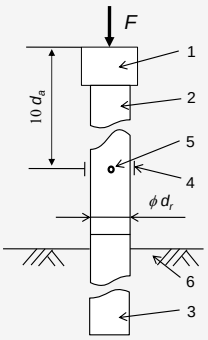
WS11 – core 1.0 – 3.0m

SPT Calibration Report

www.equipegroup.com

Hammer Energy Measurement Report

Type of Hammer		DANDO TERRIER
Client		CC GROUND INVESTIGATIONS LTD
Test No		EQU1994
Test Depth (m)		10.20
Mass of hammer	m =	63.5kg
Falling height	h =	0.76m
E_{theor} =	$m \times g \times h$ =	473J



Key

1 Anvil
2 Part of instrumented rod
3 Drive Rod
4 Strain Gauge
5 Accelerometer
6 Ground

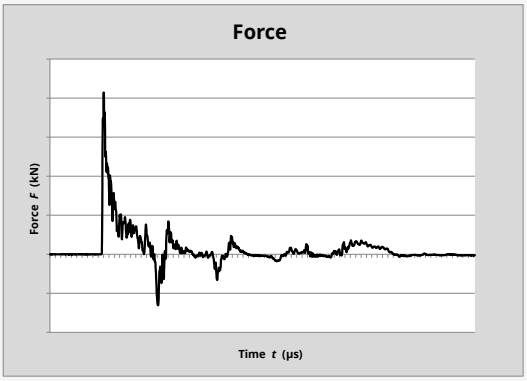
F Force
d_r Diameter of rod

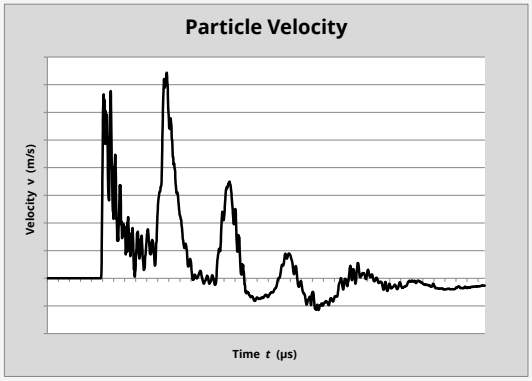
Fig. B.1 and B.2
BS EN ISO 22476-3 : 2005 + A1 : 2011

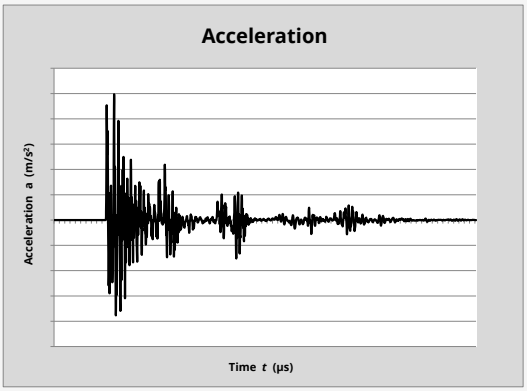
Characteristics of the instrumented rod

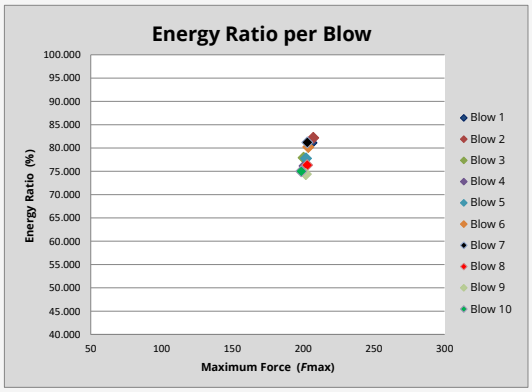
Diameter	d_r =	0.052 m
Length of instrumented rod		0.558 m
Area	A =	11.61 cm²
Modulus	E_a =	206843 MPa

DATE OF TEST	VALID UNTIL	HAMMER ID
02/01/2018	02/01/2019	T06









Observations:
1.

E_{meas} =	**0.369**	kN-m
E_{theor} =	**0.473**	kN-m

Energy Ratio = $\frac{E_{meas}}{E_{theor}}$ (E_r) **77.94%**

Equipe SPT Analyzer Operators: AF

Prepared by: **Checked by:** **Date:** 05/01/2018

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APPENDIX 2

CONTAMINATION
STATUTORY FRAMEWORK / METHODOLOGY
AND
CERTIFIED CONTAMINATION TEST RESULTS

A2 CONTAMINATION RISK ASSESSMENT

Statutory Framework

A2.1 Part 2A of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on the Contaminated Land (England) Regulations 2000, the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only 'contaminated land' where it appears to the regulatory authority, by reason of substances within or under the land, that:

- Significant harm is being caused or there is significant possibility of such harm being caused; or
- Pollution of controlled waters is being, or is likely to be, caused.

A2.2 In 2012 revised Statutory Guidance for Part 2A of the Environmental Protection Act (1990) came into force for England and Wales. This introduced a new four category approach for classifying land affected by contamination to assist decisions by regulators in cases of Significant Possibility of Significant Harm (SPOSH) to specified receptors, including humans, and significant pollution of controlled waters.

Category 1 describes land which is clearly problematic e.g. because similar sites are known to have caused a significant problem in the past. The legal definition is where "there is an unacceptably high probability, supported by robust science-based evidence, that significant harm would occur if no action is taken to stop it".

Categories 2 and 3 cover land where detailed consideration is needed before deciding whether it may be contaminated land. Category 2 is defined as land where "there is a strong case for considering that the risks from the land are of sufficient concern that the land poses a significant possibility of significant harm". Category 3 is defined as land where there is not the strong case described in the test for Category 2, and may include "land where the risks are not low, but nonetheless the authority considers that regulatory intervention under Part 2A is not warranted". The decision basis is initially related to human health risks, and if this is not conclusive due to uncertainty over risks, wider socio-economic factors (e.g. cost, local perception etc).

Category 4 describes land that is clearly not contaminated land, where there is no risk or the level or risk posed is low.

This same 4 category system has also been introduced to assist in identifying whether there is a significant possibility of significant pollution of controlled waters. Part 2A states that normal levels of contaminants in soil should not be considered to cause land to qualify as contaminated land, unless there is a particular reason to consider otherwise.

Following publication of the revised Statutory Guidance, DEFRA commissioned a research project to develop new Category 4 Screening Levels (C4SLs) to provide a simplified test for regulators to aid decision-making on when land was suitable for use and definitely not contaminated land under the statutory regime. The output from this research project was published by CL:AIRE in December 2013, with Policy Companion Documents published in England by DEFRA in March 2014 and the Welsh Government in May 2014. The culmination of this work was the development of a framework and methodology for deriving C4SLs and the publication of final C4SLs for use as new screening values for six common contaminants.

Further research by LQM on behalf of CIEH lead to the publication in 2015 of the Suitable for Use Levels known as S4ULs, and these are now widely adopted as a robust and authoritative source of guidance (see A2.14 below).

Once land has been determined as contaminated land, the enforcing authority must consider how it should be remediated and, where appropriate, it must issue a remediation notice to require such remediation. The enforcing authority for the purposes of remediation may be the local authority which determined the land, or the Environment Agency which takes on responsibility once land has been determined if the land is deemed to be a “special site”. The rules on what land is to be regarded as special sites, and various rules on the issuing of remediation notices, are set out in the Contaminated Land (England) Regulations 2006

A2.3 The UK guidance on the assessment of land contamination has developed as a direct result of the introduction of the above two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document (CLR 11 was published in

2004. In 2008 CLR reports 7 to 10 were withdrawn by the Department of Environment Food & Rural Affairs and the Environment Agency and updated versions of CLR 9 and 10 were produced in the form of Science Reports SR2 and SR3.

A2.4 The guidance defines 'risk' as the combination of:

- The probability, or frequency, of occurrence of a defined hazard (e.g. exposure of a property to a substance with the potential to cause harm); and
- The magnitude (including the seriousness) of the consequences.

A2.5 For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- A source, i.e. a substance that is capable of causing pollution or harm;
- A pathway, i.e. a route by which the contaminant can reach the receptor; and
- A receptor (or target), i.e. something which could be adversely affected by the contaminant.

A2.6 If any one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

A2.7 The presence of contamination is also a material issue in the determination of planning applications, and where a change of use is proposed, especially on brownfield (former industrial) land, investigation, assessment and remediation of contamination is often a requirement of the Planning Authority. The presence of contamination may consequently require remedial action prior to redevelopment, in circumstances which would otherwise be unlikely to result in the determination of the land as contaminated land as defined in the above legislation.

Contamination Assessment Methodology

A2.8 The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the preliminary conceptual site model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

A2.9 Stages 1 and 2 develop a *'preliminary conceptual model'* based upon information collated from desk studies and usually a site walkover inspection. The formation of a conceptual site model is an iterative process, and it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

A2.10 The information gleaned from the desk studies and associated enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the preliminary conceptual site model. CLR 8, together with specific DoE 'Industry Profiles' provides guidance on the nature of contaminants relating to specific industrial processes. Whilst it is acknowledged that CLR 8 has been withdrawn no replacement guidance has yet been published that lists the contaminants likely to be present on contaminated sites, thus CLR 8 guidance is still considered relevant.

A2.11 If the preliminary conceptual model identifies potential pollutant linkages, a Phase 2 site investigation is normally recommended, unless appropriate mitigation measures can be incorporated into the proposed development sufficient to negate the identified risks, subject to local planning authority approval. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the preliminary conceptual model can be updated and relevant pollutant linkages identified.

Preliminary Risk Assessment

A2.12 By considering the various potential sources, pathways and receptors, a preliminary assessment of potential risk is made based upon the likelihood of the occurrence and the severity of the potential consequence, the latter being a function of the sensitivity

of the receptor. At Phase 1 desk study stage the qualitative risk assessment is based on the categories tabulated below.

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution to controlled waters
Moderate	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures
Mild	Pollution of non-sensitive waters, minor damage to buildings or structures
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non-sensitive ecosystems or species

A2.13 The likelihood of an event (probability) takes into account both the presence of the hazard and receptor and viability of the pathway, and is based on the categories tabulated below.

Category	Definition
Highly likely	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Possible	Pollution linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable

A2.14 On this basis potential hazards are assigned a risk rating as shown below.

		Consequence			
		Severe	*Moderate*	*Mild*	*Minor*
Probability (Likelihood)	**Highly likely**	very high	high	moderate	low
	Likely	high	moderate	low/moderate	low
	Possible	moderate	low/moderate	low	very low
	Unlikely	low/moderate	low	very low	very low

A2.15 At Phase 2 stage, quantitative assessment of human health risk posed by ground contamination is achieved by comparison of soil concentrations with Tier 1 Category Four Screening Levels (C4SL) published by DEFRA (2014), and/or Suitable for Use Levels (S4UL) as published by LQM/CIEH (2015). The official Soil Guideline Values utilise a soil organic matter content of 6% which is considered to be higher than typical UK soils, however three sets of S4UL's have been developed for organic matter contents of 1%, 2.5% and 6%, thus the most appropriate set is selected based upon proven site conditions.

A2.16 Contaminant concentrations below the threshold screening values are considered not to warrant further risk assessment. Concentrations of contaminants above these screening values require further consideration of potential pollutant linkages and may indicate potentially unacceptable risks to site users. Such exceedances may trigger a Tier 2 detailed quantitative risk assessment (DQRA) where site-specific parameters are used to derive site specific assessment criteria (SSAC), usually by using the CLEA Model (V1.06 at time of writing). It should be noted that exceedance of a screening value does not necessarily indicate that the site requires remediation.

A2.17 In order to assess any risk to controlled waters posed by contaminants within the underlying soils and groundwater, laboratory results have been screened against Level 1 Environmental Quality Standard (EQS) values derived from the Water Framework Directive (Standards & Classification) Directions (England & Wales) 2015 and the current UK Drinking Water Supply (Water Quality) Regulations (DWS), dependent upon the most vulnerable receptor. The EQS is usually an upper concentration set for the receiving watercourse and not the discharge itself. The DWS is established for compliance at the point of use or abstraction and not the source area.

Wilson Associates

SUMMARY OF CONTAMINATION TESTING RESULTS

Sample Ref	Sample Depth	Sample of	SOILS: pH	TOXIC METALS (mg/kg): Arsenic	Cadmium	Chromium III	Lead	Mercury	Selenium	Nickel	PHYTOTOXIC METALS (mg/kg): Copper	Zinc	Moisture @ 105C (%)	Soil Organic Matter (%)	Asbestos Screen	LEACHATES: TOXIC METALS (µg/l): Arsenic	Cadmium	Chromium	Lead	Mercury	Selenium	Nickel	PHYTOTOXIC METALS (µg/l): Copper	Zinc
WS1	0.1	topsoil (clay)	5.9	22	1	35	190	<1	<3	32	41	190	23											
WS1	0.3	made ground (clay)	6.6	21	<1	43	79	<1	<3	31	23	100	18											
WS2	0.3	CMF (clay)	6.0	16	<1	42	27	<1	<3	35	21	100	16											
WS2	0.5	CMF (clay)	6.3	15	<1	53	32	<1	<3	33	22	94	20	1.0										
WS3	0.15	topsoil (clay)	5.9	16	<1	37	110	<1	<3	26	23	130	27			0.3	<0.02	9	0.4	<0.05	<0.5	5	3.1	5
WS3	0.4	CMF (clay)	6.6	15	<1	42	24	<1	<3	31	16	87	55											
WS4	0.25	made ground (gravel)	7.9	17	<1	31	46	<1	<3	27	23	100	55		CHR	0.4	<0.02	<1	0.4	<0.05	<0.5	1	1.5	3
WS4	0.45	CMF (clay)	7.7	18	<1	47	33	<1	<3	46	27	110	19											
WS5	0.1	topsoil (clay)	5.2	15	<1	38	110	<1	<3	27	18	100	24											
WS5	0.25	made ground (clay)	5.9	15	<1	40	100	<1	<3	28	15	93	24			<0.2	<0.02	<1	<0.3	<0.05	<0.5	<1	0.8	3
WS6	0.1	topsoil (clay)	5.5	16	<1	42	60	<1	<3	31	21	120	22											
WS6	0.5	CMF (clay)	6.6	13	<1	58	22	<1	<3	33	21	95	18											
WS7	0.15	topsoil (clay)	5.2	16	<1	43	51	<1	<3	37	20	120	19											
WS7	0.6	CMF (clay)	4.9	15	<1	62	17	<1	<3	30	22	86	19	0.5		<0.2	<0.02	<1	<0.3	<0.05	<0.5	<1	0.6	3
WS8	0.1	topsoil (clay)	5.4	15	<1	40	52	<1	<3	29	18	110	23											
WS8	0.3	CMF (clay)	5.5	11	<1	55	17	<1	<3	34	20	96	16											
WS9	0.2	topsoil (clay)	5.5	17	<1	46	54	<1	<3	33	24	110	22			<0.2	<0.02	<1	<0.3	<0.05	<0.5	<1	0.6	<2
WS9	0.5	CMF (clay)	5.7	14	<1	44	26	<1	<3	31	17	85	14	1.30										
WS10	0.05	topsoil (clay)	5.6	21	<1	52	53	<1	<3	28	77	100	24											
WS10	0.2	CMF (clay)	6.8	38	<1	66	26	<1	<3	33	28	100	20											
WS11	0.1	topsoil (clay)	6.9	19	<1	47	35	<1	<3	28	21	110	20											
WS11	0.5	CMF (clay)	7.0	22	<1	46	23	<1	<3	29	19	140	16											
TIER 1: GENERIC ASSESSMENT CRITERIA																								
S4UL (Residential with plant uptake)				37	11	910	200♠	40	250	180	2,400	3,700												
S4UL (Residential without plant uptake)				40	85	910	310♠	56	430	180	7,100	40,000												
S4UL (Allotments)				43	1.9	18,000	80♠	19	88	230	520	620												
S4UL (Commercial)				640	190	8,600	2330♠	1,100	12,000	980	68,000	730,000												
S4UL (Public Open Space - Residential)				79	120	1,500	630♠	120	1,100	230	12,000	81,000												
S4UL (Public Open Space - Park)				170	532	33,000	1300♠	240	1,800	3,400	44,000	170,000												
TIER 2: SITE SPECIFIC																								
Upper Confidence Limit [on true mean concentration, u] (CIEH Statistical Calculator)				22.6																				
Site-Specific Assessment Criteria (SSAC's) residential with homegrown produce				36.5																				
		WFD "Water Framework Directive Standards & Classification (England & Wales)" 2015 *(Groundwater)*														7.5	3.75	37.5	7.5	0.75	75	15	1500	
		WFD "Water Framework Directive Standards & Classification (England & Wales)" 2015 *(Fresh Surface Water)*														50	0.08	3.4	1.2	0.07		<1	1	12.3
		EA EQS "River Basin Districts Typology, Standards & Groundwater Threshold Values (Water Framework Directive) (England & Wales) Directions 2010"														50	0.08-0.25	4.7	7.2	0.07		20	1-28	8-125
		UK Drinking Water Standards "The Water Supply (Water Quality) Regulations 2000"														10	5	50	25	1	10	20	2000	5000

CIEH/LQM s= GAC/S4UL presented exceeds the solubility saturation limit, which is presented in brackets

CIEH/LQM v = GAC/S4UL presented exceeds the vapour saturation limit, which is presented in brackets

CIEH/LQM S4UL d = S4UL based on a threshold protective of direct skin contact with phenol (guideline in brackets based on health effects following long term expsoure provided for illustration only)

S4UL LQM/CIEH published Suitable for use levels (2015)

Based on Soil Organic Matter of 1%

DEFRA ♠ = C4SL (2014)

(13) = Results have been blank corrected

ND = None Detected

CHR = Chrysotile loose fibres detected

SUMMARY OF POLYAROMATIC HYDROCARBON (PAH) AND INSECTICIDES TESTING RESULTS

Sample Ref	Sample Depth (m)	Sample of	POLYAROMATIC HYDROCARBONS (PAH) (mg/kg): TOTAL PAH	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)Anthracene	Chrysene	Benzo(b)Fluoranthene	Benzo(k)Fluoranthene	Benzo(a)Pyrene	Indeno(1,2,3)pe)ylene	Dibenz(a)Anthracene	Benzo(ghi)Perylene	SOIL ORGANOCHLORINE INSECTICIDES (mg/kg): Hexachlorocyclohexane	Hexachlorobenzene	Heptachlor	Aldrin	Heptachlor epoxide	Chlordane	Endosulphan	DDE	Deldrin	Endrin	DDD	DDT	ORGANOPHOSPHOROUS INSECTICIDES (mg/kg): Dichlorvos	Mevinphos	Dimethoate	Diazinon	Primiphos methyl	Malathion	Fenitrothion	Pasithion	Azinphos methyl
WS1	0.3	made ground (clay)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1																				
WS2	0.3	CMF (clay)																		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	(162.131) <0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
WS4	0.45	CMF (clay)	5.1	<0.1	<0.1	<0.1	<0.1	0.6	0.2	1.0	0.9	0.4	0.4	0.4	0.3	0.3	0.2	<0.1	0.2																				
WS6	0.5	CMF (clay)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1																				
WS8	0.1	topsoil (clay)																		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	(162.131) <0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
WS10	0.2	CMF (clay)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1																				
WS11	0.1	topsoil (clay)																		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	(162.131) <0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
WS11	0.5	CMF (clay)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1																				
TIER 1: GENERIC ASSESSMENT CRITERIA																																						
S4UL (Residential with plant uptake)				2.3	170	210	170	95	2,400	280	620	7.2	15	2.6	77	2.2 (5♠)	27	0.24	320		1.8		5.7					0.97			0.032								
S4UL (Residential without plant uptake)				2.3	2,900	3,000	2,800	1,300	31,000	1,500	3,700	11	30	3.9	110	3.2 (5.3♠)	45	0.31	360		4.1		7.3					7.0			6.4								
S4UL (Allotments)				4.1	28	34	27	15	380	62	110	2.9	4.1	0.99	37	0.97 (5.7♠)	9.5	0.17	290		0.47		3.2					0.17			0.0049								
S4UL (Commercial)				190.0	83,000	84,000	63,000	22,000	520,000	23,000	54,000	170.00	350	44	1200	35 (76♠)	500	3.50	3,900		110		170					170			140								
S4UL (Public Open Space - Residential)				4,900	15,000	15,000	9,900	3,100	74,000	3,100	7,400	29	57	7.1	190	5.7 (10♠)	82	0.57	640		16		18					8			16								
S4UL (Public Open Space - Park)				1,200	29,000	29,000	20,000	6,200	150,000	6,300	15,000	49	93	13	370	11 (21♠)	150	1.1	1,400		30		30					30			26								
TIER 2: SITE SPECIFIC																																						
Upper Confidence Limit [on true mean concentration, u] (CIEH Statistical Calculator)																																						
Site-Specific Assessment Criteria (SSAC's) residential with homegrown produce																																						

CONCEPT LIFE SCIENCES
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Concept Life Sciences

Certificate of Analysis

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Report Number: 757007-1

Date of Report: 17-Aug-2018

Customer: Wilson Associates (Consulting) Limited
36 Brunswick Road
Gloucester
GL1 1JJ

Customer Contact: Mr Charlie Morton

Customer Job Reference: 4360/2
Customer Purchase Order: 4360/2/CM
Customer Site Reference: Cheltenham
Date Job Received at Concept: 03-Aug-2018
Date Analysis Started: 06-Aug-2018
Date Analysis Completed: 17-Aug-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service Advisor

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757007 001**	**757007 002**	**757007 006**	**757007 007**	**757007 008**
				Customer Sample Reference	**WS1**	**WS1**	**WS2**	**WS2**	**WS3**
				Top Depth	**0.10**	**0.30**	**0.30**	**0.50**	**0.15**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**23**	**18**	**16**	**20**	**27**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757007 009**	**757007 010**	**757007 011**	**757007 012**	**757007 013**
				Customer Sample Reference	**WS3**	**WS4**	**WS4**	**WS5**	**WS5**
				Top Depth	**0.40**	**0.25**	**0.45**	**0.10**	**0.25**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**55**	**55**	**19**	**24**	**24**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757007 017**	**757007 018**	**757007 019**	**757007 020**	**757007 021**
				Customer Sample Reference	**WS6**	**WS6**	**WS7**	**WS7**	**WS8**
				Top Depth	**0.10**	**0.50**	**0.15**	**0.60**	**0.10**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**31-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**22**	**18**	**19**	**19**	**23**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757007 022**	**757007 026**	**757007 027**	**757007 031**	**757007 032**
				Customer Sample Reference	**WS8**	**WS9**	**WS9**	**WS10**	**WS10**
				Top Depth	**0.30**	**0.20**	**0.50**	**0.05**	**0.20**
				Date Sampled	**31-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Moisture @105C	T162	AR	0.1	%	**16**	**22**	**14**	**24**	**20**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

Concept Reference	**757007 033**	**757007 034**
Customer Sample Reference	**WS11**	**WS11**
Top Depth	**0.10**	**0.50**
Date Sampled	**30-JUL-2018**	**30-JUL-2018**
Matrix Class	**Clay**	**Clay**

Determinand	Method	Test Sample	LOD	Units		
Moisture @105C	T162	AR	0.1	%	**20**	**16**
Retained on 10mm sieve	T2	M40	0.1	%	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Heavy Metals(9)

Concept Reference					**757007 001**	**757007 002**	**757007 006**	**757007 007**	**757007 008**
Customer Sample Reference					**WS1**	**WS1**	**WS2**	**WS2**	**WS3**
Top Depth					**0.10**	**0.30**	**0.30**	**0.50**	**0.15**
Date Sampled					**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
Matrix Class					**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**22**	**21**	**16**	**15**	**16**
Cadmium	T6	M40	1	mg/kg	**1**	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**35**	**43**	**42**	**53**	**37**
Copper	T6	M40	1	mg/kg	**41**	**23**	**21**	**22**	**23**
Lead	T6	M40	1	mg/kg	**190**	**79**	**27**	**32**	**110**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**32**	**31**	**35**	**33**	**26**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**190**	**100**	**100**	**94**	**130**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Heavy Metals(9)

Concept Reference					**757007 009**	**757007 010**	**757007 011**	**757007 012**	**757007 013**
Customer Sample Reference					**WS3**	**WS4**	**WS4**	**WS5**	**WS5**
Top Depth					**0.40**	**0.25**	**0.45**	**0.10**	**0.25**
Date Sampled					**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
Matrix Class					**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**15**	**17**	**18**	**15**	**15**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**42**	**31**	**47**	**38**	**40**
Copper	T6	M40	1	mg/kg	**16**	**23**	**27**	**18**	**15**
Lead	T6	M40	1	mg/kg	**24**	**46**	**33**	**110**	**100**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**31**	**27**	**46**	**27**	**28**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**87**	**100**	**110**	**100**	**93**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Heavy Metals(9)

				Concept Reference	**757007 017**	**757007 018**	**757007 019**	**757007 020**	**757007 021**
				Customer Sample Reference	**WS6**	**WS6**	**WS7**	**WS7**	**WS8**
				Top Depth	**0.10**	**0.50**	**0.15**	**0.60**	**0.10**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**31-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**16**	**13**	**16**	**15**	**15**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**42**	**58**	**43**	**62**	**40**
Copper	T6	M40	1	mg/kg	**21**	**21**	**20**	**22**	**18**
Lead	T6	M40	1	mg/kg	**60**	**22**	**51**	**17**	**52**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**31**	**33**	**37**	**30**	**29**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**120**	**95**	**120**	**86**	**110**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Heavy Metals(9)

				Concept Reference	**757007 022**	**757007 026**	**757007 027**	**757007 031**	**757007 032**
				Customer Sample Reference	**WS8**	**WS9**	**WS9**	**WS10**	**WS10**
				Top Depth	**0.30**	**0.20**	**0.50**	**0.05**	**0.20**
				Date Sampled	**31-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Arsenic	T6	M40	2	mg/kg	**11**	**17**	**14**	**21**	**38**
Cadmium	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Chromium	T6	M40	1	mg/kg	**55**	**46**	**44**	**52**	**66**
Copper	T6	M40	1	mg/kg	**20**	**24**	**17**	**77**	**28**
Lead	T6	M40	1	mg/kg	**17**	**54**	**26**	**53**	**26**
Mercury	T6	M40	1	mg/kg	<1	<1	<1	<1	<1
Nickel	T6	M40	1	mg/kg	**34**	**33**	**31**	**28**	**33**
Selenium	T6	M40	3	mg/kg	<3	<3	<3	<3	<3
Zinc	T6	M40	1	mg/kg	**96**	**110**	**85**	**100**	**100**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Heavy Metals(9)

				Concept Reference	**757007 033**	**757007 034**
				Customer Sample Reference	**WS11**	**WS11**
				Top Depth	**0.10**	**0.50**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
Arsenic	T6	M40	2	mg/kg	**19**	**22**
Cadmium	T6	M40	1	mg/kg	<1	<1
Chromium	T6	M40	1	mg/kg	**47**	**46**
Copper	T6	M40	1	mg/kg	**21**	**19**
Lead	T6	M40	1	mg/kg	**35**	**23**
Mercury	T6	M40	1	mg/kg	<1	<1
Nickel	T6	M40	1	mg/kg	**28**	**29**
Selenium	T6	M40	3	mg/kg	<3	<3
Zinc	T6	M40	1	mg/kg	**110**	**140**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Wilson Sulphate Suite

				Concept Reference	**757007 003**	**757007 004**	**757007 005**	**757007 014**	**757007 015**
				Customer Sample Reference	**WS1**	**WS1**	**WS1**	**WS5**	**WS5**
				Top Depth	**1.50**	**2.50**	**3.50**	**1.00**	**2.00**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**6.8**	**7.9**	**7.7**	**6.8**	**7.8**
(Water soluble) SO4 as SO3	T251	A40	0.01	g/l	**0.04**	**0.70**	**1.9**	**0.02**	**0.04**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	<0.05	**0.84**	**2.2**	<0.05	<0.05
(Acid Soluble) SO4	T192	A40	0.01	%	**0.04**	**0.19**	**4.9**	**0.01**	**0.03**
Sulphur (total)	T6	A40	0.01	%	**0.02**	**0.07**	**1.7**	**0.01**	**0.01**
(Total Potential) SO4(Total) Expressed as SO4	T403	A40	0.03	%	**0.06**	**0.21**	**5.1**	**0.03**	**0.03**
(Oxidisable) Sulphide Expressed as SO4	T194	A40	0.03	%	<0.03	<0.03	**0.20**	<0.03	<0.03

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Wilson Sulphate Suite

				Concept Reference	**757007 016**	**757007 023**	**757007 024**	**757007 025**	**757007 028**
				Customer Sample Reference	**WS5**	**WS8**	**WS8**	**WS8**	**WS9**
				Top Depth	**3.00**	**1.30**	**2.30**	**3.30**	**0.70**
				Date Sampled	**30-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**7.5**	**6.9**	**7.8**	**7.4**	**6.0**
(Water soluble) SO4 as SO3	T251	A40	0.01	g/l	**0.06**	**0.01**	**0.02**	**0.02**	**0.01**
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	**0.07**	<0.05	<0.05	<0.05	<0.05
(Acid Soluble) SO4	T192	A40	0.01	%	**0.03**	<0.01	**0.03**	**0.03**	**0.04**
Sulphur (total)	T6	A40	0.01	%	**0.02**	<0.01	**0.01**	**0.05**	**0.02**
(Total Potential) SO4(Total) Expressed as SO4	T403	A40	0.03	%	**0.06**	<0.03	**0.03**	**0.15**	**0.06**
(Oxidisable) Sulphide Expressed as SO4	T194	A40	0.03	%	**0.03**	<0.03	<0.03	**0.12**	<0.03

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Wilson Sulphate Suite

				Concept Reference	**757007 029**	**757007 030**
				Customer Sample Reference	**WS9**	**WS9**
				Top Depth	**1.70**	**2.70**
				Date Sampled	**31-JUL-2018**	**31-JUL-2018**
				Matrix Class	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
pH	T7	A40			**5.8**	**7.4**
(Water soluble) SO4 as SO3	T251	A40	0.01	g/l	<0.01	<0.01
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	<0.05	<0.05
(Acid Soluble) SO4	T192	A40	0.01	%	**0.01**	**0.01**
Sulphur (total)	T6	A40	0.01	%	<0.01	<0.01
(Total Potential) SO4(Total) Expressed as SO4	T403	A40	0.03	%	<0.03	<0.03
(Oxidisable) Sulphide Expressed as SO4	T194	A40	0.03	%	<0.03	<0.03

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Asbestos ID

Concept Reference	**757007 010**
Customer Sample Reference	**WS4**
Top Depth	**0.25**
Date Sampled	**30-JUL-2018**
Matrix Class	**Clay**

Determinand	Method	Test Sample	LOD	Units	
Asbestos ID	T27	A40			Chrysotile Loose Fibres Detected

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Miscellaneous

Concept Reference					**757007 001**	**757007 002**	**757007 006**	**757007 007**	**757007 008**
Customer Sample Reference					**WS1**	**WS1**	**WS2**	**WS2**	**WS3**
Top Depth					**0.10**	**0.30**	**0.30**	**0.50**	**0.15**
Date Sampled					**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
Matrix Class					**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**5.9**	**6.6**	**6.0**	**6.3**	**5.9**
Soil Organic Matter	T287	A40	0.1	%	-	-	-	**1.0**	-

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Miscellaneous

Concept Reference					**757007 009**	**757007 010**	**757007 011**	**757007 012**	**757007 013**
Customer Sample Reference					**WS3**	**WS4**	**WS4**	**WS5**	**WS5**
Top Depth					**0.40**	**0.25**	**0.45**	**0.10**	**0.25**
Date Sampled					**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
Matrix Class					**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**6.6**	**7.9**	**7.7**	**5.2**	**5.9**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Miscellaneous

Concept Reference					**757007 017**	**757007 018**	**757007 019**	**757007 020**	**757007 021**
Customer Sample Reference					**WS6**	**WS6**	**WS7**	**WS7**	**WS8**
Top Depth					**0.10**	**0.50**	**0.15**	**0.60**	**0.10**
Date Sampled					**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**31-JUL-2018**
Matrix Class					**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**5.5**	**6.6**	**5.2**	**4.9**	**5.4**
Soil Organic Matter	T287	A40	0.1	%	-	-	-	**0.5**	-

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**757007 022**	**757007 026**	**757007 027**	**757007 031**	**757007 032**
				Customer Sample Reference	**WS8**	**WS9**	**WS9**	**WS10**	**WS10**
				Top Depth	**0.30**	**0.20**	**0.50**	**0.05**	**0.20**
				Date Sampled	**31-JUL-2018**	**31-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
pH	T7	A40			**5.5**	**5.5**	**5.7**	**5.6**	**6.8**
Soil Organic Matter	T287	A40	0.1	%	-	-	**1.3**	-	-

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Miscellaneous

				Concept Reference	**757007 033**	**757007 034**
				Customer Sample Reference	**WS11**	**WS11**
				Top Depth	**0.10**	**0.50**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
pH	T7	A40			**6.9**	**7.0**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
PAH US EPA 16 (B and K split)

				Concept Reference	**757007 002**	**757007 011**	**757007 018**	**757007 032**	**757007 034**
				Customer Sample Reference	**WS1**	**WS4**	**WS6**	**WS10**	**WS11**
				Top Depth	**0.30**	**0.45**	**0.50**	**0.20**	**0.50**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
Naphthalene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	T207	M105	0.1	mg/kg	<0.1	**0.6**	<0.1	<0.1	<0.1
Anthracene	T207	M105	0.1	mg/kg	<0.1	**0.2**	<0.1	<0.1	<0.1
Fluoranthene	T207	M105	0.1	mg/kg	<0.1	**1.0**	<0.1	<0.1	<0.1
Pyrene	T207	M105	0.1	mg/kg	<0.1	**0.9**	<0.1	<0.1	<0.1
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	<0.1	**0.4**	<0.1	<0.1	<0.1
Chrysene	T207	M105	0.1	mg/kg	<0.1	**0.4**	<0.1	<0.1	<0.1
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	<0.1	**0.4**	<0.1	<0.1	<0.1
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	<0.1	**0.3**	<0.1	<0.1	<0.1
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	<0.1	**0.3**	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	<0.1	**0.2**	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	<0.1	**0.2**	<0.1	<0.1	<0.1
PAH(total)	T207	M105	0.1	mg/kg	<0.1	**5.1**	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Organochlorine insecticides

	Concept Reference	757007 006	757007 021	757007 033
	Customer Sample Reference	WS2	WS8	WS11
	Top Depth	0.30	0.10	0.10
	Date Sampled	30-JUL-2018	31-JUL-2018	30-JUL-2018
	Matrix Class	Clay	Clay	Clay

Determinand	Method	Test Sample	LOD	Units			
Hexachlorocyclohexane (sum of alpha, beta and gamma)	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Hexachlorobenzene	T1	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Heptachlor	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Aldrin	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Heptachlor epoxide	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Chlordane	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Endosulphan	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
DDE	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Dieldrin	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Endrin	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
DDD	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
DDT	T16	AR	0.01	mg/kg	(162,131) <0.02	(131,162) <0.02	(131,162) <0.02

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Organophosphorous insecticides

	Concept Reference	757007 006	757007 021	757007 033
	Customer Sample Reference	WS2	WS8	WS11
	Top Depth	0.30	0.10	0.10
	Date Sampled	30-JUL-2018	31-JUL-2018	30-JUL-2018
	Matrix Class	Clay	Clay	Clay

Determinand	Method	Test Sample	LOD	Units			
Dichlorvos	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Mevinphos	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Dimethoate	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Diazinon	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Pirimiphos methyl	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Malathion	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Fenitrothion	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Parathion	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01
Azinphos methyl	T16	AR	0.01	mg/kg	<0.01	<0.01	<0.01

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
BS 3882:2015

				Concept Reference	**757007 035**	**757007 036**	**757007 037**
				Customer Sample Reference	**West Topsoil**	**Cent Topsoil**	**East Topsoil**
				Date Sampled	**30-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Carbon / Nitrogen ratio	T85	AR			Ratio 10:1	Ratio 10:1	Ratio 13:1
Carbonate	T22	AR	0.1	%	**0.6**	**0.6**	**0.5**
Clay Content	T2	AR	1.0	%	**36**	**41**	**39**
Dry density	T85	AR	0.1	g/cm3	**0.5**	**0.9**	**0.6**
Electrical Conductivity	T7	A40	10	µS/cm	**2100**	**1900**	**2100**
LOI (OM) (125-440)C	T873	A40		%	**22.0**	**19.1**	**17.7**
Mg (Extractable BS 3882)	T272	A40	10	mg/l	**95**	**200**	**22**
Nitrogen (Total)	T837	AR	100	mg/kg	**6100**	**2400**	**4900**
pH	T7	A40			**5.5**	**6.3**	**5.7**
Extractable P	T392	AR	10	mg/l	**47**	**12**	**23**
K (Extractable BS 3882)	T272	A40	10	mg/l	**140**	**110**	**18**
Sand Content	T2	AR	1.0	%	**19**	**9.0**	**11**
Silt Content	T2	AR	1.0	%	**45**	**50**	**50**
Total Organic Carbon	T21	A40	0.1	%	**4.0**	**2.0**	**5.7**
Visible Contaminants	T161	AR	0.5	%	<0.5	<0.5	<0.5

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
% Stones

				Concept Reference	**757007 035**	**757007 036**	**757007 037**
				Customer Sample Reference	**West Topsoil**	**Cent Topsoil**	**East Topsoil**
				Date Sampled	**30-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Retained on 20mm	T2	AR	0.1	%	<0.1	<0.1	<0.1
Retained on 2mm	T2	A40	0.1	%	**4.8**	**3.8**	**5.2**
Retained on 50mm	T2	AR	0.1	%	<0.1	<0.1	<0.1

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Phytotoxic Contaminants

				Concept Reference	**757007 035**	**757007 036**	**757007 037**
				Customer Sample Reference	**West Topsoil**	**Cent Topsoil**	**East Topsoil**
				Date Sampled	**30-JUL-2018**	**31-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Copper	T312	A40	1	mg/kg	**22**	**16**	**16**
Nickel	T312	A40	1	mg/kg	**24**	**25**	**23**
Zinc	T312	A40	1	mg/kg	**110**	**89**	**100**

Concept Reference: 757007
Project Site: Cheltenham
Customer Reference: 4360/2

Leachate Analysed as Water
Heavy Metals(9)

				Concept Reference	**757007 008**	**757007 010**	**757007 013**	**757007 020**	**757007 026**
				Customer Sample Reference	**WS3**	**WS4**	**WS5**	**WS7**	**WS9**
				Top Depth	**0.15**	**0.25**	**0.25**	**0.60**	**0.20**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**	**31-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**Test Sample**	**LOD**	**Units**					
As (Dissolved)	T281	10:1	0.2	µg/l	**0.3**	**0.4**	<0.2	<0.2	<0.2
Cd (Dissolved)	T281	10:1	0.02	µg/l	<0.02	<0.02	<0.02	<0.02	<0.02
Cr (Dissolved)	T281	10:1	1	µg/l	**9**	<1	<1	<1	<1
Cu (Dissolved)	T281	10:1	0.5	µg/l	**3.1**	**1.5**	**0.8**	**0.6**	**0.6**
Pb (Dissolved)	T281	10:1	0.3	µg/l	**0.4**	**0.4**	<0.3	<0.3	<0.3
Hg (Dissolved)	T281	10:1	0.05	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05
Ni (Dissolved)	T281	10:1	1	µg/l	**5**	**1**	<1	<1	<1
Se (Dissolved)	T281	10:1	0.5	µg/l	<0.5	<0.5	<0.5	<0.5	<0.5
Zn (Dissolved)	T281	10:1	2	µg/l	**5**	**3**	**3**	**3**	<2

Index to symbols used in 757007-1

Value	Description
A40	Assisted dried < 40C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
AR	As Received
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
10:1	Leachate
162	LOD determined by matrix spike recovery
131	Result is outside of the scope of accreditation due to a QC Failure
S	Analysis was subcontracted
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Asbestos was subcontracted to REC Asbestos.
Nitrogen and Sand/Silt/Clay content were subcontracted to NRM.

Method Index

Value	Description
T7	Probe
T272	ICP/OES (Ammonium Nitrate)
T6	ICP/OES
T161	Visual
T242	2:1 Extraction/ICP/OES (TRL 447 T1)
T287	Calc TOC/0.58
T312	ICP-OES (Nitric Acid Extraction)
T1	GC/MS (HR)
T194	Calc (TRL 447 T 4.11)
T403	Calc (TRL 447 T4.13 ICP/OES)
T27	PLM
T251	2:1 Extraction/ICP/OES
T192	HCl Extraction/ICP/OES (TRL 447 T2)
T837	CSOP Nut007 (Dumas)
T873	Grav (4 Dec) (Dry 125 C)(Ign 440 C)
T2	Grav
T21	OX/IR
T22	Titration
T162	Grav (1 Dec) (105 C)
T207	GC/MS (MCERTS)

T281	ICP/MS (Filtered)
T85	Calc
T392	ICP/OES (Sodium Hydrogen Carbonate Extract)
T16	GC/MS

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Carbon / Nitrogen ratio	T85	AR			N	035-037
Carbonate	T22	AR	0.1	%	N	035-037
Clay Content	T2	AR	1.0	%	SN	035-037
Dry density	T85	AR	0.1	g/cm3	N	035-037
Electrical Conductivity	T7	A40	10	µS/cm	N	035-037
LOI (OM) (125-440)C	T873	A40		%	N	035-037
Mg (Extractable BS 3882)	T272	A40	10	mg/l	N	035-037
Nitrogen (Total)	T837	AR	100	mg/kg	SN	035-037
Extractable P	T392	AR	10	mg/l	N	035-037
K (Extractable BS 3882)	T272	A40	10	mg/l	N	035-037
Sand Content	T2	AR	1.0	%	SN	035-037
Silt Content	T2	AR	1.0	%	SN	035-037
Total Organic Carbon	T21	A40	0.1	%	N	035-037
Visible Contaminants	T161	AR	0.5	%	N	035-037
Retained on 20mm	T2	AR	0.1	%	N	035-037
Retained on 2mm	T2	A40	0.1	%	N	035-037
Retained on 50mm	T2	AR	0.1	%	N	035-037
Copper	T312	A40	1	mg/kg	N	035-037
Nickel	T312	A40	1	mg/kg	N	035-037
Zinc	T312	A40	1	mg/kg	N	035-037
pH	T7	A40			M	001-002,006-013,017-022,026-027,031-034
Soil Organic Matter	T287	A40	0.1	%	N	007,020,027
Hexachlorocyclohexane (sum of alpha, beta and gamma)	T16	AR	0.01	mg/kg	U	006,021,033
Hexachlorobenzene	T1	AR	0.01	mg/kg	U	006,021,033
Heptachlor	T16	AR	0.01	mg/kg	U	006,021,033
Aldrin	T16	AR	0.01	mg/kg	U	006,021,033
Heptachlor epoxide	T16	AR	0.01	mg/kg	U	006,021,033
Chlordane	T16	AR	0.01	mg/kg	U	006,021,033
Endosulphan	T16	AR	0.01	mg/kg	U	006,021,033
DDE	T16	AR	0.01	mg/kg	U	006,021,033
Dieldrin	T16	AR	0.01	mg/kg	U	006,021,033
Endrin	T16	AR	0.01	mg/kg	U	006,021,033
DDD	T16	AR	0.01	mg/kg	U	006,021,033
DDT	T16	AR	0.01	mg/kg	U	006,021,033
Naphthalene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Acenaphthylene	T207	M105	0.1	mg/kg	U	002,011,018,032,034
Acenaphthene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Fluorene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Phenanthrene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Anthracene	T207	M105	0.1	mg/kg	U	002,011,018,032,034
Fluoranthene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Pyrene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Benzo(a)Anthracene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Chrysene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Benzo(b)fluoranthene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Benzo(k)fluoranthene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Benzo(a)Pyrene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Indeno(123-cd)Pyrene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Dibenzo(ah)Anthracene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
Benzo(ghi)Perylene	T207	M105	0.1	mg/kg	M	002,011,018,032,034
PAH(total)	T207	M105	0.1	mg/kg	U	002,011,018,032,034
Dichlorvos	T16	AR	0.01	mg/kg	U	006,021,033
Mevinphos	T16	AR	0.01	mg/kg	U	006,021,033
Dimethoate	T16	AR	0.01	mg/kg	U	006,021,033
Diazinon	T16	AR	0.01	mg/kg	U	006,021,033
Pirimiphos methyl	T16	AR	0.01	mg/kg	U	006,021,033
Malathion	T16	AR	0.01	mg/kg	U	006,021,033
Fenitrothion	T16	AR	0.01	mg/kg	U	006,021,033
Parathion	T16	AR	0.01	mg/kg	U	006,021,033
Azinphos methyl	T16	AR	0.01	mg/kg	U	006,021,033
Asbestos ID	T27	A40			SU	010
As (Dissolved)	T281	10:1	0.2	µg/l	U	008,010,013,020,026

Determinand	Method	Test Sample	LOD	Units	Symbol	Concept References
Cd (Dissolved)	T281	10:1	0.02	µg/l	U	008,010,013,020,026
Cr (Dissolved)	T281	10:1	1	µg/l	U	008,010,013,020,026
Cu (Dissolved)	T281	10:1	0.5	µg/l	U	008,010,013,020,026
Pb (Dissolved)	T281	10:1	0.3	µg/l	U	008,010,013,020,026
Hg (Dissolved)	T281	10:1	0.05	µg/l	U	008,010,013,020,026
Ni (Dissolved)	T281	10:1	1	µg/l	U	008,010,013,020,026
Se (Dissolved)	T281	10:1	0.5	µg/l	U	008,010,013,020,026
Zn (Dissolved)	T281	10:1	2	µg/l	U	008,010,013,020,026
Arsenic	T6	M40	2	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Cadmium	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Chromium	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Copper	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Lead	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Mercury	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Nickel	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Selenium	T6	M40	3	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Zinc	T6	M40	1	mg/kg	M	001-002,006-013,017-022,026-027,031-034
Moisture @105C	T162	AR	0.1	%	N	001-002,006-013,017-022,026-027,031-034
Retained on 10mm sieve	T2	M40	0.1	%	N	001-002,006-013,017-022,026-027,031-034
pH	T7	A40			U	003-005,014-016,023-025,028-030,035-037
(Water soluble) SO4 as SO3	T251	A40	0.01	g/l	N	003-005,014-016,023-025,028-030
(Water Soluble) SO4 expressed as SO4	T242	A40	0.05	g/l	U	003-005,014-016,023-025,028-030
(Acid Soluble) SO4	T192	A40	0.01	%	U	003-005,014-016,023-025,028-030
Sulphur (total)	T6	A40	0.01	%	U	003-005,014-016,023-025,028-030
(Total Potential) SO4(Total) Expressed as SO4	T403	A40	0.03	%	U	003-005,014-016,023-025,028-030
(Oxidisable) Sulphide Expressed as SO4	T194	A40	0.03	%	U	003-005,014-016,023-025,028-030

APPENDIX 3

TOPSOIL CERTIFICATE OF ANALYSIS
(BS3882:2015)

Certificate of Analysis

Client:	Robert Hitchins Limited	*Our Ref:*	4360/2
Client Reference:	Oakley Farm	*Date Received:*	03/08/18
Suite ID:	BS 3882:2015	*Date Reported:*	17/08/18
Site Details:	Harp Hill, Cheltenham	*Sampled by:*	CM

Soil Sample Reference: Western Fields - Composite Sample (WS1 - WS3)

Particle Size Distribution*	(UK Classification)		
Clay (<0.002mm)	%	36	
Silt (0.002-0.06mm)	%	45	
Sand (0.06-2.0mm)	%	19	
Textual Class		ZC	×
		√	

Stone Content (Dry Weight Basis)			
Stones 2-20mm	%w/w	4.8	✓
Stones 20-50mm	%w/w	<0.1	✓
Stones >50mm	%w/w	<0.1	✓

Soil Reaction & Soluble Salts			
pH Value ❖	units	5.5	✓
Electrical Conductivity ($CaSO_4$)✚	µS/cm	2100	✓

Organic Matter & Nutrient Status			
Organic Matter (LOI)	%	22.0	×
Total Nitrogen	%	6100	
Carbon: Nitrogen Ratio		10:1	✓
Total Organic Carbon	%	4.0	
Carbonate	%	0.6	
Extractable Phosphate	mg/l	47	✓
Extractable Potassium	mg/l	140	✓
Extractable Magnesium	mg/l	95	✓
Dry Density	g/cm^3	0.5	

Phytotoxic Metals'			
Zinc (Zn)	mg/kg	110	✓
Copper (Cu)	mg/kg	22	✓
Nickel (Ni)	mg/kg	24	✓

Visibile Contaminants (Dry Weight Basis)			
Total foreign matter > 2mm	%w/w	<0.5	✓
… of which plastics	%w/w		
… of which sharps	%w/w		

Soil Description

Notes:

☑ Conforms to BS3882:2015 Multipurpose Grade
☒ Fails to conform to BS3882:2015 Multipurpose Grade

* ADAS pipette
❖ 1:2.5 water extract
✚ $CaSO_4$ extract
' Total metals
ne not evaluated

UK Soil Texture Classification

C Clay
SC Sandy Clay
CL Clay loam
SL Sandy Loam
SCL Sandy Clay Loam
LS Loamy Sand
ZC Silty Clay
ZCL Silty Clay Loam
SZL Sandy Silt Loam
ZL Silt Loam
S Sand

Sample(s) were analysed at the UKAS accredited laboratory of NRM

Certificate of Analysis

Client:	Robert Hitchins Limited	*Our Ref:*	4360/2
Client Reference:	Oakley Farm	*Date Received:*	03/08/18
Suite ID:	BS 3882:2015	*Date Reported:*	17/08/18
Site Details:	Harp Hill, Cheltenham	*Sampled by:*	CM

Soil Sample Reference: Central Fields - Composite Sample (WS4, WS7 - WS8 and WS10

Particle Size Distribution*	(UK Classification)		
Clay (<0.002mm)	%	41	
Silt (0.002-0.06mm)	%	50	
		9	
Textual Class		ZC	×
Stone Content (Dry Weight Basis)			
Stones 2-20mm	%w/w	3.8	✓
Stones 20-50mm	%w/w	<0.1	✓
Stones >50mm	%w/w	<0.1	✓
Soil Reaction & Soluble Salts			
pH Value ❖	units	6.3	✓
Electrical Conductivity ($CaSO_4$)✚	µS/cm	1900	✓
Organic Matter & Nutrient Status			
Organic Matter (LOI)	%	19.1	✓
Total Nitrogen	%	2400	
Carbon: Nitrogen Ratio		10:1	✓
Total Organic Carbon	%	2.0	
Carbonate	%	0.6	
Extractable Phosphate	mg/l	12	×
Extractable Potassium	mg/l	110	×
Extractable Magnesium	mg/l	200	✓
Dry Density	g/cm^3	0.9	
Phytotoxic Metals'			
Zinc (Zn)	mg/kg	89	✓
Copper (Cu)	mg/kg	16	✓
Nickel (Ni)	mg/kg	25	✓
Visibile Contaminants (Dry Weight Basis)			
Total foreign matter > 2mm	%w/w	<0.5	✓
… of which plastics	%w/w		
… of which sharps	%w/w		

Soil Description

Notes:

☑ Conforms to BS3882:2015 Multipurpose Grade
☒ Fails to conform to BS3882:2015 Multipurpose Grade

* ADAS pipette
❖ 1:2.5 water extract
✚ $CaSO_4$ extract
' Total metals
ne not evaluated

UK Soil Texture Classification

C Clay
SC Sandy Clay
CL Clay loam
SL Sandy Loam
SCL Sandy Clay Loam
LS Loamy Sand
ZC Silty Clay
ZCL Silty Clay Loam
SZL Sandy Silt Loam
ZL Silt Loam
S Sand

Sample(s) were analysed at the UKAS accredited laboratory of NRM

Certificate of Analysis

Client:	Robert Hitchins Limited	*Our Ref:*	4360/2
Client Reference:	Oakley Farm	*Date Received:*	03/08/18
Suite ID:	BS 3882:2015	*Date Reported:*	17/08/18
Site Details:	Harp Hill, Cheltenham	*Sampled by:*	CM

Soil Sample Reference: Eastern Fields - Composite Sample (WS5 - WS7, WS9 and WS11)

Particle Size Distribution*	(UK Classification)		
Clay (<0.002mm)	%	39	
Silt (0.002-0.06mm)	%	50	
Sand (0.06-2.0mm)	%	11	
Textual Class		ZC	×
Stone Content (Dry Weight Basis)			
Stones 2-20mm	%w/w	5.2	✓
Stones 20-50mm	%w/w	<0.1	✓
Stones >50mm	%w/w	<0.1	✓
Soil Reaction & Soluble Salts			
pH Value ❖	units	5.7	✓
Electrical Conductivity ($CaSO_4$)✚	µS/cm	2100	✓
Organic Matter & Nutrient Status			
Organic Matter (LOI)	%	17.7	✓
Total Nitrogen	%	4900	
Carbon: Nitrogen Ratio		13:1	✓
Total Organic Carbon	%	5.7	
Carbonate	%	0.5	
Extractable Phosphate	mg/l	23	✓
Extractable Potassium	mg/l	18	×
Extractable Magnesium	mg/l	22	×
Dry Density	g/cm³	0.6	
Phytotoxic Metals'			
Zinc (Zn)	mg/kg	100	✓
Copper (Cu)	mg/kg	16	
Nickel (Ni)	mg/kg	23	
Visibile Contaminants (Dry Weight Basis)			
Total foreign matter > 2mm	%w/w	<0.5	
… of which plastics	%w/w		
… of which sharps	%w/w		

Soil Description

Notes:

☑ Conforms to BS3882:2015 Multipurpose Grade
☒ Fails to conform to BS3882:2015 Multipurpose Grade

* ADAS pipette
❖ 1:2.5 water extract
✚ $CaSO_4$ extract
' Total metals
ne not evaluated

UK Soil Texture Classification

C Clay
SC Sandy Clay
CL Clay loam
SL Sandy Loam
SCL Sandy Clay Loam
LS Loamy Sand
ZC Silty Clay
ZCL Silty Clay Loam
SZL Sandy Silt Loam
ZL Silt Loam
S Sand

Sample(s) were analysed at the UKAS accredited laboratory of NRM

APPENDIX 4

CERTIFIED GEOTECHNICAL TEST RESULTS

Laboratory Report

GEO Site & Testing Services Ltd

Contract Number: 40257

Client Ref: **4360/2**
Client PO: **4360/2/CM**

Report Date: **22-08-2018**

Client **Wilson Associates**
36 Brunswick Road
Gloucester
GL1 1JJ

Contract Title: **Cheltenham**
For the attention of: **Tim Coe**

Date Received: **07-08-2018**
Date Commenced: **07-08-2018**
Date Completed: **22-08-2018**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	27
4 Point Liquid & Plastic Limit (LL/PL) BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	21
Dry Den/MC (2.5kg Rammer Method 1 Litre Mould) BS 1377:1990 - Part 4 : 3.3 - * UKAS	1
Consolidated Drained Peak and Residual Shear Strength - set of 3 60 x 60mm Shear Box Specimens (5 days) BS1377 : 1990 Part 7 : 4 - * UKAS	2
Disposal of samples for job	1

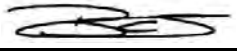
Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Alex Wynn (Associate Director) - Ben Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Richard John (Advanced Testing Manager) - Sean Penn (Administrative/Accounts Assistant)
Wayne Honey (Administrative/Quality Assistant)

GEO Site & Testing Services Ltd
Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5) DESCRIPTIONS	
Contract Number	**40257**	
Site Name	**Cheltenham**	

WS Window Sample	Sample Number	Sample Type	Depth (m)			Descriptions
WS1	1	Dist	2.00	-		Brown slightly silty CLAY
WS1	1	Dist	3.50	-		Brown slightly silty CLAY
WS2	1	Dist	0.70	-		Brown slightly silty CLAY
WS2	1	Dist	1.00	-		Brown slightly silty CLAY
WS2	1	Dist	3.00	-		Brown slightly silty CLAY
WS3	1	Dist	0.50	-		Brown slightly silty CLAY
WS3	1	Dist	3.80	-		Brown slightly silty CLAY
WS4	1	Dist	1.50	-		Brown slightly silty CLAY
WS4	1	Dist	2.50	-		Brown slightly silty CLAY
WS5	1	Dist	0.50	-		Brown slightly silty CLAY
WS5	1	Dist	1.70	-		Brown slightly silty CLAY
WS7	1	Dist	1.50	-		Brown slightly silty CLAY
WS7	1	Dist	2.50	-		Brown slightly silty CLAY
WS8	1	Dist	0.50	-		Brown slightly silty CLAY
WS8	1	Dist	2.00	-		Brown slightly silty CLAY
WS9	1	Dist	1.30	-		Brown slightly silty CLAY
WS9	1	Dist	2.30	-		Brown slightly silty CLAY
WS10	1	Dist	0.50	-		Brown slightly silty CLAY
WS10	1	Dist	1.50	-		Brown slightly silty CLAY
WS11	1	Dist	0.75	-		Brown slightly silty CLAY
WS11	1	Dist	1.75	-		Brown slightly silty CLAY
				-		
				-		
				-		

Operators	Checked	21/08/2018	Richard John	
RO/MH	Approved	22/08/2018	Ben Sharp	

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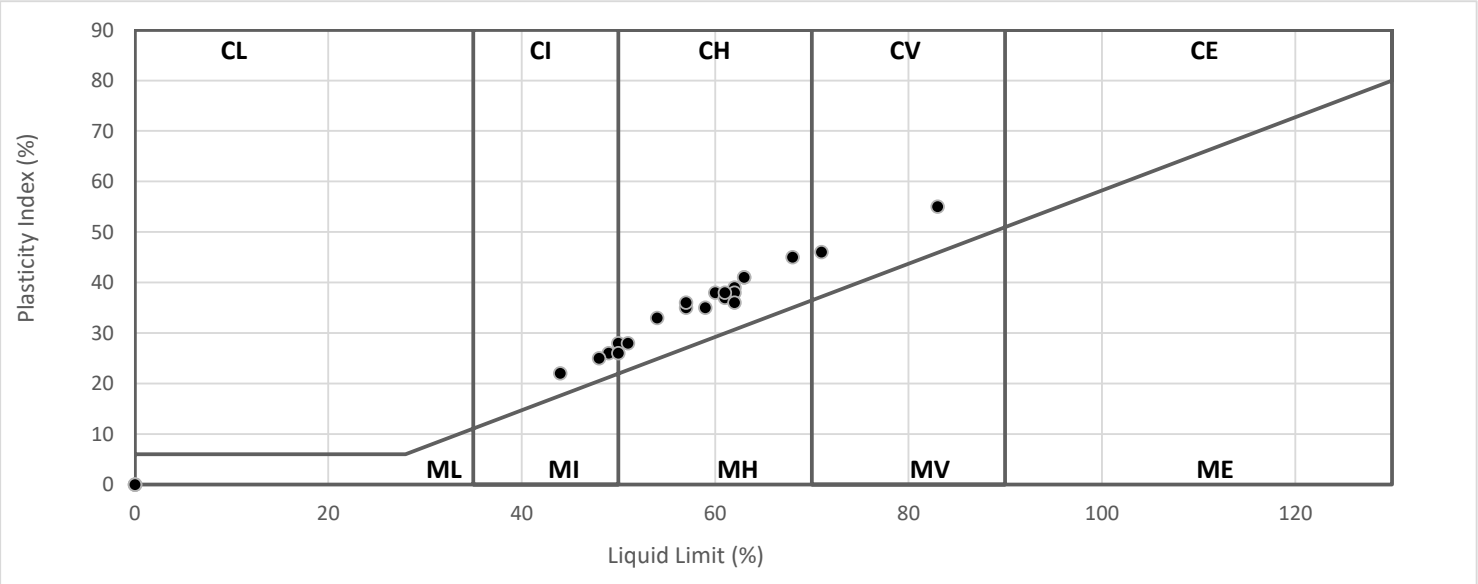
GSTL	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	**40257**	
Site Name	**Cheltenham**	

WS Window Sample	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	Remarks
WS1	1	Dist	2.00	-		26	62	23	39	100	CH High Plasticity
WS1	1	Dist	3.50	-		24	63	22	41	100	CH High Plasticity
WS2	1	Dist	0.70	-		25	83	28	55	100	CV Very High Plasticity
WS2	1	Dist	1.00	-		26	63	22	41	100	CH High Plasticity
WS2	1	Dist	3.00	-		27	60	22	38	100	CH High Plasticity
WS3	1	Dist	0.50	-		25	49	23	26	100	CI Intermediate Plasticity
WS3	1	Dist	3.80	-		22	62	24	38	100	CH High Plasticity
WS4	1	Dist	1.50	-		27	71	25	46	100	CV Very High Plasticity
WS4	1	Dist	2.50	-		25	61	24	37	100	CH High Plasticity
WS5	1	Dist	0.50	-		20	50	22	28	100	CI/H Inter/High Plasticity
WS5	1	Dist	1.70	-		22	61	23	38	100	CH High Plasticity
WS7	1	Dist	1.50	-		25	59	24	35	100	CH High Plasticity
WS7	1	Dist	2.50	-		20	57	22	35	100	CH High Plasticity
WS8	1	Dist	0.50	-		20	44	22	22	100	CI Intermediate Plasticity
WS8	1	Dist	2.00	-		22	57	21	36	100	CH High Plasticity
WS9	1	Dist	1.30	-		23	68	23	45	100	CH High Plasticity
WS9	1	Dist	2.30	-		21	62	26	36	100	CH High Plasticity
WS10	1	Dist	0.50	-		27	51	23	28	100	CH High Plasticity
WS10	1	Dist	1.50	-		23	50	24	26	100	CI/H Inter/High Plasticity
WS11	1	Dist	0.75	-		25	48	23	25	100	CI Intermediate Plasticity
WS11	1	Dist	1.75	-		18	54	21	33	100	CH High Plasticity
				-							
				-							
				-							

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	21/08/2018	Richard John	
DB	Approved	22/08/2018	Ben Sharp	

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GSTL	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5) DESCRIPTIONS	
Contract Number	**40257**	
Site Name	**Cheltenham**	

Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
6	1	Dist	0.50	-		Brown slightly silty CLAY
6	1	Dist	1.00	-		Brown slightly silty CLAY
6	1	Dist	1.50	-		Brown slightly silty CLAY
6	1	Dist	2.00	-		Brown slightly silty CLAY
6	1	Dist	2.50	-		Brown slightly silty CLAY
6	1	Dist	3.00	-		Brown slightly silty CLAY
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Operators	Checked	21/08/2018	Richard John	
RO/MH	Approved	22/08/2018	Ben Sharp	

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GSTL	LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377 : Part 2 : 1990 Method 5)	
Contract Number	**40257**	
Site Name	**Cheltenham**	

Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing .425mm %	Remarks
6	1	Dist	0.50	-		21.7					
6	1	Dist	1.00	-		24.3					
6	1	Dist	1.50	-		24.7					
6	1	Dist	2.00	-		19.3					
6	1	Dist	2.50	-		18.8					
6	1	Dist	3.00	-		19.5					
				-							
				-							
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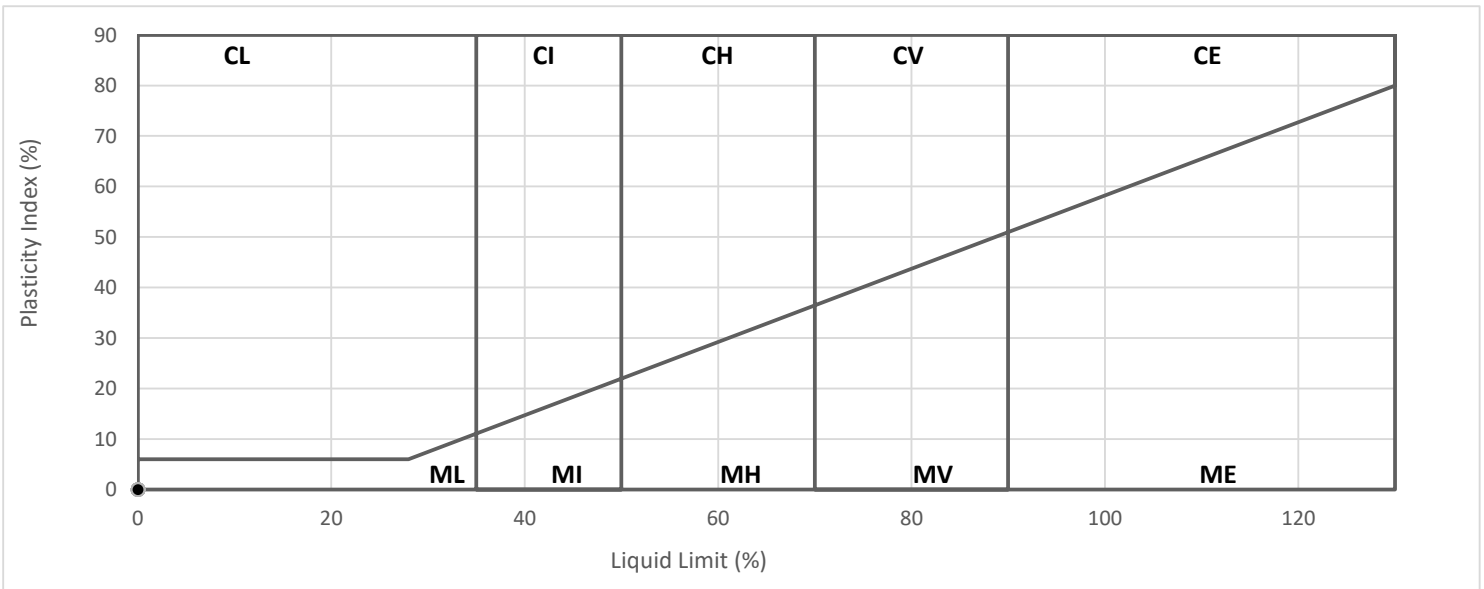
Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators	Checked	21/08/2018	Richard John	
DB	Approved	22/08/2018	Ben Sharp	

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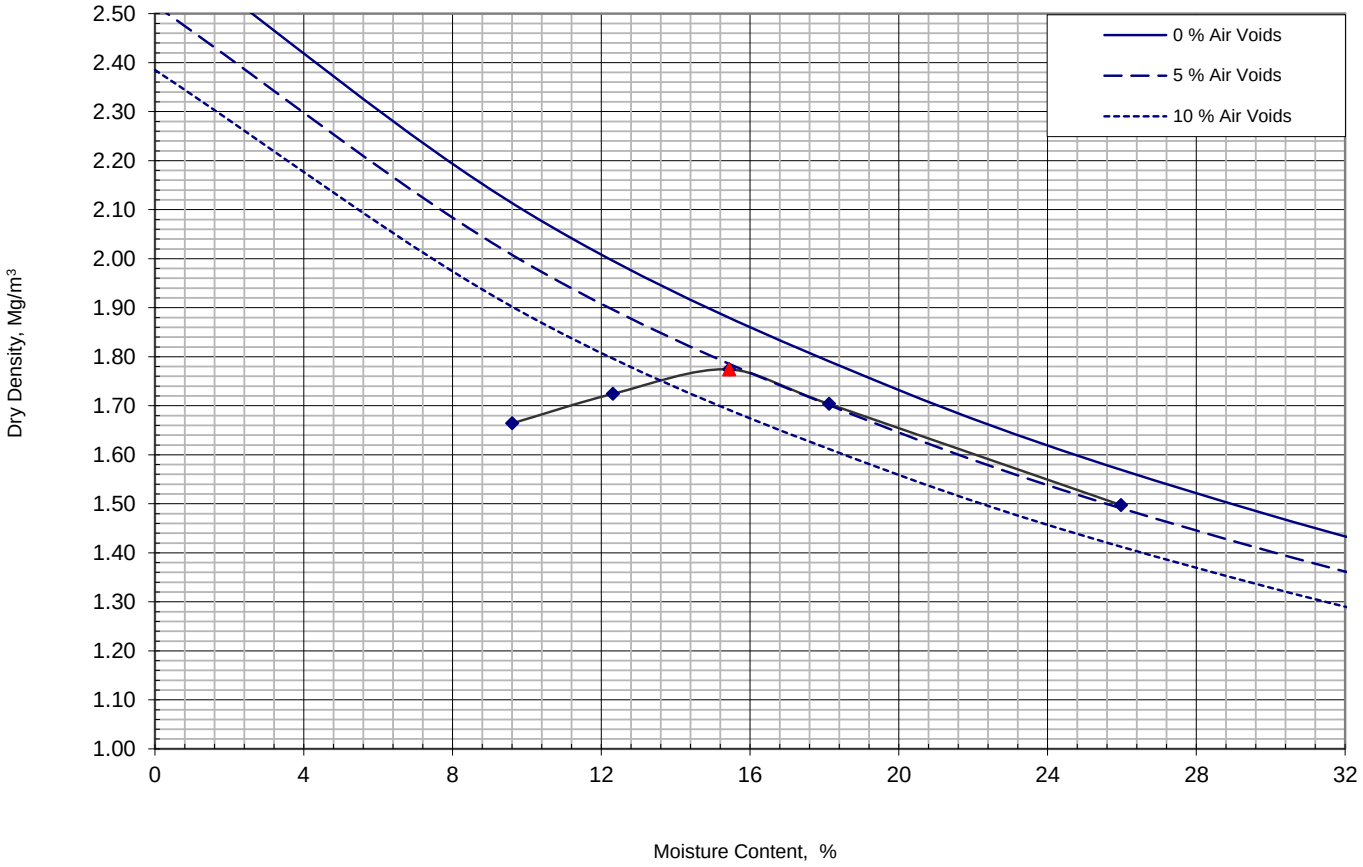
GSTL	Dry Density / Moisture Content Relationship BS 1377:Part 4:1990	Contract Number	40257
		Borehole / Pit No	WS3
Site Name	Cheltenham	Sample No	1
Soil Description	Brown silty CLAY	Depth Top	0.50
Compaction Method	2.5 Kg Rammer	Depth Base	3.50
Compaction Clause	BS1377:Part 4:1990, Clause 3.4	Sample Type	BULK



Compaction Point	1	2	3	4	5							
Moisture Content	9.6	12	15	18	26							
Bulk Density	1.82	1.94	2.05	2.01	1.89							
Dry Density	1.66	1.72	1.77	1.70	1.50							

Initial Moisture Content	26	%
Maximum Dry Density	1.77	Mg/m3
Optimum Moisture Content	15	%
Particle Density	2.65 Assumed	Mg/m3
Material Retained 37.5mm	0	%
Material Retained 20mm	0	%

Operators	Checked	21/08/2018	Richard John	
CA	Approved	22/08/2018	Ben Sharp	

UKAS TESTING 2788

Test Report: CONSOLIDATED DRAINED PEAK AND RESIDUAL SHEARBOX TEST.

BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

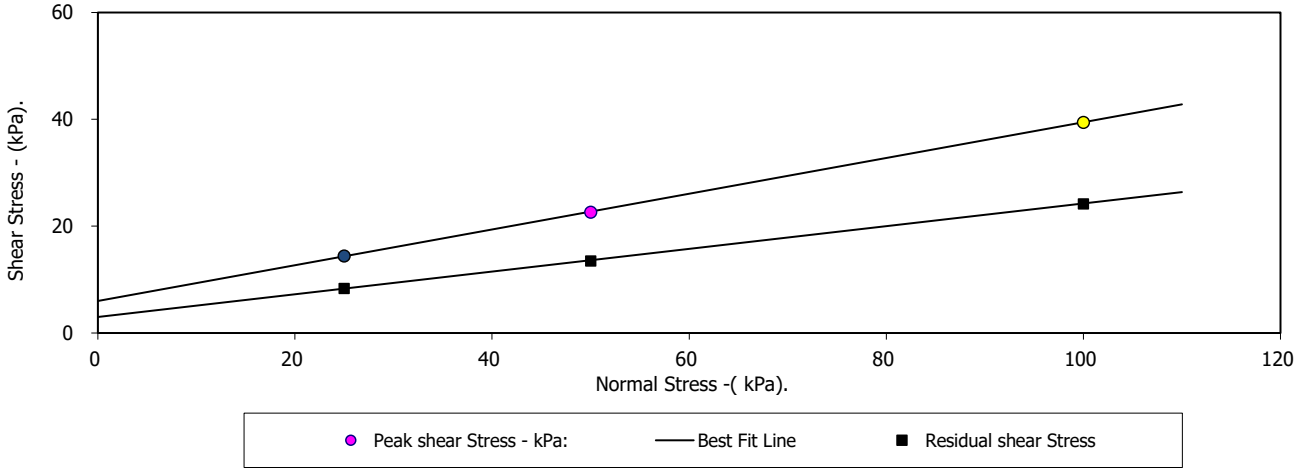
Borehole Number:	WS1	Depth from (m):	0.85
Sample Number:		Depth to (m):	0.00

Sample Type: D	Remoulded (Light Tamping) material above 2.5mm removed
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	Submerged
Sample Description: **Greyish brown slightly silty CLAY**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	23.98	23.98	23.98
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	19	19	19
Bulk Density - Mg/m3:	1.45	1.46	1.46
Dry Density - Mg/m3:	1.22	1.23	1.23
Voids Ratio:	1.1706	1.1568	1.1568
Normal Pressure- kPa	25	50	100
Consolidation			
Consolidated Height - mm:	22.78	21.79	20.79
Shear			
Rate of Strain (mm/min)	0.010	0.010	0.010
Strain at peak shear stress (mm)	4.17	5.94	5.40
Peak shear Stress - kPa:	14	23	39

PEAK	
Angle of Shearing Resistance:(θ)	**18.5**
Effective Cohesion - kPa:	**6**
RESIDUAL	
Angle of Shearing Resistance:(θ)	**12.0**
Effective Cohesion - kPa:	**3**

Failure Conditions



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Contract No.:
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Cheltenham

Client Ref Number:
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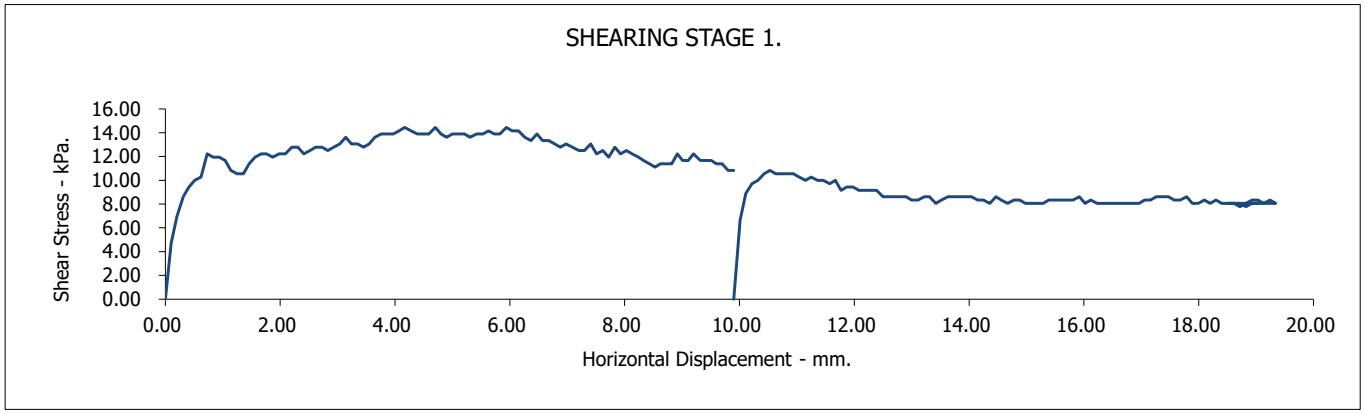
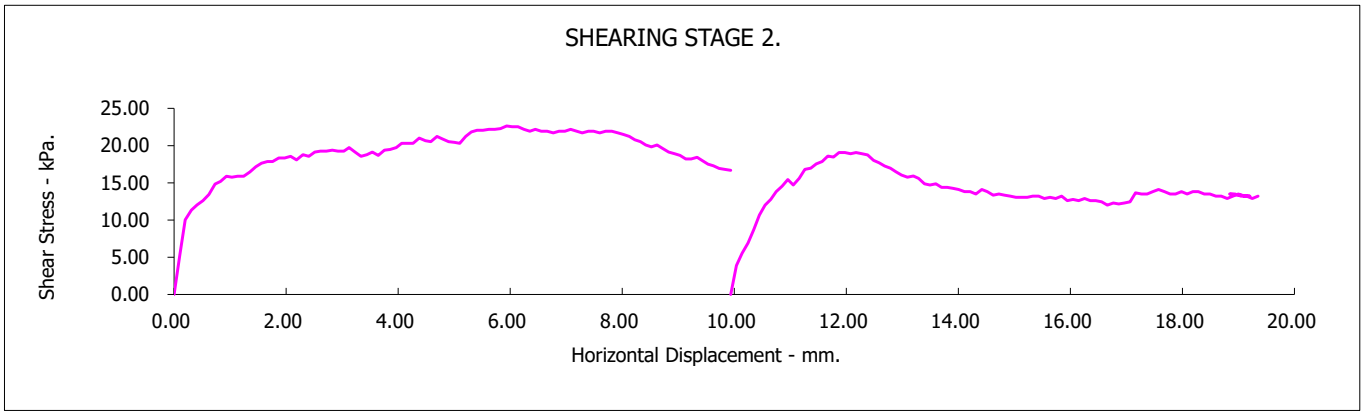
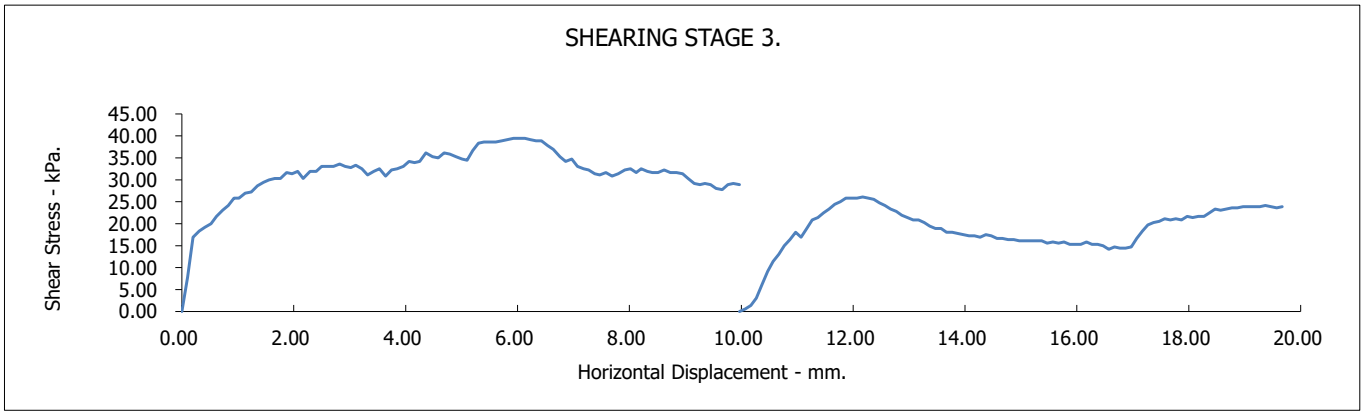
Test Report: CONSOLIDATED DRAINED PEAK AND RESIDUAL SHEARBOX TEST.

BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

Borehole/Sample Number:	WS1	Depth (m):	0.85







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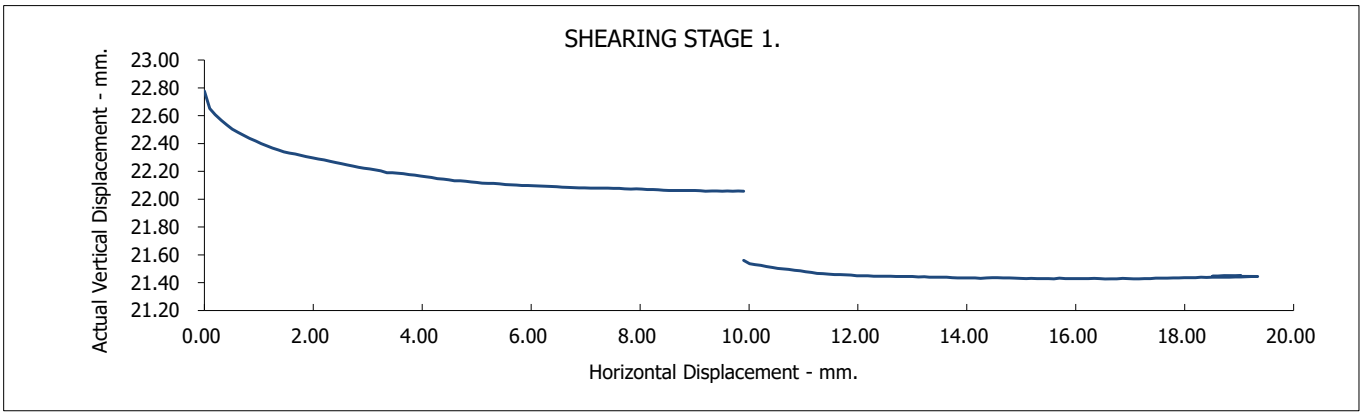
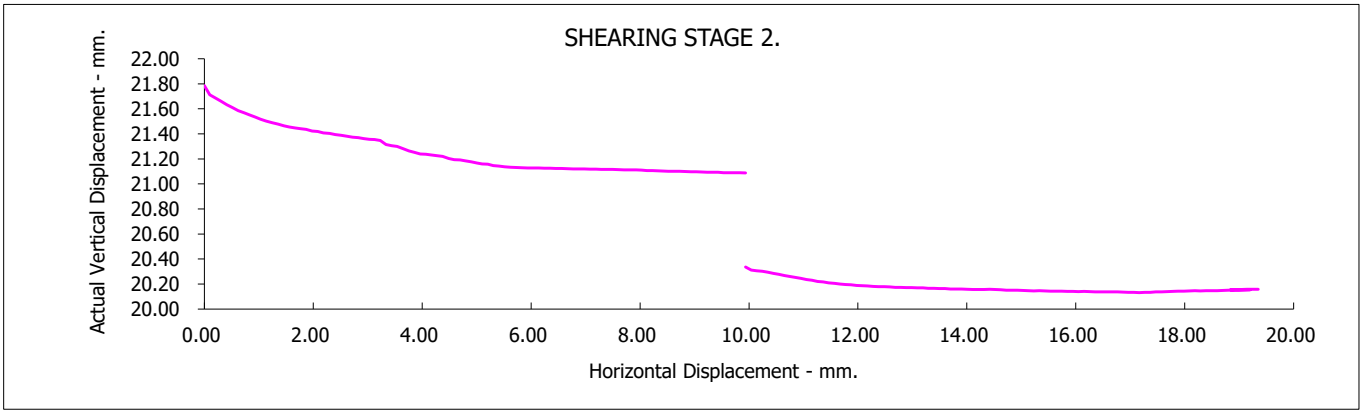
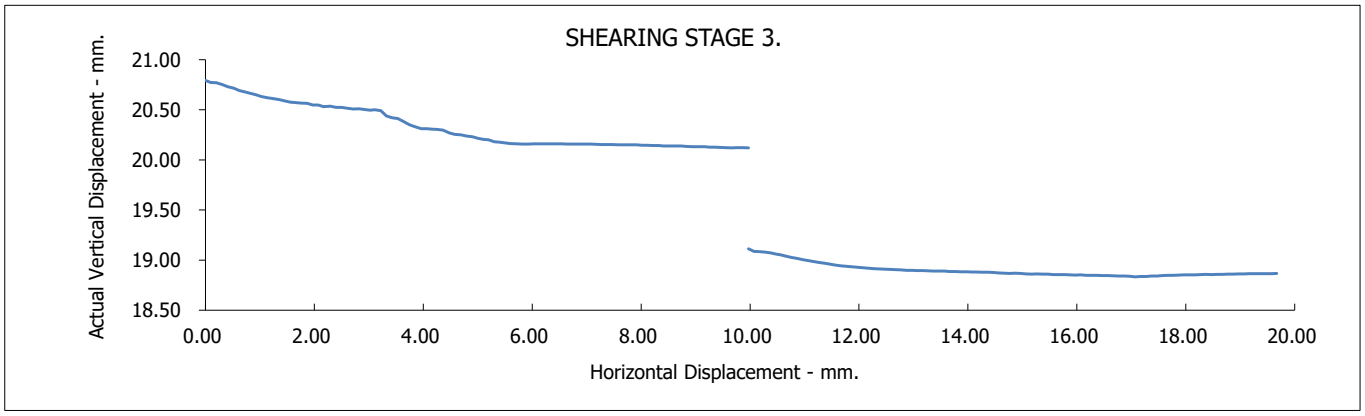
Borehole/Sample Number:	WS1	Depth (m):	0.85







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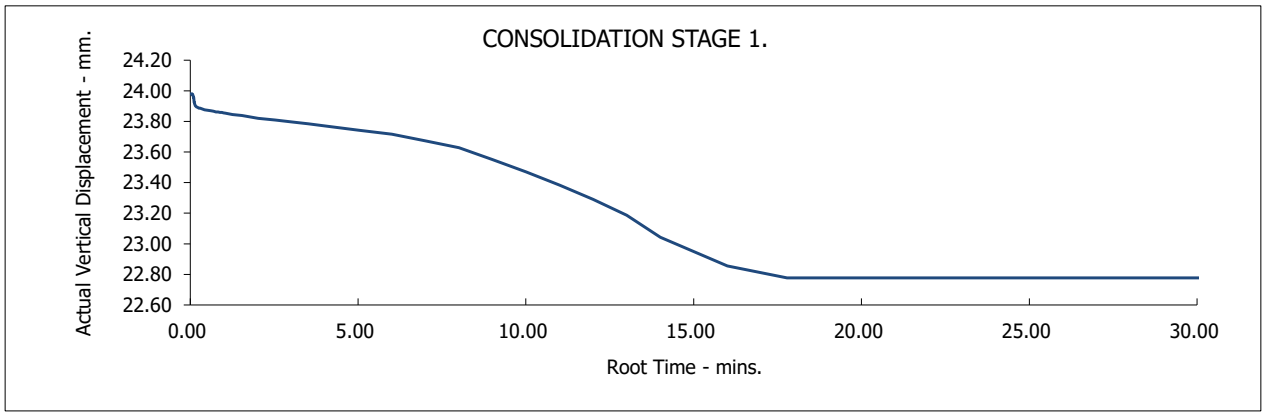
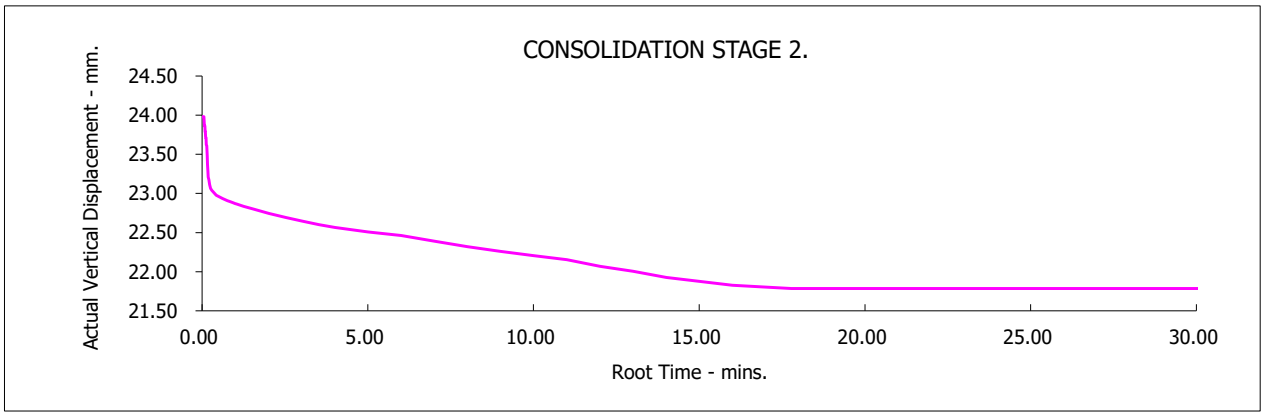
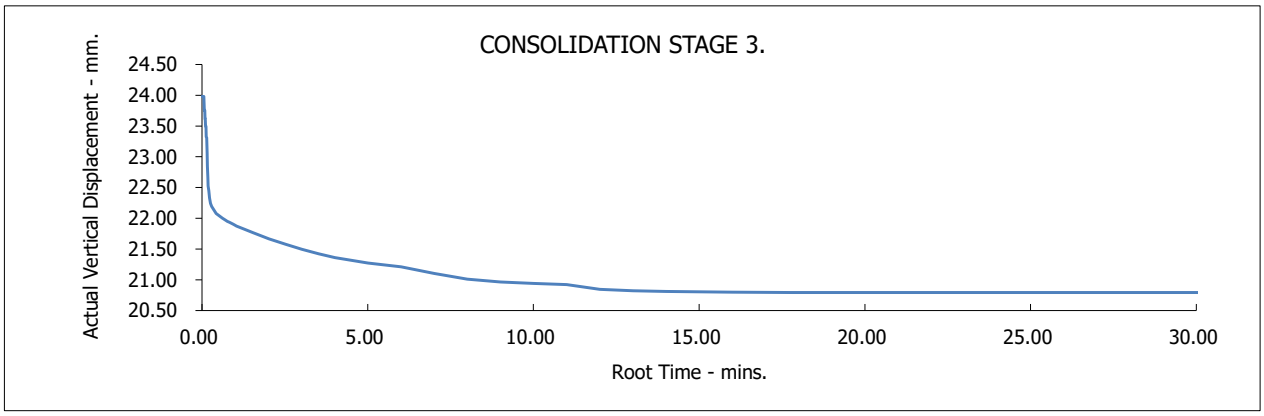
BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

Borehole/Sample Number:	WS1	Depth (m):	0.85







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Contract No.:
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Client Ref Number:
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Test Report: CONSOLIDATED DRAINED PEAK AND RESIDUAL SHEARBOX TEST.

BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

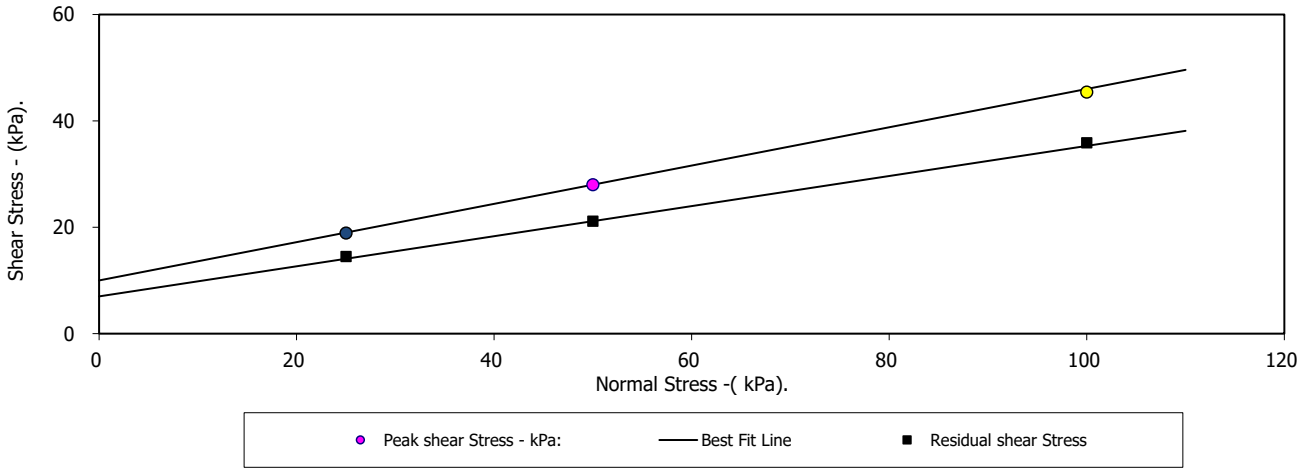
Borehole Number:	WS8	Depth from (m):	0.80
Sample Number:		Depth to (m):	0.00

Sample Type: D	Remoulded (Light Tamping) material above 2.5mm removed
Particle Density - Mg/m3:	2.65 (Assumed)
Specimen Tested:	Submerged
Sample Description: **Greyish brown slightly silty CLAY**	

STAGE	**1**	**2**	**3**
Initial Conditions			
Height - mm:	23.98	23.98	23.98
Length - mm:	60.00	60.00	60.00
Moisture Content - %:	14	14	14
Bulk Density - Mg/m3:	1.80	1.80	1.82
Dry Density - Mg/m3:	1.58	1.58	1.60
Voids Ratio:	0.6730	0.6730	0.6581
Normal Pressure- kPa	25	50	100
Consolidation			
Consolidated Height - mm:	23.33	22.34	21.36
Shear			
Rate of Strain (mm/min)	0.010	0.010	0.010
Strain at peak shear stress (mm)	5.01	4.94	4.17
Peak shear Stress - kPa:	19	28	45

PEAK	
Angle of Shearing Resistance:(θ)	**19.8**
Effective Cohesion - kPa:	**10**
RESIDUAL	
Angle of Shearing Resistance:(θ)	**15.8**
Effective Cohesion - kPa:	**7**

Failure Conditions



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DP Evans 21/08/18

Approved Pages 1-4 by Date

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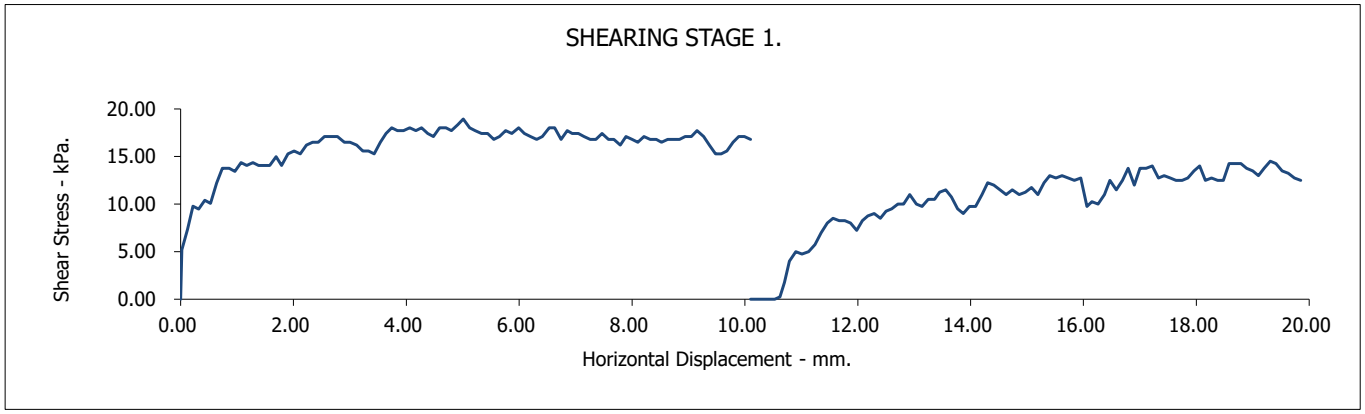
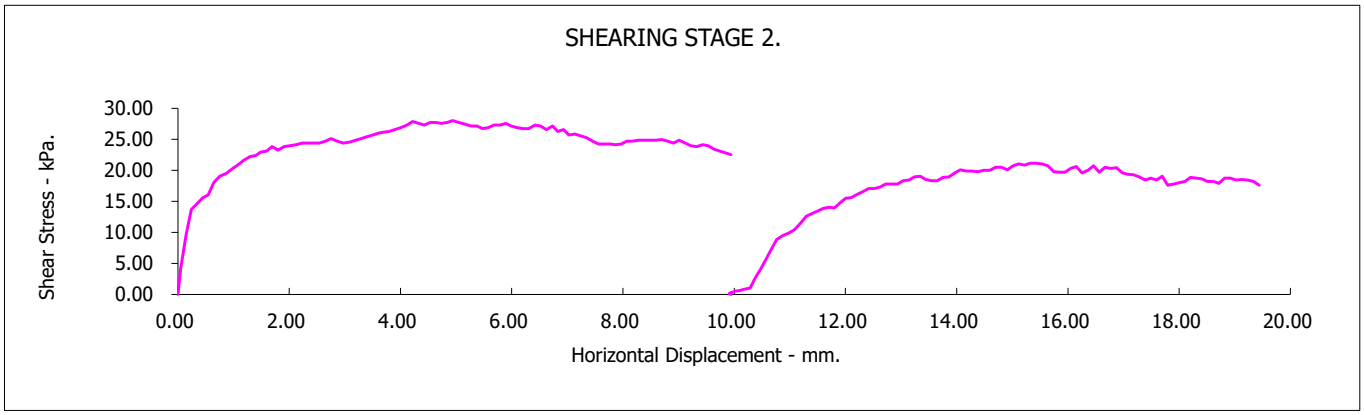
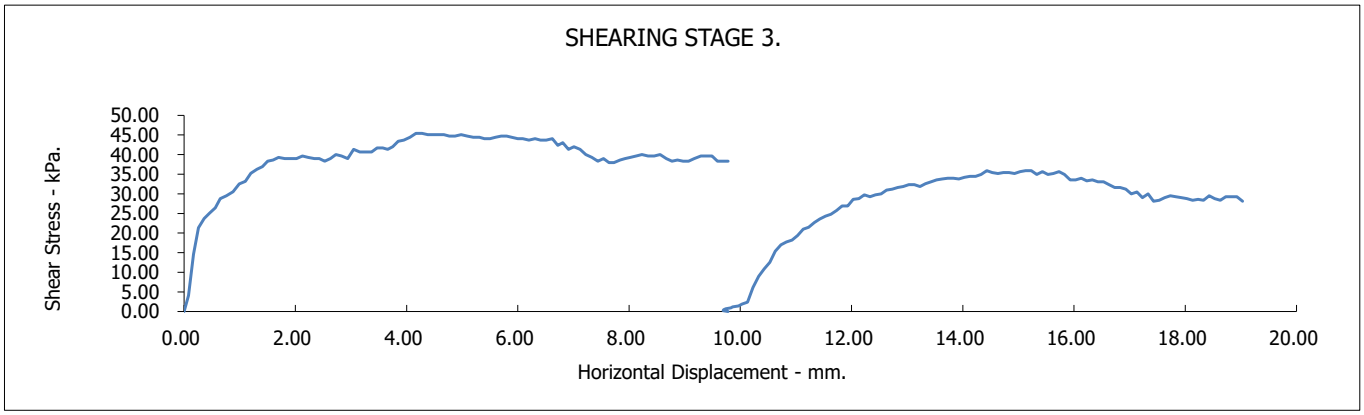
Test Report: CONSOLIDATED DRAINED PEAK AND RESIDUAL SHEARBOX TEST.

BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

Borehole/Sample Number:	WS8	Depth (m):	0.80







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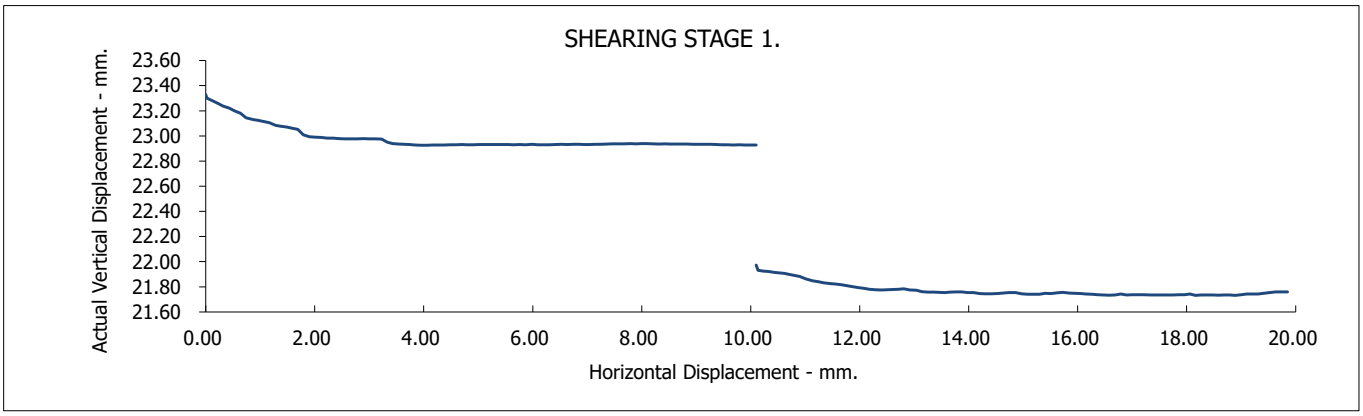
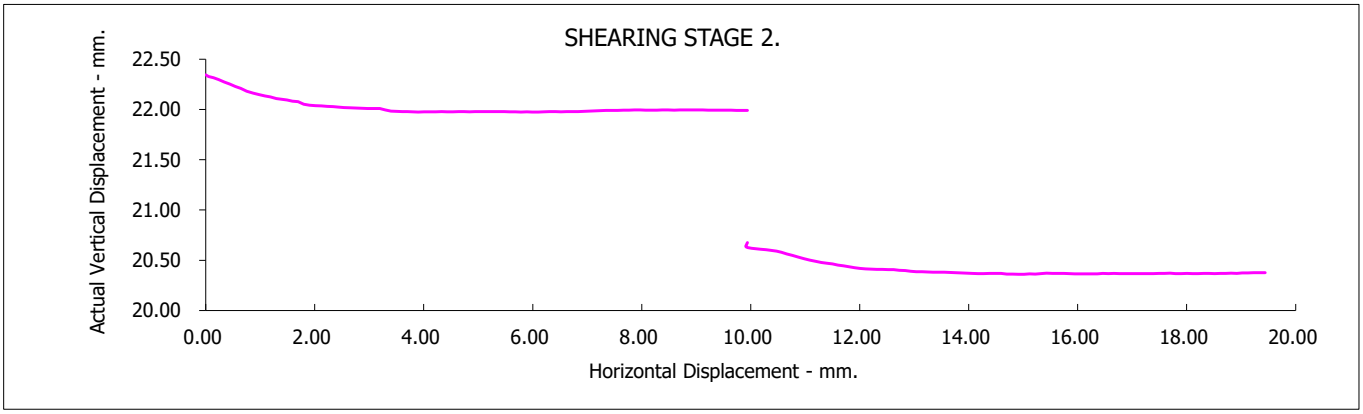
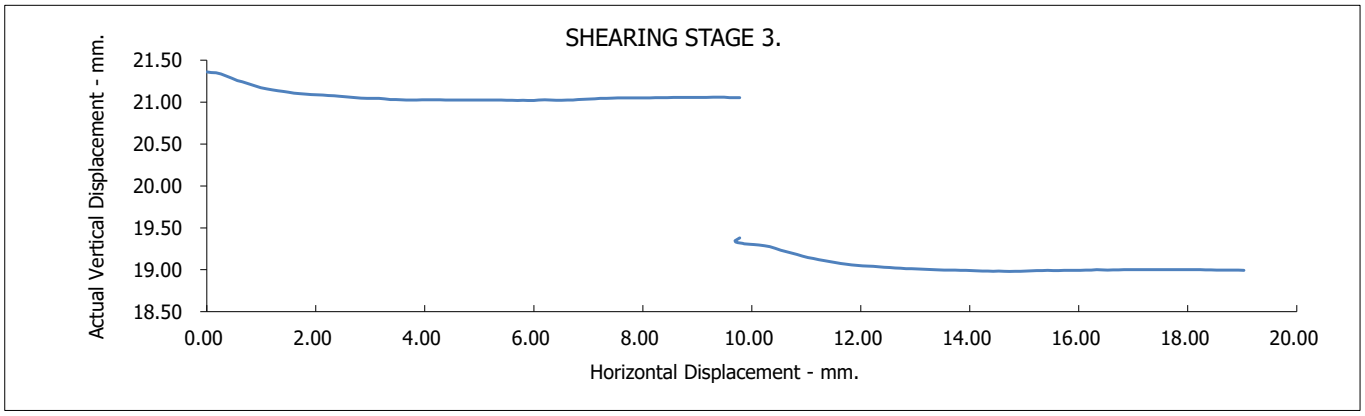
BS1377:Part 7.4.5.5 Shearing: multi-reversal test :1990

Borehole/Sample Number: WS8 Depth (m): 0.80







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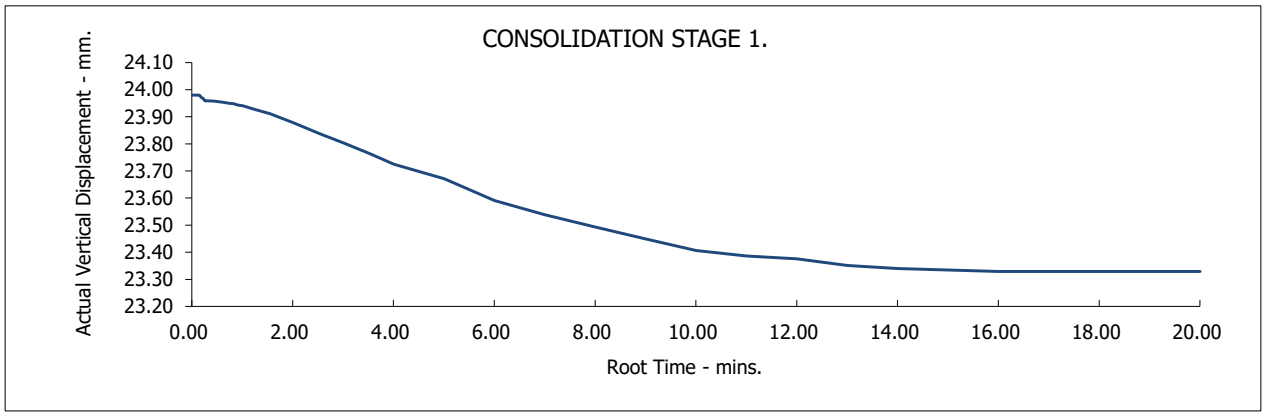
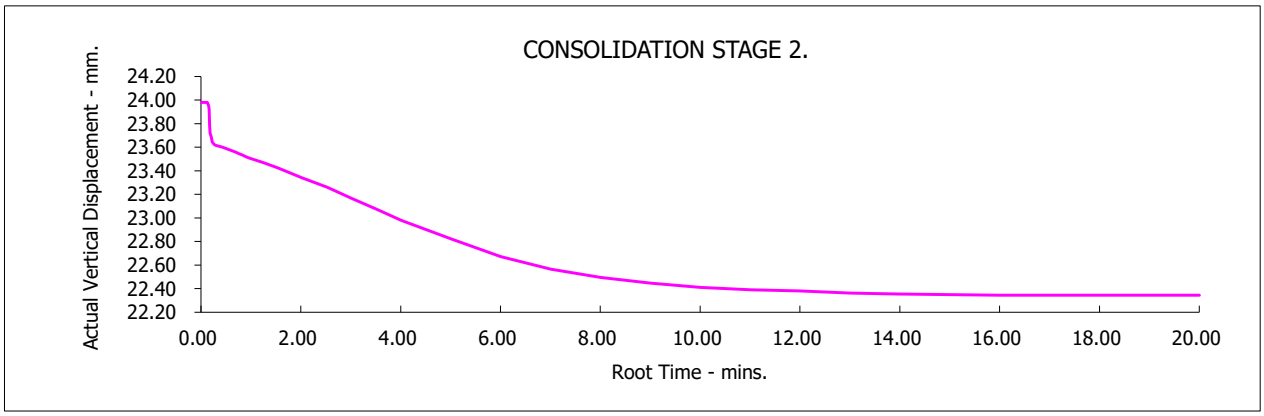
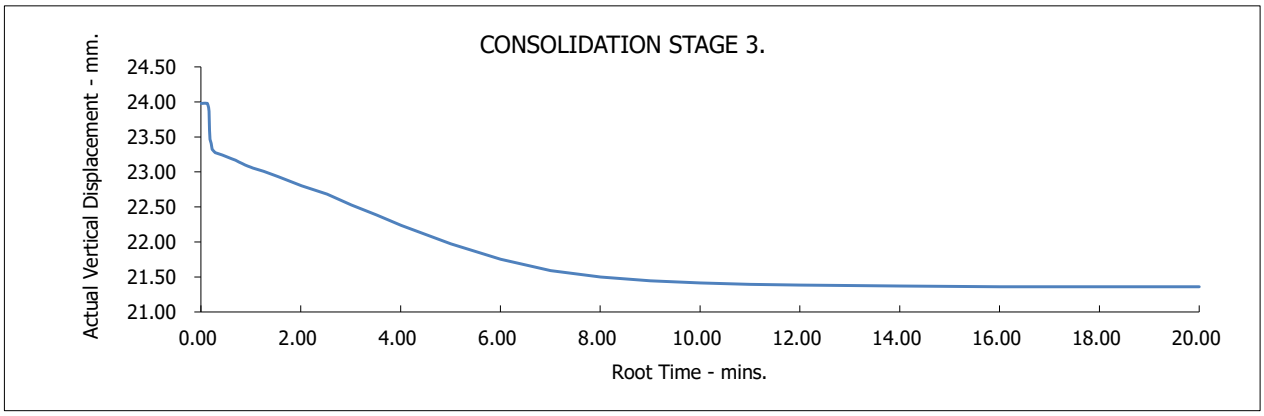
Borehole/Sample Number: WS8 Depth (m): 0.80







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Contract No.:
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Client Ref Number:
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APPENDIX 5

WASTE CLASSIFICATION REPORT AND CERTIFIED WASTE ACCEPTANCE CRITERIA (WAC) RESULTS

Waste Classification Report

ETM39-7N3K9-7X7UP

Job name

Oakley Farm

Description/Comments

Project

4360/2

Site

Oakley Farm, Priors Road, Cheltenham

Related Documents

#	Name	Description
None		

Waste Stream Template

Wilson Associates (Consulting) Limited

Classified by

Name:
Tim Coe
Date:
16 Nov 2018 14:08 GMT
Telephone:
01452422843

Company:
Wilson Associates
36 Brunswick Road
Gloucester
GL1 1JJ

Report

Created by: Tim Coe
Created date: 16 Nov 2018 14:08 GMT

Job summary

Classification of sample: Sample 1

Non Hazardous Waste
Classified as **17 05 04**
in the List of Waste

Sample details

Sample Name:
Sample 1

LoW Code:
Chapter: 17: Construction and Demolition Wastes (including excavated soil from contaminated sites)
Entry: 17 05 04 (Soil and stones other than those mentioned in 17 05 03)

Hazard properties

None identified

Determinands

Moisture content: 0% Dry Weight Moisture Correction applied (MC)

#	Determinand	CLP index number	EC Number	CAS Number	CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
1	arsenic { arsenic trioxide }	033-003-00-0	215-481-4	1327-53-3		38	mg/kg	1.32	50.172	mg/kg	0.00502 %	✓	
2	cadmium { cadmium oxide }	048-002-00-0	215-146-2	1306-19-0		1	mg/kg	1.142	1.142	mg/kg	0.000114 %	✓	
3	chromium in chromium(III) compounds { chromium(III) oxide }		215-160-9	1308-38-9		66	mg/kg	1.462	96.463	mg/kg	0.00965 %	✓	
4	copper { dicopper oxide; copper (I) oxide }	029-002-00-X	215-270-7	1317-39-1		77	mg/kg	1.126	86.693	mg/kg	0.00867 %	✓	
5	lead { lead chromate }	082-004-00-2	231-846-0	7758-97-6	1	190	mg/kg	1.56	296.365	mg/kg	0.019 %	✓	
6	mercury { mercury dichloride }	080-010-00-X	231-299-8	7487-94-7		<1	mg/kg	1.353	<1.353	mg/kg	<0.000135 %		<**LOD**
7	nickel { nickel chromate }	028-035-00-7	238-766-5	14721-18-7		46	mg/kg	2.976	136.908	mg/kg	0.0137 %	✓	
8	selenium { selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex }	034-002-00-8				<3	mg/kg	2.554	<7.661	mg/kg	<0.000766 %		<**LOD**
9	zinc { zinc chromate }	024-007-00-3				190	mg/kg	2.774	527.088	mg/kg	0.0527 %	✓	
10	pH			PH		6.1	pH		6.1	pH	6.1 pH		
11	naphthalene	601-052-00-2	202-049-5	91-20-3		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
12	acenaphthylene		205-917-1	208-96-8		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
13	acenaphthene		201-469-6	83-32-9		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
14	fluorene		201-695-5	86-73-7		<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		<**LOD**
15	phenanthrene		201-581-5	85-01-8		0.6	mg/kg		0.6	mg/kg	0.00006 %	✓	

#		Determinand			CLP Note	User entered data		Conv. Factor	Compound conc.		Classification value	MC Applied	Conc. Not Used
		CLP index number	EC Number	CAS Number									
16	●	anthracene				0.2	mg/kg		0.2	mg/kg	0.00002 %	✓	
			204-371-1	120-12-7									
17	●	fluoranthene				1	mg/kg		1	mg/kg	0.0001 %	✓	
			205-912-4	206-44-0									
18	●	pyrene				0.9	mg/kg		0.9	mg/kg	0.00009 %	✓	
			204-927-3	129-00-0									
19		benzo[a]anthracene				0.4	mg/kg		0.4	mg/kg	0.00004 %	✓	
		601-033-00-9	200-280-6	56-55-3									
20		chrysene				0.4	mg/kg		0.4	mg/kg	0.00004 %	✓	
		601-048-00-0	205-923-4	218-01-9									
21		benzo[b]fluoranthene				0.4	mg/kg		0.4	mg/kg	0.00004 %	✓	
		601-034-00-4	205-911-9	205-99-2									
22		benzo[k]fluoranthene				0.3	mg/kg		0.3	mg/kg	0.00003 %	✓	
		601-036-00-5	205-916-6	207-08-9									
23		benzo[a]pyrene; benzo[def]chrysene				0.3	mg/kg		0.3	mg/kg	0.00003 %	✓	
		601-032-00-3	200-028-5	50-32-8									
24	●	indeno[123-cd]pyrene				0.2	mg/kg		0.2	mg/kg	0.00002 %	✓	
			205-893-2	193-39-5									
25		dibenz[a,h]anthracene				<0.1	mg/kg		<0.1	mg/kg	<0.00001 %		**<LOD**
		601-041-00-2	200-181-8	53-70-3									
26	●	benzo[ghi]perylene				0.2	mg/kg		0.2	mg/kg	0.00002 %	✓	
			205-883-8	191-24-2									
27		DDT (ISO); clofenotane (INN); dicophane; 1,1,1-trichloro-2,2-bis(4-chlorophenyl)ethane; dichlorodiphenyltrichloroethane				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-045-00-7	200-024-3	50-29-3									
28		chlordane (ISO); 1,2,4,5,6,7,8,8-octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindan				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-047-00-8	200-349-0	57-74-9									
29		hexachlorocyclohexanes, including lindane				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-043-00-6	210-168-9, 200-401-2, 206-270-8, 206-271-3	58-89-9, 319-84-6, 319-85-7, 608-73-1									
30		dieldrin (ISO)				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-049-00-9	200-484-5	60-57-1									
31		endrin (ISO); 1,2,3,4,10,10-hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4:5,8-dimethanonaphthalene				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-051-00-X	200-775-7	72-20-8									
32		heptachlor (ISO); 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-methanoindene				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-046-00-2	200-962-3	76-44-8									
33		hexachlorobenzene				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-065-00-6	204-273-9	118-74-1									
34		aldrin (ISO)				<0.01	mg/kg		<0.01	mg/kg	<0.000001 %		**<LOD**
		602-048-00-3	206-215-8	309-00-2									
										Total:	0.11 %		

Key

	User supplied data
	Determinand values ignored for classification, see column 'Conc. Not Used' for reason
●	Determinand defined or amended by HazWasteOnline (see Appendix A)
	Speciated Deteminand - Unless the Determinand is Note 1, the Conversion Factor is used to calculate the compound concentration
<LOD	Below limit of detection
CLP: Note 1	Only the metal concentration has been used for classification

Appendix A: Classifier defined and non CLP determinands

- **chromium(III) oxide** (EC Number: 215-160-9, CAS Number: 1308-38-9)

Conversion factor: 1.462
Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Repr. 1B H360FD , Skin Sens. 1 H317 , Resp. Sens. 1 H334 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302 , Acute Tox. 4 H332

- **pH** (CAS Number: PH)

Description/Comments: Appendix C4
Data source: WM3 1st Edition 2015
Data source date: 25 May 2015
Hazard Statements: None.

- **acenaphthylene** (EC Number: 205-917-1, CAS Number: 208-96-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 1 H310 , Acute Tox. 1 H330 , Acute Tox. 4 H302

- **acenaphthene** (EC Number: 201-469-6, CAS Number: 83-32-9)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Aquatic Chronic 2 H411 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

- **fluorene** (EC Number: 201-695-5, CAS Number: 86-73-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

- **phenanthrene** (EC Number: 201-581-5, CAS Number: 85-01-8)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Skin Irrit. 2 H315 , Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Carc. 2 H351 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Acute Tox. 4 H302

- **anthracene** (EC Number: 204-371-1, CAS Number: 120-12-7)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 17 Jul 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Skin Sens. 1 H317 , Skin Irrit. 2 H315 , STOT SE 3 H335 , Eye Irrit. 2 H319

- **fluoranthene** (EC Number: 205-912-4, CAS Number: 206-44-0)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , Acute Tox. 4 H302

- **pyrene** (EC Number: 204-927-3, CAS Number: 129-00-0)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 2014
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 21 Aug 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400 , STOT SE 3 H335 , Eye Irrit. 2 H319 , Skin Irrit. 2 H315

indeno[123-cd]pyrene (EC Number: 205-893-2, CAS Number: 193-39-5)

Description/Comments: Data from C&L Inventory Database
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 06 Aug 2015
Hazard Statements: Carc. 2 H351

benzo[ghi]perylene (EC Number: 205-883-8, CAS Number: 191-24-2)

Description/Comments: Data from C&L Inventory Database; SDS Sigma Aldrich 28/02/2015
Data source: http://echa.europa.eu/web/guest/information-on-chemicals/cl-inventory-database
Data source date: 23 Jul 2015
Hazard Statements: Aquatic Chronic 1 H410 , Aquatic Acute 1 H400

Appendix B: Rationale for selection of metal species

arsenic {arsenic trioxide}

Reasonable case CLP species based on hazard statements/molecular weight and most common (stable) oxide of arsenic. Industrial sources include: smelting; main precursor to other arsenic compounds (edit as required)

cadmium {cadmium oxide}

Reasonable case CLP species based on hazard statements/molecular weight, very low solubility in water. Industrial sources include: electroplating baths, electrodes for storage batteries, catalysts, ceramic glazes, phosphors, pigments and nematocides. (edit as required) Worst case compounds in CLP: cadmium sulphate, chloride, fluoride & iodide not expected as either very soluble and/or compound's industrial usage not related to site history (edit as required)

chromium in chromium(III) compounds {chromium(III) oxide}

Reasonable case species based on hazard statements/molecular weight. Industrial sources include: tanning, pigment in paint, inks and glass (edit as required)

copper {dicopper oxide; copper (I) oxide}

Reasonable case CLP species based on hazard statements/molecular weight and insolubility in water. Industrial sources include: oxidised copper metal, brake pads, pigments, antifouling paints, fungicide. (edit as required) Worse case copper sulphate is very soluble and likely to have been leached away if ever present and/or not enough soluble sulphate detected. (edit as required)

lead {lead chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

mercury {mercury dichloride}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

nickel {nickel chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

selenium {selenium compounds with the exception of cadmium sulphoselenide and those specified elsewhere in this Annex}

Harmonised group entry used as most reasonable case. Pigment cadmium sulphoselenide not likely to be present in this soil. No evidence for the other CLP entries: sodium selenite, nickel II selenite and nickel selenide, to be present in this soil. (edit as required)

zinc {zinc chromate}

Worst case CLP species based on hazard statements/molecular weight (edit as required)

Appendix C: Version

HazWasteOnline Classification Engine: WM3 1st Edition v1.1, May 2018
HazWasteOnline Classification Engine Version: 2018.306.3704.7580 (03 Nov 2018)
HazWasteOnline Database: 2018.306.3704.7580 (03 Nov 2018)

This classification utilises the following guidance and legislation:
WM3 v1.1 - Waste Classification - 1st Edition v1.1 - May 2018
CLP Regulation - Regulation 1272/2008/EC of 16 December 2008
1st ATP - Regulation 790/2009/EC of 10 August 2009
2nd ATP - Regulation 286/2011/EC of 10 March 2011
3rd ATP - Regulation 618/2012/EU of 10 July 2012
4th ATP - Regulation 487/2013/EU of 8 May 2013
Correction to 1st ATP - Regulation 758/2013/EU of 7 August 2013
5th ATP - Regulation 944/2013/EU of 2 October 2013
6th ATP - Regulation 605/2014/EU of 5 June 2014
WFD Annex III replacement - Regulation 1357/2014/EU of 18 December 2014
Revised List of Wastes 2014 - Decision 2014/955/EU of 18 December 2014
7th ATP - Regulation 2015/1221/EU of 24 July 2015
8th ATP - Regulation (EU) 2016/918 of 19 May 2016
9th ATP - Regulation (EU) 2016/1179 of 19 July 2016
10th ATP - Regulation (EU) 2017/776 of 4 May 2017
HP14 amendment - Regulation (EU) 2017/997 of 8 June 2017
13th ATP - Regulation (EU) 2018/1480 of 4 October 2018
POPs Regulation 2004 - Regulation 850/2004/EC of 29 April 2004
1st ATP to POPs Regulation - Regulation 756/2010/EU of 24 August 2010
2nd ATP to POPs Regulation - Regulation 757/2010/EU of 24 August 2010

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Concept Life Sciences

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 757158-1

Date of Report: 15-Aug-2018

Customer: Wilson Associates (Consulting) Limited
36 Brunswick Road
Gloucester
GL1 1JJ

Customer Contact: Mr Charlie Morton

Customer Job Reference: 4360/2
Customer Purchase Order: 4360/2/CM
Customer Site Reference: Cheltenham
Date Job Received at Concept: 03-Aug-2018
Date Analysis Started: 06-Aug-2018
Date Analysis Completed: 15-Aug-2018

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with Concept Life Sciences SOPs

All results have been reviewed in accordance with Section 25 of the Concept Life Sciences, Analytical Services Quality Manual

UKAS TESTING
1549

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Report checked and authorised by :
Aleksandra Pacula
Senior Customer Service Advisor

Issued by :
Aleksandra Pacula
Senior Customer Service Advisor

Waste Acceptance Criteria

Customer Sample Reference : West Wac
Our Sample Reference : 757158 001
Project Site : Cheltenham
Customer Reference : 4360/2
Test Portion Mass (g) : 175
Empty Dish Weight : 0
Wet Sample in Dish Weight : 100
Sample in Dish @ 105C : 79.1
Date Sampled : 30-JUL-2018
Matrix Class : Clay

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PCB EC7 (Sum)	Calc	0.007	mg/kg	U	<0.007	1.0		
Loss on Ignition	Grav	0.1	%	N	**8.2**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
pH	Probe			M	**7.5**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**0.8**	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) <1	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	<0.0020	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.17**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	**230**	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**23**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**4.3**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**6900**	**1000.0**	20000.0	50000.0
Total Dissolved Solids	Calc	1000	mg/kg	N	**8100**	**4000.0**	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	<0.020	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Waste Acceptance Criteria

Customer Sample Reference : Cent Wac
Our Sample Reference : 757158 002
Project Site : Cheltenham
Customer Reference : 4360/2
Wet Sample in Dish Weight : 100
Empty Dish Weight : 0
Test Portion Mass (g) : 175
Sample in Dish @ 105C : 82.4
Date Sampled : 30-JUL-2018
Matrix Class : Clay

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PCB EC7 (Sum)	Calc	0.007	mg/kg	U	<0.007	1.0		
Loss on Ignition	Grav	0.1	%	N	**5.2**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
pH	Probe			M	**6.9**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**0.3**	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) <1	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	<0.0020	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	**34**	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**29**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**6.0**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**42**	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	1000	mg/kg	N	<1000	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	<0.020	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427077/LIT_10121.pdf

Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Waste Acceptance Criteria

Customer Sample Reference : East Wac
Our Sample Reference : 757158 003
Project Site : Cheltenham
Customer Reference : 4360/2
Test Portion Mass (g) : 175
Sample in Dish @ 105C : 81.1
Wet Sample in Dish Weight : 100
Empty Dish Weight : 0
Date Sampled : 30-JUL-2018
Matrix Class : Clay

Soil					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Acid Neutralising Capacity (pH 4)	Titration	2	Mol/kg	N	<2			
Acid Neutralising Capacity (pH 7)	Titration	2	Mol/kg	N	<2			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
PCB EC7 (Sum)	Calc	0.007	mg/kg	U	<0.007	1.0		
Loss on Ignition	Grav	0.1	%	N	**6.7**			10.0
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
pH	Probe			M	**7.3**		> 6.0	
Total Organic Carbon	OX/IR	0.1	%	N	**0.4**	3.0	5.0	6.0
Total Petroleum Hydrocarbons C10-C40 (Sum)	Calc	1	mg/kg	N	(13) <1	500.0		

Data for BS EN 12457-2 (10:1)					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	**Technique**	**LOD**	**Units**	**Symbol**				
Antimony	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.06	0.7	5.0
Arsenic	Calc WAC ICP/MS	0.0020	mg/kg	N	<0.0020	0.5	2.0	25.0
Barium	Calc WAC ICP/MS	0.010	mg/kg	N	**0.016**	20.0	100.0	300.0
Cadmium	Calc WAC ICP/MS	0.00020	mg/kg	N	<0.00020	0.04	1.0	5.0
Chloride	Calc (W)	10	mg/kg	N	<10	800.0	15000.0	25000.0
Chromium	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	2.0	50.0	100.0
Dissolved Organic Carbon	Calc	10	mg/kg	N	**30**	500.0	800.0	1000.0
Fluoride	Calc (W)	0.50	mg/kg	N	**9.5**	10.0	150.0	500.0
Lead	Calc WAC ICP/MS	0.0030	mg/kg	N	<0.0030	0.5	10.0	50.0
Mercury	Calc WAC ICP/MS	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.5	10.0	30.0
Nickel	Calc WAC ICP/MS	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols (Total-Mono)	Calc	1.0	mg/kg	N	<1.0	1.0		
Selenium	Calc WAC ICP/MS	0.0050	mg/kg	N	<0.0050	0.1	0.5	7.0
Sulphate	Calc (W)	5	mg/kg	N	**7**	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	1000	mg/kg	N	<1000	4000.0	60000.0	100000.0
Zinc	Calc WAC ICP/MS	0.020	mg/kg	N	<0.020	4.0	50.0	200.0

Following the recommendation from the Environment Agency (England and Wales)*, the leachate preparation in this report has been carried out to BS EN 12457-2 : One Stage batch test at a liquid to solid ratio of 10 l/kg. This is also compliant with Schedule 10 of the Environmental Permitting Regulations 2010.

Note : This is the minimum amount of testing which is required.

Further testing may be required if :

- evidence of immediately leachable parameters becomes available.
- evidence to indicate that the sample could be classified as hazardous under H1-H14 of the Waste(England and Wales) Regulations 2011(as amended) becomes available.

Acceptance of waste at landfill is always at the discretion of the Landfill Operator.

*** Waste Sampling and Testing for Disposal at Landfill, EBPRI 11507B, Environment Agency (England and Wales) March 2013**

As detailed in- Waste Classification. Guidance on the classification and assessment of waste. Technical Guidance WM3:

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Landfill WAC analysis (specifically leaching test results) should not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757158 001**	**757158 002**	**757158 003**
				Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	**21**	**18**	**19**

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
MCERTS Preparation

				Concept Reference	**757158 001**	**757158 002**	**757158 003**
				Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
				Test Sample	**M40**	**M40**	**M40**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Retained on 10mm sieve	Grav	0.1	%	N	<0.1	<0.1	<0.1

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
BTEX

				Concept Reference	**757158 001**	**757158 002**	**757158 003**
				Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
				Test Sample	**M105**	**M105**	**M105**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Benzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	(13) <10	(13) <10	(13) <10
Toluene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10
EthylBenzene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10
Meta/Para-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10
Ortho-Xylene	GC/MS (Head Space)(MCERTS)	10	µg/kg	M	<10	<10	<10

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
PCB EC7 and Total

				Concept Reference	**757158 001**	**757158 002**	**757158 003**
				Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
				Test Sample	**AR**	**AR**	**AR**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Polychlorinated biphenyl BZ#28	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#52	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#101	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#118	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#138	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#153	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1
Polychlorinated biphenyl BZ#180	GC/MS (SIR)	1	µg/kg	U	<1	<1	<1

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
Total and Speciated USEPA16 PAH, Coronene & Phenol

					Concept Reference	**757158 001**	**757158 002**	**757158 003**
					Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
					Test Sample	**M105**	**M105**	**M105**
					Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
					Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Naphthalene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Acenaphthylene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1
Acenaphthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Fluorene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Phenanthrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Anthracene	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1
Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Benzo(a)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Chrysene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Benzo(b/k)Fluoranthene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Benzo(a)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Indeno(123-cd)Pyrene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Dibenzo(ah)Anthracene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Benzo(ghi)Perylene	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Polyaromatic Hydrocarbons (Total)	GC/MS (MCERTS)	0.1	mg/kg	U	<0.1	<0.1	<0.1
Phenol	GC/MS (MCERTS)	0.1	mg/kg	M	<0.1	<0.1	<0.1
Coronene	GC/MS	0.1	mg/kg	N	<0.1	<0.1	<0.1

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Soil Analysed as Soil
TPH

					Concept Reference	**757158 001**	**757158 002**	**757158 003**
					Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
					Test Sample	**M105**	**M105**	**M105**
					Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
					Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Total Petroleum Hydrocarbons	GC/FID	1	mg/kg	M	(13) <1	(13) <1	(13) <1
Total Petroleum Hydrocarbons (C35-C40)	GC/FID	1	mg/kg	N	(13) <1	(13) <1	(13) <1

Concept Reference: 757158
Project Site: Cheltenham
Customer Reference: 4360/2

Leachate to BS EN 12457-2 (10:1) Analysed as Water

Waste Acceptance Criteria

				Concept Reference	**757158 001**	**757158 002**	**757158 003**
				Customer Sample Reference	**West Wac**	**Cent Wac**	**East Wac**
				Test Sample	**10:1**	**10:1**	**10:1**
				Date Sampled	**30-JUL-2018**	**30-JUL-2018**	**30-JUL-2018**
				Matrix Class	**Clay**	**Clay**	**Clay**
Determinand	**Method**	**LOD**	**Units**	**Symbol**			
Arsenic (Dissolved)	ICP/MS (Filtered)	0.2	µg/l	U	<0.2	<0.2	<0.2
Barium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	**17**	<1	**2**
Molybdenum (Dissolved)	ICP/MS (Filtered)	1	µg/l	N	<1	<1	<1
Total Dissolved Solids	Grav	100	mg/l	N	**810**	<100	<100
Phenols (Total-Mono)	Colorimetry	0.1	mg/l	U	<0.1	<0.1	<0.1
Dissolved Organic Carbon	OX/IR	1	mg/l	N	**2**	**3**	**3**
Electrical Conductivity	Probe	10	µS/cm	N	**1400**	**70**	**150**
Antimony (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1	<1
Cadmium (Dissolved)	ICP/MS (Filtered)	0.02	µg/l	U	<0.02	<0.02	<0.02
Chromium (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1	<1
Copper (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	<0.5	<0.5	<0.5
Lead (Dissolved)	ICP/MS (Filtered)	0.3	µg/l	U	<0.3	<0.3	<0.3
Mercury (Dissolved)	ICP/MS (Filtered)	0.05	µg/l	U	<0.05	<0.05	<0.05
Nickel (Dissolved)	ICP/MS (Filtered)	1	µg/l	U	<1	<1	<1
Selenium (Dissolved)	ICP/MS (Filtered)	0.5	µg/l	U	<0.5	<0.5	<0.5
Zinc (Dissolved)	ICP/MS (Filtered)	2	µg/l	U	<2	<2	<2
Chloride	Discrete Analyser	1	mg/l	U	**23**	**3**	<1
Fluoride	Discrete Analyser	0.05	mg/l	U	**0.43**	**0.60**	**0.95**
Sulphate	Discrete Analyser	0.5	mg/l	U	**690**	**4.2**	**0.7**

Index to symbols used in 757158-1

Value	Description
10:1	Leachate to BS EN 12457-2 (10:1)
A40	Assisted dried < 40C
M105	Analysis conducted on an "as received" aliquot. Results are reported on a dry weight basis where moisture content was determined by assisted drying of sample at 105C
M40	Analysis conducted on sample assisted dried at no more than 40C. Results are reported on a dry weight basis.
10:1 S	Data for BS EN 12457-2 (10:1)
AR	As Received
13	Results have been blank corrected.
M	Analysis is MCERTS accredited
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

These samples have been analysed exceeding recommended holding times for PCB. It is possible therefore that the results provided may be compromised.

APPENDIX 6

GAS/WATER MONITORING RESULTS

Monitoring undertaken 17 August 2018

Atmospheric Pressure (mb) and Trend	Temperature (°C) and Weather	BH No	Concentrations (%)			Flow rates (l/hr)	Standing water level (m, bgl)	Depth and horizon of response zone (m,bgl)
			CH_4	CO_2	O_2			
1013	16 - 17° C Fair	WS1	0.0	1.7	19.3	-0.1/-0.0	3.76	1.0 – 4.0
1010		WS2	0.0	0.6	20.0	-0.0/+0.0	3.46	1.0 – 4.0
		WS3					3.64	1.0 – 4.0
1012		WS4	0.0	5.3	16.6	-0.0/+0.0	3.48	1.0 – 4.0
1010		WS6	0.0	1.5	19.6	+0.0/+0.0	3.38	1.0 – 4.0
		WS8					1.05	1.0 – 4.0
		WS10					1.53	1.0 – 4.0
1008		WS11	0.0	1.4	20.1	+0.0/+0.1	1.65	1.0 – 4.0

Subcontracted to CC Ground Investigations

Gas monitoring carried out using a GA5000 Gas Analyser

Water monitoring carried out using a Geotechnical Instruments Dip Meter

Monitoring undertaken 24 August 2018

Atmospheric Pressure (mb) and Trend	Temperature (°C) and Weather	BH No	Time (secs/ mins)	Concentrations (%)			Flow rates time (secs/mins)	Flow rates (l/hr)	Standing water level (m, bgl)	Depth and horizon of response zone (m,bgl)
				CH_4	CO_2	O_2				
1005	14° C Cloudy / sunny	WS1	15s	0.0	1.6	20.2	15s	0.0	3.76	1.0 – 4.0
			30s	0.0	1.6	19.9	30s	0.0		
			45s	0.0	1.6	19.9	45s	0.0		
			1m	0.0	1.6	19.9	1m	0.0		
			2m	0.0	1.6	19.9	2m	0.0		
			3m	0.0	1.6	19.9	3m	-0.1		
			4m	0.0	1.6	19.8	4m	-0.1		
			5m	0.0	1.5	19.8	5m	-0.1		
			Max Peak	0.0	1.6		Max Peak	0.0		
			Steady Values	0.0	1.6		Steady Values	0.0		
1004	14° C Cloudy / sunny	WS2	15s	0.0	0.5	20.4	15s	0.0	3.26	1.0 – 4.0
			30s	0.0	0.5	20.3	30s	0.0		
			45s	0.0	0.5	20.3	45s	0.0		
			1m	0.0	0.5	20.3	1m	0.0		
			2m	0.0	0.5	20.3	2m	0.0		
			3m	0.0	0.5	20.3	3m	-0.1		
			4m	0.0	0.5	20.3	4m	0.0		
			5m	0.0	0.5	20.3	5m	-0.1		
			Max Peak	0.0	0.5		Max Peak	0.0		
			Steady Values	0.0	0.5		Steady Values	0.0		
1004	14° C Cloudy / sunny	WS3							3.47	1.0 – 4.0
1004	15° C Light cloud / sunny	WS4	15s	0.0	2.5	19.2	15s	0.0	3.26	1.0 – 4.0
			30s	0.0	3.6	18.3	30s	-0.1		
			45s	0.0	4.3	17.9	45s	-0.1		
			1m	0.0	4.7	17.7	1m	-0.1		
			2m	0.0	4.9	17.6	2m	0.0		
			3m	0.0	4.9	17.6	3m	0.0		
			4m	0.0	4.9	17.6	4m	0.0		
			5m	0.0	4.6	17.8	5m	0.0		
			6m	0.0	4.2	18.0	6m			
			7m	0.0	3.8	18.4	7m			
			8m	0.0	3.5	18.6	8m			
			9m	0.0	3.2	18.9	9m			
			10m	0.0	3.0	19.0	10m			
			Max Peak	0.0	4.9		Max Peak	0.0		
			Steady Values	0.0			Steady Values	0.0		

Atmospheric Pressure (mb) and Trend	Temperature (°C) and Weather	BH No	Time (secs/ mins)	Concentrations (%)			Flow rates time (secs/mins)	Flow rates (l/hr)	Standing water level (m, bgl)	Depth and horizon of response zone (m,bgl)
				CH_4	CO_2	O_2				
1002	15° C Cloudy	WS6	15s	0.0	1.5	20.4	15s	0.0	3.13	1.0 – 4.0
			30s	0.0	1.5	20.2	30s	0.0		
			45s	0.0	1.5	20.0	45s	0.0		
			1m	0.0	1.5	20.0	1m	0.0		
			2m	0.0	1.5	20.0	2m	0.0		
			3m	0.0	1.5	20.0	3m	0.0		
			4m	0.0	1.5	20.0	4m	0.0		
			5m	0.0	1.5	20.0	5m	0.0		
			Max Peak	0.0	1.5		Max Peak	0.0		
			Steady Values	0.0	1.5		Steady Values	0.0		
	15° C Cloudy	WS8							1.02	1.0 – 4.0
	15° C Cloudy	WS10							1.48	1.0 – 3.0
1002	15° C Cloudy	WS11	15s	0.0	1.3	20.5	15s	0.0	1.68	1.0 – 4.0
			30s	0.0	1.3	20.1	30s	0.0		
			45s	0.0	1.3	20.1	45s	0.0		
			1m	0.0	1.3	20.1	1m	0.0		
			2m	0.0	1.3	20.0	2m	0.0		
			3m	0.0	1.3	20.0	3m	0.0		
			4m	0.0	1.3	20.0	4m	0.0		
			5m	0.0	1.3	20.0	5m	0.0		
			Max Peak	0.0	1.3		Max Peak	0.0		
			Steady Values	0.0	1.3		Steady Values	0.0		

Monitoring undertaken by Wilson Associates Consulting Limited

Gas monitoring carried out using a GA5000 Gas Analyser

Water monitoring carried out using a Geotechnical Instruments Dip Meter

Monitoring undertaken 18 September 2018

Atmospheric Pressure (mb) and Trend	Temperature (°C) and Weather	BH No	Concentrations (%)			Flow rates (min / max) (l/hr)	Standing water level (m, bgl)	Depth and horizon of response zone (m,bgl)
			CH_4	CO_2	O_2			
1000	16 - 17° C Cloudy with gusts of wind	WS1	0.0	0.9	20.3	+0.1/+0.2	3.52	1.0 – 4.0
999		WS2	0.0	0.3	20.6	+0.0/+0.0	2.61	1.0 – 4.0
		WS3					3.01	1.0 – 4.0
999		WS4	0.0	3.8	18.5	+0.0/+0.1	2.62	1.0 – 4.0
998		WS6	0.0	1.1	20.2	+0.0/+0.1	2.81	1.0 – 4.0
		WS8					1.12	1.0 – 4.0
		WS10					1.53	1.0 – 3.0
996		WS11	0.0	1.0	20.3	+0.0/+0.1	1.68	1.0 – 4.0

Subcontracted to CC Ground Investigations

Gas monitoring carried out using a GA5000 Gas Analyser

Water monitoring carried out using a Geotechnical Instruments Dip Meter

SERVICE REPORT

4533

Geotech

Date Of Calibration: 02-Jul-2018

Certificate Number: G501432_2/20881

ISSUED BY: GEOTECHNICAL INSTRUMENTS (UK) LTD

Customer: **Wilson Associates (Consulting) Ltd**
36 Brunswick Road GLOUCESTER Gloucestershire
GL1 1JJ UNITED KINGDOM

Description: Gas Analyser

Model: GA5000

Serial Number: G501432

UKAS Accredited results:

Results after adjustment :

Methane (CH_4)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	4.9	0.41
15.0	14.9	0.64
50.0	49.3	0.94

Carbon Dioxide (CO_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
5.0	4.8	0.43
15.0	14.7	0.70
50.0	49.8	1.1

Oxygen (O_2)		
Certified Gas (%)	**Instrument Reading (%)**	**Uncertainty (%)**
21.0	21.0	0.31

The inwards assessment was carried out 15-Jun-2018.
The maximum adjustment was less than the inwards assessment uncertainty.
Inwards assessment data is available if requested.

All concentrations are molar.

CH_4, CO_2 readings recorded at : 35.5 °C ± 2.5 °C

O2 readings recorded at : 23.8 °C ± 2.5 °C

Barometric Pressure : 1011 mbar ± 4 mbar

Method of Test : The analyser is calibrated in a temperature controlled chamber using a series of reference gases, in compliance with procedure LP004.

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The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Calibrations marked 'Non-UKAS Accredited results' on this certificate have been included for completeness.

Non-UKAS accredited results after adjustment:

Barometer (mbar)	
Reference	**Instrument Reading**
1011	1011

Internal Flow	
Applied (l/hr)	**Instrument Reading (l/hr)**
5.0	5.1
10.0	10.1

Date of Issue : 03-Jul-2018 **Approved by Signatory**

Dawn Hemings

Laboratory Inspection

17025	5	50	65	7,384	340	25
Our ISO accreditation for our customised auto-calibration facilities	Number of days we aim to complete your service within	Number of checks instruments are subject to when serviced	Number of countries from which we service instruments/ accessories each year	Number of calibrations completed in last 12 months	Minimum number of service instruments we process each month	Cost (in £) of fully insured analyser collection for our UK customers

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