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GEOTECHNICAL ENVIRONMENTAL

PHASE 2 GEO-ENVIRONMENTAL REPORT

job number	date
C177/19/E/269 – Rev 1	10/07/2020

site address
New Waste Water Treatment Plant,
Lenzing Fibers Ltd,
Energy Park Way,
Grimsby, DN31 2TT

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Report on a Phase 2 Geo-environmental Investigation

Location:	New Waste Water Treatment Plant, Lenzing Fibers Ltd, Energy Park Way, Grimsby, DN31 2TT
For:	ACWA Services Limited
Report No.	C177/19/E/269 – Revision 1
Report date:	July 2020

For and on behalf of **Rogers Geotechnical Services Ltd**

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Environmental Engineer

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Report Summary[1]

Item	Comments	Section
Development	Erection of new waste water treatment plant with associated access roads.	1.
Geology	Superficial geology – Tidal Flat Deposits. Solid geology – Flamborough Chalk Formation.	5.
Strata Conditions	Limited thicknesses of made ground. Tidal flat deposits overlying weathered chalk.	6.
Groundwater	Groundwater strikes were noted in numerous locations.	6.2
Foundation Design	Piled foundation solution.	10.1
Effect of Sulphates	DC-2 concrete.	10.5
Soil Contamination	Asbestos contamination revealed at some locations.	11.1
Water Contamination	Perched at the base of the made ground at the site is contaminated sulphate, boron, copper, nickel, lead and zinc.	11.2
Volatile Contamination	No elevated levels of volatile contamination detected during PID monitoring.	11.3

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

It is understood that an area of brownfield land located at Lenzing Fibers Ltd, off Energy Park Way, Grimsby is to be developed by the construction of a new waste water treatment plant with associated access roads. Consequently, a site investigation has been undertaken in accordance with the instruction from the client. This work was required in order to determine the nature of the underlying soils, to assess their engineering properties and to assist in the design of safe and economical foundations for the proposed development. This investigation also takes into consideration the risk of any contamination present. This report describes the work undertaken, presents the data obtained and discusses the ground conditions in relation to the proposed works.

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site and of the laboratory test results. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between borehole positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Desk Study

A Phase 1 Desk Study has been undertaken by Rogers Geotechnical Services (RGS) and the results were presented as report number C177/19/E/268 in December 2019. This report has been used extensively during the current intrusive investigation. It should also be appreciated that a number of previous reports have been undertaken at the site, most notably a White Young Green (WYG) Environmental report in 2004.

4. Fieldworks

The fieldworks were undertaken between the 26th November and the 9th December 2019 and included the following:

- Three cable percussive boreholes.
- Standard penetration tests within each borehole.
- Three gas monitoring standpipes.
- Seven Trial Pits
- Headspace Testing using a Photo-ionisation Detector (PID)

The investigatory locations are shown on the site plan which is presented in Appendix 1 to this report.

4.1 Cable Percussive Boreholes

The boreholes were sunk using a 1.5 tonne capacity light cable percussive (shell and auger) drilling rig with 150mm diameter tools and casing.

During the boring operations, representative disturbed samples of the arisings were taken at regular depth intervals and sealed in plastic bags. Standard penetration tests (SPTs) were undertaken at regular depth increments. The SPTs were conducted in accordance with the procedures given in BS EN ISO 22476: Part 3: 2005 +A1: 2011, and the results are summarised on the borehole records. During this work an automatic trip hammer of 63.5kg falling through 760mm was employed to drive either a cone or split barrel sampler assembly into the ground, the barrel samples were retained in air tight plastic containers. It may be appreciated that the approximate cohesion of clay soils may be obtained by multiplying the equivalent SPT value by approximately 4.5 (after Stroud, 1975). Groundwater levels were recorded when struck and boring stopped for a period of time to allow the water level to be monitored.

All recovered samples were returned to the laboratory for subsequent logging and testing. The soils were described in general accordance with BS5930: 2015 and full descriptions are given on the borehole records, which are presented in Appendix 2. Also included on these records are the water levels, casing details, standard penetration test results and a record of samples taken.

It should be appreciated that BH1 encountered refusal at shallow depths within in the made ground on potential concrete slab and was therefore moved to position BH1A, which was on top of the previously undertaken TP4.

4.2 Gas Monitoring Standpipes

Gas monitoring standpipes were installed to depths of between 4.0m and 15.0m in BH1A, BH2 and BH3 and the installation details are shown on the appropriate borehole records. In all cases, the monitoring standpipe consisted of a perforated pipe from the pipe base to between 1.0m and 5.0m below surface, with a non-perforated pipe to ground level. The response zone was filled with pea gravel, with a bentonite seal at the base and above, and the installation was capped with a stop box cover in a concrete surround.

4.3 Trial Pits

A total of 5 trialpits (TP1, TP2, TP3, TP4 and TP6) were excavated, in order to reveal the nature of the near surface soils, using a mechanical excavator. Due to the underground services restricting use of the mechanical excavator, a further 2 trialpits were also excavated using hand-held digging equipment. These pits were excavated immediately to the historical electrical substation (TP5) and in the southern corner of the site (TP7), in order to assess target areas and provide coverage across the site.

The soils were logged on site in general accordance with BS5930: 2015, and full descriptions are given on the trial pit records which are presented in Appendix 3. Samples were taken from the trialpits for both geotechnical and chemical testing. The chemical test specimens were retained in the appropriate air tight containers within cool boxes for onward transition to the chemical laboratory.

Once excavations were completed, the trialpits were carefully re-instated with the arisings. Whilst every care was taken during the infilling process, including compacting of the infill at regular intervals with the back acting arm of the excavator, it should be appreciated that some mounding of the surface may have resulted. Moreover, the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations e.g. livestock or agricultural plant equipment. Furthermore, it must be realised that the infilled pits represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

4.4 Headspace Testing using a Photo-ionisation Detector (PID)

In order to assess any VOCs present within the soils at the trial pit locations, a PID[2] was employed to undertake headspace testing of selected samples. At regular depth intervals soils were recovered from the trial pits, in bulk sample bags.

These bags were sealed and left for several minutes in order for any volatiles present to accumulate within the headspace above the sample soil. The probe of the PID was then inserted into the sample bags, without making contact with the soil, and the bag resealed around the shaft of the probe. A measurement of the VOCs present was then undertaken with the PID for a minimum of 1 minute and the peak result recorded.

5. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

Strata Type	Strata Name[3]	Previous Name[4]	Description[3]
Made Ground/Fill	Made Ground (Site wide except for northern corner)	N/A	Made ground is an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified. Variable composition.
Superficial Geology	Tidal Flat Deposits	Estuarine Alluvium	Tidal flat deposits, including mud flat and sand flat deposits, are deposited on extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit. A normally consolidated soft silty clay, with layers of sand, gravel and peat. Characteristically low relief.
Solid Geology	Flamborough Chalk Formation	Flamborough Formation	White, well-bedded, flint-free chalk with common marl seams (typically about one per metre). Common stylolitic surfaces and pyrite nodules.

[2] RAE Systems MiniRAE 3000 (Calibrated to isobutylene and equipped with a 10.6eV lamp with a detection range of 0ppm to 10000ppm. N.B. the readings will be a total of all organic and inorganic compounds with an ionisation potential of 10.6eV or less, i.e. the monitor does not distinguish between compounds)
[3] Sources: British Geological Survey (NERC) Map Sheet 81; Patrington; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[4] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

6. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile

Depth m below ground level to underside of layer	Strata Type	Positions Encountered	Groundwater Strikes m below ground level
+0.1 – +1.5	MADE GROUND	BH1, BH2, BH3 TP1, TP2, TP3, TP4, TP5, TP6, TP7	Bh1, BH2, BH3
2.0+ – 8.5	Brown, locally gravelly, CLAY	BH1A, BH2, BH3 TP1, TP2, TP3, TP4	BH1A, BH2, BH3
9.3 – 10.0	Greyish brown mottled black clayey PEAT	BH1A, BH2, BH3	None
10.7 – 11.5	Greyish brown slightly gravelly CLAY	BH2, BH3	None
11.7 – 11.8	Loose brown clayey, locally gravelly, SAND	BH2, BH3	BH1A, BH2, BH3
17.2 – 17.8	Greyish brown slightly gravelly CLAY	BH1A, BH2	None
18.9 – 19.7	Light brown clayey, locally gravelly, SAND	BH1A, BH2	BH2
20.8 – +22.5	Greyish brown sandy gravelly CLAY	BH1A, BH2, BH3	None
+23.6 – +26.5	Light yellow clayey fine to coarse, locally cobbly, GRAVEL of chalk	BH1A, BH3	BH1A, BH3

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated

6.1 General Strata

In general, the borehole and trial pit records indicate that made ground was present to depths of between 1.0m and 1.6m bgl at positions BH1A, BH2, BH3 and TP1 – TP4, as well as to the termination depths of BH1 and TP5 – TP7.

Beneath the made ground, generally very soft to firm brown organic, locally gravelly, clay was revealed to depths of between 8.0m and 8.5m bgl at the positions of BH1A, BH2 and BH3, as well as to the termination depths of TP1 – TP4. Underlying the locally gravelly clays, generally soft greyish brown clayey peat was then revealed to depths of between 9.3m and 10.0m bgl at the borehole positions. With respect to the published geological data for the site, it is considered that these soils represent tidal flat deposits, which are anticipated to be present below the site.

Beneath the clayey peat, typically firm gravelly clay with bands of loose to medium dense gravelly sand were revealed to depths of between 20.8m and 21.2m bgl at positions BH1A and BH3, and to the termination depth of BH2. It is considered that these soils also represent tidal flat deposits, which are anticipated to be present below the site.

Within BH1A and BH3, generally medium dense to dense clayey cobbly gravel of chalk was revealed below these strata to the termination of the boreholes. It is anticipated that this stratum is representative of the weathered fraction of the underlying Flamborough Chalk Formation that is indicated to underlie the site.

6.2 Groundwater

A number of groundwater strikes were noted with BH1, BH1A, BH2, BH3, TP2, TP3 and TP4. It should be noted that most of these water strikes were recorded within the made ground or granular horizons in the underlying natural strata.

Notwithstanding the above, it should be appreciated that the normal rate of boring does not permit the recording of an equilibrium water level for any one strike, moreover, groundwater levels are subject to seasonal variation or changes on local drainage conditions.

7. Insitu Testing

7.1 Standard Penetration Tests

The standard penetration tests carried out in all boreholes and are summarised in the following table:

Table 3: Summary of Standard Penetration Tests

Strata	Depth Range (m)	SPT 'N' (Blows/300mm)		Comments
		Granular soils	Cohesive soils	
MADE GROUND (Sandy gravelly CLAY)	1.2m to 1.65m	–	6	SPT's indicate a soft in-situ condition.
Greyish brown slightly gravelly CLAY	2.3m to 3.95m	–	2-3	SPT's indicate a very soft in-situ condition.
Greyish brown CLAY	2.5m to 7.95m	–	2-4	SPT's indicate a very soft in-situ condition.
Greyish brown mottled black clayey PEAT	8.5m to 9.45m	–	4-5	SPT's indicate a soft in-situ condition.
Greyish brown slightly gravelly CLAY	10.5m to 15.45m	–	11-31	SPT's indicate a firm to stiff in-situ condition.
Brown clayey SAND/ Light brown gravelly SAND	11.5m to 18.45m	5-10	–	SPT's indicate a loose to medium dense in-situ condition.
Greyish brown sandy gravelly CLAY	19.7m to 22.45m	–	17 -42	SPT's indicate a firm to stiff in-situ condition.
Light yellow clayey fine to coarse GRAVEL of chalk	21.0m to 26.45m	30-50	–	SPT's indicate a medium dense to dense in-situ condition

7.2 Gas and Water Level Monitoring

The standpipes were monitored on the 19th December 2019 and the 30th June 2020. The results of the gas monitoring undertaken to date are tabulated below.

Table 4: Gas Monitoring

Location	Date	CH_4 (%)	CO_2 (%)	O_2 (%)	Flow (l/h)	Barometric Pressure (mb)	Water Level (m)	Standpipe Depth (m)
BH1A	19.12.19	91.4	4.9	11.6	0.1	995↓	1.05	3.8
	06.01.20	79.9	5.1	7.0	0.1	1013↔	1.00	
	17.01.20	75.0	5.4	13.1	0.1	1006↑	1.10	
	24.01.20	36.4	4.7	15.7	0.1	1020↓	0.95	
	17.03.20	67.6	5.3	6.8	0.1	1023↑	0.95	
	31.03.20	39.7	4.1	11.9	0.1	1035↑	0.95	
	07.04.20	33.6	4.4	12.7	0.1	1030↔	0.90	
	28.04.20	20.7	2.7	15.9	0.0	1007↓	0.90	
	20.05.20	29.2	4.4	11.3	0.2	1023↔	1.05	
	02.06.20	12.9	3.5	15.8	0.0	1020↓	0.95	
	19.06.20	14.5	3.3	14.5	0.0	1012↔	0.85	
	30.06.20	15.4	3.5	15.3	0.1	1005↓	0.80	
BH2	Unable to take readings due to extruding water							14.3
BH3	19.12.19	5.2	0.1	20.0	N/A	994↓	0.50	4.3
	06.01.20	8.4	0.1	19.6	N/A	1013↔	0.70	
	17.01.20	0.1	0.0	20.9	0.0	1006↑	0.90	
	24.01.20	1.9	0.1	19.7	0.1	1020↓	0.80	
	17.03.20	7.9	0.5	19.1	0.1	1023↑	0.75	
	31.03.20	2.3	0.3	20.2	0.2	1035↑	0.80	
	07.04.20	1.3	0.2	19.2	0.0	1030↔	0.70	
	28.04.20	5.8	0.2	19.6	0.0	1007↓	0.80	
	20.05.20	1.4	0.2	19.4	0.0	1023↔	0.95	
	02.06.20	5.8	0.4	19.4	0.0	1020↓	0.75	
	19.06.20	5.7	0.4	19.0	0.0	1012↔	0.65	
	30.06.20	7.0	2.5	15.9	0.3	1005↓	0.60	

↑ - rising pressure ↓ - falling pressure ↔ -steady pressure

This work was undertaken using a Geotechnical Instruments (UK) Ltd. GA5000. It should be appreciated that due to excess water infilling BH2 it was not possible to undertake a representative reading from this borehole.

7.3 PID Monitoring

The results of the PID monitoring are summarised below, background readings at the time of measurement were in the range of 0ppm to 0.1ppm:

Table 5: Summary of PID results

Location	Depth (m)	Soil Type	Peak concentration of VOCs
TP1	0 – 1.1	MADE GROUND	0.3 ppm
TP1	1.1 – 2.0	CLAY	0.1 ppm
TP2	0 – 1.0	MADE GROUND	0.2 ppm
TP2	1 – 2.3	CLAY	0 ppm
TP3	0 – 1.0	MADE GROUND	0.7 ppm
TP3	1 – 2.3	CLAY	0 ppm

TP4	0 – 1.4	MADE GROUND	0.4 ppm
TP4	1.4 – 2.0	MADE GROUND	0.3 ppm
TP4	2.0 – 2.8	CLAY	0 ppm
TP5	0 – 0.1	MADE GROUND	0.2 ppm
TP6	0 – 1.5	MADE GROUND	0.1 ppm
TP7	0 – 0.25	MADE GROUND	0.7 ppm

MG – Made Ground, RTD – River Terrace Deposits, RM – Reworked Materials

8. Laboratory Testing - Geotechnical

The following programme of laboratory testing has been undertaken on samples obtained during this investigation:

- Moisture content determinations — BS 1377: 1990: Pt2: 3.2
- Index properties (1 point) — BS 1377: 1990: Pt2: 4.4, 5.3 & 5.4
- Linear shrinkage — BS 1377: 1990: Pt2: 6.3
- Particle size distribution (Dry sieve) — BS 1377: 1990: Pt2: 9.3
- Soluble sulphate content — BS 1377: 1990: Pt3: 5
- pH value — BS 1377: 1990: Pt3: 9
- One-dimensional consolidation — BS 1377: 1990: Pt5: 3
- Undrained shear strength (Triaxial) — BS 1377: 1990: Pt7: 8 & 9

The test results are presented in Appendix 4 and are summarised below:

Table 6: Summary of Geotechnical Test Results

Test type	Number of tests	Range of results		Comments
Moisture content determinations	11		15% to 49%	Up to 142% in the peat layer.
Index Properties (1 Point)	11	LL PL PI LS	25 to 62% 13 to 27% 12 to 35% 8 to 15%	Greyish brown, locally gravelly CLAY Consistency index – -1.9 to 0.8 NHBC Class – Low to medium
	1	LL PL PI LS	145% 73% 72% 24%	Greyish brown mottled black clayey PEAT Consistency index – 0.0 NHBC Class – High
Particle size distribution (Dry sieve)	1	Sand Silt/Clay	71% 3%	Slightly clayey SAND Uniformity coefficient 2.6 Curvature coefficient 1.4
Soluble sulphate & pH	11	SO_4 pH	0.1 to 2.0g/l 7.2 to 9.8	
One–dimensional consolidation	3	c_v m_v	0.37 to 2.9 m^2/yr 0.038 to 0.24 m^2/MN	Low to fast rate of settlement. Very low to medium compressibility.
Undrained shear strength (Triaxial)	4	c_u γ	2 to 126 kN/m^2 18.3 to 21.4 kN/m3	Cohesion increases significantly with depth.

8.1 Geotechnical Properties

The idealised geotechnical properties employed in design are summarised below.

Table 7: Summary of Geotechnical Properties

Property	Range of values	Comments
Volume change potential (NHBC)	Medium	Greyish brown, locally gravelly CLAY
	High	Greyish brown mottled black clayey PEAT
Consolidation characteristics	c_v 3m^2/yr m_v 0.25m^2/MN	Assume m_v gradually reduced with increasing depth
Concrete classification	DC2	Brownfield ground locations (Static water)

9. Laboratory Testing - Environmental

A suite of testing was conducted on soil samples from across the site and the following regime was undertaken.

- Metals – Cd, Cr(VI), Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN^- and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO_4^{2-}.
- Thiocyanate
- Boron, Sulphate and Sulphide

Where perched water was encountered, at the base of the made ground, water samples were collected and the following regime was undertaken.

- Metals – Cd, Cr(VI), Cu, Hg, Ni, Pb, V and Zn.
- Semi and Non-Metals - As, Se, Free CN^- and Phenols.
- Polycyclic aromatic hydrocarbons (PAHs).
- Petroleum hydrocarbons (TPHs).
- Others – pH, organic content and total/soluble SO_4^{2-}.
- Thiocyanate
- Boron, Sulphate and Sulphide
- SVOCs

This testing was undertaken by Chemtest Ltd and the results of all of the chemical testing are presented in Appendix 4 of this report.

10. Discussion of Ground Conditions - Geotechnical

It is understood that the site is to be developed by the construction of a new waste water treatment plant with associated access roads. At the time of writing this report the precise layout and method of construction is not known, thus the discussion below is of a generalised nature.

It cannot be recommended that foundations be constructed directly within the made ground or weak near surface soils associated with the superficial deposits. These soils are also present in a weak

and variable condition, such that excessive total and or differential settlement could occur under moderately light surface loading.

In view of the significant thickness of weak material encountered, it cannot be recommended that shallow footings or raft foundations are considered for the development and piles should be adopted in order to transfer foundation loads through the weak and variable made ground and superficial deposits to competent strata at depth. A piled foundation will have the advantage of limiting differential settlement of the new structure across the site.

10.1 Piled Foundations

In order to formulate a suitable design, it is recommended that the advice of specialist piling contractors be sought. However, for preliminary design and estimating purposes the following discussion is presented.

It is considered that the use of driven pre-cast concrete piles could be adopted at this site. However, it will be necessary to ensure that vibrations do not cause settlement of, or damage to, nearby structures, particularly if they have been founded at shallow depth (e.g. the adjoining water reservoirs). Furthermore, in view of the weak and variable nature of the soils encountered to depths of around 10m, it will be necessary to check the buckling performance of the piles through this material. Additionally, the possibility of negative skin friction acting on the piles due to consolidation or degradation of the peat layer should be accounted for.

Consideration may also be given to the use of bored cast-in-place piles using continuous flight augers (CFA). In this type of piling an auger borehole is formed and concrete placed via the hollow stem of the auger as they are withdrawn. A reinforcement cage is then placed into the fluid concrete filled hole to complete the pile. However, spoil will be produced at the surface which will need to be disposed of. Moreover, should such piles encounter an obstruction or the underlying bedrock, a condition known as ‘flighting’ may occur. Flighting is where loose soils immediately adjacent to the pile borehole are pulled laterally into the drill string when the augers rotate quickly with little downward penetration.

It should be appreciated that the methods and installation of piles will largely be dependent on the characteristic properties of the underlying undifferentiated Flamborough Chalk Formation (for example, the density of the chalk and nature of discontinuities). In addition, it should be noted that gains in load bearing capacity of piles over time can be ascribed to time-dependent changes within remoulded chalk, which may lead to an increase in shaft resistance.

It should also be appreciated that the installation of driven piles into chalk, such as that observed at the base of the boreholes, commonly leads to remoulded chalk to form along the pile length and the annulus at the pile base. Thus low shaft resistances may result from the creation of a layer of remoulded chalk around the pile.

In addition, a working platform must be provided, the thickness of which will be determined by the type of piling rig employed and the strength of the near surface soils. The design of the platform should be undertaken in accordance with the procedures and specification given in the BRE publication entitled *Working platforms for tracked plant*.

In order to formulate a suitable design and installation method, it is recommended that the advice of specialist piling contractors be sought. The chosen piling contractor will need to consider the possibility of negative skin friction occurring as a result of settlement of the very soft deposits.

In addition, the cohesive fraction of the superficial geology has been found to possess medium volume change potential, in the most onerous case. Therefore, piles should be able to cater for shrinkage or swelling of the cohesive soils should they be installed within the zone of any existing trees or shrubs. For design purposes, in particular the derivation of heave forces on the piles, the zone of desiccation may be considered as equivalent to the minimum foundation depth recommended for a shallow footing in the NHBC Standards, Chapter 4.2 – *Building Near Trees.*

10.2 Ground-floors

In light of the made ground and weak near surface soils, it is not recommended that ground bearing ground floor slabs be employed. In this instance it would be necessary to suspend floors between foundation positions, such that the floor loads are transmitted via the foundations to competent soils at depth.

Further to the above, due to the volume change potential at the site, should the floor be placed within the zone of influence of any existing, or proposed, trees and shrubs, an allowance for soil volume change should be included. Further guidance is available in the NHBC standards, however, soil volume change can typically be catered for by providing a suitable void or utilize proprietary materials beneath the floor slab.

10.3 Effect of Sulphates

In view of the nature of the underlying soils it is considered that the design sulphate class be assessed with reference to Table C2[5], which is provided in BRE Special Digest 1, *Concrete in aggressive ground*: Part C. On the basis of this table and considering the soluble sulphate contents recorded, it can be shown that well compacted buried concrete should be designed in accordance with Class DS-3 requirements. Assuming static groundwater, the table also indicates that the aggressive chemical environment for concrete (ACEC) classification is AC-2s.

In order to evaluate the design chemical (DC) class for the buried concrete at this site reference should be made to Table D1[6], which can be found in Part D, *Specifying concrete for general cast-in-situ use,* of BRE Special Digest 1. From this table it may be shown that for an intended working life of at least 50 years the concrete design class DC-2 is required.

11. Discussion of Ground Conditions - Environmental

11.1 Discussion of Test Results

It is understood that the site is to be developed by the construction of a new waste water treatment plant with associated access roads. Consequently, the site may be classified as commercial.

[5] Table C2, *Aggressive Chemical Environment for Concrete (ACEC) classification for brownfield locations*
[6] Table D1, *Selection of the DC Class and the number of APMs for concrete elements where the hydraulic gradient due to groundwater is 5 or less: for general in-situ use of concrete.*

11.1.1 Soil Samples

The results of the chemical testing undertaken on soil samples obtained during this investigation have been compared to the ATRISK soil screening values (SSVs) as compiled by WS Atkins plc. With respect to the results it should be appreciated that the soil organic matter (SOM) content for the samples tested was found to range between 1.3% and 33%. On this basis, it is considered that the screening values associated with 1% SOM should be adopted as the most onerous case. These values have been derived in such a way as to adhere to the principles within the revised CLEA model and include the most current release of the SGVs. A list of subscribers is provided within the website[7] and these include many local authorities.

A comparison of the results of the testing, together with the data given above, can be found within Appendix 4. These results indicate the following:

Table 8: Summary of Contaminated Areas

Location	Depth (m)	Strata	Contaminants found to be exceeding SSVs (Commercial)	Asbestos Screen
BH2	6 – 6.45	CLAY	None.	-
BH3	7.5 – 7.95	CLAY	None.	-
TP1	0 – 1.1	MADE GROUND	None.	Asbestos (Amosite, Chrysotile)
TP2	0 – 1.0	MADE GROUND	None.	Asbestos (Chrysotile)
TP2	1 – 2.3	CLAY	None.	None
TP3	0 – 1.0	MADE GROUND	PAHs (Chrysene).	Asbestos (Amosite, Chrysotile)
TP4	0 – 1.4	MADE GROUND	None.	Asbestos (Amosite)
TP4	1.4 – 2.0	MADE GROUND	None.	Asbestos (Amosite, Chrysotile)
TP4	2.0 – 2.8	REWORKED CLAYS	PAHs (Chrysene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene).	None
TP6	0 – 1.5	MADE GROUND	None.	None
TP7	0 – 0.25	MADE GROUND	PAHs (Benzo[a]anthracene, Chrysene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Indeno(1,2,3-c,d)Pyrene, Dibenz(a,h)Anthracene, Benzo[g,h,i]perylene).	Asbestos (Anthophyllite)

Concentrations of chromium(VI), free cyanide, phenols (total) and total petroleum hydrocarbons (aliphatic C5 to C12; aromatic C5 to C12) were below the detection limits for the tests. Detectable levels of all other contaminants were recorded, but these fell below the associated Atrisk Soil Screening Values.

It should also be appreciated that a test was undertaken for Thiocyanate, based upon a historical spill being noted on site. Concentrations of Thiocyanate were below the detection limits for the tests and is thus not considered to be contaminative.

[7] http://www.atrisksoil.co.uk/pages/general/subscribers.asp

It should be appreciated that the soil screening values for PAHs (where appropriate) represents vapour saturation limits. The inhalation of vapour pathway contributes less than 10% of total exposure, which is unlikely to significantly affect the combined assessment criterion[8]. In view of this, the ATRISK soil SSVs notes that the users may wish to consider using a combined assessment criterion if free product is not observed, the values for which are also provided on the summary of contamination analysis. It is therefore considered that the criteria for no free product should be adopted for the PAHs at this site. The results of the contaminants found to exceed these screening values are tabulated below:

Table 9: Summary of Areas Contaminated by PAHs & TPHs

Location	Depth (m)	Strata	PAHs found to be exceeding SSVs (Commercial)	Asbestos Screen
BH2	6 – 6.45	CLAY	None.	-
BH3	7.5 – 7.95	CLAY	None.	-
TP1	0 – 1.1	MADE GROUND	None.	Asbestos (Amosite, Chrysotile)
TP2	0 – 1.0	MADE GROUND	None.	Asbestos (Chrysotile)
TP2	1 – 2.3	CLAY	None.	None
TP3	0 – 1.0	MADE GROUND	None.	Asbestos (Amosite, Chrysotile)
TP4	0 – 1.4	MADE GROUND	None.	Asbestos (Amosite)
TP4	1.4 – 2.0	MADE GROUND	None.	Asbestos (Amosite, Chrysotile)
TP4	2.0 – 2.8	REWORKED CLAYS	None.	None
TP6	0 – 1.5	MADE GROUND	None.	None
TP7	0 – 0.25	MADE GROUND	None.	Asbestos (Anthophyllite)

In addition to the above testing, due to the historical contamination noted on site during the WYG survey (please refer to Phase 1), sulphate, sulphide and boron were also tested.

In regards to the boron tested, the range of values observed was between 1.4 mg/kg and 5.3 mg/kg. Whilst no ATRISK SSVs exist for boron, a screening value (S4UL) of 240,000 mg/kg is provided by LQM within their publication *"LQM/CIEH S4ULs for Human health Risk Assessment"*. As the concentrations of boron fall well below this limit, the boron observed at the site it considered to be of low risk. It should be noted that WYG offer a screening value of 3 mg/kg in their report, as this report was compiled in 2004 and the justification for this values is unknown, it is considered that the newer LQM/CIEH S4ULs should take precedence over this value.

In regards to the sulphate and sulphide tested, no ATRISK SSVs or S4ULs exist for these parameters. However, as these values fall significantly below the WYG of assessment criteria (WYGE ATVs) in their report (2000 mg/kg and 250 mg/kg, respectively), the concentrations of sulphate and sulphide are also considered to be of low risk.

[8] Ref: ATRISK soil, SSVs derived using CLEA v1.071 for 6% SOM, Residential without home grown produce land use, 23.06.17.

Table 10: Summary of Contamination by Strata	
Strata	**Locations of Exceedances**
MADE GROUND	Asbestos.
REWORKED CLAY	None.
CLAY	None.

On the basis of the above information, the results of the investigation have concluded that the made ground at the site is contaminated by asbestos. However, the underlying natural strata and reworked clays appear to be generally uncontaminated in respect to the sites proposed end use.

11.1.2 Water Samples

In the context of the water testing, it should be appreciated that the following determinants were below detection limits and are therefore not considered contaminative;

- Some metals (Chromium (VI), Cadmium, Mercury, Nickel and Selenium).
- All PAHs.
- All TPH's
- All SVOCs.
- Thiocyanate.
- Sulphide.

With regards to those contaminants above detection limit, it should be appreciated that the Environment Agency have provided limits for Environmental Quality Standards[9] (EQS) which should be met in respect to a variety of media.

The results of the water testing site should be compared to the most appropriate EQS values. Given the nature of the site and the proximity of the River Holme, EQS for *freshwater* and/or *surface water* media types are considered the most appropriate. Where no EQS values are available for the aforementioned parameters, then EQSs for *UK Drinking Water Standards* and/or *Surface Water Intended for Abstraction for Drinking Water* should be utilised. Where no current EQS exists, results should be compared to existing background quality or taken as the limit of detection.

Table 11: Summary of water concentration and associated EQSs						
				Most onerous EA EQS limit		
Determinand	**Exceeds Appropriate EQSs?**	**Maximum Concentration in Water**	**Drinking Water**	**Freshwater**	**Surface Water**	**Surface Water Intended for Abstraction for Drinking Water**
Metals and Semi-Metals						
Sulphate	Yes	1700 mg/l	250 mg/l	-	400 mg/l (Guideline)	250 mg/l
Arsenic	No	3.4 µg/l	10 µg/l	-	50 µg/l	50 µg/l
Boron	Yes	1500 µg/l	500 µg/l	-	1000 µg/l	1000 µg/l

[9] Environment Agency Chemical Standards Database [*online resource http://evidence.environment-agency.gov.uk/ChemicalStandards/Home.aspx]*

Cadmium	No	1.9 µg/l	3 µg/l		2 µg/l*	5 µg/l
Chromium	No	10 µg/l	50 µg/l	5 ug/l*	3.4 µg/l	50 µg/l
Copper	Yes	170 µg/l	2000 µg/l	5 µg/l*	20 µg/l*	20 µg/l*
Nickel	Yes	90 µg/l	20 µg/l	-	50 µg/l*	-
Lead	Yes	17 µg/l	10 µg/l	-	4 µg/l*	50µg/l*
Zinc	Yes	6500 µg/l	-	30 µg/l*	30 µg/l*	3000 µg/l*

*Most onerous value shown.

On the basis of the above information, the results of the investigation have concluded that the water perched at the base of the made ground at the site is contaminated sulphate, boron, copper, nickel, lead and zinc.

Notwithstanding the above, visually observations during the trial pitting exercise demonstrated that this water to be perched within the made ground at the site above the clay layers below. It is considered that the clay layers below the made ground would be of very low permeability. Thus, this contaminated perched water is not considered to represent a risk to the controlled waters within the underlying aquifer.

11.1.3 VOC Measurements

PID readings from made ground across the site were typically low at less than or equal to 0.7ppm. PID readings within the natural strata fell within the range of ambient background, 0 ppm to 0.1 ppm.

It is reasoned that the PID results within the made ground are low as the quantities of PAH contamination observed were minor. Furthermore, any PAHs in the observed coal ash fragments are likely to be bound strongly and hence can be considered to be of low volatility. The lack of vapours also serves to confirm the absence of other volatiles (e.g. TPHs, Thiocyanate) at the site.

Notwithstanding the above, it should be appreciated that due to the nature of the PID, the above data should only be considered to represent a qualitative indication of VOCs present within the soils at the site.

11.1.4 Waste Acceptance Criteria

It is anticipated that the elevated mound of made ground on site is to be disposed to landfill, a diagram indicating the approximate area of this mound is included within Appendix 1.

Waste producers must consider information from the visual assessment, knowledge of the source material and chemical analysis to determine whether a waste is hazardous or non-hazardous. The chemical analysis should also identify whether the waste could comply with the WAC limit values for the proposed class of landfill.

The material tested represents construction waste largely comprising soil and stones. As such, this material could be assigned the List of Waste Code 17-05-X. It should be appreciated that material can be classified as ‘hazardous’ (03*) or ‘non-hazardous’ (04), in accordance with the Environment Agency’s Technical Guidance WM3. In order to assess which classification applies to the stockpiled soil, the results of the chemical testing above have been considered. Considering that the WAC

sample was taken from the mound of made ground where TP6 was excavated, the results of the chemical analyses from this location indicated that there was a low level of risk posed to site operatives or end users of the site from these soils. In view of this, it is considered that the stockpiled material may be classified as hazardous, thus the Waste Code would be 17-05-02.

Analysis of the sample was undertaken to assess the suitability of the site material for use in a landfill. In order to achieve this, WAC testing has been undertaken to demonstrate compliance, the testing was undertaken by Chemtest Ltd and the results of all of the chemical testing are presented within Appendix 4. The WAC have been set as maximum limit values which must not be exceeded and should not be viewed as minimum treatment specifications for landfill. The following table has been extracted from the Environment Agency[10] and adapted to compare against the chemical test results attached to this letter.

Table 12: Landfill Waste Acceptance Criteria

Determinand	Maximum Concentration (mg/kg)	Landfill Waste Acceptance Criteria Limits			Class of Landfill Maximum
		Inert	Non-Hazardous	Hazardous	
Total Organic Carbon %	0.85	3	5	6	Inert
Loss on Ignition %	5.7	-	-	10	Inert
BTEX	<0.010	6	-	-	Inert
PCBs (7 Congeners)	<0.10	1	-	-	Inert
TPH (Mineral Oil)	<10	500	-	-	Inert
Total (of 17) PAHs	<2.0	100	-	-	Inert
pH	8.3	-	>6	-	Inert
Acid Neutralisation Capacity	0.014	-	To be evaluated	To be evaluated	-
	Maximum Cumulative Concentration (mg/kg) 10:1	**Limit values (mg/kg) for compliance leaching test using BS EN 12457 - 3 at L/S 10 l/kg**			
As	<0.05	0.5	2	25	Inert
Ba	<0.5	20	100	300	Inert
Cd	<0.01	0.04	1	5	Inert
Cr	<0.05	0.5	10	70	Inert
Cu	0.053	2	50	100	Inert
Hg	<0.005	0.01	0.2	2	Inert
Mo	0.11	0.5	10	30	Inert
Ni	<0.05	0.4	10	40	Inert
Pb	<0.01	0.5	10	50	Inert
Sb	<0.01	0.06	0.7	5	Inert
Se	0.018	0.1	0.5	7	Inert
Zn	<0.5	4	50	200	Inert

[10] Guidance on sampling and testing of wastes to meet landfill waste acceptance procedures, Version 1, April 2005.

Cl	190	800	15 000	25 000	Inert
F	13	10	150	500	Exceeds Inert
SO_4	1100	1000	20 000	50 000	Inert
Total Dissolved Solids (TDS)	3800	4000	60000	100 000	Inert
Phenol index	<0.5	1	-	-	Inert
Dissolved Organic Carbon at own pH or pH 7.5-8.0	1900	500	800	1000	Exceeds Hazardous

In this instance, it should be appreciated that the results of the loss of dissolved organic carbon testing exceed the upper limits for hazardous WAC. In addition, leachate concentrations of fluoride exceed the upper limits for an inert WAC.

As such, should the material be disposed of to landfill, it will be necessary to determine the appropriate waste code in accordance with the document *Waste Classification: Guidance on the classification and assessment of waste (1st Edition v1.1)*. Given the exceedances encountered, it is likely that any landfill operator will request that the material is treated prior to disposal. Further testing could be undertaken post treatment in order to determine the suitability of the treated material for the appropriate landfill.

For further guidance, please refer to the following documents which are available on the *www.gov.uk* website:

- Environment Agency – LIT 5234 *Waste Acceptance at Landfills - Guidance on waste acceptance procedures and criteria* – November 2010.
- Environment Agency – LIT 5902 *Treatment of waste for landfill* – June 2014.
- Waste Classification: Guidance on the classification and assessment of waste (1st Edition v1.1) May 2018: Appendix A: How to use the list of waste

11.1.3 Gas Concentrations

With respect to ground gas, the results of the monitoring visits indicated a maximum concentration of 91.4% methane, with concentrations of carbon dioxide ranging between 0.1% and 5.4%, in association with oxygen levels of between 6.8% and 20.3%. It should be appreciated that on non-contaminated sites there is generally about 20% by volume of oxygen, associated with low levels of carbon dioxide and methane. In addition, a maximum flow rate of 0.3 litres per hour was recorded and will be employed in the following calculations.

In addition to the above, it should be noted that the previous WYG investigation observed a peak concentration of 82.1% methane within BH14 (the only WYG borehole which is within the current site boundary). WYG consider these high levels likely to be “associated with the natural peat deposits underlying the site”. This layer of peat was also observed during the current investigation and is noted on the borehole logs (Appendix 2).

Further to the above, the levels of methane and carbon dioxide gas at WS1 appear to undergo a gradually decrease during the course of the monitoring. This is consistent with a trapped pool of gasses within the peat layer being released over a prolonged period of time and thus reinforces the conclusions of WYG above. In this regard, it is noted that, in general, peat has a gas generation rate of ~<0.1m^3 per tonne per year. This is relatively low, compared to modern landfill (>10m^3), or coal

workings (<1m^3). Notwithstanding this, there remains the possibility that a credible pathway could be present between the peat and the near surface (through permeable superficial soils), to enable the upwards migration of methane.

The principal driving force for initiating the movement of gas in the ground is a change in barometric pressure. The most onerous gas condition on a site is usually observed on days of low or falling barometric pressure, preferably below 1000mb. It has been noted that measurements undertaken solely during high pressure conditions may be of lesser value. At this site the readings undertaken to date were at atmospheric pressures of between 994mb and 1023mb and at a range of rising, falling and steady pressures.

In order to establish the gas screening value (GSV) for carbon dioxide or methane, the maximum gas concentration (expressed as a decimal) is multiplied by the borehole flow rate (l/hr). In this case 91.4% (0.914) methane was recorded along with 5.4% (0.054) carbon dioxide, in association with a maximum flow rate of 0.3 l/hr. This results in a GSV of 0.2742 l/hr for methane and a GSV of 0.0048l/hr for carbon dioxide.

In accordance with Table 2 of BS8485: 2015*, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,* the site may be characterised as *Characteristic Situation Level 2*. Therefore, it is considered that there is a risk of harm to end users, therefore some protection measures are required.

With regard to the number of monitoring visits required reference is made to Tables 5.5a and 5.5b of CIRIA report C665 (2007)[11]. Accepting that the proposed development is of low sensitivity and that the generation potential is high, these tables suggest that 12 readings could be undertaken over a period of 6 months. However, C665 notes that *not all sites will require gas monitoring for the period and frequency indicated in Tables 5.5a and 5.5b.*

In this case, a total of 12 monitoring visits were undertaken over a six month time period and for the purpose of this assessment, it is considered that the site can be fully classified as Characteristic Situation Level 2.

11.2 Site Specific Risk Assessment

11.2.1 Approach

The presence of contamination hazards and the risks associated with them should be assessed in accordance with industry practice and the 'suitable for use' approach. This has been conducted with reference to The Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency[12] advice on the assessment of risks arising from the presence of contamination in soils and using the source-pathway-receptor approach.[13] This method dictates that there must be a risk of contaminant produced at a 'source' in sufficient concentration to cause harm and there must be a 'pathway' for the contaminant to reach an identifiable 'receptor' for the linkage to be proved and a contamination hazard to be considered present. Not all substances are

[11] Adapted from tables 5.5a and 5.5b of CIRIA C665, 2007, *Assessing risks posed by hazardous ground gas to buildings, p60.*
[12] R&D Publication CLR 8, 'Assessment of Risks to Human Health from Land Contamination: An overview of the Development of Soil Guideline Values and Related Research'.
[13] The pollution linkage approach was developed by 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990' which provides meanings for the terms contained in The Environmental Protection Act 1990 Part IIA, the primary legislation for addressing the issues of contaminated land.

contaminants and not all contaminants are considered to be a risk. Indeed DEFRA and The Environment Agency state that 'a contaminant is a substance which has the potential to cause harm, while a risk itself is considered to exist if such a substance is present in sufficient concentration to cause harm and a pathway exists for a receptor to be exposed to the substance.'[14]

11.2.2 Conceptual Ground Model and Risk Assessment

In view of the results of the chemical testing undertaken the conceptual site model is presented accordingly as Table 10. Sources of contamination include the following:

On-site – Made Ground (Asbestos).
Hazardous Ground Gasses (Methane and Carbon Dioxide).
Perched Water (Sulphate, Boron, Copper, Nickel, Lead and Zinc).

The preliminary risk assessment has been evaluated with reference to the following ratings and definitions:

N/A -	A source-pathway-receptor linkage is not considered to exist and therefore a risk assessment is not required.
Low -	A pollution linkage is unlikely and/or the likelihood of harm occurring is low and of minor consequence.
Moderate -	The linkage exists but the likelihood of harm occurring is not considered to be significant although remedial action may be necessary
High -	The linkage exists and the available data indicates that significant harm may be caused and remedial action could be necessary.

The results of the risk assessment are presented in Table 13.

[14] See 'Circular 2/2000 Contaminated Land: Implementation of Part II of The Environmental Protection Act 1990', appendix A.

Table 13: Conceptual Site Model and Site Specific Risk Assessment

Conceptual Site Model			Site Specific Risk Assessment	
Pathways	**Receptor**	**Linkage Present?**	**Risk Rating**	**Notes**
Direct contact/dermal absorption/soil ingestion	Operative	Yes – asbestos contamination found to be present at the site and contact with soil likely during works.	High	Some contamination is present in the soils underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – asbestos contamination found to be present at the site and site to be developed by construction of a new waste water treatment plant.	High	
	Neighbours	Yes – contamination found to be present and adjacent industrial properties are present.	Low	However, as the site is anticipated to be secured during the development phase and asbestos contamination is not anticipated to be mobile.
Inhalation of Dust/Vapours	Operative	Yes – dust may be derived from asbestos contaminated soils. However, no significant vapours were detected on site during PID monitoring.	High (Dust) Low (Vapours)	Some contamination is present underlying the site. Precautionary measures will be required during the construction phase. Remediation will be required to either remove the contamination or break pathways.
	End User	Yes – dust may be derived from asbestos contaminated soils. However, no significant vapours were detected on site during PID monitoring.	High (Dust) Low (Vapours)	
	Neighbours	Yes – asbestos contamination found to be present at the site and industrial properties located within 250m radius of the site and possible inhalation of dust during the works.	High (Dust) Low (Vapours)	
Ingestion of fruit/vegetables and/or waters	Operative	Yes – no edible plants are present on site. However, contaminated perched water is present within the made ground which may pose a risk to operatives during site works.	Low (Vegetation) High (Water)	
	End User	Yes – no garden areas are proposed as part of the new development. However, contaminated perched water is present within the made ground.	Low	However, end users are not anticipated to come into contact with the contaminated perched water.
	Neighbours	No – no residential properties or garden areas adjoin the site.	N/A	
Migration of hazardous gases via permeable strata or shallow mining activity	Operative	Yes – high concentrations of methane and carbon dioxide have been found to be present at the site.	High	Further testing to be undertaken. Remediation will be required to either remove the contamination or break pathways. Particular note should be paid to the risks posed to operatives should the groundworks necessitate the installation of piles through methane rich stratum.
	End User		High	
	Neighbours		High	

Spillage/loss/run off direct to receiving water	Controlled Waters	Yes – contaminated perched water is present within the made ground. However, the site is underlain by cohesive soils of low permeability through which the perched water is not anticipated to be significantly mobile.	Low	Controlled waters present within 250m. A Principal aquifer is present below the site.
Migration via permeable unsaturated strata	Controlled Waters	Yes – contaminated perched water is present within the made ground. However, the site is underlain by cohesive soils of low permeability through which the perched water is not anticipated to be significantly mobile.	Low	
Run off via drainage/sewers etc	Controlled Waters	Yes – old services may be present on site and contaminated perched water is present within the made ground.	High	Old services to be removed or capped.
Direct contact with contaminated soils	Plants	No – no garden areas are proposed as part of the new development	N/A	
Uptake via root system			N/A	
Direct contact with contaminated soils	Building Materials	Yes – minor PAH contamination revealed at the site may represent a risk to building materials or plastic water pipes. Moreover, testing indicates that the aggressive chemical environment for concrete classification is AC-2s.	Moderate (plastic services) Moderate (buried concrete)	Please see section 11.3.3 for information on good building practice.
Direct contact with contaminated groundwater				
Exposure to Radon	Operative End User	No – Not in a radon affected area.	N/A	Less than 1% of properties are above the action level. No radon protection measures required.

11.3 Indicative Remediation Strategy

In view of the site specific risk assessment it is considered that remediation will be required at this site. Such a strategy should include the following main elements.

11.3.1 Remediation Objectives

Based on the site specific risk assessment the object of the remediation is likely to be as follows.

- To protect the site operatives during the construction process from the ingestion of soil or dust, dermal contact with the soil and inhalation of dust.
- To protect the end user from the ingestion of soil or dust and dermal contact with the soil.
- To protect neighbours from the inhalation and ingestion dust during the construction process.
- To protect operatives, from the ingestion of contaminated waters.
- To ensure that contamination cannot enter the former services occupying the site which may return to controlled waters.
- To protect plastic services from being penetrated by, or degrading due to the presence of, contamination in the soil or groundwater.

11.3.2 Development Requirements

Whilst the precise nature of this development has not been finalised it is understood that it is to be developed by the construction of a new waste water treatment plant with associated access roads. In view of the above a site specific remediation strategy should be undertaken after the proposed development has been finalised. However, for preliminary design and costing the following remediation proposals are offered.

11.3.3 Outline Strategy

In order to fulfil the objectives defined above it is likely that the following remedial strategy could be utilised. It is recommended that a pragmatic approach be undertaken, with observational techniques being employed at each stage of the work.

Ground-works

During the ground-works phase of the development, protection to the site operatives is required. The risk to site operatives is considered under the Health and Safety at Work Act 1974, together with regulations made under the act, which includes the Control of Substances Hazardous to Health (COSHH) regulations. Therefore the risks to site personnel must be considered under the Construction Design and Management (CDM) regulations at the planning stage and be included in the contractor's

Health and Safety Plan and site specific Method Statements. These documents should include the following main elements.

- Site operatives at all levels should be made aware of the hazards of working with contaminated soils and waters.
- Site operatives at all levels should be made aware of the hazards of working in an area where accumulations of bulk ground gasses (carbon dioxide or methane) could occur.
- Site operatives should be made aware of hazards of working in an area where with potentially flammable levels of methane may occur.
- Personal hygiene facilities, including washing and messing, must be provided and site operatives be encouraged to use them.
- Where work is undertaken in dry weather the site should be dampened down to avoid dust. In addition.
- Dust masks must be provided to all site operatives for use at all times.
- Any stockpiles of contaminated soil on site should be sheeted over to prevent excessive amounts of airborne dust and cross contamination of imported fill.
- Where vehicles are transferring soil to the landfill site they should be covered to prevent contamination of the surrounding area by dust.
- Where work is undertaken in wet weather, vehicle and wheel washing facilities are required to ensure that the vehicles leaving the site do not transfer contamination to surrounding areas.
- Undertake risk assessments in relation to the presence of asbestos within parts of site and ensure appropriate PPE is provided or protection measures undertaken where necessary, particularly if workers undertaking excavations of potentially asbestos contaminated soils.
- Undertake risk assessments with regards to the presence of high levels of carbon dioxide and methane in the subsurface. This should include, but may not be limited to the following;
    - It will be necessary to ensure that site operatives are equipped with appropriate personal carbon dioxide and methane detector at all times.
    - In particular, extra care should be afforded where site operatives are entering confined spaces or activities where the peat layer may be broken/exposed.
    - No exposed lights (e.g. smoking and welding) should be permitted around the areas of open surface workings.
    - Where methane is detected, it will be necessary to cease work and undertake further risk assessment.

On completion of the ground-works a careful site inspection of the sub-grade would be required. Should visual or olfactory evidence of contamination be revealed then further testing may become necessary.

Construction

During the construction phase of the contract the following items are required to protect the end user from the potential contaminants revealed at this site.

- Beneath buildings, pavements and hard-standings clean inert granular sub-base should be employed.
- Any redundant services revealed at this site should be de-commissioned and piped services sealed. Any existing services that are to be employed in the new development should be carefully inspected to ensure that they are serviceable.

- New plastic services should be constructed in a surround of clean inert material and selected in accordance with the recommendation given in the United Kingdom Water Industry Research (UKWIR) website under Report Ref. No. 10/WM/03/21 - 'Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites'. The statutory water authority for the area in which site is located may have a risk assessment form to complete which allows these recommendations to be met. However, further determinand specification contamination testing may be necessary.
- For buried concrete the results of the sulphate and pH testing indicate that the design sulphate class for the site should be DS-2.

Gas Protection Measures

In order to assess the protection measures required BS8485: 2015: *Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* has been employed. In accordance with Table 3, *Building types,* of the code, the development may be considered to conform to Type C. Therefore, on the basis of Table 4 *Gas protection score by CS and type of building,* and on the basis that the site is classified as Characteristic Situation Level 2, the minimum gas protection score (points) is 2.5. The gas protection system should consist of at least two different elements. The elements work independently and collaboratively, and a single element should not be used because there would be no redundancy to allow for defects in the component.

In order to achieve this score and based on the assumption that a fully suspended floor-slab will be utilised (based on geotechnical recommendations) the following should be undertaken.

Table 14: Combination of protection elements (BS8485: 2015) for CS2

Reference	Protection Element	Score
Table 5	*Precast suspended segmental sub-floor (i.e. beam and block).*	0
Table 6[15]	*Pressure relief pathway*[16] *(usually formed of low fines gravel with a thin geocomposite blanket or strips terminating in a gravel trench external to the building)*	0.5
	Passive sub-floor dispersal layer ***(Note 1)****:* *Good Performance* *Very good performance*	 1.5 2.5
Table 7	*Gas resistant membrane complying with the requirements given in Table 7 (****Note 2****)*	2
	Total Score	**Min: 2.5** **Max: 4.5**

Note 1:
The gas resistant membrane shall meet the following criteria (from Table 7, BS 8485: 2015):

- Sufficiently impervious (methane gas transmission rate <40.0ml/day/m^2/atm (average) BS ISO 15105-1 manometric method).
- Sufficiently durable and strong to remain serviceable for the anticipated life of the building, to withstand in-service stresses and installation process.

[15] For details on the criteria for good and very good performance see Annex B of BS84845: 2015.
[16] If the layer has a low permeability and/or is not terminated in a venting trench (or similar), then the score is zero.

- Capable, after installation, of providing a complete barrier to the entry of the relevant gas.
- Verified in accordance with CIRIA C735: 2014: *Good practice on the testing and verification of protection systems of buildings against hazardous ground gasses.*
- Chemically resistant to degradation by other contamination that might be present (including TPHs and PAHs as revealed within this investigation).

Installation of Hardstanding

It is currently understood that the site is to be mainly capped by hardstanding at the surface. In light of the nature of the contamination revealed on site it is considered that areas where hard-standing is installed, this will serve to enclose any asbestos contaminated soils and/or perched waters such that no further remediation would be required.

Landscaped Areas

Notwithstanding the above, in view of the potential contamination on site it is considered that, in areas where soft landscaping is to be employed, these areas will require some remediation. This could include the provision of a clean cover system including a capping layer of say 500mm of inert material, which will put the contaminated ground out of the end users' dig range. At the base of this layer, a granular capillary break of say 100mm of free draining granular soil should be placed in order to prevent mobile contamination rising upward. This expedient should also provide a suitable root barrier to isolate the plants from the underlying contaminated ground.

Furthermore, it may be prudent to employ an impermeable membrane around the edges clean cover system to prevent the intrusion of any contaminated perched water.

11.4 Fill Materials

It should also be appreciated that any fill material, either site-won or imported, to be employed at the site should be subjected to the following assessment to determine its suitability.

Fill materials should be initially screened, by a suitably qualified engineer to establish that:

- It is a suitable growing media if it is to be employed as such, including compliance with BS3883 (2007)
- It is free from obvious contamination i.e. visual or olfactory evidence
- It has not come from areas where Japanese Knotweed or other invasive or injurious plants are suspected to be growing
- It is not a statutory nuisance, such as being odorous
- It is free from unsuitable material i.e. whole bricks, brick ties, timber or glass.

It should also be appreciated that any fill should be subjected to validation testing to assess its suitability. The following table has been taken from YALPAG[17] documentation and may be used as a

[17] *YALPAG Technical Guidance for Developers, Landowners and Consultants – Verification Requirements for Cover Systems V3.3* Appendix 1a, October 2016.

guide. Depending on the origin and nature of the material, not all fill will require the sampling frequency and testing indicated, although this should be in agreement with any regulatory bodies (such as the Local Authority).

Table 15: Validation Sampling and Testing

Fill Type	Frequency	Minimum Determinands
Virgin Quarried Material	1 or 2 depending on the type of stone (to confirm the inert nature of the material)	Standard metals/metalloids (As, Cd, Cr, Cr(VI), Cu, Hg, Ni, Pb, Se, Zn)
Crushed Hardcore, Stone, Brick	Minimum 1 per 1000m³	Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos
Greenfield/ Manufactured Soils	The greater of a minimum of 3 or 1 per 250m³	Standard metals/metalloids as above plus PAH (16 USEPA) and Asbestos
Brownfield/ Screened Soils	The greater of a minimum of 6 or 1 per 100m³	Standard metals/metalloids as above plus PAH (16 USEPA), TPH (CWG banded) and Asbestos Any additional analysis dependant on the history of the donor site.

The screening values for the above regime should also be agreed with any regulatory bodies; however, the following is recommended in the first instance.

Table 16: Fill Screening Values

Contaminant	Screening Value (Commercial) (mg/kg)		Reference
	1% SOM	6% SOM	
As	635	635	Atrisk^{SOIL} SSVs
Cd	410	410	Atrisk^{SOIL} SSVs
Cr(VI)	19.7	19.7	Atrisk^{SOIL} SSVs
Cu	106000	106000	Atrisk^{SOIL} SSVs
Hg	350	405	Atrisk^{SOIL} SSVs
Ni	1770	1770	Atrisk^{SOIL} SSVs
Pb	2310	2310	Atrisk^{SOIL} SSVs
V	7490	7490	Atrisk^{SOIL} SSVs
Zn	1100000	1100000	Atrisk^{SOIL} SSVs
TPH CWG	See attached summary sheet		Atrisk^{SOIL} SSVs
PAH 16 USEPA	See attached summary sheet		Atrisk^{SOIL} SSVs

Please see summary sheet within Appendix 5 for full screening values including PAHs & TPHs.

The above screening values should be considered with respect to the Soil Organic Matter (SOM) of the subject material i.e. 1% SOM would be typical for granular fill and 6% SOM for topsoil. Testing should comply with UKAS and MCERTS, where applicable, and undertaken by an accredited laboratory.

Where the material has been derived from a commercial company, certificates or other industry quality protocol compliance i.e. WRAP should be obtained. However, it will be necessary to ensure that this documentation specifically related to the material being imported, it is no more than two months old and complies with the screening and frequency requirements given above.

Suitable fill materials should be either placed immediately or sufficiently quarantined to prevent cross-contamination. If it is necessary, the quarantined material should be placed on appropriate sheeting and covered to prevent it becoming mixed with contaminated soils or dust, or penetrated by mobile contaminants.

11.5 Verification Report

In order to demonstrate that the remedial works and provision of clean cover has been sufficiently carried out where applicable, it will be necessary to produce a verification report for submission to any statutory authorities.

It will be necessary for this report to include the following;

Ground Works

- Evidence of the extents of any areas where made ground has been wholly removed.
- Photographic evidence of the installation of any new hardstanding.
- A record of the measures taken to cap and seal any disused services.
- The methods used for handling and final destination of any contaminated soils removed from the site.
- The qualifications or relevant experience/training of the persons carrying out the verification.

Ground Gas Protection System

In order to assess the performance of the ground gas protection, verification of the system will be carried out throughout the installation process and the following will be included in a report to be produced at the end of the construction process:

- The qualifications or relevant experience/training of the persons carrying out the installation.
- The independence of the person carrying out the verification, along with evidence of their qualifications or relevant experience/training.
- Details of the verification process including the dates of inspections and findings.
- Signed statements to confirm that protection measures were constructed as agreed. These statements shall also include confirmation that:
    - Membranes were free from tears and punctures, and installed in accordance within manufacturer guidelines.
    - Underfloor voids were clear and free from debris.
- Clear photographic evidence of the construction of membranes and/or underfloor voids, which should include key details such as air vents, membrane penetrations etc.
- Details of non-conformances and how they were rectified.
- A declaration that remedial objectives set out in the conceptual site model have been achieved.

Imported Fill

- Characterisation of the suitability of the clean material including the derivation of the material, comments from a visual screen, the tests results of chemical screening, delivery tickets where appropriate and the conditions by which the clean material has been stored and handled on site.
- Photographic and logged evidence the clean material has been handled on site and placed in a sufficient thickness over areas where made ground remains. This may be either at the time of placement or after placement by means of hand excavated trialpits. Photographs should include visual site references or reference boards to prove the location and date taken. A measurement reference should be visible in the photographs to substantiate the thickness of material placed. Please note that it may also be necessary to undertake a topographical survey and the requirement for which should be checked with any statutory authorities.

The report detailed above should be produced by a suitably qualified engineer. The number of verification areas for the development should be confirmed with any statutory authorities for the site.

12. Recommendations for Further Work

- This report should be forwarded to the relevant authorities as soon as practicable to ensure they have sufficient time to review and discuss any issues.
- Discussions with piling contractors regarding their method for installing piles.
- Discussions with ground work contractors in relation to the disposal of materials to off-site landfills.
- Discussions with service providers regarding suitable materials for pipe work given the nature of chemical determinands found within the soils on site.
- Discussions with contractors in relation to the suitability of materials and installation methods for gas protection measures.
- Produce a validation report to demonstrate that the geo-environmental risks discussed in this report have been mitigated.
- Detailed design of the sub-structure.

Clearly Rogers Geotechnical Services Ltd would be happy to offer advice with respect to the above and assist where necessary.

13. References

- British Geological Survey (NERC) (2020), BGS, Keyworth.
  - Geology of Britain Viewer: (*http://maps.bgs.ac.uk/geologyviewer_google/googleviewer.html)*
  - Lexicon of Named Rock Units:
  - (*http://www.bgs.ac.uk/lexicon/)*

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- British Standard Institution (2005 +A1: 2011) BS EN ISO 22476-2: *Geotechnical investigation and testing – Field testing, Part 2: Dynamic Probing,* B.S.I., London.

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- British Standards Institution (2015) BS5930: *Code of practice for site investigations,* B.S.I., London.

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- British Standards Institution (2017) BS EN ISO 14688: *Geotechnical investigation and testing – Identification and classification of soil*, B.S.I., London.

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  - Part C: *Assessing the aggressive chemical environment.*
  - Part D: *Specifying concrete for general cast-in-situ use.*

- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – Final SC050021/SR2, *Human Health toxicological assessment of contaminants in soil*. Environment Agency, Bristol.

- Department for Environment, Food and Rural Affairs and the Environment Agency (2009) DEFRA Science Report – SC050021/SR3, *Updated technical background to the CLEA model*. Environment Agency, Bristol.

- Department for Environment, Food and Rural Affairs (2014) SP1010: *Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*.

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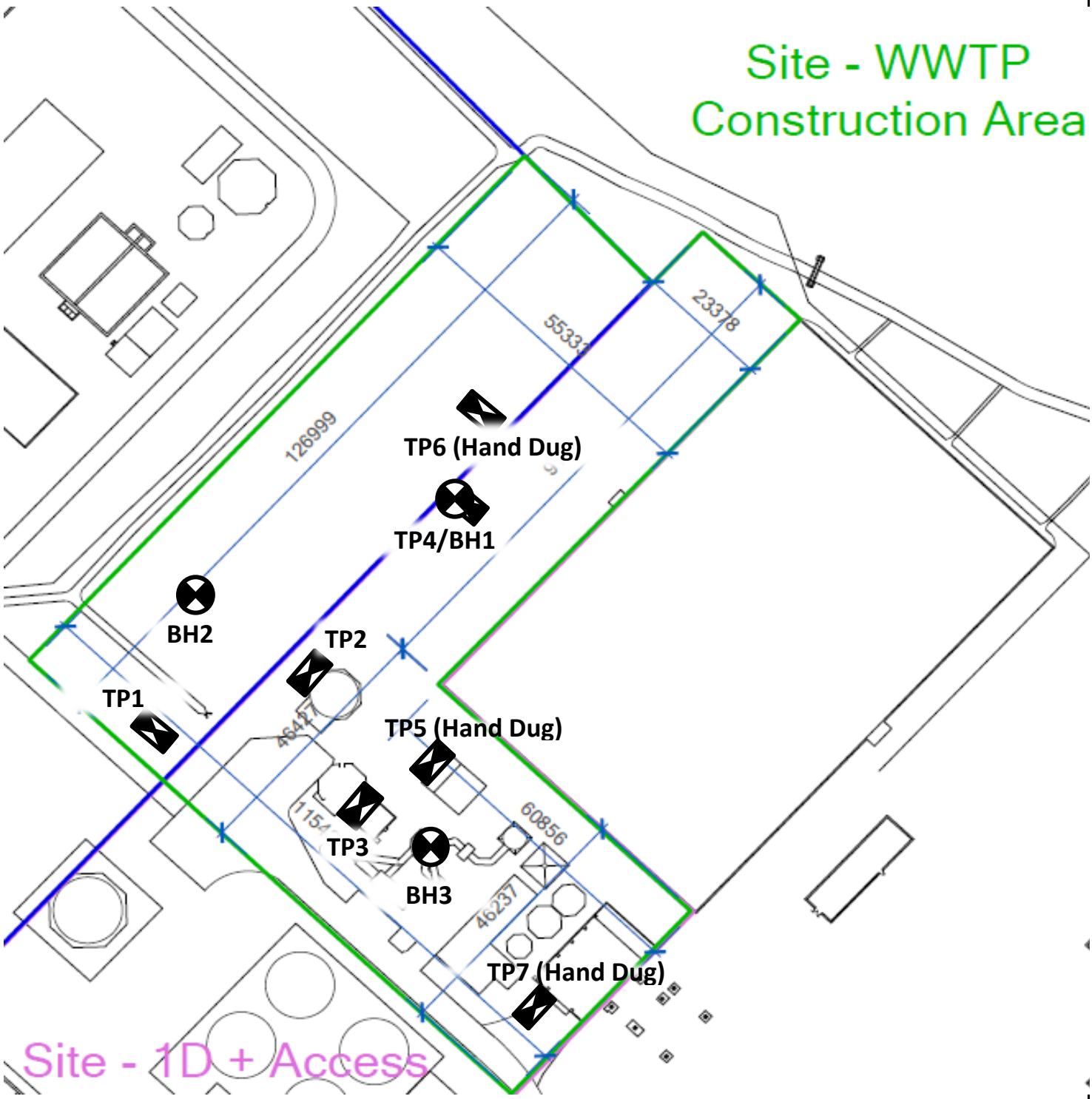
Environmental
Geotechnical
Specialists

Appendix 1

Site Plan



Plan not to scale and investigation positions approximated from site operative's notes.

Title: **Preliminary Investigation Location Plan**

Rogers Geotechnical Services Ltd	Site Name: **Lenzing Fibres**	Job No: **C177/19/E/269**

Title: **Investigation Location Plan for Lenzing Fibres Wastewater Treatment Plan**

Rogers Geotechnical Services Ltd	Site Name: New Waste Water Treatment Plant, Lenzing Fibers Ltd, Energy Park Way, Grimsby, DN31 2TT	Job No: C177/19/E/268

Appendix 2

Borehole Records

Borehole Log

Borehole No. **BH1**

Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 29/11/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
	▼							MADE GROUND (Brown and red clayey sandy GRAVEL. Gravel is fine to coarse subangular of ash and concrete).
					0.50			CONCRETE.
					1.00			End of Borehole at 1.000m

Remarks

Borehole Log

Borehole No. **BH1A**

Sheet 1 of 3

Project Name:	Lenzing Fibres	Project No. C177/19/E/283	Co-ords:
Location:	Energy Park Way, Grimsby, DN31 2TT		Level:
Client:	ACWA Services Ltd		Dates: 05/12/2019 - 09/12/2019

Hole Type: CP

Scale: 1:50

Logged By: MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								MADE GROUND (Backfilled trial pit, see description for TP4).
					2.80			Very soft greyish brown sightly gravelly organic CLAY. Gravel is subrounded to subangular fine of chalk.
		3.50 - 3.70	D					
		3.50	SPT	N=3 (0,1/1,0,1,1)				
		4.50 - 4.95	U					
		6.00	SPT	N=2 (0,0/0,1,0,1)				
		7.00 - 7.45	D					
					8.30			Soft greyish brown mottled black clayey PEAT.
		9.00	SPT	N=4 (0,1/1,0,1,2)				
					10.00			Continued on Next Sheet

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Borehole No. **BH1A**

Sheet 2 of 3

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 05/12/2019 - 09/12/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								Very soft greyish brown CLAY.
		10.50	SPT	N=24 (3,4/6,5,7,6)	10.50			Firm brown silghtly sandy sightly gravelly CLAY. Gravel is subrounded to subangular fine of chalk.
								10.6 to 10.9m: Lens of loose yellow sandy GRAVEL
		12.00	SPT	N=28 (3,4/7,7,7,7)				
		13.50 - 13.95	D					
		15.00	SPT	N=31 (3,4/7,8,8,8)				
					17.20			Medium dense brown clayey SAND.
		18.00	SPT	N=10 (2,3/3,3,2,2)	17.80			Medium dense light brown clayey gravelly SAND. Gravel is subrounded to subangular fine of mixed lithologies.
					18.90			Firm to stiff brown sandy gravelly CLAY. Gravel is subrounded to subangular fine of mixed lithologies.
								Continued on Next Sheet

11 12 13 14 15 16 17 18 19 20

Remarks

Borehole Log

Borehole No. **BH1A**

Sheet 3 of 3

Project Name:	Lenzing Fibres	Project No. C177/19/E/283	Co-ords:
Location:	Energy Park Way, Grimsby, DN31 2TT		Level:
Client:	ACWA Services Ltd		Dates: 05/12/2019 - 09/12/2019

Hole Type: CP

Scale: 1:50

Logged By: MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					20.75			Medium dense becoming dense light yellow very clayey fine to coarse GRAVEL of chalk.
		21.00	SPT	N=30 (4,5/7,7,8,8)				
		21.50	D					
		22.50	SPT	N=50 (6,7/10,12,14,14)				
		23.60	SPT	50 (12,12/50 for 160mm)	23.60			End of Borehole at 23.600m

21 22 23 24 25 26 27 28 29 30

Remarks

AGS

Borehole Log

Borehole No. **BH2**

Sheet 1 of 3

Project Name:	Lenzing Fibres	Project No. C177/19/E/283	Co-ords:
Location:	Energy Park Way, Grimsby, DN31 2TT		Level:
Client:	ACWA Services Ltd		Dates: 26/11/2019 - 28/11/2019

Hole Type: CP

Scale: 1:50

Logged By: MC

Well	Water Strikes	Samples and In Situ Testing: Depth (m)	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
								MADE GROUND (Loose black mottled orange gravelly SAND. Gravel is subrounded to subangular fine to medium of ash, clinker and brick.
								Becomes clayey
					0.80			MADE GROUND (Soft brown mottled orange sandy gravelly cobbely CLAY. Gravel is subangular fine of brick and concrete).
					1.30			Soft brown CLAY.
					2.20			Very soft greyish brown organic CLAY.
		2.50 - 2.95	D					
		2.50	SPT	N=4 (0,0/1,1,1,1)				
		3.50	SPT	N=3 (0,1/0,1,1,1)				
		6.00	SPT	N=2 (0,1/0,0,1,1)				
		8.50	D		8.50			Soft greyish brown mottled black clayey PEAT.
		9.00	SPT	N=5 (1,1/1,1,1,2)				
					9.40			Very soft becoming soft brown sandy slightly gravelly CLAY. Gravel is subrounded fine of chalk.
								Continued on Next Sheet

Remarks

Borehole Log

Borehole No. **BH2**

Sheet 2 of 3

Project Name:	Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location:	Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client:	ACWA Services Ltd		Dates: 26/11/2019 - 28/11/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
								10.6m-10.9m: Lens of greenish yellow sandy GRAVEL
		11.50	SPT	N=5 (1,1/1,1,1,2)	11.50			Loose brown clayey SAND.
					11.80			Firm to stiff brown slightly sandy slightly gravelly CLAY. Gravel is subrounded fine of chalk with some other lithologies.
		15.00	SPT	N=23 (3,3/5,5,5,8)				
		16.50 - 16.95	U					
		18.00 - 18.45	D		17.80			Medium dense light brown slightly clayey SAND.
		18.00	SPT	N=29 (4,4/5,7,8,9)				
		19.50 - 19.95	D					
		19.50	SPT	N=34 (3,4/7,8,8,11)	19.70			Stiff brown soft to firm sandy slightly gravelly
								Continued on Next Sheet

11 12 13 14 15 16 17 18 19 20

Remarks

AGS

Borehole Log

Borehole No. **BH2**

Sheet 3 of 3

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 26/11/2019 - 28/11/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		21.00	SPT	N=41 (5,5/9,11,10,11)				CLAY. Gravel is subrounded fine of mixed lithologies.
		22.00	SPT	N=42 (5,5/8,11,11,12)				
					22.45			End of Borehole at 22.450m

21 22 23 24 25 26 27 28 29 30

Remarks

AGS

Borehole Log

Borehole No. **BH3**

Sheet 1 of 3

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 29/11/2019 - 05/12/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		1.20 - 1.65	D					MADE GROUND (Soft brown sandy gravelly cobbly CLAY. Gravel and cobbles are subrounded to subangular fine to coarse of brick and clinker).
		1.20	SPT	N=6 (4,5/2,2,1,1)				
					1.60			
		2.30	SPT	N=2 (0,1/0,1,0,1)				Very soft brown slightly gravely CLAY, Gravel is subrounded of mudstone and chalk.
					2.55			Very soft greyish brown organic CLAY.
		3.50 - 3.75	D					
		4.50	SPT	N=3 (0,0/1,0,1,1)				
		6.00 - 6.45	U					
		7.50	SPT	N=4 (0,1/0,1,2,1)				
					8.00			Soft greyish brown mottled black clayey PEAT.
					9.30			Firm brown sandy gravelly CLAY. Gravel is subrounded fine of chalk.
								Continued on Next Sheet

1 2 3 4 5 6 7 8 9 10

Remarks

AGS

Borehole Log

Borehole No. **BH3**

Sheet 2 of 3

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 29/11/2019 - 05/12/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		10.50	SPT	N=11 (2,2/3,3,2,3)	10.70			Medium dense light brown clayey gravelly SAND. Gravel is subrounded to subangular fine of mixed lithologies.
					11.70			Firm brown sandy gravelly CLAY. Gravel is subrounded fine of chalk.
		13.50 - 13.95	D					
		13.50	SPT	N=21 (3,3/6,6,2,7)				
		15.00 - 15.45	U					
		16.50	SPT	N=32 (4,4/8,8,8,8)				
		18.50	D					*19.0m-20.2m: Lens of greenish yellow sandy GRAVEL*
		19.50	SPT	N=17 (2,3/5,4,4,4)				

Continued on Next Sheet

Remarks

Borehole Log

Borehole No. **BH3**

Sheet 3 of 3

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords:	Hole Type CP
Location: Energy Park Way, Grimsby, DN31 2TT		Level:	Scale 1:50
Client: ACWA Services Ltd		Dates: 29/11/2019 - 05/12/2019	Logged By MC

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
					21.20			Medium dense becoming dense yellow and light orange sandy fine to coarse surrounded GRAVEL of chalk with medium cobble content.
		22.50 - 22.95 22.50	D SPT	N=45 (8,8/11,10,12,12)				
		24.00	SPT	50 (12,13/50 for 255mm)				
		25.00	SPT	50 (12,13/50 for 195mm)				
		26.00	SPT	50 (25 for 200mm/50 for 200mm)				
					26.45			End of Borehole at 26.450m

21 22 23 24 25 26 27 28 29 30

Remarks

AGS

Appendix 3

Trial Pit Records

Trial Pit Log

Trialpit No **TP1**

Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 2.00	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							MADE GROUND (Brown clayey gravelly SAND. Gravel is subangular fine and medium of brick).
				1.10			Soft brown CLAY.
				2.00			End of pit at 2.00 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP2
Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 2.30	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼							MADE GROUND (Black gravelly SAND. Gravel is subrounded fine and medium of clinker and ash).
				1.00			Soft to firm brown CLAY.
				2.30			End of pit at 2.30 m

1 2 3 4 5 6 7 8 9 10

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP3
Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 2.30	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼				1.00			MADE GROUND (Brown sandy gravely cobbly CLAY. Gravel is subangular fine to coarse of brick)
				2.30			Soft to firm brown CLAY.
							End of pit at 2.30 m

1 2 3 4 5 6 7 8 9 10

Remarks:

Stability:

AGS

Trial Pit Log

Trialpit No **TP4**

Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 2.80	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							MADE GROUND (Brown sandy gravely CLAY. Gravel is subangular fine to coarse of brick)
				1.40			MADE GROUND (Brown and black sandy gravely cobbly CLAY. Gravel is subangular fine to coarse of brick).
▼				2.00			Very soft to soft brown CLAY (Possibly reworked)
				2.80			End of pit at 2.80 m

1 2 3 4 5 6 7 8 9 10

Remarks:

Stability:

AGS

Trial Pit Log

Trialpit No **TP5**

Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 0.10	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.10			MADE GROUND (Brown clayey gravelly SAND. Gravel is subangular fine of brick and concrete). End of pit at 0.10 m

Remarks:

Stability:

Trial Pit Log

Trialpit No **TP6**

Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 1.50	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				1.50			MADE GROUND (Brown organic silty CLAY). End of pit at 1.50 m

Remarks:

Stability:

Trial Pit Log

Trialpit No
TP7
Sheet 1 of 1

Project Name: Lenzing Fibres	Project No. C177/19/E/283	Co-ords: - Level:	Date
Location: Energy Park Way, Grimsby, DN31 2TT		Dimensions (m): Depth 0.25	Scale 1:50
Client: ACWA Services Ltd			Logged MC

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.25			MADE GROUND (Brown clayey gravelly SAND. Gravel is subangular fine of brick and concrete). End of pit at 0.25 m

1 2 3 4 5 6 7 8 9 10

Remarks:

Stability:

Appendix 4

Laboratory Testing

Environmental
Geotechnical
Specialists

LABORATORY REPORT

job number: C177/19/E/269	client ref:
site address: Lenzing Fibers Grimsby Ltd, Energy Park Way, Healing, Grimsby, Lincolnshire, DN31 2TT	client address: ACWA Services Ltd, Unit 9 Acorn Business Park, Keighley Road, Skipton, North Yorkshire, BD23 2UE
consultant:	
date scheduled: 18/12/2019	date issued: 08/01/2020
issued by: C J Norcliffe	job title: Laboratory Manager

Rogers Geotechnical Services Ltd **Telephone 01484 607 977**
Email jude.norcliffe@rogersgeotech.co.uk www.rogersgeotech.co.uk
Offices 1 & 2, Barncliffe Business Park, Near Bank, Shelley,
Huddersfield, West Yorkshire HD8 8LU.

GEOTECHNICAL ENVIRONMENTAL

8948

Environmental
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Schedule of UKAS Accredited Laboratory Tests

		Accredited (A)	Unaccredited (U)
1. CLASSIFICATION OF SOIL	**BS 1377-2:1990**		
1.1 Moisture content determination			
i) Oven drying	Pt 2 : 3.2	**A**	
ii) Saturation m/c of chalk	Pt 2 : 3.3		U
1.2 Index Properties			
i) Liquid limit – cone penetrometer	Pt 2 : 4.3	**A**	
ii) Plastic limit	Pt 2 : 5.3	**A**	
iii) Shrinkage limit	Pt 2 : 6.3		U
iv) Linear shrinkage	Pt 2 : 6.5	**A**	
1.3 Particle Density			
i) Gas jar	Pt 2 : 8.2		U
ii) Large pyknometer	Pt 2 : 8.3		U
iii) Small pyknometer	Pt 2 : 8.4		U
1.4 Density Tests			
i) Linear measurement	Pt 2 : 7.2	**A**	
ii) Immersion in water	Pt 2 : 7.3		U
iii) Water displacement	Pt 2 : 7.4		U
iv) Sand replacement	Pt 9 : 2.1, 2.2		U
v) Core cutter	Pt 9 : 2.4		U
1.5 Particle Size Distribution			
i) Dry Sieve	Pt 2 : 9.2	**A**	
ii) Wet Sieve	Pt 2 : 9.3	**A**	
iii) Sedimentation by pipette	Pt 2 : 9.4	**A**	
iv) Sedimentation by hydrometer	Pt 2 : 9.5		U
2. CHEMICAL TESTS	**BS 1377-3:2018**		
ii) Mass loss on ignition	Pt 3 : 4		U
3. COMPACTION RELATED TESTS	**BS 1377-4:1990**		
3.1 Dry density/moisture relationship			
i) 2.5kg rammer – 1 litre mould	Pt 4 : 3		U
- CBR mould	Pt 4 : 3		U
ii) 4.5kg rammer – 1 litre mould	Pt 4 : 3		U
- CBR mould	Pt 4 : 3		U
3.2 Moisture Condition Value			
i) Single point test	Pt 4 : 5.4		U
ii) MCV/moisture content relationship	Pt 4 : 5.5		U
3.3 California Bearing Ratio			
i) Undisturbed sample	Pt 5 : 7		U
ii) Recompacted sample	Pt 5 : 7		U
iii) Soaked, inc measurement of swell	Pt 5 : 7		U
4. COMPRESSIBILITY OF SOIL	**BS 1377-5:1990**		
i) One dimensional consolidation	Pt 5 : 3		U
ii) Swelling pressure test	Pt 5 : 3		U
5. SHEAR STRENGTH OF SOIL	**BS 1377-7:1990**		
i) Hand shear vane	Makers instructions		U
ii) Shear box (100mm square sample)	BS 1377 : Pt 7 : 4		U
iii) Triaxial – quick undrained	BS 1377 : Pt 7 : 8, 9		U
6. PERMEABILITY			
i) Falling head	K. H. Head Vol 2		U
ii) Constant head	BS 1377 : Pt 6 : 6		U
iii) Triaxial cell	BS 1377 : Pt 6 : 6		U
7. ROCK TESTS			
7.1 Classification Tests			
i) Natural moisture content	-		U
ii) Saturated moisture content	-		U
iii) Natural density	-		U
iv) Porosity	-		U
7.2 Strength Tests			
i) Point load index	ISRM '85		U
ii) Uniaxial compression test	ISRM '81		U

GEOTECHNICAL ENVIRONMENTAL

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Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

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Company No: 5130864

Summary of Classification Test Results

Project No.	Project Name
C177/19/E/269	Lenzing Fibres

Hole No.	Sample				Soil Description	Density bulk / dry Mg/m3		*w* %	Passing 425µm %	LL %	PL %	PI %	Particle density Mg/m3	Remarks
	Ref	Top	Base	Type										
BH1	6	3.50	3.70	D	Soft Brown Clay			48.0	100	51 -1pt	23	28		
BH1	7	7.00	7.45	D	Soft very gark grey CLAY			74.0	95	52 -1pt	26	26		
BH1	8	13.50	13.95	D	Brown slightly gravelly CLAY			19.0	88	28 -1pt	13	15		
BH1	9	21.50		D	Dark Brown CLAY			23.0	97	39 -1pt	18	21		
BH2	10	2.50	2.95	D	Dark brown CLAY			48.0	99	62 -1pt	27	35		
BH2	11	8.50		D	Very soft dark grey organic CLAY			142.0	100	145 -1pt	73	72		
BH2	13	19.50	19.95	D	Dark brown sandy CLAY			49.0	94	26 -1pt	14	12		
BH3	1	1.20	1.65	D	Slightly gravelly CLAY			41.0	93	57 -1pt	24	33		
BH3	2	3.50	3.75	D	Very soft dark brown mottled dark grey CLAY			62.0	100	54 -1pt	25	29		
BH3	3	13.50	13.95	D	Soft greyish brown silty CLAY			15.0	90	25 -1pt	13	12		
BH3	4	18.50	18.50	D	Soft dark brown CLAY			17.0	93	26 -1pt	14	12		

All tests performed in accordance with BS1377:1990 unless specified otherwise

Key			Date Printed	Approved By	Table
Density test	Liquid Limit	Particle density			1
Linear measurement unless :	4pt cone unless :	sp - small pyknometer	01/09/2020 00:00		
wd - water displacement	cas - Casagrande method	gj - gas jar			sheet
wi - immersion in water	1pt - single point test			Harry	1

Linear Shrinkage - Summary of Results

Project No.	Project Name
C177/19/E/269	Lenzing Fibres

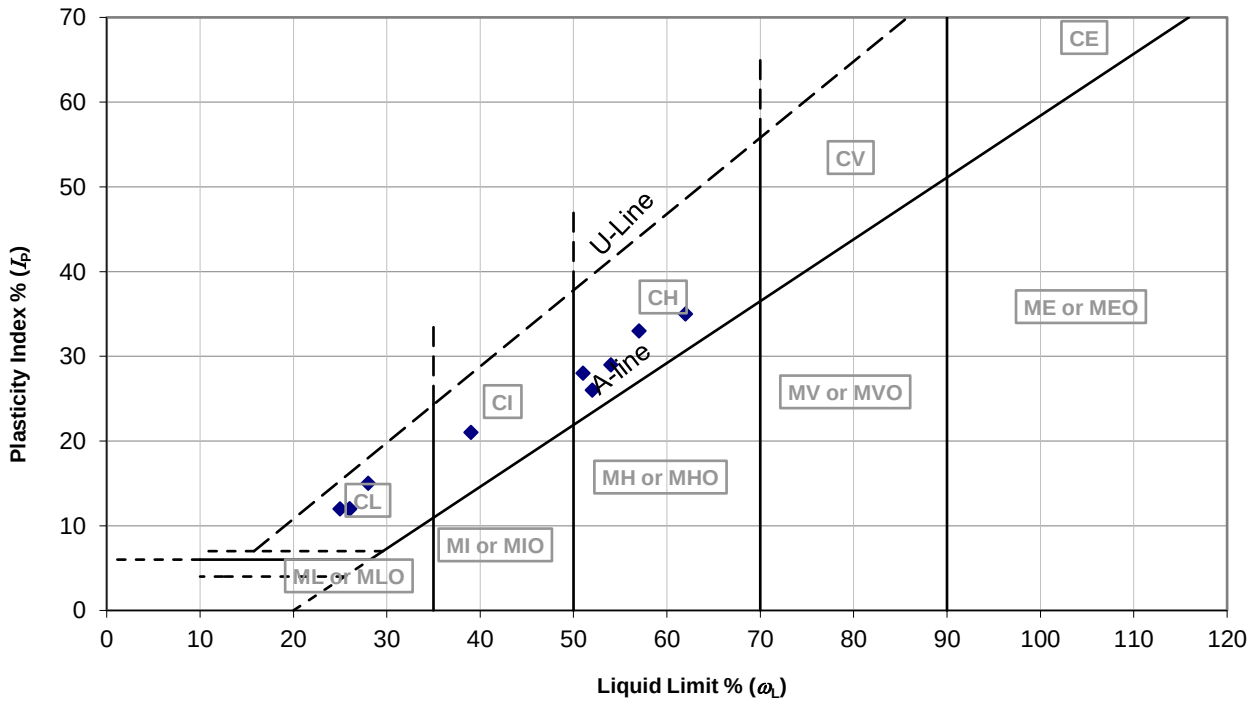
Hole No.	Sample				Soil Description	Material <425µm %	Preparation	Linear Shrinkage %	Date Tested
	Ref	Top	Base	Type					
BH1	6	3.50	3.70	D	Soft Brown Clay	100	Specimen prepared from natural material	13	17/12/2019
BH1	7	7.00	7.45	D	Soft very gark grey CLAY	95	Specimen prepared from natural material	13	17/12/2019
BH1	8	13.50	13.95	D	Brown slightly gravelly CLAY	88	Specimen prepared from natural material	8	17/12/2019
BH1	9	21.50		D	Dark Brown CLAY	97	Specimen prepared from natural material	10	17/12/2019
BH2	10	2.50	2.95	D	Dark brown CLAY	99	Specimen prepared from natural material	14	17/12/2019
BH2	11	8.50		D	Very soft dark grey organic CLAY	100	Specimen prepared from natural material	24	17/12/2019
BH2	13	19.50	19.95	D	Dark brown sandy CLAY	94	Specimen prepared from natural material	15	17/12/2019
BH3	1	1.20	1.65	D	Slightly gravelly CLAY	93	Specimen prepared from natural material	13	16/12/2019
BH3	2	3.50	3.75	D	Very soft dark brown mottled dark grey CLAY	100	Specimen prepared from natural material	13	16/12/2019
BH3	3	13.50	13.95	D	Soft greyish brown silty CLAY	90	Specimen prepared from natural material	8	16/12/2019
BH3	4	18.50	18.50	D	Soft dark brown CLAY	93	Specimen prepared from natural material	9	17/12/2019

Remarks:

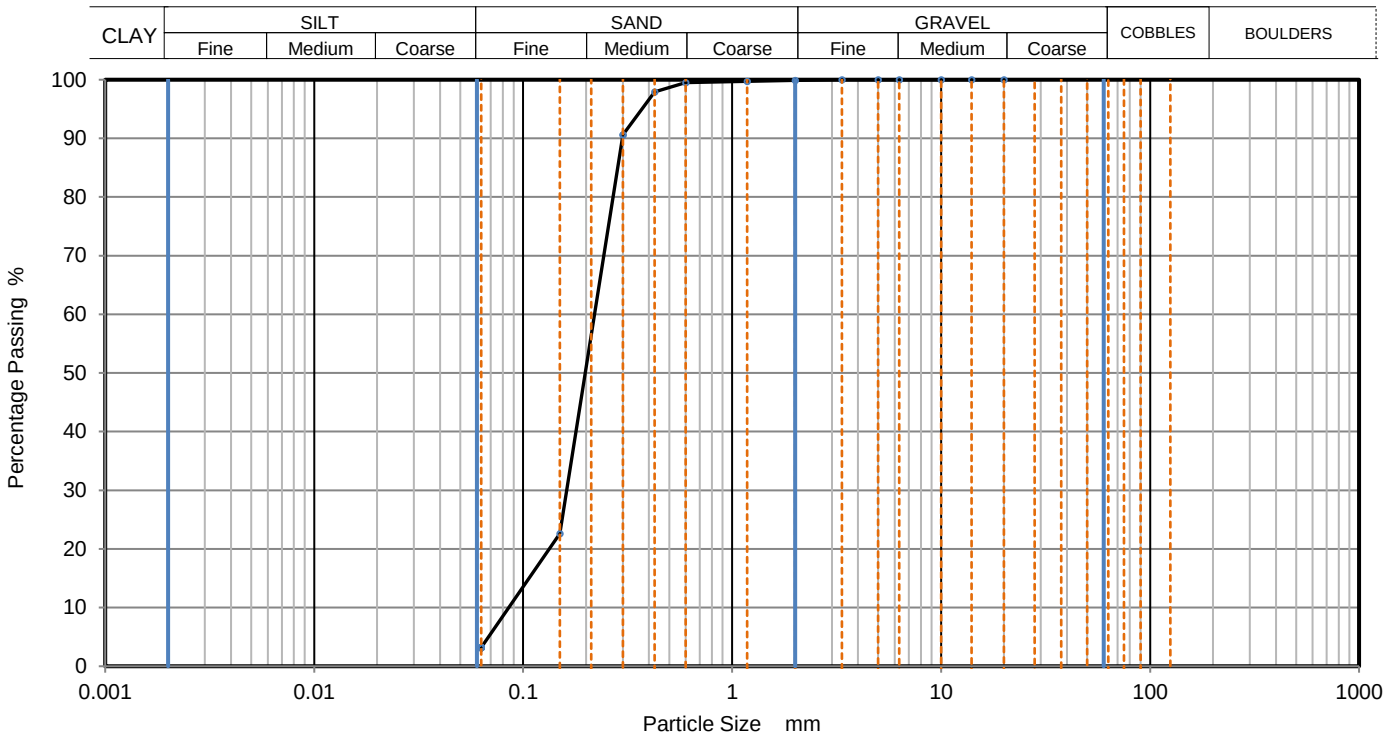
Notes	Date Printed	Approved By	Table
Tests performed in accordance with BS 1377 : Part 2 : 1990, clause 6.5 unless annotated otherwise	01/09/2020	Harry	2
			Sheet 1

Rogers Geotechnical Services Ltd. Offices 1&2, Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU	**Classification of Index Properties**	**C177/19/E/269**
Project Name: Lenzing Fibres	**B.S 1377: Part 2: 1990: 3.2, 4 and 5**	Fig. 3 Sheet. 1
Location:		Input By: Harry
Client:		Check By: Jude

Location	Depth (m)	Moisture Content (w) (%)	Liquid Limit (wL) (%)	Plastic Limit (wP) (%)	Plasticity Index (IP) (%)	Retained by 425mm (%)	Modified (w) (w') (%)	Modified (IP) (IP') (%)	Liquidity/ Consistency (IL) (%)	Liquidity/ Consistency (IC) (%)	Casagrande Class	N.H.B.C Class (%)
BH1	3.50	48	51	23	28	0	48	28	0.9	0.1	C H	MEDIUM
BH1	7.00	74	52	26	26	5	78	25	1.8	-0.8	C H	MEDIUM
BH1	13.50	19	28	13	15	12	22	13	0.4	0.6	C L	LOW
BH1	21.50	23	39	18	21	3	24	20	0.2	0.8	C I	MEDIUM
BH2	2.50	48	62	27	35	1	48	35	0.6	0.4	C H	MEDIUM
BH2	8.50	142	145	73	72	0	142	72	1.0	0.0	M E	HIGH
BH2	19.50	49	26	14	12	6	52	11	2.9	-1.9	C L	LOW
BH3	1.20	41	57	24	33	7	44	31	0.5	0.5	C H	MEDIUM
BH3	3.50	62	54	25	29	0	62	29	1.3	-0.3	C H	MEDIUM
BH3	13.50	15	25	13	12	10	17	11	0.2	0.8	C L	LOW
BH3	18.50	17	26	14	12	7	18	11	0.3	0.8	C L	LOW



	PARTICLE SIZE DISTRIBUTION			Job Ref	C177/19/E/269
				Borehole/Pit No.	BH2
Site Name	Lenzing Fibres			Sample No.	12
Soil Description	Clayey SAND			Depth, m	18.00
Specimen Reference	D12	Specimen Depth	18.0-18.45 m	Sample Type	D
Test Method	BS1377:Part 2:1990, clause 9.3			KeyLAB ID	12



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	100		
1.18	100		
0.6	100		
0.425	98		
0.3	91		
0.15	23		
0.063	3		

Dry Mass of sample, g	6919

Sample Proportions	% dry mass
Very coarse	0
Gravel	0
Sand	97
Fines <0.063mm	3

Grading Analysis		
D100	mm	
D60	mm	0.22
D30	mm	0.162
D10	mm	0.0855
Uniformity Coefficient		2.6
Curvature Coefficient		1.4

Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator	Checked	Approved	Sheet printed	Fig 4
Jude	Jude	Harry	09/01/2020	Sheet 1

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*4.0-4.50m*
Borehole number	*BH1A*	Sample type	*Undisturbed*
Sample number	*U4*	Specimen orientation	*Vertical*
		Specimen depth (m)	*4.10m*
Sample description	*Firm dark brown CLAY*		
Preparation method	*Prepared from a sample tube in accordance with BS 1377:2016:Part 1:Clause 9.6*		
Particle density (Mg/m³)	*2.65 (Assumed)*	Swelling pressure (kPa)	

INITIAL CONDITIONS	
Height (mm)	*20*
Diameter (mm)	*75*
Moisture content (trimmings) (%)	*56*
Bulk density (Mg/m³)	*1.65*
Dry density (Mg/m³)	*1.06*
Voids ratio	*1.501*
Degree of saturation (%)	*99*

Comments / variations from procedures:

Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*21/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*4.0-4.50m*
Borehole number	*BH1A*	Sample type	*Undisturbed*
Sample number	*U4*	Specimen orientation	*Vertical*

Average laboratory temperature (°C) *20* Method of time fitting *Log time*

Pressure stage (kPa)	Coefficient of consolidation c_v (m^2/year)	Coefficient of volume compressibility m_v (m^2/MN)	Coefficient of secondary compression c_{sec} (-)
0 - 74	*0.27*	*2.0*	-
74 - 148	*0.39*	*0.47*	-
148 - 296	*0.37*	*0.24*	-
296 - 592	*0.95*	*0.10*	-
592 - 74	-	-	-

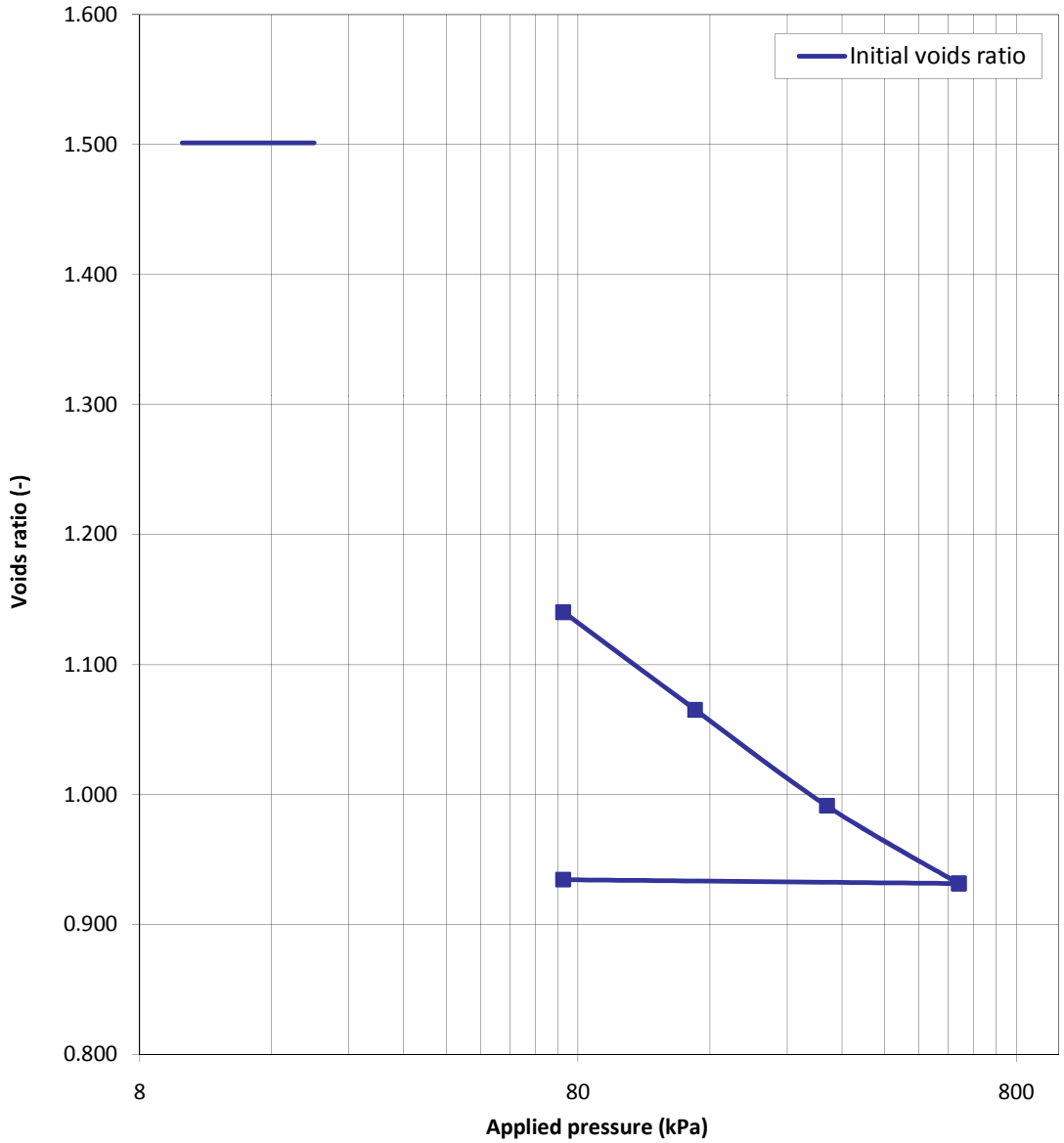
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*21/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*4.0-4.50m*
Borehole number	*BH1A*	Sample type	*Undisturbed*
Sample number	*U4*	Specimen orientation	*Vertical*



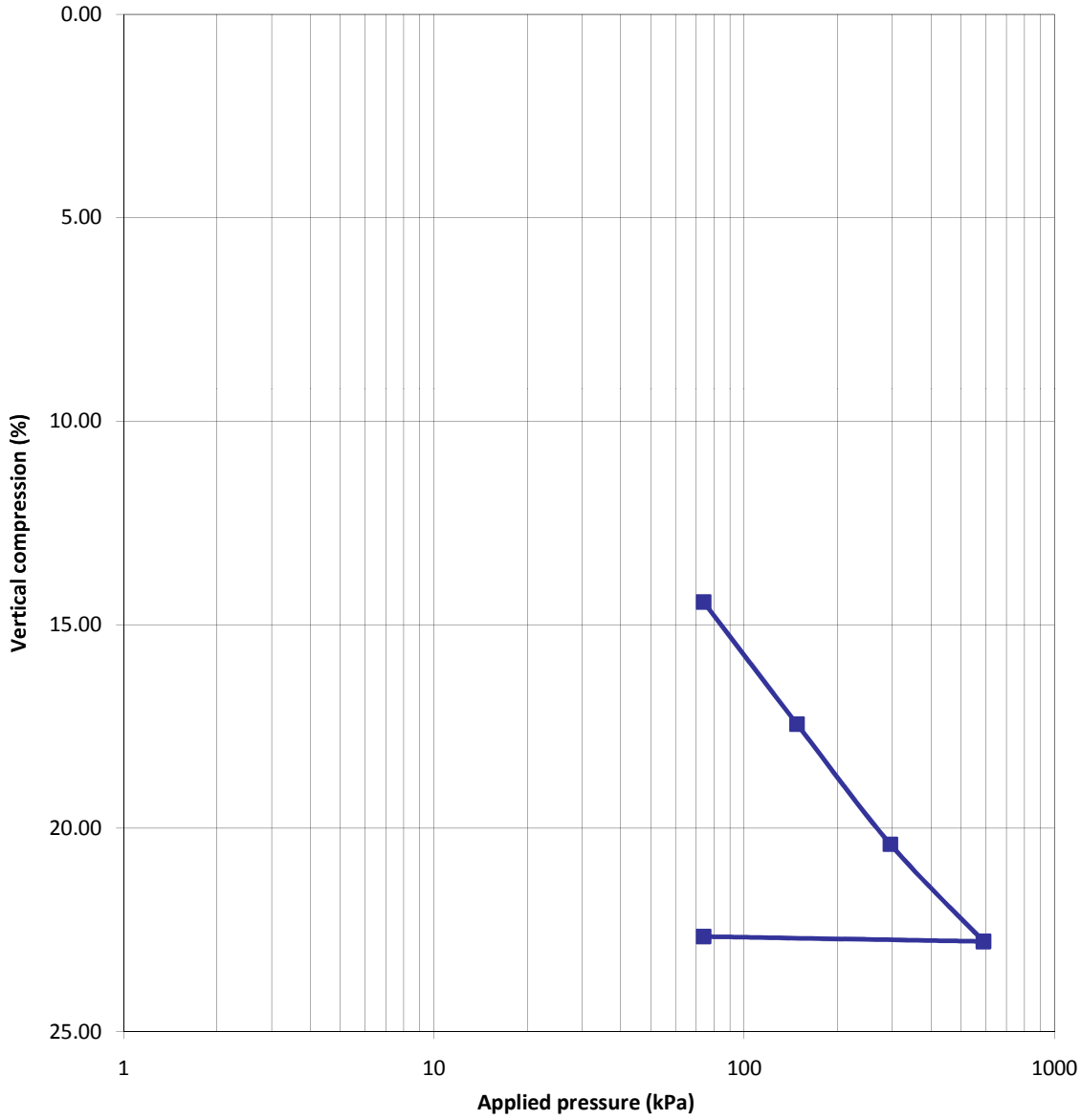
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*21/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*4.0-4.50m*
Borehole number	*BH1A*	Sample type	*Undisturbed*
Sample number	*U4*	Specimen orientation	*Vertical*



Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*21/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	*Lenzing Fibers*		
Project reference	*C177/19/E/269*	Sample depth (m)	*16.5-16.95*
Borehole number	*BH2*	Sample type	*Undisturbed*
Sample number	*U16*	Specimen orientation	*Vertical*
		Specimen depth (m)	*16.60*
Sample description	*Soft-firm brown slightly gravelly silty CLAY*		
Preparation method	*Prepared from a sample tube in accordance with BS 1377:2016:Part 1:Clause 9.6*		
Particle density (Mg/m³)	*2.65 (Assumed)*	Swelling pressure (kPa)	

INITIAL CONDITIONS	
Height (mm)	*20*
Diameter (mm)	*75*
Moisture content (trimmings) (%)	*12*
Bulk density (Mg/m³)	*2.24*
Dry density (Mg/m³)	*2.00*
Voids ratio	*0.325*
Degree of saturation (%)	*99*

Comments / variations from procedures:

Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*03/01/2020*	Date	*08/01/2020*	Date	*08/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	*Lenzing Fibers*		
Project reference	*C177/19/E/269*	Sample depth (m)	*16.5-16.95*
Borehole number	*BH2*	Sample type	*Undisturbed*
Sample number	*U16*	Specimen orientation	*Vertical*

Average laboratory temperature (°C)	*20*	Method of time fitting	*Log time*

Pressure stage (kPa)	Coefficient of consolidation c_v (m^2/year)	Coefficient of volume compressibility m_v (m^2/MN)	Coefficient of secondary compression c_{sec} (-)
0 - 330	*2.9*	*0.038*	-
330 - 660	*4.3*	*0.029*	-
660 - 1320	*4.8*	*0.018*	-
1320 - 2640	*5.8*	*0.012*	-
2640 - 330	-	-	-

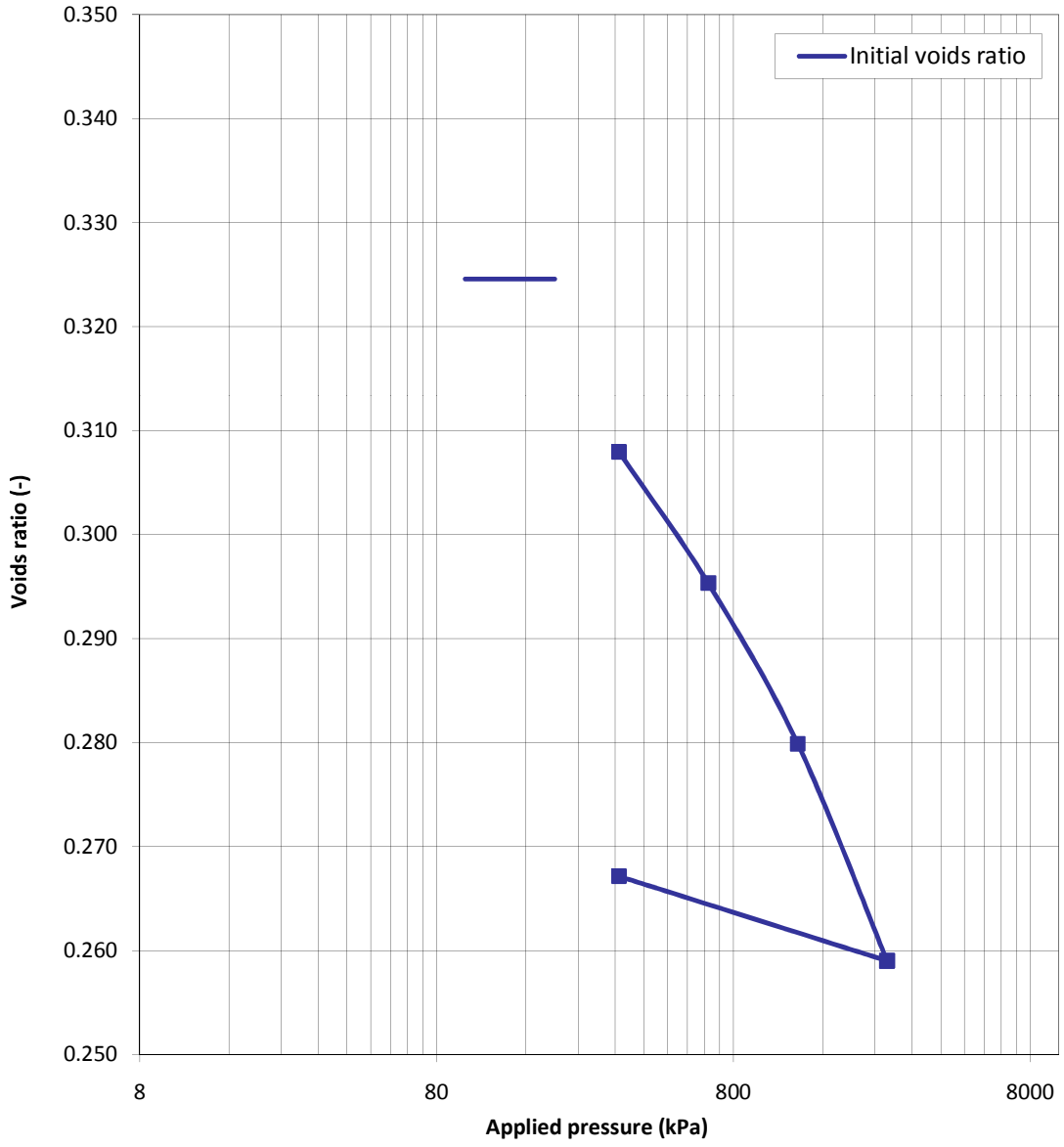
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*03/01/2020*	Date	*08/01/2020*	Date	*08/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	*Lenzing Fibers*		
Project reference	*C177/19/E/269*	Sample depth (m)	*16.5-16.95*
Borehole number	*BH2*	Sample type	*Undisturbed*
Sample number	*U16*	Specimen orientation	*Vertical*



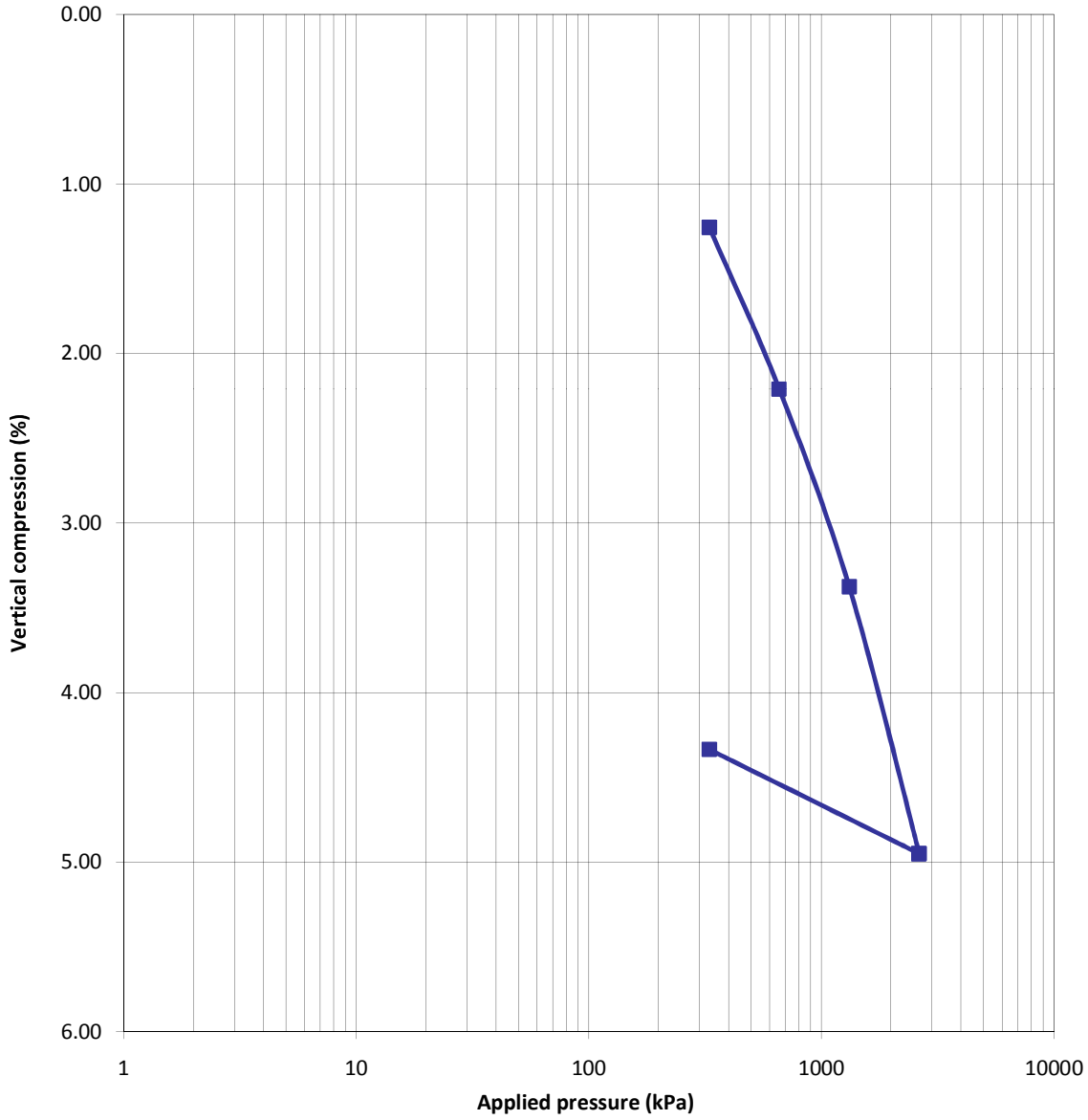
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*03/01/2020*	Date	*08/01/2020*	Date	*08/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	*Lenzing Fibers*		
Project reference	*C177/19/E/269*	Sample depth (m)	*16.5-16.95*
Borehole number	*BH2*	Sample type	*Undisturbed*
Sample number	*U16*	Specimen orientation	*Vertical*



Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*03/01/2020*	Date	*08/01/2020*	Date	*08/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*15.0-15.45*
Borehole number	*BH3*	Sample type	*Undisturbed*
Sample number	*U13*	Specimen orientation	*Vertical*
		Specimen depth (m)	*15.20*
Sample description	*Very soft-firm dark grey brown CLAY*		
Preparation method	*Prepared from a sample tube in accordance with BS 1377:2016:Part 1:Clause 9.6*		
Particle density (Mg/m³)	*2.65 (Assumed)*	Swelling pressure (kPa)	

INITIAL CONDITIONS	
Height (mm)	*20*
Diameter (mm)	*75*
Moisture content (trimmings) (%)	*16*
Bulk density (Mg/m³)	*2.15*
Dry density (Mg/m³)	*1.85*
Voids ratio	*0.431*
Degree of saturation (%)	*99*

Comments / variations from procedures:

Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*20/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*15.0-15.45*
Borehole number	*BH3*	Sample type	*Undisturbed*
Sample number	*U13*	Specimen orientation	*Vertical*

Average laboratory temperature (°C) *20* Method of time fitting *Log time*

Pressure stage (kPa)	Coefficient of consolidation c_v (m²/year)	Coefficient of volume compressibility m_v (m^2/MN)	Coefficient of secondary compression c_{sec} (-)
0 - 305	*1.4*	*0.14*	-
305 - 610	*1.9*	*0.067*	-
610 - 1220	*2.4*	*0.033*	-
1220 - 2440	*2.7*	*0.018*	-
2440 - 305	-	-	-

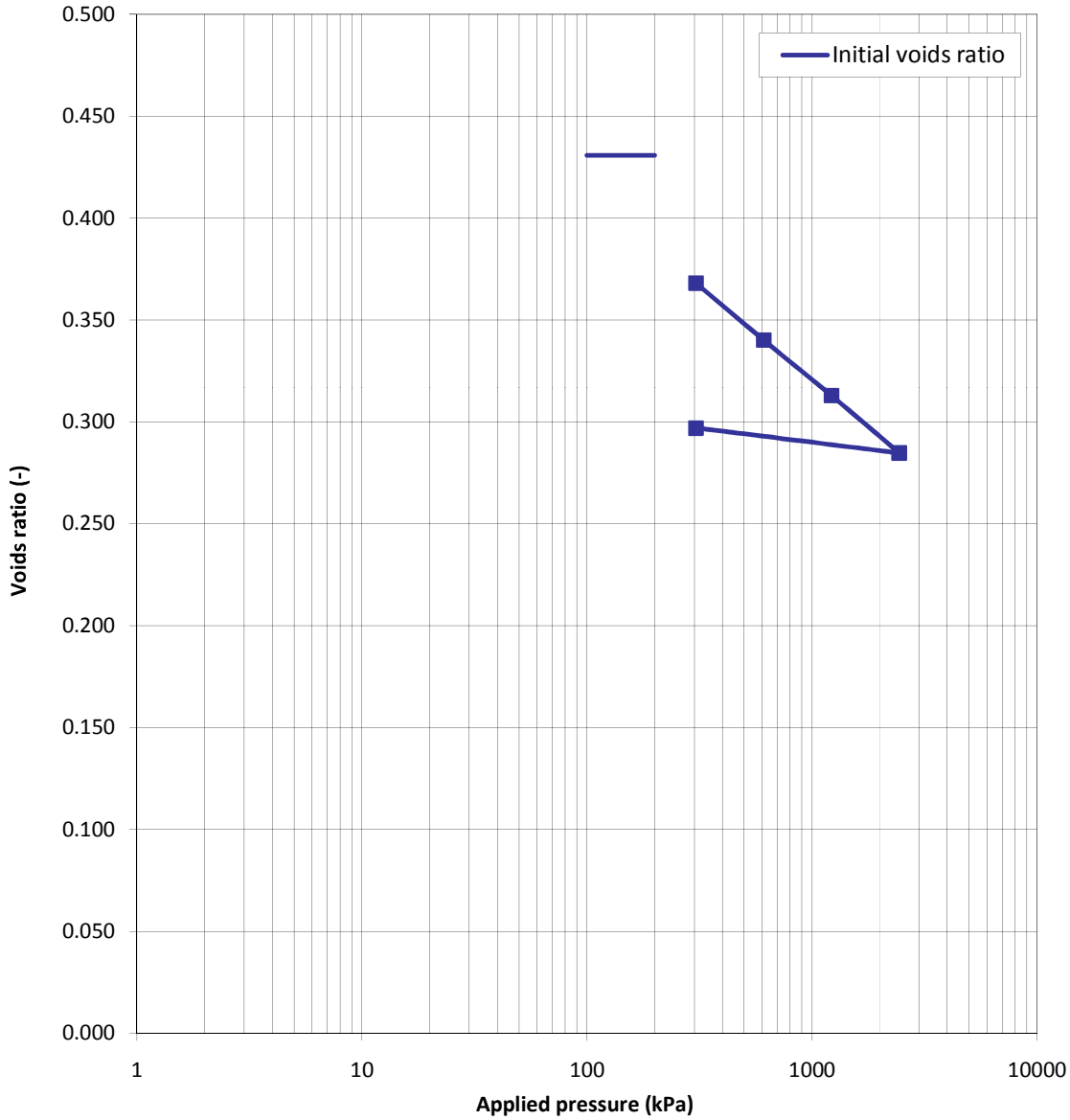
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*20/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*15.0-15.45*
Borehole number	*BH3*	Sample type	*Undisturbed*
Sample number	*U13*	Specimen orientation	*Vertical*



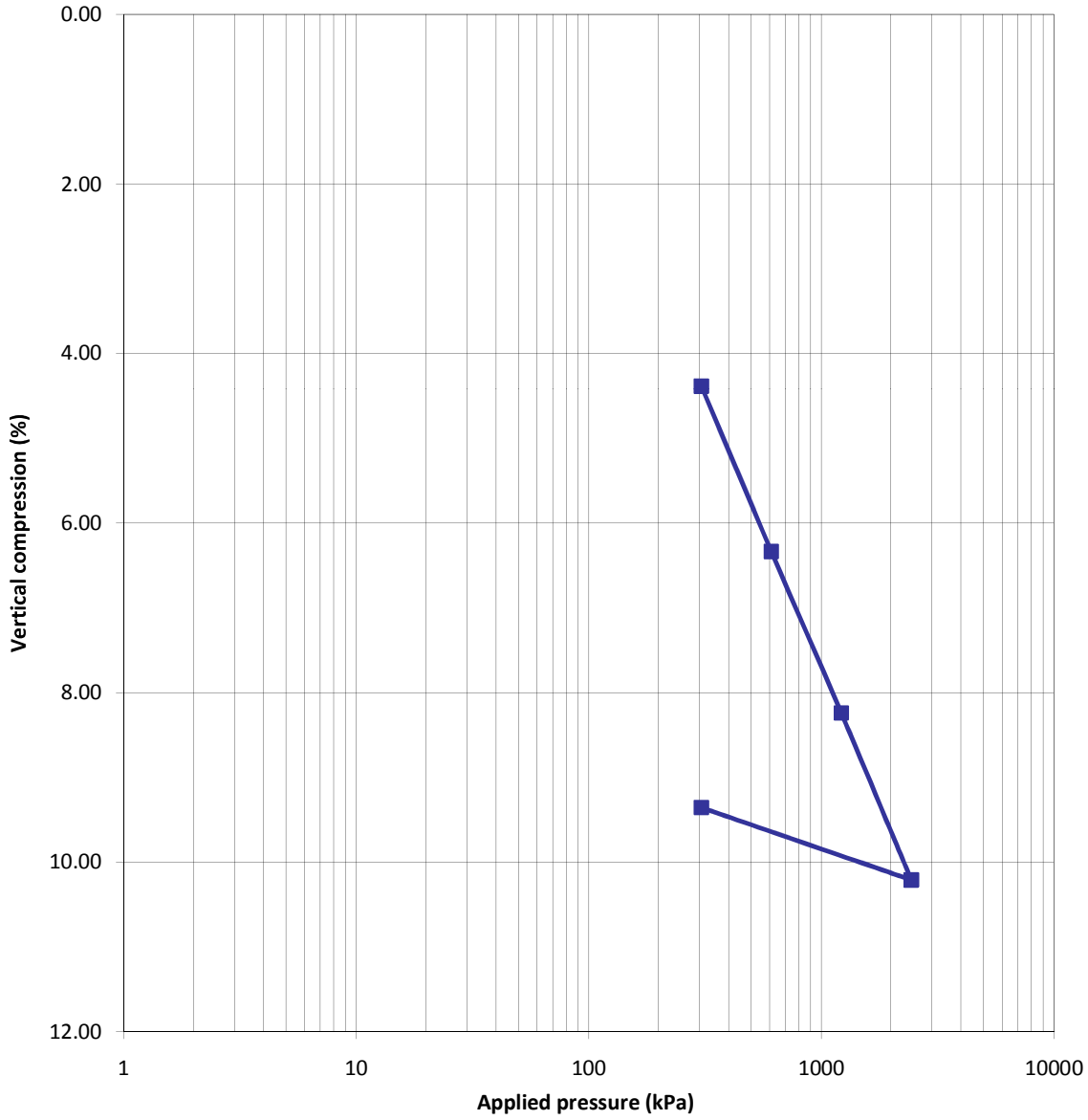
Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*20/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

DETERMINATION OF ONE-DIMENSIONAL CONSOLIDATION PROPERTIES

Tested in accordance with BS 1377:1990:Part 5:Clause 3

TEST REPORT

Project location	Lenzing Fibers		
Project reference	*C177/19/E/269*	Sample depth (m)	*15.0-15.45*
Borehole number	*BH3*	Sample type	*Undisturbed*
Sample number	*U13*	Specimen orientation	*Vertical*

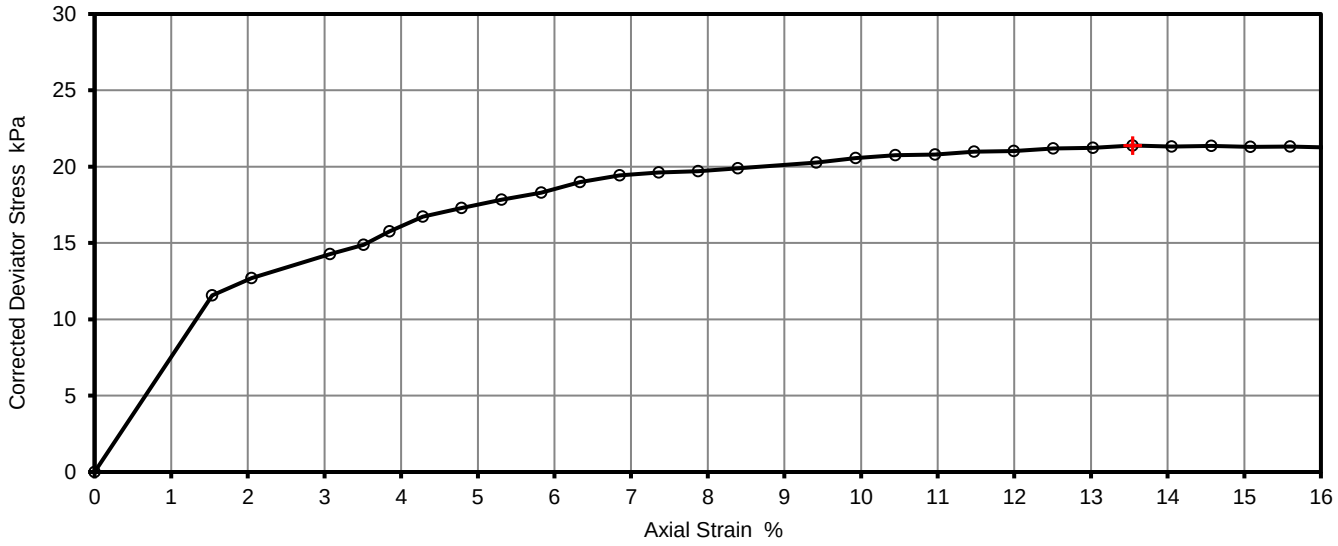


Tested	*HJL*	Checked	*CJN*	Approved	*CJN*
Date	*20/12/2019*	Date	*06/01/2020*	Date	*06/01/2020*

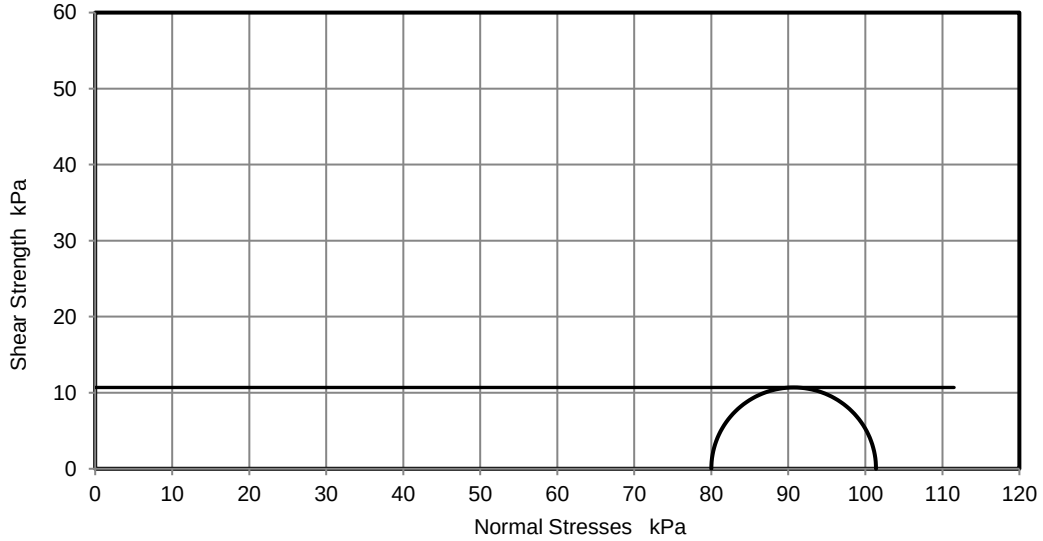
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen				Job Ref	C177/19/E/269
					Borehole/Pit No.	BH1
Site Name	Lenzing Fibres				Sample No.	5
Soil Description	Very soft dark brown organic CLAY				Depth	4.50
Specimen Reference	U5	Specimen Depth	4.50	m	Sample Type	U
Specimen Description	Very soft dark brown organic CLAY				KeyLAB ID	RGS_201912180
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen				Date of test	20/12/2019

Test Number		1	
Length		200.0	mm
Diameter		100.0	mm
Bulk Density		1.87	Mg/m3
Moisture Content		52.2	%
Dry Density		1.23	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		80	kPa
At failure	Axial Strain	13.5	%
	Deviator Stress, (σ1 - σ3)f	21	kPa
	Undrained Shear Strength, cu	11	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Approved: Harry

Printed: 09/01/2020 14:07

Fig. No. 6

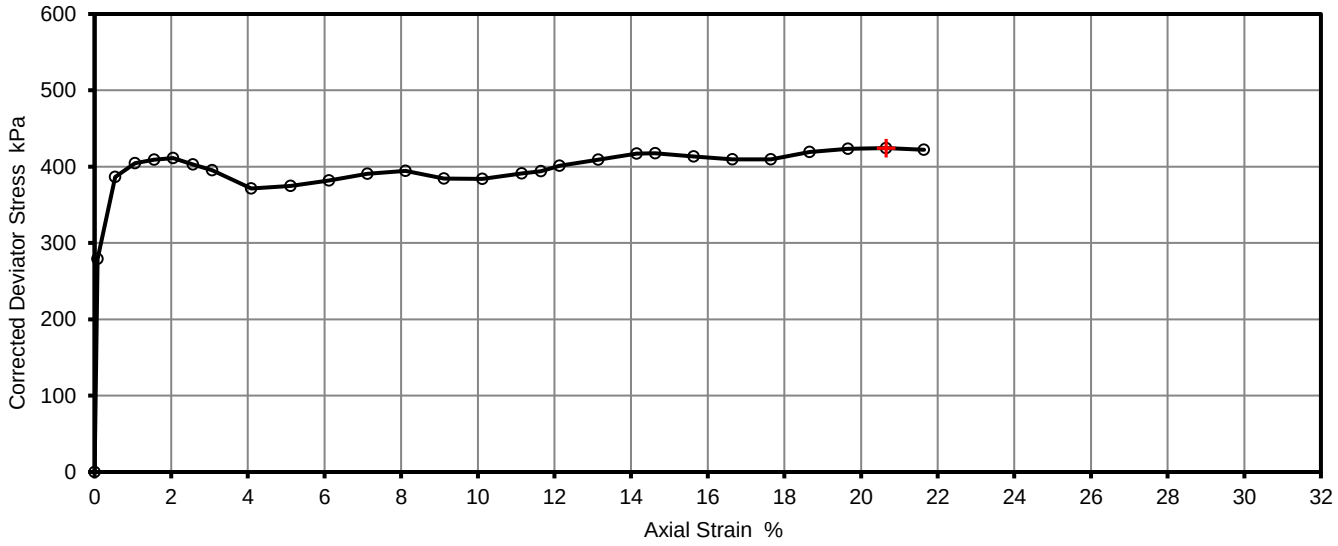
Sheet 1

Lab Sheet Reference :

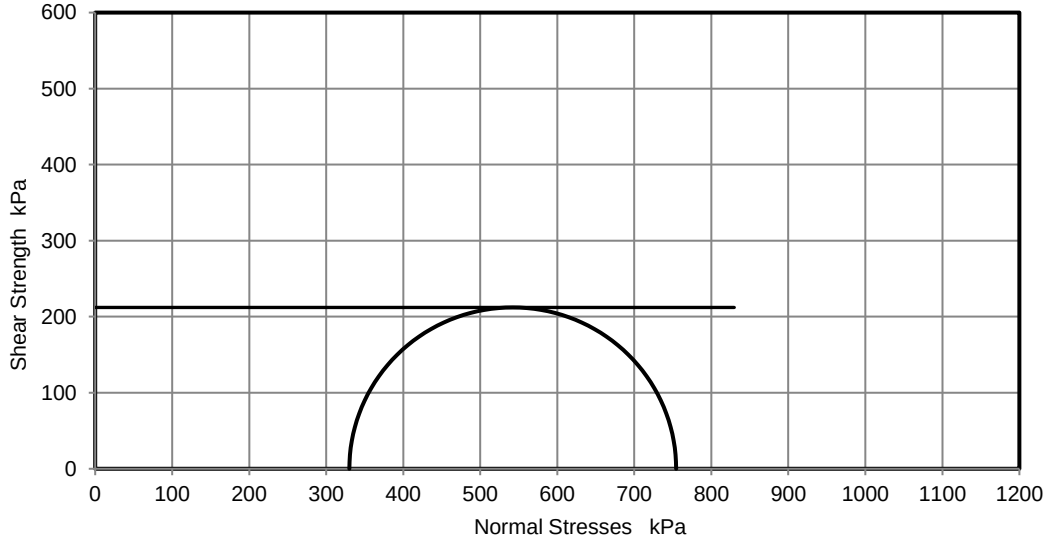
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen				Job Ref	C177/19/E/269
					Borehole/Pit No.	BH2
Site Name	Lenzing Fibres				Sample No.	5
Soil Description	Soft to firm brown slighly gravelly CLAY				Depth	16.50
Specimen Reference	U5	Specimen Depth	16.70	m	Sample Type	U
Specimen Description	Soft to firm brown slightly gravelly CLAY				KeyLAB ID	RGS_201912181
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen				Date of test	03/01/2020

Test Number		1	
Length		76.0	mm
Diameter		38.0	mm
Bulk Density		2.16	Mg/m3
Moisture Content		15.4	%
Dry Density		1.88	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		330	kPa
At failure	Axial Strain	20.7	%
	Deviator Stress, (σ1 - σ3)f	424	kPa
	Undrained Shear Strength, cu	212	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Approved: Harry

Printed: 09/01/2020 14:07

Lab Sheet Reference :

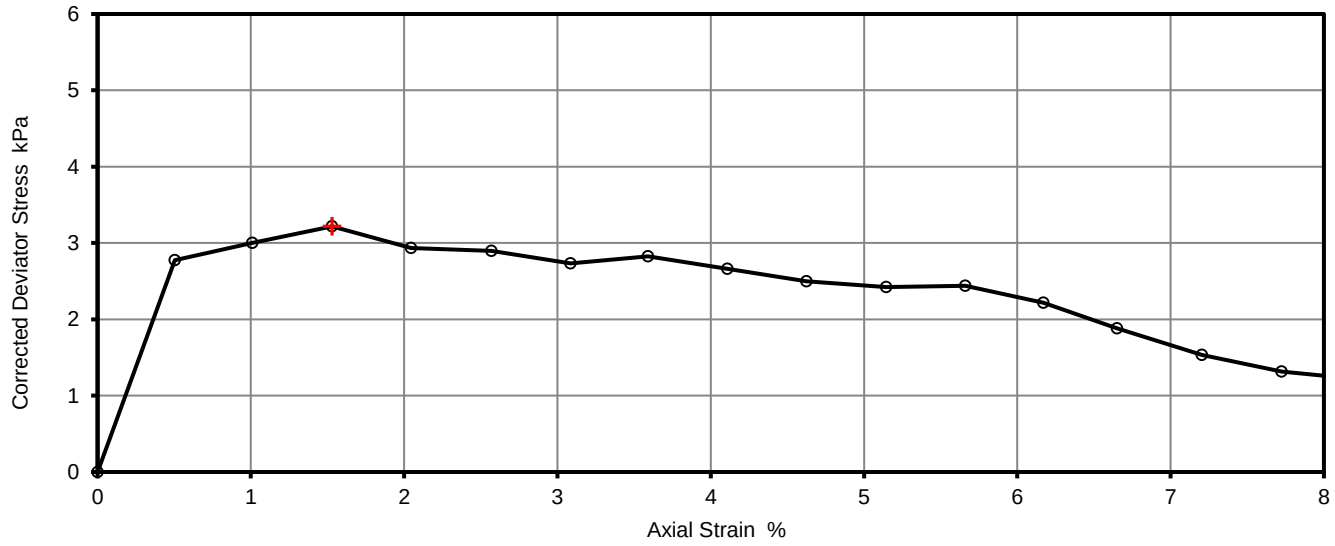
Fig. No. 6

Sheet 2

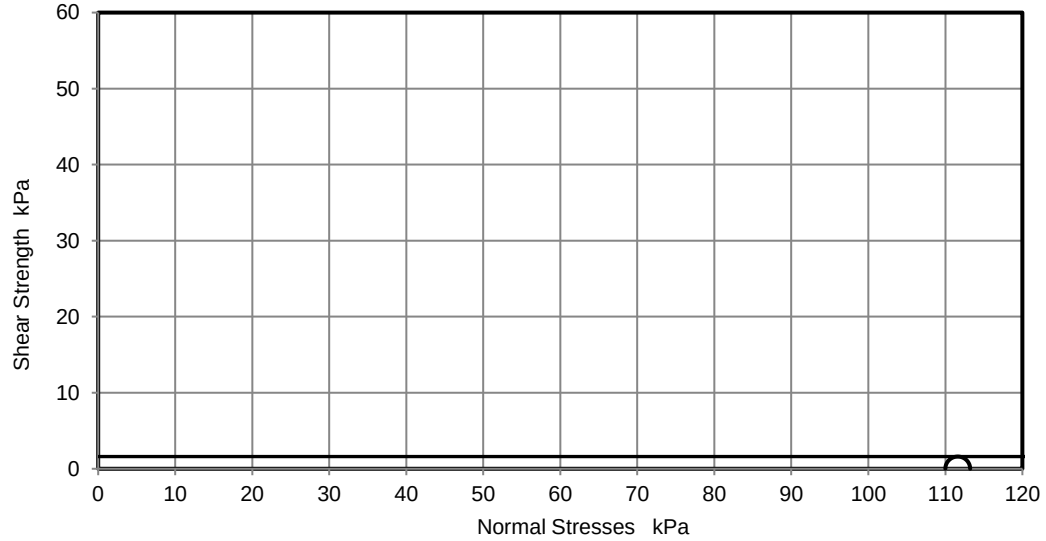
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen				Job Ref	C177/19/E/269
					Borehole/Pit No.	BH3
Site Name	Lenzing Fibres				Sample No.	6
Soil Description	V soft dark grey organic CLAY				Depth	6.00
Specimen Reference	U6	Specimen Depth	6.00	m	Sample Type	U
Specimen Description	V soft dark grey organic CLAY				KeyLAB ID	RGS_201912182
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen				Date of test	20/12/2019

Test Number		1	
Length		200.0	mm
Diameter		100.0	mm
Bulk Density		1.89	Mg/m3
Moisture Content		45.2	%
Dry Density		1.30	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		110	kPa
At failure	Axial Strain	1.5	%
	Deviator Stress, (σ1 - σ3)f	3	kPa
	Undrained Shear Strength, cu	2	kPa ½(σ1 - σ3)f
	Mode of Failure	Plastic	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
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Remarks

Sample was very soft and fully saturated behaviour was more liquid.

Lab Sheet Reference :

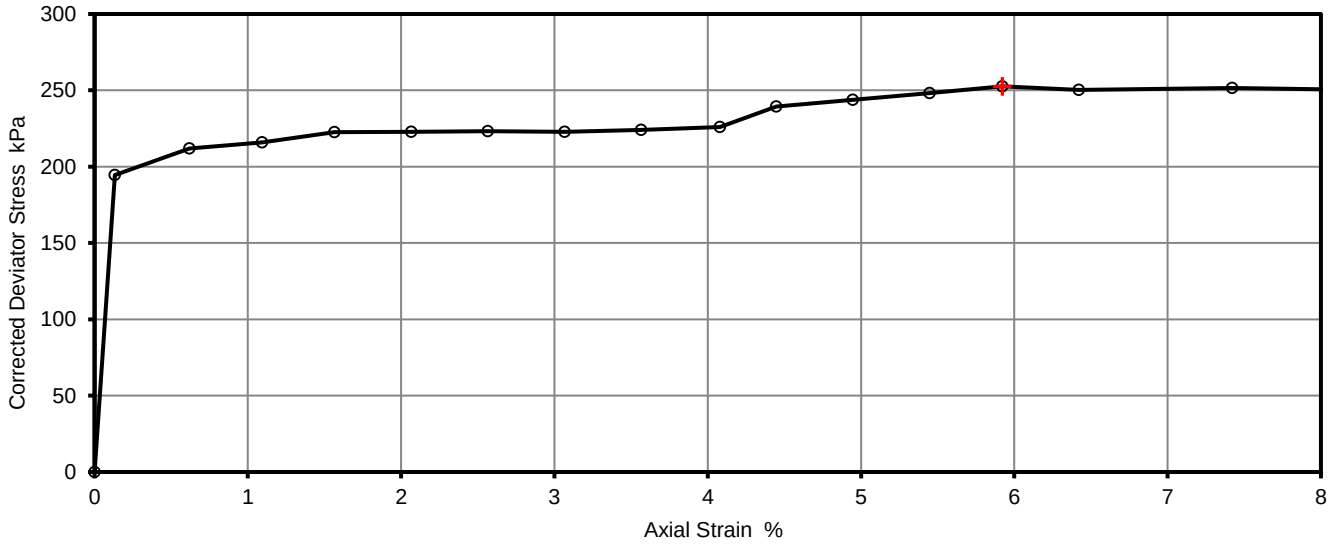
Approved	Printed
Harry	09/01/2020 14:07

Fig. No. 6

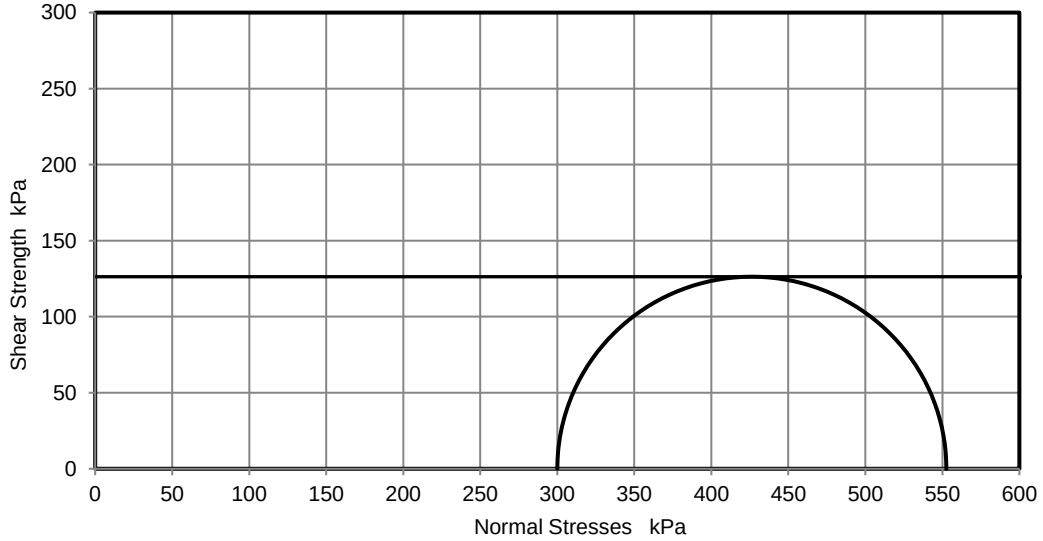
	Unconsolidated Undrained Triaxial Compression Test without measurement of pore pressure - single specimen				Job Ref	C177/19/E/269
					Borehole/Pit No.	BH3
Site Name	Lenzing Fibres				Sample No.	7
Soil Description	Firm brown CLAY				Depth	15.00
Specimen Reference	U7	Specimen Depth	15.00	m	Sample Type	U
Specimen Description	Firm brown CLAY				KeyLAB ID	RGS_201912183
Test Method	BS1377 : Part 7 : 1990, clause 8, single specimen				Date of test	20/12/2019

Test Number		1	
Length		76.0	mm
Diameter		38.0	mm
Bulk Density		2.18	Mg/m3
Moisture Content		15.0	%
Dry Density		1.90	Mg/m3
Rate of Strain		2.0	%/min
Cell Pressure		300	kPa
At failure	Axial Strain	5.9	%
	Deviator Stress, (σ1 - σ3)f	253	kPa
	Undrained Shear Strength, cu	126	kPa ½(σ1 - σ3)f
	Mode of Failure	Compound	

Deviator Stress v Axial Strain



Mohr Circles



Deviator stress corrected for area change and membrane effects

Mohr circles and their interpretation is not covered by BS1377.
This is provided for information only.

Remarks

Approved: Harry

Printed: 09/01/2020 14:07

Lab Sheet Reference :

Fig. No. 6

Sheet 4

Environmental
Geotechnical
Specialists

RGS

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GEOTECHNICAL
ENVIRONMENTAL

Rogers Geotechnical Services Ltd
Office 1 & 2 Barncliffe Business Park,
Near Bank, Shelley, Huddersfield, HD8 8LU

Telephone 01484 607977
Company No: 5130864

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RGS

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End of Report

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Telephone 01484 607977
Company No: 5130864

Chemtest
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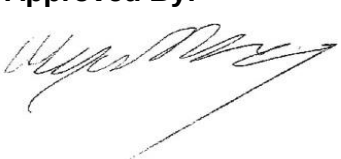
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-41608-1
Initial Date of Issue:	23-Dec-2019
Client	Rogers Geotechnical Services Ltd
Client Address:	Unit 4, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU
Contact(s):	Jude Norcliffe
Project	C177/19/E/269 Lenzing Fibres

Quotation No.:		**Date Received:**	12-Dec-2019
Order No.:	PO-0490	**Date Instructed:**	12-Dec-2019
No. of Samples:	1		
Turnaround (Wkdays):	7	**Results Due:**	20-Dec-2019
Date Approved:	23-Dec-2019		

Approved By:



Details: Glynn Harvey, Laboratory Manager

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		19-41608
Quotation No.:			**Chemtest Sample ID.:**		942438
			Client Sample ID.:		D
			Sample Location:		TP4
			Sample Type:		SOIL
			Top Depth (m) ($):		0.00
			Bottom Depth (m) ($):		1.40
			Date Sampled ($):		09-Dec-2019
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Cadmium	M	2450	mg/kg	0.10	0.49
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50
Copper	M	2450	mg/kg	0.50	71
Mercury	M	2450	mg/kg	0.10	0.39
Nickel	M	2450	mg/kg	0.50	51
Lead	M	2450	mg/kg	0.50	61
Zinc	M	2450	mg/kg	0.50	230
Vanadium	U	2450	mg/kg	5.0	68
Arsenic	M	2450	mg/kg	1.0	21
Selenium	M	2450	mg/kg	0.20	0.44
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.30	< 0.30
Naphthalene	M	2700	mg/kg	0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	0.50
Pyrene	M	2700	mg/kg	0.10	0.82
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		19-41608
Quotation No.:			**Chemtest Sample ID.:**		942438
			Client Sample ID.:		D
			Sample Location:		TP4
			Sample Type:		SOIL
			Top Depth (m) ($):		0.00
			Bottom Depth (m) ($):		1.40
			Date Sampled ($):		09-Dec-2019
			Asbestos Lab:		DURHAM
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10
pH	M	2010		4.0	8.5
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.73
ACM Type	U	2192		N/A	Fibres/Clumps
Asbestos Identification	U	2192	%	0.001	Amosite
ACM Detection Stage	U	2192		N/A	Stereo Microscopy
Moisture	N	2030	%	0.020	17
Soil Colour	N	2040		N/A	Brown
Other Material	N	2040		N/A	Stones
Soil Texture	N	2040		N/A	Clay
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	2.5
Thiocyanate	M	2300	mg/kg	5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	18
Sulphate (Total)	M	2430	%	0.010	0.85
Organic Matter	M	2625	%	0.40	4.1

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Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
$	This information has been supplied by the client and can affect the integrity of test data.

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
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Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-41318-1
Initial Date of Issue:	03-Jan-2020
Client	Rogers Geotechnical Services Ltd
Client Address:	Unit 4, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU
Contact(s):	Jude Norcliffe
Project	C177/19/E/269 Lenzing Fibres

Quotation No.:		**Date Received:**	11-Dec-2019
Order No.:	PO-0490	**Date Instructed:**	11-Dec-2019
No. of Samples:	6		
Turnaround (Wkdays):	7	**Results Due:**	19-Dec-2019
Date Approved:	03-Jan-2020		

Approved By:

Details: Glynn Harvey, Laboratory Manager

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			19-41318	19-41318	19-41318	19-41318	19-41318	19-41318
Quotation No.:		**Chemtest Sample ID.:**			941004	941005	941006	941007	941008	941009
		Client Sample ID.:			D	D	D	D	D	D
		Sample Location:			TP2	TP2	TP7	TP5	TP1	TP3
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.00	1.00	0.00	0.00	0.00	0.00
		Bottom Depth (m):			1.00	2.30	0.25	0.10	1.10	1.00
		Date Sampled:			09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY		COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Cadmium	M	2450	mg/kg	0.10	0.69	0.17	1.0		0.23	0.30
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50
Copper	M	2450	mg/kg	0.50	200	24	51		30	25
Mercury	M	2450	mg/kg	0.10	0.63	< 0.10	3.1		0.21	0.23
Nickel	M	2450	mg/kg	0.50	43	41	37		28	61
Lead	M	2450	mg/kg	0.50	110	45	210		110	43
Zinc	M	2450	mg/kg	0.50	3100	180	1900		150	440
Vanadium	U	2450	mg/kg	5.0	250	73	81		310	170
Arsenic	M	2450	mg/kg	1.0	29	22	19		23	14
Selenium	M	2450	mg/kg	0.20	1.4	0.40	< 0.20		< 0.20	0.30
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30		< 0.30	< 0.30
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10	1.4		< 0.10	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	0.71		< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	0.42		< 0.10	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10	0.44		< 0.10	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	7.1		< 0.10	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	1.3		< 0.10	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	15		< 0.10	1.4
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	17		< 0.10	2.5
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	14		< 0.10	0.87
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10	10		< 0.10	0.85
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	13		< 0.10	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10	5.3		< 0.10	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	9.7		< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10	5.4		< 0.10	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10	1.6		< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10	5.6		< 0.10	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0	110		< 2.0	5.6
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	2.2		< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	13		< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	74	77		< 1.0	< 1.0

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd		Chemtest Job No.:			19-41318	19-41318	19-41318	19-41318	19-41318	19-41318
Quotation No.:		Chemtest Sample ID.:			941004	941005	941006	941007	941008	941009
		Client Sample ID.:			D	D	D	D	D	D
		Sample Location:			TP2	TP2	TP7	TP5	TP1	TP3
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.00	1.00	0.00	0.00	0.00	0.00
		Bottom Depth (m):			1.00	2.30	0.25	0.10	1.10	1.00
		Date Sampled:			09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019	09-Dec-2019
		Asbestos Lab:			COVENTRY	COVENTRY	COVENTRY		COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	74	92		< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	13		< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	29	110		< 1.0	10
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	140	1000		< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0		< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	170	1100		< 5.0	10
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	240	1200		< 10	10
pH	M	2010		4.0	7.2	8.6	9.8		9.7	8.5
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	1.7	0.47	2.0		1.7	1.5
ACM Type	U	2192		N/A	Fibres/Clumps	-	Fibres/Clumps		Fibres/Clumps	Fibres/Clumps
Asbestos Identification	U	2192	%	0.001	Chrysotile	No Asbestos Detected	Anthophyllite		Amosite Chrysotile	Amosite Chrysotile
ACM Detection Stage	U	2192		N/A	Stereo Microscopy	-	Stereo Microscopy		Stereo Microscopy	Stereo Microscopy
Moisture	N	2030	%	0.020	18	24	13	19	19	21
Soil Colour	N	2040		N/A	Black,	Brown,	Brown,	Brown,	Brown,	Brown,
Other Material	N	2040		N/A	Stones,	Stones	Stones	Stones	Stones, Brick,	Stones,
Soil Texture	N	2040		N/A	Sand,	Clay,	Sand,	Sand,	Sand,	Clay,
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	1.5	4.3	1.4		1.4	1.8
Thiocyanate	M	2300	mg/kg	5.0	< 5.0	< 5.0	< 5.0		< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	15	1.9	23		21	17
Sulphate (Total)	M	2430	%	0.010	9.2	0.41	7.7		5.3	3.2
Organic Matter	M	2625	%	0.40	33	2.2	2.8		3.1	2.1
PCB 28	M	2815	mg/kg	0.010				< 0.010		
PCB 52	M	2815	mg/kg	0.010				< 0.010		
PCB 90+101	M	2815	mg/kg	0.010				< 0.010		
PCB 118	M	2815	mg/kg	0.010				< 0.010		
PCB 153	M	2815	mg/kg	0.010				< 0.010		
PCB 138	M	2815	mg/kg	0.010				< 0.010		
PCB 180	M	2815	mg/kg	0.010				< 0.010		
Total PCBs (7 Congeners)	N	2815	mg/kg	0.10				< 0.10		

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Test Methods

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

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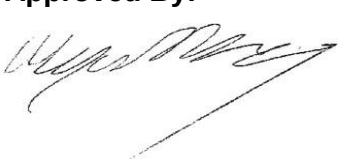
Final Report

Report No.:	19-40446-1
Initial Date of Issue:	13-Dec-2019
Client	Rogers Geotechnical Services Ltd
Client Address:	Unit 4, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU
Contact(s):	Jude Norcliffe
Project	C177/19/E/269 Lenzing Fibres

Quotation No.:	Q19-18929	**Date Received:**	02-Dec-2019
Order No.:	PO-0474	**Date Instructed:**	03-Dec-2019
No. of Samples:	2		
Turnaround (Wkdays):	7	**Results Due:**	11-Dec-2019
Date Approved:	13-Dec-2019		

Approved By:



Details: Glynn Harvey, Laboratory Manager

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Results - Water

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			19-40446	19-40446
Quotation No.: Q19-18929		**Chemtest Sample ID.:**			936602	936603
		Client Sample ID.:			D	D
		Sample Location:			TP3	TP4
		Sample Type:			WATER	WATER
		Top Depth (m) ($):			1.00	2.00
		Date Sampled ($):			28-Nov-2019	28-Nov-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10
pH	U	1010		N/A	4.8	7.2

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Results - Water

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		19-40446	19-40446
Quotation No.: Q19-18929			**Chemtest Sample ID.:**		936602	936603
			Client Sample ID.:		D	D
			Sample Location:		TP3	TP4
			Sample Type:		WATER	WATER
			Top Depth (m) ($):		1.00	2.00
			Date Sampled ($):		28-Nov-2019	28-Nov-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Sulphate	U	1220	mg/l	1.0	1700	1400
Sulphur	N	1220	mg/l	1.0	570	470
Thiocyanate	U	1300	mg/l	0.50	< 0.50	< 0.50
Sulphide	U	1325	mg/l	0.050	[B] < 0.050	[B] < 0.050
Arsenic (Dissolved)	U	1450	µg/l	1.0	2.4	3.4
Boron (Dissolved)	U	1450	µg/l	20	1500	1500
Cadmium (Dissolved)	U	1450	µg/l	0.080	1.9	0.17
Chromium (Dissolved)	U	1450	µg/l	1.0	10	5.0
Copper (Dissolved)	U	1450	µg/l	1.0	170	11
Mercury (Dissolved)	U	1450	µg/l	0.50	1.4	0.82
Nickel (Dissolved)	U	1450	µg/l	1.0	90	18
Lead (Dissolved)	U	1450	µg/l	1.0	10	17
Selenium (Dissolved)	U	1450	µg/l	1.0	3.7	3.8
Zinc (Dissolved)	U	1450	µg/l	1.0	6500	150
N-Nitrosodimethylamine	N	1790	µg/l	0.50	< 0.50	< 0.50
Phenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylphenol (o-Cresol)	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachloroethane	N	1790	µg/l	0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Nitrobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Isophorone	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Naphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobutadiene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50

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Results - Water

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd			**Chemtest Job No.:**		19-40446	19-40446
Quotation No.: Q19-18929			**Chemtest Sample ID.:**		936602	936603
			Client Sample ID.:		D	D
			Sample Location:		TP3	TP4
			Sample Type:		WATER	WATER
			Top Depth (m) ($):		1.00	2.00
			Date Sampled ($):		28-Nov-2019	28-Nov-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Hexachlorocyclopentadiene	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthylene	N	1790	µg/l	0.50	< 0.50	< 0.50
Dimethylphthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50
Acenaphthene	N	1790	µg/l	0.50	< 0.50	< 0.50
3-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenzofuran	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Chlorophenylphenylether	N	1790	µg/l	0.50	< 0.50	< 0.50
2,4-Dinitrotoluene	N	1790	µg/l	0.50	< 0.50	< 0.50
Fluorene	N	1790	µg/l	0.50	< 0.50	< 0.50
Diethyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Nitroaniline	N	1790	µg/l	0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Azobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	1790	µg/l	0.50	< 0.50	< 0.50
Hexachlorobenzene	N	1790	µg/l	0.50	< 0.50	< 0.50
Pentachlorophenol	N	1790	µg/l	0.50	< 0.50	< 0.50
Phenanthrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50
Carbazole	N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50
Chrysene	N	1790	µg/l	0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[b]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[k]fluoranthene	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[a]pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	1790	µg/l	0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	1790	µg/l	0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene	N	1790	µg/l	0.50	< 0.50	< 0.50

Results - Water

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd					**Chemtest Job No.:**	19-40446	19-40446
Quotation No.: Q19-18929					**Chemtest Sample ID.:**	936602	936603
					Client Sample ID.:	D	D
					Sample Location:	TP3	TP4
					Sample Type:	WATER	WATER
					Top Depth (m) ($):	1.00	2.00
					Date Sampled ($):	28-Nov-2019	28-Nov-2019
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
4-Nitrophenol	N	1790	µg/l	0.50		< 0.50	< 0.50

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
936602		D	TP3	28-Nov-2019	B	Coloured Winchester 1000ml
936602		D	TP3	28-Nov-2019	B	EPA Vial 40ml
936602		D	TP3	28-Nov-2019	B	Plastic Bottle 1000ml
936603		D	TP4	28-Nov-2019	B	Coloured Winchester 1000ml
936603		D	TP4	28-Nov-2019	B	EPA Vial 40ml
936603		D	TP4	28-Nov-2019	B	Plastic Bottle 1000ml

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Test Methods

SOP	Title	Parameters included	Method summary
1010	pH Value of Waters	pH	pH Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1300	Cyanides & Thiocyanate in Waters	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Continuous Flow Analysis.
1325	Sulphide in Waters	Sulphides	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using N,N–dimethyl-pphenylenediamine.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1490	Hexavalent Chromium in Waters	Chromium [VI]	Automated colorimetric analysis by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
1675	TPH Aliphatic/Aromatic split in Waters by GC-FID(cf. Texas Method 1006 / TPH CWG)	Aliphatics: >C5–C6, >C6–C8, >C8– C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Pentane extraction / GCxGC FID detection
1700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Waters by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
1790	Semi-Volatile Organic Compounds (SVOCs) in Waters by GC-MS	Semi-volatile organic compounds	Solvent extraction / GCMS detection

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"
$	This information has been supplied by the client and can affect the integrity of test data.

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	19-41636-1
Initial Date of Issue:	07-Jan-2020
Client	Rogers Geotechnical Services Ltd
Client Address:	Unit 4, Barncliffe Business Park Near Bank Shelley Huddersfield West Yorkshire HD8 8LU
Contact(s):	Jude Norcliffe
Project	C177/19/E/269 Lenzing Fibres

Quotation No.:		**Date Received:**	13-Dec-2019
Order No.:	PO-0490	**Date Instructed:**	13-Dec-2019
No. of Samples:	7		
Turnaround (Wkdays):	7	**Results Due:**	23-Dec-2019
Date Approved:	07-Jan-2020		

Approved By:

Details: Glynn Harvey, Laboratory Manager

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			19-41636	19-41636	19-41636	19-41636	19-41636	19-41636
Quotation No.:		**Chemtest Sample ID.:**			942577	942578	942579	942580	942581	942582
		Client Sample ID.:			D	D	D	D	D	D
		Sample Location:			BH2	BH3	TP3	TP4	TP4	TP6
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			6.00	7.50	0.00	1.40	2.00	0.00
		Bottom Depth (m):			6.45	7.91	0.30	2.00	2.80	1.50
		Date Sampled:			11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019
		Asbestos Lab:						COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Cadmium	M	2450	mg/kg	0.10	0.13	0.24		0.85	0.14	0.11
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50
Copper	M	2450	mg/kg	0.50	14	17		88	20	16
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10		0.47	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	35	31		47	48	45
Lead	M	2450	mg/kg	0.50	15	13		170	23	22
Zinc	M	2450	mg/kg	0.50	76	64		400	100	89
Vanadium	U	2450	mg/kg	5.0	54	37		53	64	67
Arsenic	M	2450	mg/kg	1.0	18	11		20	19	21
Selenium	M	2450	mg/kg	0.20	0.45	0.32		0.48	0.35	0.41
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30		< 0.30	< 0.30	< 0.30
Naphthalene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.26	0.50	< 0.10
Acenaphthylene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.25	< 0.10	< 0.10
Acenaphthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.68	0.28	< 0.10
Fluorene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.26	0.16	< 0.10
Phenanthrene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.68	1.3	< 0.10
Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.20	0.23	< 0.10
Fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		0.93	1.8	< 0.10
Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10		1.0	1.9	< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.78	< 0.10
Chrysene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.96	< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.95	< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.52	< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.97	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.77	< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.24	< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10	< 0.10	< 0.10		< 0.10	0.67	< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0	< 2.0	< 2.0		4.3	12	< 2.0
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0		39	< 1.0	< 1.0

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Results - Soil

Project: C177/19/E/269 Lenzing Fibres

Client: Rogers Geotechnical Services Ltd		**Chemtest Job No.:**			19-41636	19-41636	19-41636	19-41636	19-41636	19-41636
Quotation No.:		**Chemtest Sample ID.:**			942577	942578	942579	942580	942581	942582
		Client Sample ID.:			D	D	D	D	D	D
		Sample Location:			BH2	BH3	TP3	TP4	TP4	TP6
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			6.00	7.50	0.00	1.40	2.00	0.00
		Bottom Depth (m):			6.45	7.91	0.30	2.00	2.80	1.50
		Date Sampled:			11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019	11-Dec-2019
		Asbestos Lab:						COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**						
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0		39	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0		240	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0		< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0		240	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10		270	< 10	< 10
pH	M	2010		4.0	9.0	8.6		8.0	8.6	8.3
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010	0.19	0.11	1.4	1.3	0.39	0.22
ACM Type	U	2192		N/A				Fibres/Clumps	-	-
Asbestos Identification	U	2192	%	0.001				Amosite Chrysotile	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A				Stereo Microscopy	-	-
Moisture	N	2030	%	0.020	26	21	13	15	23	19
Soil Colour	N	2040		N/A	Brown,	Brown,	Brown,	Brown,	Brown	Brown
Other Material	N	2040		N/A	NONE,	NONE,	NONE,	NONE,	Stones	Stones
Soil Texture	N	2040		N/A	Clay,	Clay,	Clay,	Clay,	Clay	Clay
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	5.3	2.4		1.8	4.2	3.2
Total Sulphur	M	2175	%	0.010			6.3			
Thiocyanate	M	2300	mg/kg	5.0	< 5.0	< 5.0		< 5.0	< 5.0	< 5.0
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	28	27	14	24	9.9	7.6
Sulphate (Total)	M	2430	%	0.010	2.3	2.0		0.74	0.16	0.076
Organic Matter	M	2625	%	0.40	3.1	1.3		17	1.9	1.3

Results - 2 Stage WAC

Project: C177/19/E/269 Lenzing Fibres

							Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	19-41636								
Chemtest Sample ID:	942583								
Sample Ref:									
Sample ID:	D								
Sample Location:	TP6								
Top Depth(m):	0.00								
Bottom Depth(m):	1.50								
Sampling Date:	11-Dec-2019								
Determinand	**SOP**	**Accred.**	**Units**				**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%			0.85	3	5	6
Loss On Ignition	2610	M	%			5.7	--	--	10
Total BTEX	2760	M	mg/kg			< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg			< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg			< 10	500	--	--
Total (Of 17) PAH's	2700	N	mg/kg			< 2.0	100	--	--
pH	2010	M				8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg			0.014	--	To evaluate	To evaluate
Eluate Analysis			**2:1 mg/l**	**8:1 mg/l**	**2:1 mg/kg**	**Cumulative mg/kg 10:1**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	0.0012	< 0.0010	< 0.050	< 0.050	0.5	2	25
Barium	1450	U	0.026	0.014	< 0.50	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.00010	< 0.010	< 0.010	0.04	1	5
Chromium	1450	U	0.0018	< 0.0010	< 0.050	< 0.050	0.5	10	70
Copper	1450	U	0.059	0.030	0.12	0.053	2	50	100
Mercury	1450	U	< 0.00050	< 0.00050	< 0.0010	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.016	0.011	< 0.050	0.11	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.0010	< 0.050	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.0010	< 0.010	< 0.010	0.06	0.7	5
Selenium	1450	U	0.0024	0.0018	< 0.010	0.018	0.1	0.5	7
Zinc	1450	U	0.012	0.0036	< 0.50	< 0.50	4	50	200
Chloride	1220	U	63	15	120	190	800	15000	25000
Fluoride	1220	U	1.8	1.2	3.5	13	10	150	500
Sulphate	1220	U	410	79	790	1100	1000	20000	50000
Total Dissolved Solids	1020	N	1100	310	2200	3800	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.030	< 0.30	< 0.50	1	-	-
Dissolved Organic Carbon	1610	U	18	210	< 50	1900	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.175
Moisture (%)	19

Leachate Test Information	
Leachant volume 1st extract/l	0.309
Leachant volume 2nd extract/l	1.400
Eluant recovered from 1st extract/l	0.157

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must 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.

Test Methods

SOP	Title	Parameters included	Method summary
1020	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Electrical Conductivity and Total Dissolved Solids (TDS) in Waters	Conductivity Meter
1220	Anions, Alkalinity & Ammonium in Waters	Fluoride; Chloride; Nitrite; Nitrate; Total; Oxidisable Nitrogen (TON); Sulfate; Phosphate; Alkalinity; Ammonium	Automated colorimetric analysis using 'Aquakem 600' Discrete Analyser.
1450	Metals in Waters by ICP-MS	Metals, including: Antimony; Arsenic; Barium; Beryllium; Boron; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Tin; Vanadium; Zinc	Filtration of samples followed by direct determination by inductively coupled plasma mass spectrometry (ICP-MS).
1610	Total/Dissolved Organic Carbon in Waters	Organic Carbon	TOC Analyser using Catalytic Oxidation
1920	Phenols in Waters by HPLC	Phenolic compounds including: Phenol, Cresols, Xylenols, Trimethylphenols Note: Chlorophenols are excluded.	Determination by High Performance Liquid Chromatography (HPLC) using electrochemical detection.
2010	pH Value of Soils	pH	pH Meter
2015	Acid Neutralisation Capacity	Acid Reserve	Titration
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2040	Soil Description(Requirement of MCERTS)	Soil description	As received soil is described based upon BS5930
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Allkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2325	Sulphide in Soils	Sulphide	Steam distillation with sulphuric acid / analysis by 'Aquakem 600' Discrete Analyser, using N,N–dimethyl-p-phenylenediamine.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2610	Loss on Ignition	loss on ignition (LOI)	Determination of the proportion by mass that is lost from a soil by ignition at 550°C.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2670	Total Petroleum Hydrocarbons (TPH) in Soils by GC-FID	TPH (C6–C40); optional carbon banding, e.g. 3-band – GRO, DRO & LRO*TPH C8–C40	Dichloromethane extraction / GC-FID
2680	TPH A/A Split	Aliphatics: >C5–C6, >C6–C8,>C8–C10, >C10–C12, >C12–C16, >C16–C21, >C21–C35, >C35– C44Aromatics: >C5–C7, >C7–C8, >C8– C10, >C10–C12, >C12–C16, >C16– C21, >C21– C35, >C35– C44	Dichloromethane extraction / GCxGC FID detection

Test Methods

SOP	Title	Parameters included	Method summary
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenz[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2760	Volatile Organic Compounds (VOCs) in Soils by Headspace GC-MS	Volatile organic compounds, including BTEX and halogenated Aliphatic/Aromatics.(cf. USEPA Method 8260)*please refer to UKAS schedule	Automated headspace gas chromatographic (GC) analysis of a soil sample, as received, with mass spectrometric (MS) detection of volatile organic compounds.
2815	Polychlorinated Biphenyls (PCB) ICES7Congeners in Soils by GC-MS	ICES7 PCB congeners	Acetone/Hexane extraction / GC-MS
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.
640	Characterisation of Waste (Leaching C10)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge
650	Characterisation of Waste (Leaching WAC)	Waste material including soil, sludges and granular waste	ComplianceTest for Leaching of Granular Waste Material and Sludge

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

Appendix 5

Fill Screening Values

Rogers Geotechnical Services Ltd.

Atkins ATRISK Soil Screening Values (SSVs) - Commercial Landuse

Tox Data Report No.	Compound	Commercial (mg/kg)				Reference
	Metals	1% SOM		6% SOM		
3	Cadmium	410		410		C
4	Chromium VI	19.7	49.1	19.7	49.1	B/C
	Copper	106000		106000		A+
7	Mercury	350.00		405.00		A/D
8	Nickel	1770		1770		A+
	Lead	2310		2310		C
	Zinc	1100000		1100000		A+
	Vanadium	7490		7490		A+
	Semi and Non Metals					
1	Arsenic	635		635		C
10	Selenium	13000		13000		A
	Free Cyanide	373		373		A
9	Phenols (total)	685		3170		A
	Poly Aromatic Hydrocarbons	Free product	No free produc	Free product	No free product	
20	Naphthalene	75	90.1	432	1050	A+
	Acenaphthene	156.8	83600	106000		A+
	Fluorene	66500		72000		A+
	Anthracene	535000		544000		A+
	Fluoranthene	72200		72600		A+
	Pyrene	54100		54400		A+
	Benzo(a)anthracene	1.71	131	10.3	142	A
2	Chrysene	0.44	14000	2.64	14300	A
2	Benzo(b)fluoranthene	1.22	142	7.29	144	A
2	Benzo(k)fluoranthene	0.686	1430	4.12	1440	A
2	Benzo(a)pyrene	26.1	76.3	26.2	76.3	B/C
2	Dibenz(a,h)anthracene	0.00393	14.3	0.0236	14.4	A*
2	Indeno(1,2,3-cd)pyrene	0.0614	142	0.368	144	A*
2	Benzo(g,h,i)perylene	0.0187	1440	0.112	1450	A*
	Petroleum Hydrocarbons					
	Aliphatic C5-C6	327	4490	1100	29400	A+
	Aliphatic C6-C8	157	10400	769	98200	A+
	Aliphatic C8-C10	82.4	1370	476	14800	A+
	Aliphatic C10-C12	49.9	7900	297	69500	A+
	Aliphatic C12-C16	20.9	34000	126	139000	A+
	Aliphatic C16-C21	3620000		3620000		A+
	Aliphatic C21-C35	3620000		3620000		A+
	Aromatic C5-C7 (Benzene)	12.5		98		A+
	Aromatic C7-C8 (Toluene)	834	27900	4360	183000	A+
	Aromatic C8-C10	613	2210	3600	20800	A+
	Aromatic C10-C12	369	12300	2190	53800	A+
	Aromatic C12-C16	155	41300	65400		A+
	Aromatic C16-C21	28400		28400		A+
	Aromatic C21-C35	28400		28400		A+
	Others					
	pH	-		-		-
	Organic Content (%)	-		-		-
	Soluble Sulphate (mg/l)	-		-		-
	Total Sulphate (%)	-		-		-
	Asbestos	-		-		-

A = WS ATKINS PLC, ATRISK SOIL SCREENING VALUES BASED ON 1% SOIL ORGANIC MATTER

A+ = Values updated June 2017.

A* Atrisk's SSV is lower than Chemtest's detectable limit for this compound.

B = health criterion values, which are available from toxicological reviews published in the C4SL project methodology report.

C = Category 4 Screening Levels (C4SLs) based on 1% soil organic matter.

D - Value provided is based on Methyl Mercury. Should elemental mercury be observed or a source be known then a limit of 7.95 should be used.