

METROWEST PHASE 1B - SITE 13

FACTUAL GROUND INVESTIGATION REPORT

Prepared for VOLKERFITZPATRICK LIMITED

Report Ref: 37628

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METROWEST PHASE 1B - SITE 13



FACTUAL GROUND INVESTIGATION REPORT

Prepared for VOLKERFITZPATRICK LIMITED

Report Ref: 37628

PROJECT: New Railway

CONSULTANT: Arup

VOLUME - VERSION	STATUS	ORIGINATOR	CHECKER	APPROVED	DATE
1 of 1 – A	DRAFT	JS	JH	-	12/03/2024
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ORIGINATOR			APPROVER		
					
J SURMAN Senior Engineering Geologist			J HANSON Director		

The report is not to be used for contractual or engineering purposes unless this sheet is signed and the report designated "Final".

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CONTENTS

REPORT	PAGE
1. INTRODUCTION	1
2. SITE LOCATION AND GEOLOGY	1
3. GROUND INVESTIGATION	2
3.1 Fieldwork	2
3.2 Logging	4
3.4 Laboratory Testing	4
4. REFERENCES	6

FIGURES	Nos.
EXPLORATORY HOLE LOCATION PLAN	1

APPENDICES

APPENDIX A	FIELDWORK DATA
APPENDIX B	LABORATORY TESTING
APPENDIX C	CHEMICAL ANALYSES



1. INTRODUCTION

It is proposed to reconnect the rail junction at Parson Street to Portishead, Somerset. Geotechnical Engineering Limited (GEL) was instructed by VolkerFitzpatrick (the Client and Principal Contractor, hereafter referred to as the Client) acting on behalf of Network Rail to carry out an investigation to determine the ground conditions. Arup were appointed to the contract as the Consultant.

The scope of works and terms and conditions of appointment were specified by the Client and GEL correspondence reference T33803 Rev2 dated 13th November 2022. Arup provided the specification (referenced 140569-VLF-WST-POD-SPE-ESU-000005-P03_Ver3). The investigation was carried out under direction and supervision of the Consultant and the Client.

This report describes the investigation and presents the findings.

This report should be read in conjunction with GEL report reference 37506 dated 25th October 2023. The Site 13 site works contained in this report, are a continuation of the Metrowest Phase 1B works covered in the 37506 report.

2. SITE LOCATION AND GEOLOGY

The site is situated to the east of the A369 Clanage Road, Bristol and may be located by its National Grid co-ordinates ST 565 720.

British Geological Survey (BGS) England and Wales (Sheet No. 264, 1:50 000, 2004 and Sheet No. ST57SE, 1:10 000) and the BGS online geology (1:50,000) indicate the site is underlain by Head deposits across the majority of the site with some Alluvium in the north-west corner of the site. Bedrock geology is recorded as the Mercia Mudstone group.



3. GROUND INVESTIGATION

3.1 Fieldwork

The fieldwork was carried out in general accordance with BS5930:2015+A1:2020 during the period 15th and 16th January 2024 and comprised four windowless sample boreholes with dynamic cone penetrometer tests in two locations, and two dynamic cone penetrometer tests.

The exploratory hole locations were selected by the Consultant and set out by this Company and are shown on Figure 1. The ground level and co-ordinates at each exploratory hole were established by this Company using GPS techniques.

The boreholes, referenced S13-WS/DP01, S13-WS/DP02, TP01 and TP02 (Appendix A), were formed using a Dart 380 rig. Initially, an inspection pit was hand excavated at each borehole location to a depth of 1.20m to check for buried services. Disturbed samples were taken and retained in a combination of plastic tubs, bags and glass jars. Dynamic sampling techniques were then employed to produce a continuous disturbed sample of 73mm diameter reducing to 43mm as the borehole was advanced. The samples were recovered in semi-rigid plastic liner.

The samples were extracted horizontally from the sampler, labelled and sealed at each end to retain moisture.

Standard penetration tests (SPT) were carried out in general accordance with BS EN ISO 22476-3:2005+A1:2011. A split barrel was used depending upon the materials encountered and the split barrel samples retained in airtight jars. The SPT N value was taken as the number of blows to penetrate the 300mm test drive following a 150mm seating drive. Where low penetration was recorded the seating drive was terminated at 25 blows and the test drive completed after



a further 50 blows. Detailed SPT results, together with the energy ratio (E_r), are presented in Appendix A and summarised as uncorrected N values on the borehole logs.

Boreholes were monitored for groundwater ingress as dynamic sampling proceeded.

On completion, the boreholes were backfilled with arisings and bentonite pellets and the surface reinstated.

Dynamic probeholes, referenced S13-WS/DP01 DP and S13-WS/DP2 DP (Appendix A), were carried out using a Dart 380 rig and operated in general accordance with the DPH/DPSH(B) specification given in BS EN ISO 22476-2:2005+A1:2011. Sacrificial cones were used along with 32mm diameter x 1.00m long driving rods.

Probe depths were measured with respect to ground level and the number of blows, n_{10} , recorded for each 100mm penetration of the probe. At the end of each 1m penetration the maximum torque acting on the rods was measured.

Dynamic Cone Penetrometer tests (DCP), referenced TP01 DCP and TP02 DCP (Appendix A), were carried out using a CNS Farnell A2465 dynamic cone penetrometer. Probe depths were measured with respect to ground level and the number of blows for the penetration of the probe was recorded. Equivalent CBR values have been calculated and presented with the results in Appendix A.

Samples for chemical analyses were dispatched to i2 Analytical, Watford under a Chain of Custody. The remaining samples were brought to this Company's laboratory for testing and storage.



3.2 Logging

The logging of soils was carried out by an Engineering Geologist in general accordance with BS5930:2015+A1:2020. A key to the exploratory hole logs is presented in Appendix A.

Detailed descriptions of the samples are given in the borehole logs, Appendix A, along with details of sampling, in situ testing, groundwater ingress and relevant comments on drilling techniques.

A hand vane test was carried out. The result is presented on the borehole log and tabulated in Appendix A.

Prior to logging, photographs of the core were taken and are presented separately.

3.4 Laboratory Testing

A schedule of laboratory tests was prepared by the Consultant, the results are presented in Appendix B.

The natural water content was determined on fifteen selected samples in accordance with BS EN ISO 17892-1:2014.

Liquid limit and plastic limit tests were carried out on eleven selected samples in accordance with BS EN ISO 17892-12:2018:5.3 & 5.5. An Atterberg line plot has also been presented.

Particle size distributions were determined in accordance with BS EN ISO 17892-4:2016 for three samples by wet sieving [5.2]. The fine fractions of one of these samples was further



analysed by sedimentation using the pipette method [5.4]. The results are presented as grading curves.

The BRE SD1 (2005) suite of tests was carried out on four samples by Eurofins Chemtest, Newmarket using in-house methods.

Selected samples were despatched to i2 Analytical, Watford, where chemical analyses were carried out to in-house methods for a suite of contaminants. The results are presented in Appendix C.

GEOTECHNICAL ENGINEERING LIMITED



4. REFERENCES

British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Dynamic probing. BS EN ISO 22476-2:2005+A1:2011.

British Standards Institution (2012): Geotechnical investigation and testing. Field testing. Standard penetration test. BS EN ISO 22476-3:2005+A1:2011.

British Standards Institution (2015): Code of practice for ground investigations. BS 5930:2015+A1:2020.

British Standards Institution (2014): Geotechnical investigation and testing – Laboratory testing of soil. Part 1: Determination of water content. BS EN ISO 17892-1:2014.

British Standards Institution (2016): Geotechnical investigation and testing – Laboratory testing of soil. Part 4: Determination of particle size distribution. BS EN ISO 17892-4:2016.


British Standards Institution (2018): Geotechnical investigation and testing – Laboratory testing of soil. Part 12: Determination of liquid and plastic limits. BS EN ISO 17892-12:2018.


British Standards Institution (2016): Methods of test for soils for civil engineering purposes – Part 1: General requirements and sample preparation. BS1377-1:2016.

Building Research Establishment (2005): Concrete in aggressive ground. BRE Special Digest 1. Third Edition.



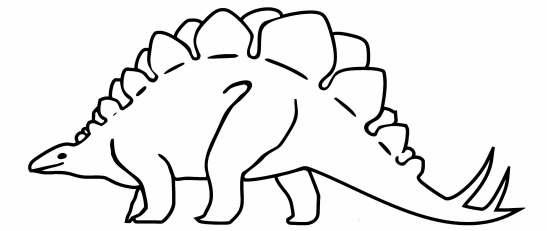
Key.

 Denotes borehole & dynamic probe location


 North

Notes:

Microsoft product screen shot(s) reprinted with permission from Microsoft Corporation



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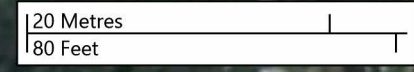
Site: METROWEST PHASE 1B - SITE 13

Title: EXPLORATORY HOLE LOCATION PLAN

Drawn By: AC	Checked By: JS	Paper Size: A3
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Scale: 1:500	Date: March 2024
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Contract: 37628	Figure: 1
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APPENDIX A

FIELDWORK DATA

KEY TO EXPLORATORY HOLE LOGS



Sample type

D Small disturbed	U Undisturbed	L Dynamic	ES Environmental - soil	CS Core subsample (prepared)
B Bulk disturbed	UT Undisturbed thin wall	C Core	EW Environmental - water	LS Dynamic subsample (prepared)
LB Large bulk disturbed	P Piston	W Water		

Test type

- S SPT - Split spoon sampler followed by uncorrected SPT 'N' Value
- C SPT - Solid cone followed by uncorrected SPT 'N' Value
 (*250 - Where full test drive not completed, linearly extrapolated 'N' value reported, ** - Denotes no effective penetration). Arrow length reflects test depth range.
- H Hand vane - direct reading in kPa - not corrected for BS1377 (1990). Re* denotes refusal. Where the limit of the equipment is reached during a test, the reported value is the minimum recorded shear strength of the material.
- M Mackintosh probe - number of blows to achieve 100mm penetration
- Mx Mexe cone - average reading of equivalent CBR value in %
- PP Pocket penetrometer - calculated reading in kPa
- Vo Headspace vapour reading, uncorrected peak values in ppm, using a PID (calibrated with isobutylene, using a 10.6eV bulb)
- TR In situ thermal resistivity by needle probe in mK/W

Sample/core range/l_r

Dynamic sample Undisturbed sample - open drive including thin wall. Symbol length reflects recovery

x x = Total Core Recovery (TCR) as percentage of core run

y y = Solid Core Recovery (SCR) as percentage of core run. Assessment of core is based on full diameter

z z = Rock Quality Designation (RQD). The amount of solid core greater then 100mm expressed as percentage of core run

Where SPT has been carried out at the beginning of core run, disturbed section of core excluded from SCR and RQD assessment

l_r - fracture spacing - the modal fracture spacing (mm) over the indicated length of core. Where spacing varies significantly, the minimum, mode and maximum values are also given. NI = non-intact core NA = not applicable NR = no recovery

Instrumentation

Piezometer Perforated standpipe Inclinometer Extensometer

Backfill

Granular response zone Bentonite seal Cement/bentonite grout Soil backfill Concrete **Cover** Raised cover Stopcock cover

Stratum boundaries

----- Estimated boundary Grading boundary

Logging

The logging of soils and rocks has been carried out in general accordance with BS 5930:2015+A1:2020

Chalk is logged in general accordance with Lord et al (2002) CIRIA C574. Where possible, dynamic samples in chalk have been logged in accordance with CIRIA C574; descriptions and gradings (if presented) should be treated with caution given the potential for sample disturbance.

For rocks the term fracture has been used to identify a mechanical break within the core. Where possible incipient and drilling induced fractures have been excluded from the assessment of fracture state. Where doubt exists, a note has been made in the descriptions. All fractures are considered to be continuous unless otherwise reported.

Made Ground is readily identified when, within the natural make up, man made constituents are evident. Where Made Ground appears to be reworked natural material the differentiation between in situ natural deposits and Made Ground is much more difficult to ascertain. The interpretation of Made Ground within the logs should therefore be treated with caution.

The descriptors "topsoil" and "tarmacadam" are used as generic terms and do not imply conformation to any particular standard or composition.

Rootlets are defined as being less than 2mm in diameter, roots are defined as in excess of 2mm diameter.

General comments

The process of drilling and sampling will inevitably lead to sample disturbance, mixing or loss of material in some soil and rocks.

Indicated water levels are those recorded during the process of drilling or excavating exploratory holes and may not represent standing water levels.

All depths are measured along the axis of the borehole and are related to ground level at the point of entry. All inclinations are measured normal to the axis of the core.

Where provided, the stratigraphical names/geological rock units are for guidance only and may not be wholly accurate.



DYNAMIC PROBE RESULTS

S13-WS/DP01 DP

CLIENT VOLKER FITZPATRICK LIMITED

SITE METROWEST PHASE 1B - SITE 13

Sheet 1 of 2

Date 15 January 2024

Easting 356577

Scale 1:25

Northing 172028

Ground Level 7.65mOD

Depth 6.75 m

Depth (m)	Blowcount / penetration (mm)	Blows / 100mm				Torque (Nm)	Remarks
		10	20	30	40		
0.00							See Log S13-WS/DP01 for details.
1.00	0 / 100 0 / 100 2 / 100 1 / 100 2 / 100 1 / 100 1 / 100 1 / 100 1 / 100						
2.00	1 / 100 2 / 100 1 / 100 2 / 100 2 / 100 2 / 100 2 / 100 1 / 100 1 / 100 1 / 100					0	
3.00	1 / 100 2 / 100 1 / 100 1 / 100 2 / 100 1 / 100 2 / 100 2 / 100 3 / 100 3 / 100					2	
4.00	2 / 100 2 / 100 2 / 100 1 / 100 1 / 100 2 / 100 2 / 100 2 / 100 2 / 100 2 / 100 2 / 100					2	
5.00	2 / 100						

Continued Next Page

Method: Undertaken in accordance with BS EN ISO 22476-2

Probe type: Superheavy (63.5kg hammer mass/750mm drop)

CONTRACT	CHECKED
37628	JH





DYNAMIC PROBE RESULTS

S13-WS/DP01 DP

CLIENT VOLKER FITZPATRICK LIMITED

SITE METROWEST PHASE 1B - SITE 13

Date 15 January 2024

Easting 356577

Northing 172028

Ground Level 7.65mOD

Sheet 2 of 2

Scale 1:25

Depth 6.75 m


Depth (m)	Blowcount / penetration (mm)	Blows / 100mm				Torque (Nm)	Remarks
		10	20	30	40		
6.00	2 / 100					2	Completed at 6.75m
	2 / 100						
	2 / 100						
	2 / 100						
	2 / 100						
	1 / 100						
	2 / 100						
	2 / 100						
	2 / 100						
	3 / 100						
	3 / 100						
	3 / 100						
	6 / 100						
	12 / 100						
	15 / 100						
	20 / 100						
	50 / 45						
7.00							
8.00							
9.00							
10.00							


Method: Undertaken in accordance with BS EN ISO 22476-2


Probe type: Superheavy (63.5kg hammer mass/750mm drop)

CONTRACT	CHECKED
37628	JH



sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range
			

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range
			

sample no & type	sample depth (m) from to	casing depth (m)	samp. /core range
			

STANDARD PENETRATION TEST



CLIENT VOLKER FITZPATRICK LIMITED

SITE METROWEST PHASE 1B - SITE 13

borehole no.	borehole depth (m)	s.w.p (mm)	base depth (m)	casing depth (m)	water level (m)	seating drive				test drive				test type	N	energy ratio %				
						blows	pen (mm)	blows	pen (mm)	blows	pen (mm)	blows	pen (mm)							
S13-WS/DP01	1.20		1.65	Nil	Dry	1	1	75	75	1	1	1	2	75	75	75	75	S	5	66
S13-WS/DP01	2.00		2.45	2.00	Dry	1	1	75	75	0	1	0	0	75	75	75	75	S	1	66
S13-WS/DP01	3.00	450	3.45	3.00	0.00	0	0			0	0	0	0					S	<1	66
S13-WS/DP01	4.00	450	4.45	3.00	0.00	0	0			0	0	0	0					S	<1	66
S13-WS/DP01	5.00		5.45	3.00	0.00	2	3	75	75	2	2	2	3	75	75	75	75	S	9	66
S13-WS/DP01	6.00		6.20	3.00	0.00	15	10	75	25	38	12			75	25			S	150	66
S13-WS/DP2	1.20		1.65	Nil	Dry	1	1	75	75	1	2	2	2	75	75	75	75	S	7	66
S13-WS/DP2	2.00		2.45	2.00	Dry	0	0	75	75	0	0	0	1	75	75	75	75	S	1	66
S13-WS/DP2	3.00		3.45	3.00	0.00	0	0	75	75	0	0	0	1	75	75	75	75	S	1	66
S13-WS/DP2	4.00		4.45	3.00	0.00	1	1	75	75	1	1	2	1	75	75	75	75	S	5	66
S13-WS/DP2	5.00		5.45	3.00	0.00	2	2	75	75	1	2	1	2	75	75	75	75	S	6	66
S13-WS/DP2	6.00		6.24	3.00	0.00	5	9	75	75	35	15			75	15			S	167	66
TP01	1.20		1.65	Nil	0.00	0	0	75	75	0	0	0	1	75	75	75	75	S	1	66
TP01	2.00		2.45	2.00	0.00	2	1	75	75	2	2	2	2	75	75	75	75	S	8	66
TP01	3.00		3.45	2.00	0.00	0	0	75	75	0	0	0	1	75	75	75	75	S	1	66
TP02	1.20		1.65	Nil	0.00	0	0	75	75	0	1	1	2	75	75	75	75	S	4	66
TP02	2.00		2.45	2.00	0.00	0	1	75	75	2	1	2	2	75	75	75	75	S	7	66
TP02	3.00		3.45	2.00	0.00	0	0	75	75	0	0	0	1	75	75	75	75	S	1	66

- notes:
1. Test carried out in general accordance with BS EN ISO 22476-3:2005 + A1:2011
 2. s.w.p = self weight penetration.
 3. N values have not been subjected to any correction.
 4. Test carried out using split spoon S, solid cone C.
 5. Where full test drive not completed, linearly extrapolated N value reported.
 6. ** Denotes no effective penetration.

CONTRACT	CHECKED
37628	JH

IN-SITU HAND VANE/POCKET PENETROMETER



CLIENT VOLKER FITZPATRICK LIMITED

SITE METROWEST PHASE 1B - SITE 13

Borehole /trial pit no.	Depth (m)	Hand vane peak (kPa)	Average hand vane peak (kPa)	Hand vane remoulded (kPa)	Average hand vane remoulded (kPa)	Pocket penetrometer (kPa)	Average pocket penetrometer (kPa)	Remarks
S13-WS/DP2	1.10	59	59	0	0			
Hand vane and pocket penetrometer test results reported as undrained shear strength							CONTRACT 37628	CHECKED JH



APPENDIX B

LABORATORY TESTING



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Version No. 1
Reason for update N/A
Page No. 1 of 11
Date of Issue 06/03/2024

For the attention of Chris Morgan / Megan Mac Court

TEST REPORT

Table with 4 columns: PROJECT/SITE, GEL REPORT NUMBER, Your ref/PO, Test report refers to, Samples received, Schedule received, Testing commenced, Status. Values include METRO WEST SITE 13, 37628, Schedule 1, 16/01/2024, 24/01/2024, 02/02/2024, Final.

SUMMARY OF RESULTS ATTACHED

Table with 3 columns: TEST METHOD & DESCRIPTION, QUANTITY, ACCREDITED TEST. Includes rows for BS EN ISO 17892-1:2014:5, BS EN ISO 17892-12:2018, BS EN ISO 17892-4: 2016: 5.2, BS EN ISO 17892-4: 2016: 5.4, and BRE SD1 Suite.

General Remarks

This report may not be partially reproduced without written permission from this laboratory. The results reported relate to samples received in the laboratory and the items tested.

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Approved Signatories:

W Jones (Laboratory Manager) J Hanson (Director)
T Best (Deputy Laboratory Manager) N Parry (Director)



LIQUID AND PLASTIC LIMITS

BS EN ISO 17892-12:2018



CLIENT NETWORK RAIL

SITE METROWEST PHASE 1B - HIGHWAYS / WECA / NSC SCOPE - SITE 13

borehole / trial pit no.	sample		specimen depth (m)	natural water content (%)	specimen preparation and test method	fraction >0.425 mm (%)	liquid limit (%)	plastic limit (%)	plasticity index (%)	description and remarks
	no./type	depth (m)								
S13-WS/DP01	7B	1.00	1.00	28.8	BXE	0	59	25	34	Brown mottled orange and grey slightly sandy silty CLAY
S13-WS/DP01	14D	2.40	2.40	37.4	E					Brown slightly gravelly slightly sandy silty CLAY
S13-WS/DP01	18D	3.40	3.40	96.8	BXD	1	74	39	35	Brown and grey slightly sandy organic clayey SILT
S13-WS/DP01	21D	4.90	4.90	62.2	BXE	3	66	36	30	Greyish brown slightly gravelly slightly sandy organic clayey SILT
S13-WS/DP01	25D	6.00	6.00	19.0	E					Light grey slightly sandy clayey SILT
S13-WS/DP2	8D	1.00	1.00	25.1	BXE	4	79	40	39	Brown mottled orange and grey slightly gravelly slightly sandy clayey SILT
S13-WS/DP2	12D	2.00	2.00	36.5	E					Brown slightly sandy clayey SILT
S13-WS/DP2	15D	3.00	3.00	55.7	BXD	3	64	30	34	Grey and brown slightly gravelly slightly sandy organic silty CLAY
S13-WS/DP2	17D	3.50	3.50	222	BYD	0	149	107	42	Dark brown slightly gravelly slightly sandy organic clayey SILT
S13-WS/DP2	21D	5.00	5.00	24.6	BXE	1	32	17	15	Brown and bluish grey slightly sandy silty CLAY
TP01	6D	0.90	0.90	36.3	BXE	1	57	28	29	Brown slightly sandy silty CLAY
TP01	12D	2.60	2.60	37.6	BXD	1	54	25	29	Greyish brown slightly sandy silty CLAY
TP02	9D	1.50	1.50	32.7	BXE	4	46	20	26	Brown mottled orange and grey slightly sandy silty CLAY
TP02	10D	2.00	2.00	31.5	E					Brown mottled grey slightly sandy silty CLAY
TP02	13D	3.00	3.00	66.8	BXE	4	48	22	26	Brown and grey slightly gravelly slightly sandy organic silty CLAY

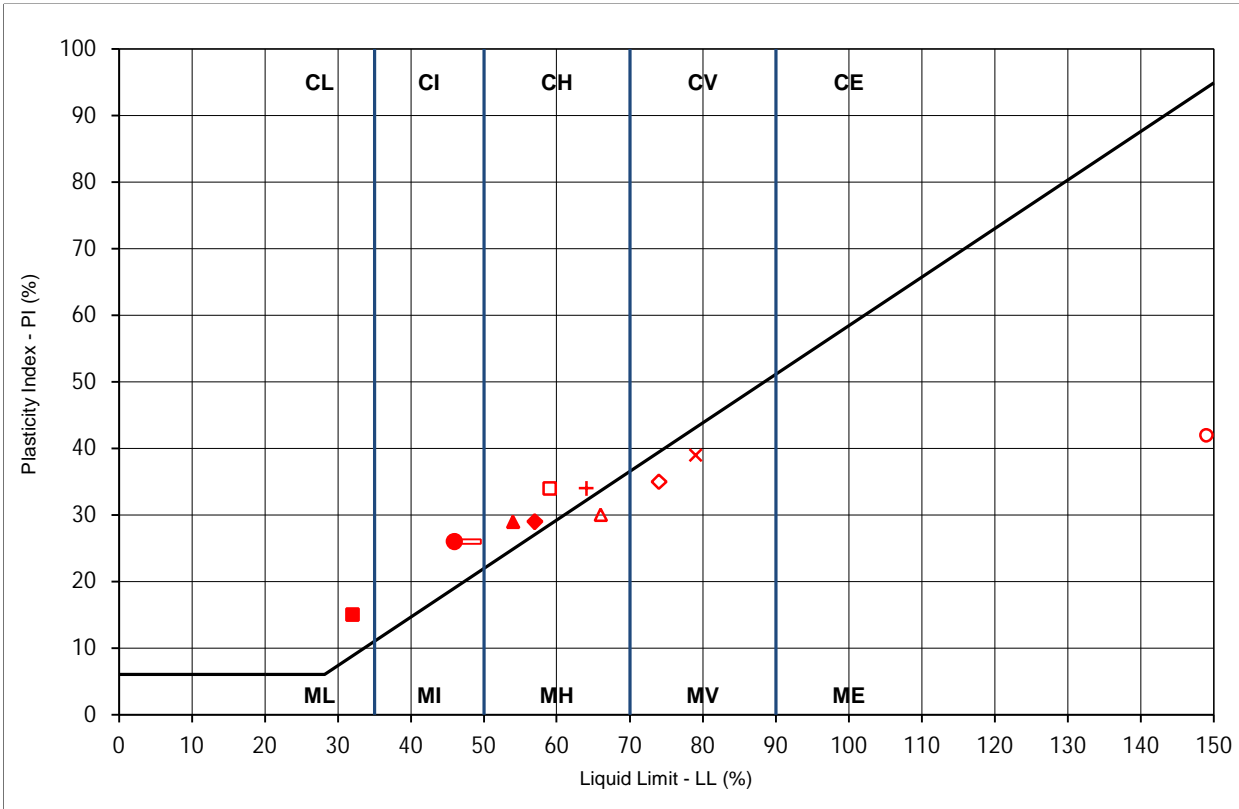
general remarks
 natural water content determined in accordance with BS EN ISO 17892 - 1 : 2014 (unless specified)
 NP denotes non plastic
 # denotes sample tested is smaller than that which is recommended in accordance with BS EN ISO 17892 or BS1377

specimen preparation	test method	CONTRACT	CHECKED
A - as received	D - oven dried (60°C)	37628	WNJ
B - washed on 0.425mm sieve	E - oven dried (105°C)		
C - air dried	F - not known		
	X - cone penetrometer (4 point)		
	Y - cone penetrometer (1 point)		
	Z - casagrande apparatus		



CLIENT NETWORK RAIL

SITE METROWEST PHASE 1B - HIGHWAYS / WECA / NSC SCOPE - SITE 13



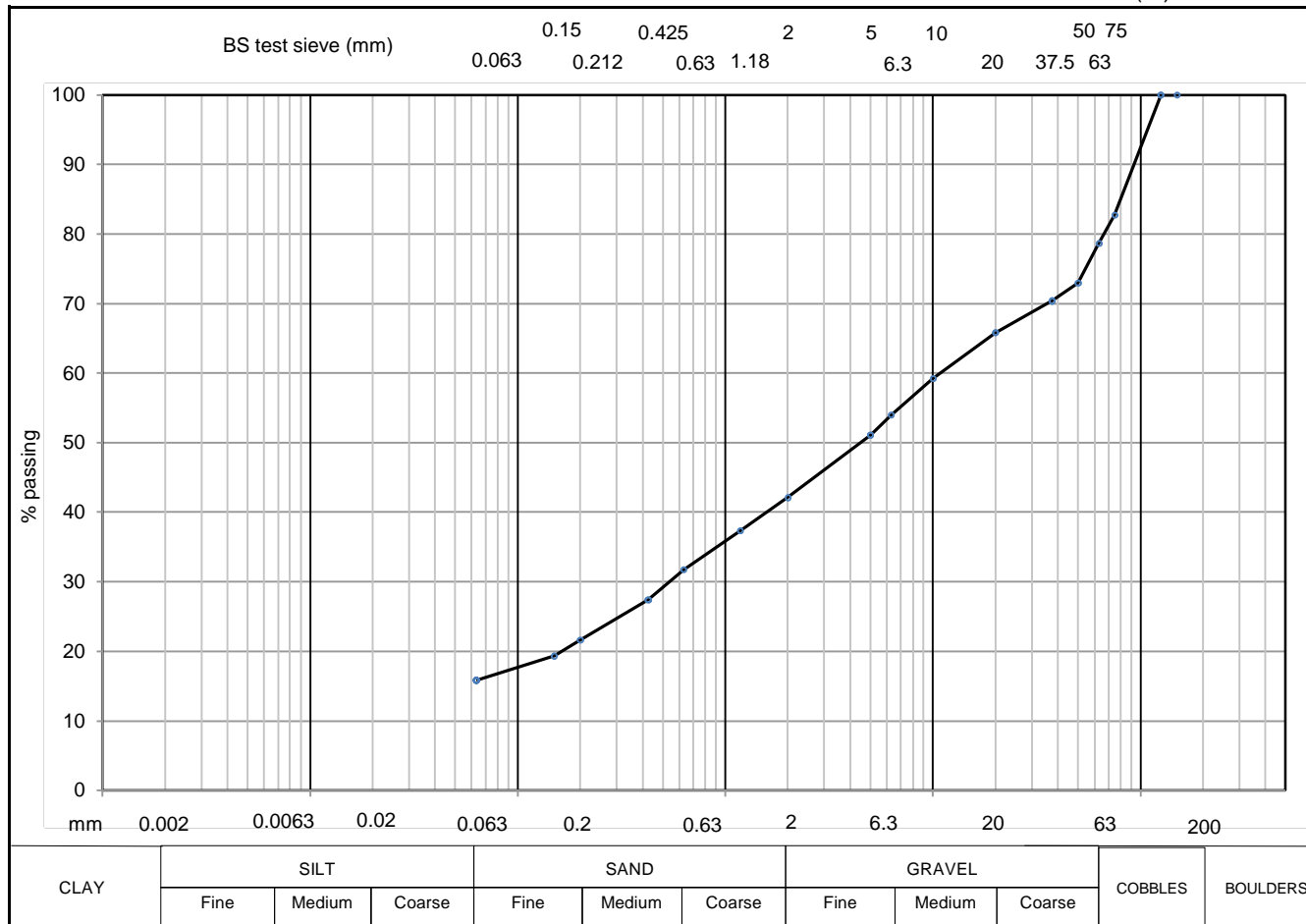
	BH/TP No.	depth (m)	LL	PL	PI	remarks
○	S13-WS/DP01	1.00	59	25	34	
↓	S13-WS/DP01	3.40	74	39	35	
r	S13-WS/DP01	4.90	66	36	30	
∅	S13-WS/DP2	1.00	79	40	39	
∪	S13-WS/DP2	3.00	64	30	34	
○	S13-WS/DP2	3.50	149	107	42	
n	S13-WS/DP2	5.00	32	17	15	
u	TP01	0.90	57	28	29	
p	TP01	2.60	54	25	29	
l	TP02	1.50	46	20	26	
∩	TP02	3.00	48	22	26	

CONTRACT	CHECKED
37628	WNJ

Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT NETWORK RAIL BH/TP No. S13-WS/DP01
 SITE METROWEST PHASE 1B - HIGHWAYS / WECA / NSC SCOPE - SAMPLE No./TYPE 3B
 SITE 13
 DESCRIPTION Dark brown clayey very sandy GRAVEL with high cobble content
 SAMPLE DEPTH (m) 0.15
 SPECIMEN TOP (m) 0.15
 SPECIMEN BASE (m) 0.25

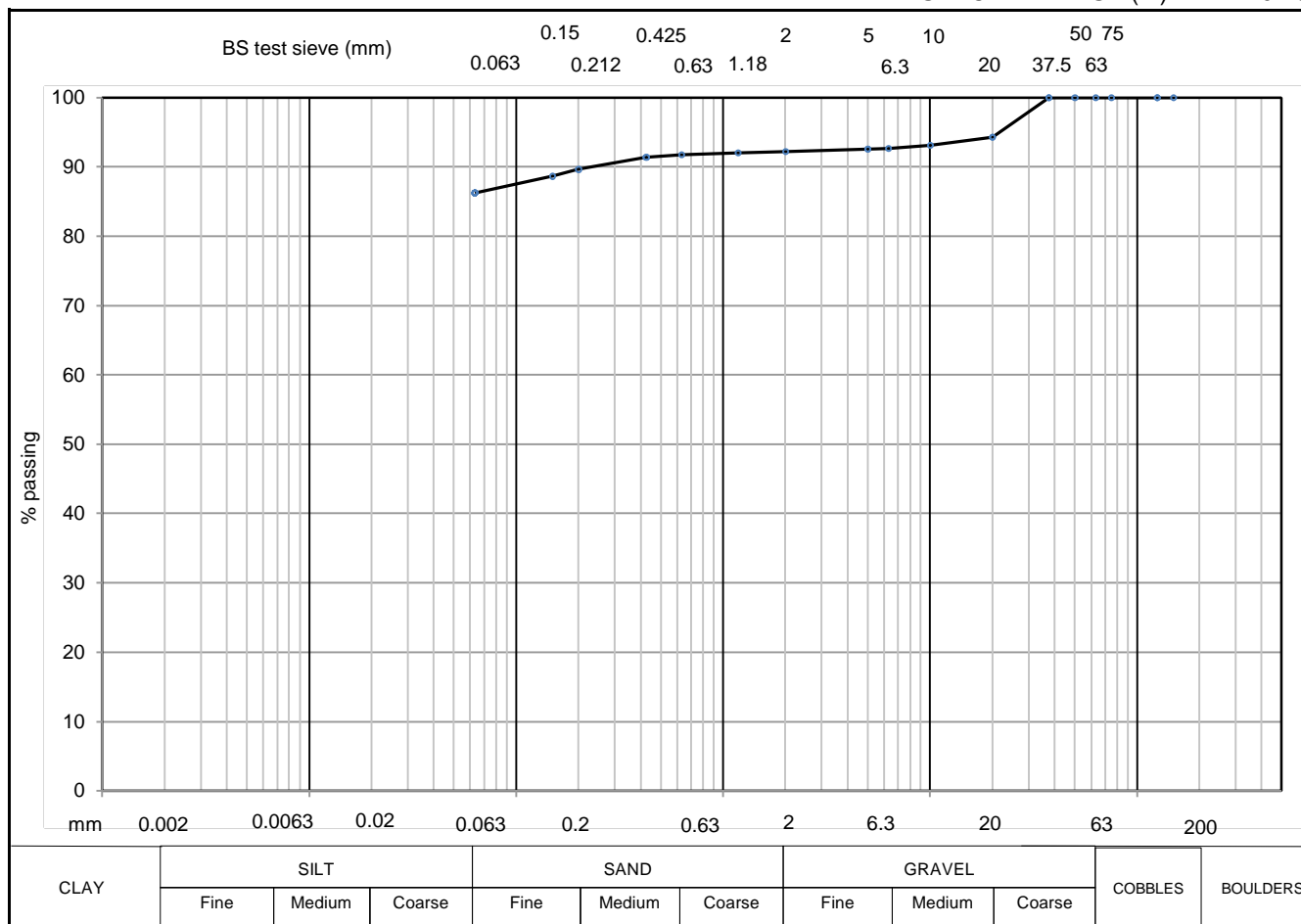


soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
SILT		150	100	5	51	20	
SILT & CLAY	16						
SAND	26	75	83	2	42	6	
GRAVEL	37						
COBBLE & BOULDER	21	63	79	1.18	37	2	
test method(s)	5.2	50	73	0.63	32		
test method		37.5	70	0.425	27		
5.2 - sieving		20	66	0.2	22		
5.3 - sedimentation by hydrometer		10	59	0.15	19		
5.4 - sedimentation by pipette		6.3	54	0.063	16		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m3					CONTRACT	CHECKED
						37628	WNJ

Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	NETWORK RAIL	BH/TP No.	TP01
SITE	METROWEST PHASE 1B - HIGHWAYS / WECA / NSC SCOPE - SITE 13	SAMPLE No./TYPE	3B
DESCRIPTION	Brown slightly gravelly slightly sandy silty CLAY	SAMPLE DEPTH (m)	0.50
		SPECIMEN TOP (m)	0.50
		SPECIMEN BASE (m)	0.70

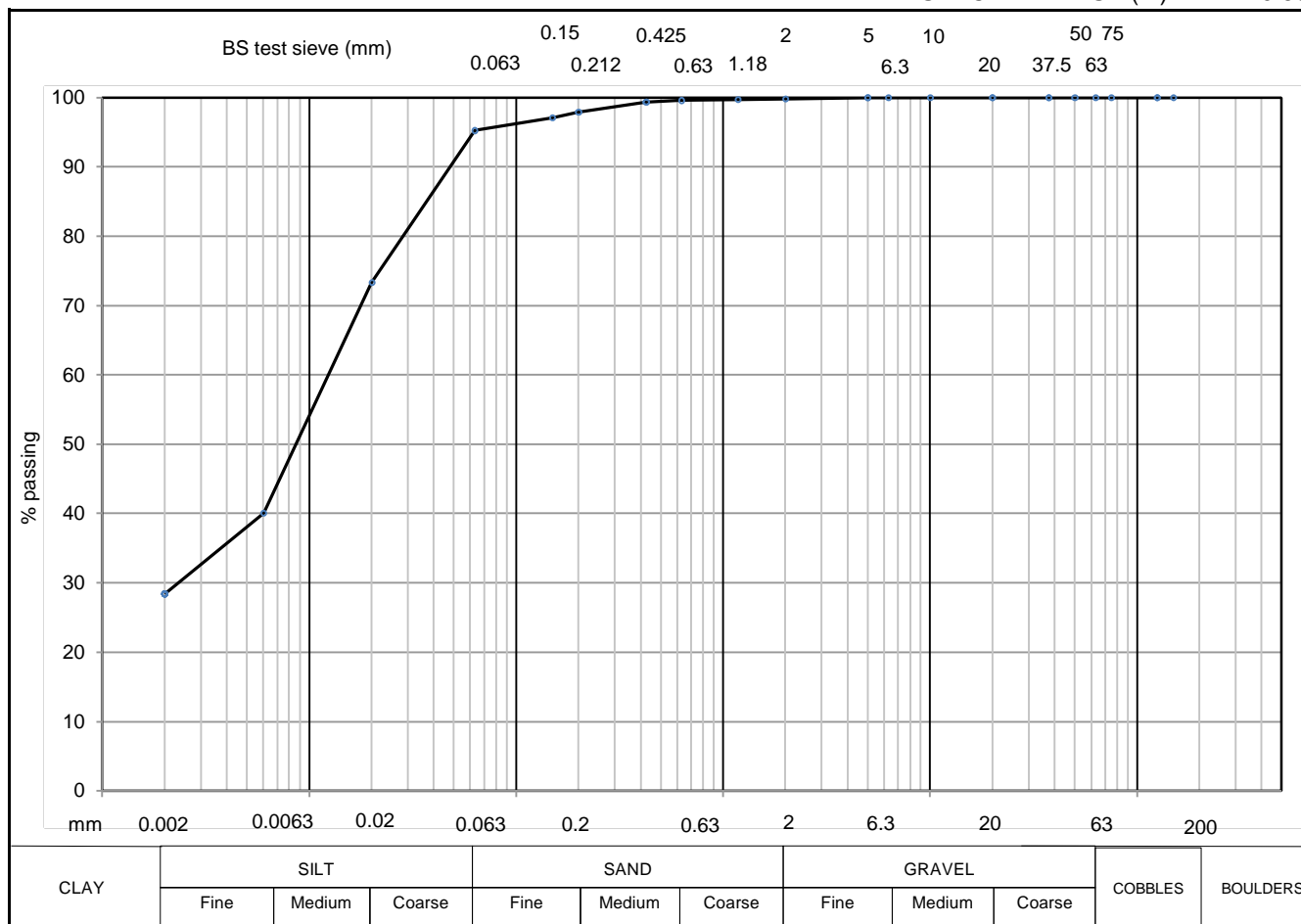


soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY		150		5	93	20	
SILT		75		2	92	6	
SILT & CLAY	86	63		1.18	92	2	
SAND	6						
GRAVEL	8						
COBBLE & BOULDER	0						
test method(s)	5.2	50		0.63	92		
test method		37.5	100	0.425	91		
5.2 - sieving		20	94	0.2	90		
5.3 - sedimentation by hydrometer		10	93	0.15	89		
5.4 - sedimentation by pipette		6.3	93	0.063	86		
remarks	# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m ³					CONTRACT	CHECKED
						37628	WNJ

Geotechnical Engineering Limited
PARTICLE SIZE DISTRIBUTION
 BS EN ISO 17892 - 4 : 2016 : 5



CLIENT	NETWORK RAIL	BH/TP No.	TP02
SITE	METROWEST PHASE 1B - HIGHWAYS / WECA / NSC SCOPE - SITE 13	SAMPLE No./TYPE	4B
DESCRIPTION	Brown slightly sandy silty CLAY	SAMPLE DEPTH (m)	0.50
		SPECIMEN TOP (m)	0.50
		SPECIMEN BASE (m)	0.60



CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	Fine	Medium	Coarse	Fine	Medium	Coarse	Fine	Medium	Coarse		

soil type	% fraction	BS test sieve (mm)	% passing	BS test sieve (mm)	% passing	BS test sieve (µm)	% finer
CLAY	28						
SILT	67	150		5	100	20	73
SILT & CLAY	95	75		2	100	6	40
SAND	5						
GRAVEL	0						
COBBLE & BOULDER	0	63		1.18	100	2	28
test method(s)	5.2 & 5.4	50		0.63	100		
test method		37.5		0.425	99		
5.2 - sieving		20		0.2	98		
5.3 - sedimentation by hydrometer		10		0.15	97		
5.4 - sedimentation by pipette		6.3		0.063	95		

remarks	CONTRACT	CHECKED
# denotes sample tested is smaller than that which is recommended in accordance with BS EN 17892 Particle density assigned an assumed value of 2.70 Mg/m ³	37628	WNJ



Final Report

Report No.: 24-04321-1

Initial Date of Issue: 19-Feb-2024

Re-Issue Details:

Client Geotechnical Engineering Ltd

Client Address: Centurion House, Olympus Park
Quedgeley
Gloucester
Gloucestershire
GL2 4NF

Contact(s): GEL
Tom Best

Project 37628 METRO WEST SITE 13

Quotation No.: **Date Received:** 14-Feb-2024

Order No.: 8221 **Date Instructed:** 14-Feb-2024

No. of Samples: 4

Turnaround (Wkdays): 5 **Results Due:** 20-Feb-2024

Date Approved: 19-Feb-2024

Approved By:



Details: Stuart Henderson, Technical
Manager

For details about application of accreditation to specific matrix types, please refer to the Table at the back of this report

Results - Soil

Project: 37628 METRO WEST SITE 13

Client: Geotechnical Engineering Ltd		Chemtest Job No.:		24-04321	24-04321	24-04321	24-04321		
Quotation No.:		Chemtest Sample ID.:		1766095	1766096	1766097	1766098		
Order No.: 8221		Client Sample Ref.:		4	19	11	3		
		Sample Location:		S13-WS/DP01	S13-WS/DP2	TP01	TP02		
		Sample Type:		SOIL	SOIL	SOIL	SOIL		
		Top Depth (m):		0.15	4.00	2.00	0.40		
		Bottom Depth (m):		0.25	5.00	3.00	0.60		
		Date Sampled:		09-Feb-2024	09-Feb-2024	09-Feb-2024	09-Feb-2024		
		Time Sampled:		9:00	9:00	9:00	9:00		
Determinand	HWOL Code	Accred.	SOP	Units	LOD				
Moisture		N	2030	%	0.020	27	51	25	20
Soil Colour		N	2040		N/A	Brown	Brown	Brown	Brown
Other Material		N	2040		N/A	Roots and Stones	Stones	Stones	Stones
Soil Texture		N	2040		N/A	Sand	Clay	Clay	Sand
pH (2.5:1) at 20C		N	2010		4.0	8.6	7.8	8.2	8.4
Magnesium (Water Soluble)		N	2120	g/l	0.010	0.090	0.090	0.018	< 0.010
Sulphate (2:1 Water Soluble) as SO4		M	2120	g/l	0.010	0.76	0.76	0.087	< 0.010
Total Sulphur		U	2175	%	0.010	0.14	1.2	0.081	0.019
Chloride (Water Soluble)		M	2220	g/l	0.010	< 0.010	0.19	0.28	< 0.010
Nitrate (Water Soluble)		N	2220	g/l	0.010	< 0.010	< 0.010	< 0.010	< 0.010
Sulphate (Acid Soluble)		U	2430	%	0.010	0.084	0.059	0.040	0.063

Test Methods

SOP	Title	Parameters included	Method summary	Water Accred.
2010	pH Value of Soils	pH at 20°C	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	
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.	
2220	Water soluble Chloride in Soils	Chloride	Aqueous extraction and measurement by 'Aquaem 600' Discrete Analyser using ferric nitrate / mercuric thiocyanate.	
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.	

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"
SOP	Standard operating procedure
LOD	Limit of detection

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 30 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

Water Sample Category Key for Accreditation

DW - Drinking Water

GW - Ground Water

LE - Land Leachate

NA - Not Applicable

PL - Prepared Leachate

PW - Processed Water

Report Information

RE - Recreational Water

SA - Saline Water

SW - Surface Water

TE - Treated Effluent

TS - Treated Sewage

UL - Unspecified Liquid

Clean Up Codes

NC - No Clean Up

MC - Mathematical Clean Up

FC - Florisil Clean Up

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



APPENDIX C

CHEMICAL ANALYSES



Justine Surman
Geotechnical Engineering Ltd
Centurion House
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Quedgeley
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GL2 4NF

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f: 01452 729 314
e: justine.surman@qeoeng.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 24-78835

Project / Site name:	Metro West Site 13	Samples received on:	17/01/2024
Your job number:	37628	Samples instructed on/ Analysis started on:	18/01/2024
Your order number:	37628-CMO	Analysis completed by:	25/01/2024
Report Issue Number:	1	Report issued on:	25/01/2024
Samples Analysed:	1 leachate sample - 2 soil samples		

Signed: 

Ben Wilding
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-78835
 Project / Site name: Metro West Site 13
 Your Order No: 37628-CMO

Lab Sample Number	2931488		2931489	
Sample Reference	TP02		TP01	
Sample Number	1		1	
Depth (m)	0.10-0.20		0.10-0.20	
Date Sampled	16/01/2024		16/01/2024	
Time Taken	None Supplied		None Supplied	
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status	
Stone Content	%	0.1	NONE	< 0.1
Moisture Content	%	0.01	NONE	21
Total mass of sample received	kg	0.001	NONE	1.3

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8	8
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	2.5	2.9

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.51
Anthracene	mg/kg	0.05	MCERTS	< 0.05	0.17
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	1.9
Pyrene	mg/kg	0.05	MCERTS	< 0.05	1.9
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	1.6
Chrysene	mg/kg	0.05	MCERTS	< 0.05	1.7
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	4
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	1.5
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	3.9
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	2.1
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.52
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	2.2

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	22
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	3.7	3.4
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	19	18
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.3	1.1
Boron (water soluble)	mg/kg	0.2	MCERTS	1.7	0.8
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	1
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	34	30
Copper (aqua regia extractable)	mg/kg	1	MCERTS	29	24
Lead (aqua regia extractable)	mg/kg	1	MCERTS	110	110
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	30	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	47	42
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	140	180

Monoaromatics & Oxygenates

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0
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Analytical Report Number: 24-78835
 Project / Site name: Metro West Site 13
 Your Order No: 37628-CMO

Lab Sample Number				2931488	2931489
Sample Reference				TP02	TP01
Sample Number				1	1
Depth (m)				0.10-0.20	0.10-0.20
Date Sampled				16/01/2024	16/01/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.05	NONE	< 0.050	< 0.050
TPH-CWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 _{EH_CU_1D_AL}	mg/kg	8.4	NONE	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.05	NONE	< 0.050	< 0.050
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	18
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	< 10	21
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	< 10	23

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



4041



Analytical Report Number: 24-78835
Project / Site name: Metro West Site 13

Your Order No: 37628-CMO

Lab Sample Number				2931490
Sample Reference				TP01
Sample Number				1
Depth (m)				0.10-0.20
Date Sampled				16/01/2024
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.9
Total Cyanide	µg/l	10	ISO 17025	< 10
Chloride	mg/l	0.15	ISO 17025	2.7
Ammoniacal Nitrogen as N	µg/l	15	NONE	85

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	NONE	< 0.01
Acenaphthylene	µg/l	0.01	NONE	< 0.01
Acenaphthene	µg/l	0.01	NONE	< 0.01
Fluorene	µg/l	0.01	NONE	< 0.01
Phenanthrene	µg/l	0.01	NONE	< 0.01
Anthracene	µg/l	0.01	NONE	< 0.01
Fluoranthene	µg/l	0.01	NONE	< 0.01
Pyrene	µg/l	0.01	NONE	< 0.01
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01
Chrysene	µg/l	0.01	NONE	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
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Heavy Metals / Metalloids

Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7
Arsenic (dissolved)	µg/l	1	ISO 17025	2
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (dissolved)	µg/l	0.4	ISO 17025	4
Copper (dissolved)	µg/l	0.7	ISO 17025	37
Lead (dissolved)	µg/l	1	ISO 17025	9.4
Manganese (dissolved)	µg/l	0.06	ISO 17025	46
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	3.1
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Vanadium (dissolved)	µg/l	1.7	ISO 17025	6.4
Zinc (dissolved)	µg/l	0.4	ISO 17025	34

Calcium (dissolved)	mg/l	0.012	ISO 17025	21
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Monoaromatics & Oxygenates

Benzene	µg/l	3	NONE	< 3.0
Toluene	µg/l	3	NONE	< 3.0
Ethylbenzene	µg/l	3	NONE	< 3.0
p & m-xylene	µg/l	3	NONE	< 3.0
o-xylene	µg/l	3	NONE	< 3.0



4041



Analytical Report Number: 24-78835
Project / Site name: Metro West Site 13

Your Order No: 37628-CMO

Lab Sample Number				2931490
Sample Reference				TP01
Sample Number				1
Depth (m)				0.10-0.20
Date Sampled				16/01/2024
Time Taken				None Supplied
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status	

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number : 24-78835
 Project / Site name: Metro West Site 13

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2931488	TP02	1	0.10-0.20	Brown clay and loam with vegetation.
2931489	TP01	1	0.10-0.20	Brown clay and loam with vegetation.

Analytical Report Number : 24-78835
 Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as received, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	MCERTS

Analytical Report Number : 24-78835
Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX in leachates (Monoaromatics)	Determination of BTEX in leachates by headspace GC-MS.	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	NONE
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID. Refer to CoA for band specific accreditation.	In-house method with silica gel split/clean up.	L088/76-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total



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Analytical Report Number : 24-78836

Project / Site name:	Metro West Site 13	Samples received on:	17/01/2024
Your job number:	37628	Samples instructed on/ Analysis started on:	18/01/2024
Your order number:	37628-CMO	Analysis completed by:	25/01/2024
Report Issue Number:	1	Report issued on:	25/01/2024
Samples Analysed:	1 leachate sample - 1 soil sample		

Signed:

Ben Wilding
Technical Reviewer
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

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Waste Acceptance Criteria Analytical Results						
Report No:	24-78836					
				Client: GEOENG		
Location	Metro West Site 13					
Lab Reference (Sample Number)	2931491 / 2931492			Landfill Waste Acceptance Criteria		
Sampling Date	16/01/2024			Limits		
Sample ID	TP02 1			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.10-0.20					
Solid Waste Analysis						
TOC (%)**	2.5			3%	5%	6%
Loss on Ignition (%) **	-			--	--	10%
BTEX (µg/kg)**	< 5.0			6000	--	--
Sum of PCBs (mg/kg)**	< 0.007			1	--	--
Mineral Oil (mg/kg) <small>PH,TD,CU,AL</small>	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85			100	--	--
pH (units)**	-			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-			--	To be evaluated	To be evaluated
Eluate Analysis						
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:1	Limit values for compliance leaching test	
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)	
Arsenic *	< 0.0010			< 0.0100	0.5	2
Barium *	0.0848			0.849	20	100
Cadmium *	< 0.0001			< 0.0008	0.04	1
Chromium *	0.0019			0.019	0.5	10
Copper *	0.015			0.15	2	50
Mercury *	< 0.0005			< 0.0050	0.01	0.2
Molybdenum *	0.0011			0.0110	0.5	10
Nickel *	0.0010			0.0099	0.4	10
Lead *	0.0032			0.032	0.5	10
Antimony *	0.0022			0.022	0.06	0.7
Selenium *	< 0.0040			< 0.040	0.1	0.5
Zinc *	0.0088			0.088	4	50
Chloride *	0.60			6.0	800	15000
Fluoride*	0.22			2.2	10	150
Sulphate *	0.98			9.8	1000	20000
TDS*	69			690	4000	60000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-
DOC	13.4			134	500	800
Leach Test Information						
Stone Content (%)	< 0.1					
Sample Mass (kg)	1.3					
Dry Matter (%)	79					
Moisture (%)	21					
Results are expressed on a dry weight basis, after correction for moisture content where applicable. * = UKAS accredited (liquid eluate analysis only)						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation ** = MCERTS accredited						

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



Analytical Report Number : 24-78836
 Project / Site name: Metro West Site 13

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2931491	TP02	1	0.10-0.20	Brown clay and loam with vegetation.

Analytical Report Number : 24-78836
Project / Site name: Metro West Site 13

Water matrix abbreviations:
Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as received, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031-PL	W	ISO 17025
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number : 24-78836
 Project / Site name: Metro West Site 13

Water matrix abbreviations:
 Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 24-78980

Replaces Analytical Report Number: 24-78980, issue no. 1
Client references/information amended.
Sample ID amended to all samples as per client's request

Project / Site name:	Metro West Site 13	Samples received on:	17/01/2024
Your job number:	37628	Samples instructed on/ Analysis started on:	18/01/2024
Your order number:	37628 CMO	Analysis completed by:	25/01/2024
Report Issue Number:	2	Report issued on:	26/01/2024
Samples Analysed:	1 leachate sample - 2 soil samples		

Signed: 

Joanna Szwagrzak
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

Excel copies of reports are only valid when accompanied by this PDF certificate.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 24-78980
 Project / Site name: Metro West Site 13
 Your Order No: 37628 CMO

Lab Sample Number	2932490		2932491		
Sample Reference	S13-WS/DP01		S13-WS/DP01		
Sample Number	1		2		
Depth (m)	0.05-0.10		0.15-0.25		
Date Sampled	15/01/2024		15/01/2024		
Time Taken	None Supplied		None Supplied		
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	12	17
Total mass of sample received	kg	0.001	NONE	1.3	1.2

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	WEM	WEM

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.4	8.3
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	0.6	3.2

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.17
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.38
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.36
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.21
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.22
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.27
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.11
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.2
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.12
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.14

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	2.18
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Heavy Metals / Metalloids

Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	2.8	3.2
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	13	19
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.5	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	0.3	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	1
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	29	43
Copper (aqua regia extractable)	mg/kg	1	MCERTS	11	33
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	76
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	28
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	34	39
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	40	110

Monoaromatics & Oxygenates

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0
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Analytical Report Number: 24-78980
 Project / Site name: Metro West Site 13
 Your Order No: 37628 CMO

Lab Sample Number				2932490	2932491
Sample Reference				S13-WS/DP01	S13-WS/DP01
Sample Number				1	2
Depth (m)				0.05-0.10	0.15-0.25
Date Sampled				15/01/2024	15/01/2024
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status		
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0
p & m-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
o-xylene	µg/kg	5	MCERTS	< 5.0	< 5.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	5	NONE	< 5.0	< 5.0

Petroleum Hydrocarbons

TPH-CWG - Aliphatic >EC5 - EC6 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020
TPH-CWG - Aliphatic >EC6 - EC8 _{HS_1D_AL}	mg/kg	0.02	NONE	< 0.020	< 0.020
TPH-CWG - Aliphatic >EC8 - EC10 _{HS_1D_AL}	mg/kg	0.05	NONE	< 0.050	< 0.050
TPH-CWG - Aliphatic >EC10 - EC12 _{EH_CU_1D_AL}	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16 _{EH_CU_1D_AL}	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35 _{EH_CU_1D_AL}	mg/kg	8	MCERTS	< 8.0	< 8.0
TPH-CWG - Aliphatic > EC35 - EC44 _{EH_CU_1D_AL}	mg/kg	8.4	NONE	< 8.4	< 8.4
TPH-CWG - Aliphatic (EC5 - EC35) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10
TPH-CWG - Aliphatic (EC5 - EC44) _{EH_CU+HS_1D_AL}	mg/kg	10	NONE	< 10	< 10

TPH-CWG - Aromatic >EC5 - EC7 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010
TPH-CWG - Aromatic >EC7 - EC8 _{HS_1D_AR}	mg/kg	0.01	NONE	< 0.010	< 0.010
TPH-CWG - Aromatic >EC8 - EC10 _{HS_1D_AR}	mg/kg	0.05	NONE	< 0.050	< 0.050
TPH-CWG - Aromatic >EC10 - EC12 _{EH_CU_1D_AR}	mg/kg	1	MCERTS	< 1.0	< 1.0
TPH-CWG - Aromatic >EC12 - EC16 _{EH_CU_1D_AR}	mg/kg	2	MCERTS	< 2.0	< 2.0
TPH-CWG - Aromatic >EC16 - EC21 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10
TPH-CWG - Aromatic >EC21 - EC35 _{EH_CU_1D_AR}	mg/kg	10	MCERTS	< 10	< 10
TPH-CWG - Aromatic > EC35 - EC44 _{EH_CU_1D_AR}	mg/kg	8.4	NONE	< 8.4	< 8.4
TPH-CWG - Aromatic (EC5 - EC35) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	< 10	< 10
TPH-CWG - Aromatic (EC5 - EC44) _{EH_CU+HS_1D_AR}	mg/kg	10	NONE	< 10	< 10

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



4041



Analytical Report Number: 24-78980
Project / Site name: Metro West Site 13

Your Order No: 37628 CMO

Lab Sample Number	2932492		
Sample Reference	S13-WS/DP01		
Sample Number	2		
Depth (m)	0.15-0.25		
Date Sampled	15/01/2024		
Time Taken	None Supplied		
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.8
Total Cyanide	µg/l	10	ISO 17025	< 10
Chloride	mg/l	0.15	ISO 17025	1.3
Ammoniacal Nitrogen as N	µg/l	15	NONE	190

Total Phenols

Total Phenols (monohydric)	µg/l	10	ISO 17025	< 10
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Speciated PAHs

Naphthalene	µg/l	0.01	NONE	< 0.01
Acenaphthylene	µg/l	0.01	NONE	< 0.01
Acenaphthene	µg/l	0.01	NONE	< 0.01
Fluorene	µg/l	0.01	NONE	< 0.01
Phenanthrene	µg/l	0.01	NONE	< 0.01
Anthracene	µg/l	0.01	NONE	< 0.01
Fluoranthene	µg/l	0.01	NONE	< 0.01
Pyrene	µg/l	0.01	NONE	< 0.01
Benzo(a)anthracene	µg/l	0.01	NONE	< 0.01
Chrysene	µg/l	0.01	NONE	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	NONE	< 0.01
Benzo(a)pyrene	µg/l	0.01	NONE	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	NONE	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	NONE	< 0.01
Benzo(ghi)perylene	µg/l	0.01	NONE	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.2	NONE	< 0.2
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Heavy Metals / Metalloids

Antimony (dissolved)	µg/l	1.7	ISO 17025	< 1.7
Arsenic (dissolved)	µg/l	1	ISO 17025	2.5
Beryllium (dissolved)	µg/l	0.2	ISO 17025	< 0.2
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08
Chromium (dissolved)	µg/l	0.4	ISO 17025	3.7
Copper (dissolved)	µg/l	0.7	ISO 17025	21
Lead (dissolved)	µg/l	1	ISO 17025	2.6
Manganese (dissolved)	µg/l	0.06	ISO 17025	49
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.2
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0
Vanadium (dissolved)	µg/l	1.7	ISO 17025	7.3
Zinc (dissolved)	µg/l	0.4	ISO 17025	26

Calcium (dissolved)	mg/l	0.012	ISO 17025	20
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4041



Analytical Report Number: 24-78980
Project / Site name: Metro West Site 13

Your Order No: 37628 CMO

Lab Sample Number	2932492		
Sample Reference	S13-WS/DP01		
Sample Number	2		
Depth (m)	0.15-0.25		
Date Sampled	15/01/2024		
Time Taken	None Supplied		
Analytical Parameter (Leachate Analysis)	Units	Limit of detection	Accreditation Status

Monoaromatics & Oxygenates

Benzene	µg/l	3	NONE	< 3.0
Toluene	µg/l	3	NONE	< 3.0
Ethylbenzene	µg/l	3	NONE	< 3.0
p & m-xylene	µg/l	3	NONE	< 3.0
o-xylene	µg/l	3	NONE	< 3.0

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected



Analytical Report Number : 24-78980
 Project / Site name: Metro West Site 13

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2932490	S13-WS/DP01	1	0.05-0.10	Brown loam with brick and vegetation.
2932491	S13-WS/DP01	2	0.15-0.25	Brown gravelly sand with vegetation.

Analytical Report Number : 24-78980
Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
BS EN 12457-1 (2:1) Leachate Prep	2:1 (as received, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-1.	L043-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with dispersion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in leachate	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in leachate	Determination of PAH compounds in leachate by extraction in dichloromethane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L102B-PL	W	NONE
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards. Refer to CoA for analyte specific accreditation.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total cyanide in leachate	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX and MTBE in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	MCERTS

Analytical Report Number : 24-78980
Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BTEX in leachates (Monoaromatics)	Determination of BTEX in leachates by headspace GC-MS.	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	NONE
Ammoniacal Nitrogen as N in leachate	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the discrete analyser (colorimetric) salicylate/nitroprusside method.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	NONE
TPHCWG (Soil)	Determination of hexane extractable hydrocarbons in soil by GC-MS/GC-FID. Refer to CoA for band specific accreditation.	In-house method with silica gel split/clean up.	L088/76-PL	D	MCERTS
TPH in (Soil)	Determination of TPH bands by HS-GC-MS/GC-FID	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	NONE
Chloride in leachate	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
D.O. for Gravimetric Quant if Screen/ID positive	Dependent option for Gravimetric Quant if Screen/ID positive scheduled.	In house asbestos methods A001 & A006.	A006-PL	D	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 24-78982

Project / Site name:	Metro West Site 13	Samples received on:	17/01/2024
Your job number:	37628	Samples instructed on/ Analysis started on:	18/01/2024
Your order number:	37628 CMO	Analysis completed by:	26/01/2024
Report Issue Number:	1	Report issued on:	26/01/2024
Samples Analysed:	10:1 WAC sample		

Signed: _____

Joanna Schwagrak
Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

i2 Analytical

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Waste Acceptance Criteria Analytical Results						
Report No:	24-78982					
				Client: GEOENG		
Location	Metro West Site 13					
Lab Reference (Sample Number)	2932499 / 2932500			Landfill Waste Acceptance Criteria		
Sampling Date	15/01/2024			Limits		
Sample ID	S13-WS/DP01 1			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.05-0.10					
Solid Waste Analysis						
TOC (%)**	0.6			3%	5%	6%
Loss on Ignition (%) **	-			--	--	10%
BTEX (µg/kg)**	< 5.0			6000	--	--
Sum of PCBs (mg/kg)**	< 0.007			1	--	--
Mineral Oil (mg/kg) <small>PH,TD,CU,AL</small>	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85			100	--	--
pH (units)**	-			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	-			--	To be evaluated	To be evaluated
Eluate Analysis						
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	10:1			10:1	Limit values for compliance leaching test	
	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)	
Arsenic *	0.0028			0.0285	0.5	2
Barium *	0.0730			0.730	20	100
Cadmium *	< 0.0001			< 0.0008	0.04	1
Chromium *	< 0.0004			< 0.0040	0.5	10
Copper *	0.0068			0.068	2	50
Mercury *	< 0.0005			< 0.0050	0.01	0.2
Molybdenum *	0.0010			0.0100	0.5	10
Nickel *	< 0.0003			< 0.0030	0.4	10
Lead *	0.0019			0.019	0.5	10
Antimony *	0.0052			0.052	0.06	0.7
Selenium *	< 0.0040			< 0.040	0.1	0.5
Zinc *	0.0014			0.014	4	50
Chloride *	0.56			5.6	800	15000
Fluoride*	0.20			2.0	10	150
Sulphate *	1.9			19	1000	20000
TDS*	65			650	4000	60000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-
DOC	13.0			130	500	800
Leach Test Information						
Stone Content (%)	< 0.1					
Sample Mass (kg)	1.3					
Dry Matter (%)	88					
Moisture (%)	12					
Results are expressed on a dry weight basis, after correction for moisture content where applicable. * = UKAS accredited (liquid eluate analysis only)						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation ** = MCERTS accredited						

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.



Analytical Report Number : 24-78982
Project / Site name: Metro West Site 13

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2932499	S13-WS/DP01	1	0.05-0.10	Brown loam with brick and vegetation.

Analytical Report Number : 24-78982
Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as received, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270.	L064-PL	D	MCERTS
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260. Refer to CoA for analyte specific accreditation	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031-PL	W	ISO 17025
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK or A' analysis have been carried out in our laboratory in the United Kingdom (WATFORD).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL or B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Analytical Report Number : 24-78982
 Project / Site name: Metro West Site 13

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total