

Llangatwg

784-B068800

Ground Investigation & Geotechnical Design Report



V3

Morgan Sindall

June 2025

Document prepared by Tetra Tech Limited. Registered in England number: 01959704



Atlantic House Greenwood Close, Gate Business Park, Pontprennau, Cardiff CF23 8RD

Tetra Tech Limited. Registered in England number: 01959704

Registered Office: 3 Sovereign Square, Sovereign Street, Leeds, United Kingdom, LS1 4ER

DOCUMENT CONTROL

Document:	Ground Investigation & Geotechnical Design Report
Project:	Llangatwg
Client:	Morgan Sindall
Project Number:	784-B068800
File Origin:	\\ds-dc-vm-101\Data\Projects\784-B068800_Llangatwg_\60_Output\61_WIP\GIR\784-B068800 Llangatwg GIR & GDR V3 June 25.docx

Revision:	V1	Prepared by:	Joel May
Date:	Feb 2025	Checked by:	Paul Vincent
Status:	Interim Draft	Approved By:	Chris Pugh
Description of Revision:	First Interim Draft – for comment		

Revision:	V2	Prepared by:	Joel May
Date:	April 2025	Checked by:	Dr Sarah Roberts
Status:	Draft	Approved By:	Paul Vincent
Description of Revision:	First full Draft – for comment		

Revision:	V3	Prepared by:	Joel May
Date:	June 2025	Checked by:	Dr Sarah Roberts
Status:	Draft	Approved By:	Paul Vincent
Description of Revision:	First full Draft with inclusion of GDR		

Revision:		Prepared by:	
Date:		Checked by:	
Status:		Approved By:	
Description of Revision:			

Llangatwg

Ground Investigation & Geotechnical Design Report

TABLE OF CONTENTS

1.0	INTRODUCTION	9
1.1	Instruction	9
1.2	Brief.....	9
1.3	report scope	10
1.4	Limitations	10
2.0	SUMMARY OF SITE INFORMATION	11
2.1	Location.....	11
2.2	Site Description.....	11
2.3	Ground Conditions.....	11
2.4	Previous Site Investigation.....	13
3.0	SITE INVESTIGATION.....	14
3.1	Scope	14
4.0	GROUND CONDITIONS ENCOUNTERED	16
4.1	Strata Encountered.....	16
4.2	Groundwater	18
4.3	Insitu testing.....	18
4.4	Visual or Olfactory Evidence of Contamination	18
4.5	Obstructions.....	19
4.6	Asphalt coring & testing.....	19
4.7	riverbank void investigation.....	20
5.0	LABORATORY TESTING.....	21
5.1	Geotechnical Testing	21
5.2	Environmental Testing	21
6.0	GROUNDWATER AND GAS MONITORING.....	23
6.1	Groundwater Monitoring.....	23
6.2	Ground Gas Monitoring.....	23
7.0	SOIL INFILTRATION TESTING	25
7.1	Background	25
7.2	Soil Infiltration Tests.....	25
7.3	Ground Conditions.....	26

Llangatwg

Ground Investigation & Geotechnical Design Report

7.4	Constraints and Limitations	26
8.0	GEOTECHNICAL ASSESSMENT.....	27
8.1	Ground Conditions.....	27
8.2	Soil Properties	27
8.3	Summary of Characteristic Material Parameters	28
9.0	PRELIMINARY GEOTECHNICAL DESIGN CONSIDERATIONS	31
9.1	Proposed Development.....	31
9.2	Earthworks	31
9.3	Foundations	31
9.4	Floor Slabs.....	31
9.5	Chemical Attack on Buried Concrete	32
9.6	Temporary Works.....	32
9.7	Pavements.....	32
9.8	Drainage	32
10.0	GEOTECHNICAL RISK REGISTER	33
10.1	Introduction	33
10.2	Risk Matrix	34
11.0	GEOTECHNICAL DESIGN	37
11.1	Material Properties	37
11.2	Foundations	37
11.3	Settlement.....	38
11.4	Spring Stiffness	38
12.0	GROUND CONTAMINATION ASSESSMENT – HUMAN HEALTH	40
12.1	Introduction	40
12.2	Assessment Criteria	40
12.3	Tier 1 – Soil Screening.....	41
12.4	Asbestos	42
13.0	GROUND CONTAMINATION ASSESSMENT – WIDER ENVIRONMENT	43
13.1	Introduction	43
13.2	Assessment Criteria	43
13.3	Tier 1 Screening Assessment – Leachate	43

Llangatwg

Ground Investigation & Geotechnical Design Report

13.4	Tier 1 Screening Assessment – Groundwater	44
13.5	Summary	45
14.0	PRELIMINARY GROUND GAS ASSESSMENT	46
14.1	Introduction	46
14.2	Preliminary Ground Gas Risk Assessment	47
14.3	Summary and Discussion	49
15.0	WASTE CLASSIFICATION ASSESSMENT	50
15.1	Introduction	50
16.0	CONCEPTUAL SITE MODEL & PRELIMINARY GROUND CONTAMINATION RISK ASSESSMENT	52
16.1	Overview	52
16.2	Current Site Usage and Proposed Development.....	52
16.3	Conceptual Site Model.....	52
16.4	Ground Conditions Risk Assessment	53
17.0	CONCLUSIONS AND RECOMMENDATIONS	57
17.1	Conclusions.....	57
18.0	NOTES.....	59
19.0	GLOSSARY	60

FIGURES

Figure 1: Site Location Plan

Figure 2: Ground Investigation Exploratory Location Plans

APPENDICES

Figures

Appendix A: Report Conditions

Appendix B: Exploratory Hole Logs

Appendix C: Soil Infiltration Test

Appendix D: CBR Test Data

Appendix E: Geotechnical Laboratory Test Results

Appendix F: chemical Laboratory Test Results

Appendix G: CIRIA C552 Risk Methodology

Appendix H: Groundwater and Ground Gas Monitoring Results

Appendix I: GDR Calculations

EXECUTIVE SUMMARY

The Site	The site is located situated at Llangatwg Community School within the area of Neath in South Wales. The site is approximately 4.82ha in area and is centred on National Grid Reference (NGR) 276707 199304. The approximate postcode of the site is SA10 8DB. The site is currently utilised as Ysgol Gyfun Cymunedol Llangatwg Community Comprehensive School and Sensitive Water Solutions Swim School centrally, with associated car parking to the south and south-west, playgrounds to the west and south-east and undeveloped amenity grasslands utilised as a playing field to the north-east.
Geology, Hydrology, Hydrogeology and Radon	Artificial Ground, such as Made Ground, is shown to be present on published BGS mapping. The Groundsure report records the entirety of the site to be underlain by Made Ground which is later classified as Landscaped Ground. BGS mapping indicates much of the site, to the west, is underlain by Glaciofluvial sheet deposits (Devensian in Age) comprising of Sand and Gravel. BGS mapping indicates that the solid geology underlying the site is comprised of the Brithdir Member comprised of sandstone. The Brithdir Member bedrock and Superficial Deposits (underlying the south-western area of the site - Glaciofluvial Sheet Deposits) are designated as a Secondary A Aquifer. The site is not shown to be situated within an EA/NRW defined groundwater SPZ. The River Neath (Afon Neath) runs in a south-westerly direction and is located immediately to the east and south of the site, alongside the Tennant Canal. There are series of other onsite watercourses that are classified as an inland river which is not influenced by normal tidal action these on ground surface level with one located underground. They were a watercourse that contains water year-round (in normal circumstances). The site is located in a low probability radon area as less than 1-3% of homes are above the action level. Radon protection measures are not required for new developments on the site.
UXO	The site is located in a low-risk area with respect to UXO.
Site History	The site comprised undeveloped fields with an assumed roadway/track running across site from the south-west to the north-east from 1877, with no mapping available prior to this. The site remained relatively unchanged, until 1935, when a school was first developed, and the school has undergone progressive development and expansion from 1935 to present.
Environmental Database	The records included in the Environmental Database show there are no pollution controls, waste, or hazardous substance locations within the 250m of the site boundary. There are no present or BGS recorded landfills, however a historic landfill is noted to be situated at Cadoxton, Neath, West Glamorgan 212m to the southwest of the site. There are no licensed waste treatment facilities within 250m of the site. Whilst the Groundsure Report records a total of twenty-three pollution incidents within 500m of the site, with the closest recorded incident being located 341m east of the site and was related to sewage materials with only a minor impact on the water. Due to the distance this is considered to not have an impact on the site. Furthermore, the Groundsure also highlighted a number of areas of potentially landscaped ground, with surface workings, within the surrounding areas, which is possibly associated with the former Colliery and Coal mining within the area. No other sensitive land uses are recorded with the exception of a designated ancient woodland, which has been classified as unknown and detailed as a restored ancient woodland site, which is present on site. As the site is located adjacent to the River Neath, the Groundsure report indicates that there is moderate risk of flooding from the river across the southern part of the site and within the south-west corner of the site. The NRW Flood Risk Map indicates some areas of elevated surface water flooding risk in a number of areas on site, with the risk being deemed to be moderate based on the current site condition.

Ground Investigation	The site investigation was undertaken on 6th to 17th January 2025. Six groundwater and ground gas monitoring visits were undertaken between 28th January and April 2025. The scope of the site investigation included the following: • 4 no. dynamically sampled/rotary cored boreholes, including in situ testing of SPT's, to refusal with dynamic probe follow on to refusal. Sampling and testing in accordance with Ground Investigation specification; • 5 no. mini percussive boreholes; • 5 No. machine excavated Trial Pits excavated with soakaway tests undertaken to BRE 365 Digest to inform drainage design; • 14 No. in-situ California Bearing Ratio (CBR) tests using the TRL-DCP method adjacent to each borehole location and soakaway; • 4 No. hand dug/augered pits to collect shallow samples; • 6 no. asphalt cores to assess for PAH; • Installation of 7 No. ground gas and groundwater monitoring wells; • On-site inspection and logging of samples; • Representative soil samples taken and submitted for geotechnical classification testing; • Representative soil samples taken, submitted and tested for a suite of potential contaminants; • Six return visits to monitor ground gas and groundwater levels;
Ground Conditions Encountered	The sequence of strata encountered beneath the site was; • Topsoil; • Made Ground; • Superficial Deposits (Glaciofluvial Sheet); • Bedrock (Brithdir Sandstone).
Soil Infiltration Testing	Three test locations were undertaken across the site, designated SA02, SA04 and SA06. SA02 was undertaken in coarse grained weathered bedrock deposits, SA04 in coarse grained Made Ground and SA06 in coarse grained superficial deposits. All three tests in SA02 and SA04 failed, while infiltration rates in SA06 were 6.63×10^{-6}, 5.58×10^{-6} and 5.24×10^{-6}.
Preliminary Geotechnical Assessment	Pad or strip foundations, placed within shallow natural deposits be designed to an allowable net bearing pressure, R_d, of 900kPa. Pad or strips founded at approximately 0.75m to 1.20m bgl should result in settlement less than 25mm. Floor slabs may be ground bearing. The Design Sulphate Class for the site be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1. A conservative CBR value of 6% is recommended for pavement design.
Geotechnical Design	Pad foundations may be Designed, in accordance with Eurocode 7 BS EN1997-1 (ULS DA1-2, partial factor of 1.25 for ϕ'), to an allowable net bearing pressure, R_d, of 870kPa / kN/m², the degree of utilisation, Λ_{GEO}, has been assessed below). $885kN \text{ max load (PF5) over a } 1.5m^2 \text{ Pad} = 394kN/m^2$ $Ed = 1 \times 394 = 394kN/m^2$ $R_d = 870 \text{ kN/m}^2 \text{ therefore } R_d > Ed \text{ therefore ULS is verified with 45\% utilisation.}$ The calculations show that the designed shallow pad foundations are suitable given the ground conditions and structural loadings.

	Values of the modulus of subgrade reaction have been assessed as the following; Therefore, from the above equation; $K_s = 120 \times 400 (\sim \text{Max Load}) \times 3 = 144,000 \text{ kN/m}^3$ Therefore, from the above equation; $K_s = 120 \times 50 (\text{GB Slab}) \times 3 = 18,000 \text{ kN/m}^3$
Ground Contamination Assessment	Human Health With respect to the risks to human health, whilst a concentration of lead was recorded in excess of the adopted screening value for a Public Open space (resi) the actual anticipated exposure to sub surface soils is likely to be significantly reduced by the presence of hard standing within the proposed development. However, if the development plan is altered to include soft landscaping in this area further testing will be required to support the development. Confirmatory testing will also be required in the event that the Made Ground from the area around SA04 will be required for re-use in other areas of the site. Due to the previous development of the site, it is recommended that a reactive approach is adopted during the development phase to identify any previously unidentified contamination which may be encountered during the site works. Controlled Waters Whilst elevated concentrations of heavy metals have been recorded in soil derived leachates and groundwater samples, the recorded concentrations and relatively aggressive nature of leachate testing procedures and limited extent of anthropogenic materials within the Made Ground indicate the concentrations are likely to be naturally occurring. Risks to controlled waters are likely to be limited. Asbestos Asbestos containing materials were not identified in site or during the subsequent laboratory testing.
Ground Gas Assessment	Based on information obtained as part of the ground investigation, the site is considered to be representative of Characteristic Situation 1 (Very Low Risk). A limited number of data points have recorded concentrations of carbon dioxide marginally above the threshold value of 5%, however given the limited number exceedances, the low flow rates and lack of significant source potential on site or in the surrounding site area the classification of CS1 has not been revised. As such ground gas protection measures are not considered necessary for new developments. The site is located in an area where radon protection measures are not required.
Conclusions and Recommendations	The following recommendations are presented within the context of the proposed development. • Remediation Strategy to manage the risks posed by demolition waste in the vicinity of the former structure on the western boundary of the site. • Asbestos Management Plan to manage risks associated with earthworks within the vicinity of the former structure on the western boundary of the site. • Reactive Remediation Strategy to provide a framework for the assessment and management of any previously unidentified contamination which may be encountered during the development phase.

1.0 INTRODUCTION

1.1 INSTRUCTION

Tetra Tech Ltd (Tetra Tech) was commissioned by Morgan Sindall (the client) to a ground investigation to assess the underlying ground conditions for the re-development for a site known as Llangatwg (known hereafter as “the site”).

1.2 BRIEF

The brief was to undertake an intrusive ground investigation to provide information on ground and groundwater regimes to assist in the proposed development of the site.

The investigation was designed to comprise the following elements:

- 4 no. dynamically sampled/rotary cored boreholes, including in situ testing of SPT's, to refusal with dynamic probe follow on to refusal. Sampling and testing in accordance with Ground Investigation specification;
- 5 no. mini percussive boreholes;
- 5 No. machine excavated Trial Pits excavated with soakaway tests undertaken to BRE 365 Digest to inform drainage design;
- 14 No. in-situ California Bearing Ratio (CBR) tests using the TRL-DCP method adjacent to each borehole location and soakaway;
- 4 No. hand dug/augered pits to collect shallow samples;
- 6 no. asphalt cores to assess for PAH;
- Installation of 7 No. ground gas and groundwater monitoring wells;
- On-site inspection and logging of samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples taken, submitted and tested for a suite of potential contaminants;
- Six return visits to monitor ground gas and groundwater levels;
- Preparation of a Ground Investigation report.

The specification of works were completed in accordance with ICE specification for ground investigation and the works themselves be completed in general accordance with the principles set out in BS EN 1997-2:2007 and with the general practice described in BS5930:2015. The geo-environmental aspects of the ground investigation complied with the general requirements of BS 10175+A1:2017.

1.3 REPORT SCOPE

This report summarises the work undertaken and includes the following elements:

- Full factual records of the site works carried out;
- Ground conditions encountered;
- Environmental laboratory testing results;
- Geotechnical laboratory testing results.

1.4 LIMITATIONS

This report has been prepared in accordance with the requirements of Morgan Sindall. This report is subject to the report conditions presented in Appendix A.

The information contained in this report is intended for the use of the Morgan Sindall and Tetra Tech can take no responsibility for the use of this information by any third party or for uses other than that described in this report or detailed within the terms of our engagement.

2.0 SUMMARY OF SITE INFORMATION

2.1 LOCATION

The site is located situated at Llangatwg Community School within the area of Neath in South Wales. The site is approximately 4.82ha in area and is centred on National Grid Reference (NGR) 276707 199304. The approximate postcode of the site is SA10 8DB.

The nearest site address is: Llangatwg Community School, Aberdulais, Neath SA10 8DB.

A site location plan is presented in Figure 1.

2.2 SITE DESCRIPTION

The site is currently utilised as Ysgol Gyfun Cymunedol Llangatwg Community Comprehensive School and Sensitive Water Solutions Swim School centrally, with associated car parking to the south and south-west, playgrounds to the west and south-east and undeveloped amenity grasslands utilised as a playing field to the north-east.

Access to the site is gained via the A4230 to the south-west and Pencynor Road on the southern boundary. The site is topographically higher in the north-east and generally slopes to the south-west with a maximum change of elevation of 5m (based on on-line aerial photography). The ground cover generally comprises tarmacadam hardstanding with localised areas of soft landscaping, shrubbery and mature trees to the south, south-west, north and east of the site with a large amenity grasslands to the north-east.

Surrounding land uses:

- NORTH: bound by dense forestry to the north and to the north-east by residential dwellings, industrial and commercial land uses;
- EAST: Pencynor Road and residential dwellings beyond;
- SOUTH: the A4230 followed by an area of forestry and the A465 beyond;
- WEST: Residential dwellings.

2.3 GROUND CONDITIONS

All information collated on ground conditions is based on extrapolation from data available on adjacent sites, and from literature sources. In summary, the following data sources have been consulted:

2.3.1 British Geological Survey Information

The geology of the site area is covered by:

- British Geological Survey (BGS) Sheet No. 247 (Swansea) Solid and Drift Edition, 1:50 000;
- BGS website (British Geological Survey, 2024);
- Environmental database (Groundsure Report)- to be presented within finalised Desk Top Study Report.

According to the BGS map of the area (plate 1 and 2) the following ground conditions appear to be underlying the site:

Made Ground

Artificial Ground, such as Made Ground, is shown to be present on published BGS mapping. The Groundsure report records the entirety of the site to be underlain by Made Ground which is later classified as Landscaped Ground;

The BGS mapping defines Made Ground as *'an area where the pre-existing (natural or artificial) land surface is raised by artificial deposits. The purpose of the made ground is unspecified.'* The Made Ground across the area is anticipated to be associated with the historic unspecified workings and historical activities within the immediate vicinity.

The BGS mapping define Landscaped Ground as Landscaped Ground as *'an area where the land surface (natural or artificial) has been extensively remodelled, but where it is impracticable or impossible to delineate separate zones of Made Ground, Worked Ground, or Disturbed Ground.'* The ground conditions are often variable in their composition.

Superficial Geology

BGS mapping indicates much of the site, to the west, is underlain by Glaciofluvial sheet deposits (Devensian in Age) comprising of Sand and Gravel.

The Glaciofluvial Deposits are defined as *'deposits deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e. sand and gravel) with some finer-grained layers (i.e. clay and silt). Sand and gravel, locally with lenses of silt, clay or organic material'*.

These superficial deposits will typically be overlying bedrock and are identified in Plate 1.

Plate 1 – BGS Superficial Geology



Solid Geology

BGS mapping, plate 2, indicates that the solid geology underlying the site is comprised of the Brithdir Member comprised of sandstone. The Brithdir Member is typically described as *'green-grey, lithic arenites ('Pennant sandstones') with conglomerate lenses at bases of units; thin mudstone/siltstone and seatearth interbeds and mainly thin coals'*.

The Groundsure Report (GS-FUY-AXJ-GIB-LB1) and BGS mapping also records the presence of Brithdir Member comprising of mudstone, siltstone and sandstone located to the immediate north-west of the site and has the same BGS lexicon definition as Brithdir Member of Sandstone. The geological map does not indicate the presence of any faults at rockhead which potentially intersect the site. The closest linear feature is located 37m west of the site and is classified as an inferred coal seam (Glyngwilym).

Plate 2 – BGS Solid Geology



2.4 PREVIOUS SITE INVESTIGATION

At the time of writing the report Tetra Tech are not aware of any previous site investigations that have been undertaken at the site, or within the immediate surrounding area.

3.0 SITE INVESTIGATION

A site investigation was undertaken by Tetra Tech between the 6th of January and 17th January 2025, with six return visits to monitor ground gas and groundwater levels between 28th January and (To be updated)

3.1 SCOPE

The scope of the site investigation was designed by Tetra Tech and outlined within the Desk Top Study Document, with specification requirements and included the following:

- 4 no. dynamically sampled/cored boreholes, including in situ testing of SPT's, to refusal with dynamic probe follow on to refusal. Sampling and testing in accordance with Ground Investigation specification (Appendix C);
- 5 no. mini percussive boreholes;
- 5 No. machine excavated Trial Pits excavated with soakaway tests undertaken to BRE 365 Digest to inform drainage design;
- 14 No. in-situ California Bearing Ratio (CBR) tests using the TRL-DCP method adjacent to each borehole location and soakaway;
- 4 No. hand dug/augered pits to collect shallow samples;
- 6 no. asphalt cores to assess for PAH;
- 1 No. additional machine excavated pit to investigate a possible sinkhole;
- Installation of 7 No. ground gas and groundwater monitoring wells;
- On-site inspection and logging of samples;
- Representative soil samples taken and submitted for geotechnical classification testing;
- Representative soil samples taken, submitted and tested for a suite of potential contaminants;
- Six return visits to monitor ground gas and groundwater levels;
- Preparation of a Ground Investigation report.

The ground investigation is required to further refine existing ground models for the development of the detailed design of the remedial measures. The objectives of the GI are:

- To collect appropriate data so to provide a ground model of the site;
- To provide a geotechnical assessment of the site to allow design; and
- To refine the Preliminary Conceptual Site Model and to quantify risks to identified receptors.

The specification was completed in accordance with ICE specification for ground investigation and the works themselves be completed in general accordance with the principles set out in BS EN 1997-2:2007 and

with the general practice described in BS5930:2015. The geo-environmental aspects of the ground investigation complied with the general requirements of BS 10175+A1:2017.

Figure 2 shows the layout of the exploratory holes advanced during the site investigation. Exploratory hole logs are presented in Appendix B with photographic plates presented in the figure section of the report.

3.1.1 Deviations to Scope

No major deviations or changes to the scope were implemented on site and works were undertaken in accordance with the Ground Investigation Specification.

Minor deviations occurred on site, where one position (SA05) was removed due to service obstructions on site.

4.0 GROUND CONDITIONS ENCOUNTERED

4.1 STRATA ENCOUNTERED

The sequence of strata encountered beneath the site was;

- Made Ground / Topsoil
- Superficial Deposits
- Bedrock

A summary of each stratum depth is provided in Table 1 below, with descriptions of each stratum detailed in the subsequent sections, as well breakdown of installations within Table 2.

Table 4-1 - Summary of strata depths (m bgl)

Location	Depth of strata (m bgl)				
	Topsoil	Made Ground	Superficial Deposits	Weathered Bedrock	Bedrock
BH01	GL – 0.10	NE	NE	0.10 – 0.30	0.30 – 5.00*
BH02	GL – 0.10	NE	NE	0.10 – 1.10	1.10 – 5.00*
BH03	GL – 0.10	0.10 – 1.00	1.00 – 4.00	NE	4.00 – 5.00*
BH04	GL – 0.10	0.10 – 1.10	1.10 – 8.60	NE	8.60 – 10.00*
SA01	GL – 0.10	NE	NE	0.10 – 0.50*	NE
SA02	GL – 0.10	NE	NE	0.10 – 1.50*	NE
SA03	GL – 0.10	0.10 – 0.35*	NE	NE	NE
SA04	GL – 0.10	0.10 – 1.00*	NE	NE	NE
SA06	GL – 0.10	NE	0.10 – 1.50*	NE	NE
WS01	GL – 0.10	NE	NE	0.10 – 0.80*	NE
WS02	GL – 0.10	NE	NE	0.10 – 1.70*	NE
WS03	GL – 0.10	NE	NE	0.10 – 0.70*	NE
WS04	GL – 0.10	0.10 – 0.70*	NE	0.70 – 1.70*	NE
WS05	GL – 0.10	0.10 – 0.50	0.50 – 1.80*	NE	NE
HP01	GL – 0.10	NE	NE	0.10 – 0.80*	NE

Location	Depth of strata (m bgl)				
	Topsoil	Made Ground	Superficial Deposits	Weathered Bedrock	Bedrock
HP02	GL – 0.15	NE	0.15 – 0.80*	NE	NE
HP03	GL – 0.10	NE	0.10 – 0.80*	NE	NE
HP04	GL – 0.10	0.10 – 0.80*	NE	NE	NE

*Base of stratum not proven

NE denotes not encountered

4.1.1 Made Ground

Made Ground was encountered in seven of the exploratory locations (BH03, BH04, HP04, SA03, SA04, WS04 and WS05) to a maximum depth of 1.10m bgl which was encountered within BH04.

Predominantly recorded as a greyish brown slightly clayey sandy GRAVEL with a range of cobble and boulder content. Sand was fine to coarse. Gravel was fine to coarse, angular to subangular of brick, coal and sandstone. Cobbles were angular to subangular of brick, coal and sandstone. Concrete blocks and metal fragments were recorded in SA04.

4.1.2 Topsoil

Topsoil was encountered in all eighteen of the exploratory locations to maximum depth of 0.15m bgl which was encountered in HP02.

Predominantly recorded as a brown slightly clayey SAND with frequent rootlets. Sand was fine to coarse. Rare roots were recorded in SA04.

4.1.3 Superficial Deposits

Superficial deposits were encountered in six of the exploratory locations (BH03, BH04, SA06, WS05, HP02 and HP04) to a maximum depth of 8.60m bgl in BH04.

Identified as Glaciofluvial Sheet Deposits and were predominantly recorded as medium becoming very dense brown gravelly rounded sandstone COBBLES. They were also recorded as clays and gravels. Full logs can be located in Appendix B.

4.1.4 Weathered Bedrock

Weathered Bedrock deposits were encountered in nine exploratory locations (BH01, BH02, SA01, SA02, WS01, WS02, WS03, WS04 and HP01) to a maximum depth of 1.70m bgl which was encountered in WS02 and WS04.

Predominantly recorded as brown slightly clayey sandy GRAVEL with a range of cobble content. Sand was fine to coarse. Gravel was fine to coarse, angular to subangular of sandstone. Cobbles were angular to subangular of sandstone. It was also recorded as clays. Full logs can be located in Appendix B.

4.1.5 Bedrock

Bedrock deposits were encountered in four exploratory locations (BH01, BH02, BH03 and BH04) to a maximum depth of 10.00m bgl which was encountered in BH04.

Predominantly encountered as strong grey fine to coarse grained SANDSTONE. Fractures were sub-horizontal, very closely to closely spaced, rough and partly open to open. Fracture descriptions changed throughout the sandstone. Full logs can be located in Appendix B.

4.2 GROUNDWATER

No obvious groundwater strikes were noted in the exploratory locations across the site during both drilling and excavations. It may be possible further water strikes would be encountered below 1.50m bgl, however due to the nature of the drilling techniques it was not possible to positively identify these to an accurate depth.

4.2.1 Ground Monitoring

Six rounds of groundwater monitoring are scheduled to be undertaken between January and April 2025.

Results of all monitoring data will be presented within the final Ground Investigation Report.

4.3 INSITU TESTING

4.3.1 Standard Penetration Testing

Standard Penetration Tests were undertaken at 1.0m intervals during dynamic sampling in the rotary percussive and mini boreholes, in accordance with BS EN ISO 22476-3 (2005) and BS5930 (2015) to assess the relative density of the superficial deposits encountered within the borehole.

As stipulated by BS5930:2015, the SPT N-values represented on the borehole log are the uncorrected results which were obtained in the field, and these are presented on the borehole logs in Appendix B.

4.3.2 Dynamic Cone Penetration Test (DCP)

DCP probing, via TRL method, to provide California Bearing Ratio values for pavement design was undertaken in all exploratory positions, up to 1.0m bgl across the site or until refusal. Results are presented in Appendix D.

4.4 VISUAL OR OLFACTORY EVIDENCE OF CONTAMINATION

No visual or olfactory evidence of gross contamination was encountered during the investigation.

Exploratory hole locations throughout the site which encountered Made Ground contained remnants of anthropogenic debris.

Environmental samples were taken from a range of depths across the site. The test results are included in Appendix F.

4.5 OBSTRUCTIONS

A drainage and full utility survey (PAS128) was undertaken by Gwalia prior to Tetra Techs arrival on site with utilities identified on drawing 3387-U Llangatwg, and as such a further survey has not been conducted on the site and was not part of the ground investigation. All exploratory positions were cleared of services and obstructions prior to the start of the works by Tetra Techs engineer using a CAT and Genny.

The positions were further re-scanned by a Tetra Tech engineer every 300mm during excavation. No further obstructions were encountered.

4.6 ASPHALT CORING & TESTING

A total of 6 No. asphalt cores, RC1 to RC6, were sampled across the site, taking representative samples from the various identified (by age and condition) asphalt types, which were then subsequently tested onsite for the presence of PAH/Coal Tar by means of PAK Marker Spray, the results of which are presented in the table below. No results were positive for PAH's.

Table 4-2 - Summary of Asphalt Cores & Testing

Core Location	Asphalt (mm)	Thickness	PAH Identified (PAK Marker Spray)	Photo
RC1	50		No	
RC2	45		No	
RC3	60		No	

Core Location	Asphalt Thickness (mm)	PAH Identified (PAK Marker Spray)	Photo
RC4	35	No	
RC5	70	No	
RC6	55	No	

4.7 RIVERBANK VOID INVESTIGATION

A suspected void opened up within the riverbank just before it entered the site via a culvert beneath the playing fields. The 'void' was investigated by utilising a mini tracked excavator. The suspected void turned out to be nothing more than 350-400mm incursion into the riverbank where the water was being diverted around a weirlike structure, some 2m downstream, and flowing parallel to the main channel, see photos below;

Plates 1 & 2: Exposed incursion into riverbank



5.0 LABORATORY TESTING

5.1 GEOTECHNICAL TESTING

Geotechnical testing was scheduled by Tetra Tech and undertaken by GSTL Ltd, an approved supplier in accordance with the requirements of Tetra Tech quality system and are UKAS accredited for a range of geotechnical tests.

The test procedures used in each case are given in Table 4. The Geotechnical Testing Results are presented in Appendix E.

Table 5-1 - Summary of Geotechnical Tests

Test	Standard (BS1377:1990) and Accreditation	No.
Moisture Content	BS 1377:1990 - Part 2 : 3.	7
4 Point Liquid & Plastic Limit	BS 1377:1990 - Part 2 : 4.3 & 5.3	7
PSD	BS EN ISO 17892-4 : 5.1	7
BRE Suite A	BRE SD1	16
Uniaxial Compressive Strength	ISRM	1
Point Load Index	ISRM	3

5.2 ENVIRONMENTAL TESTING

Environmental chemistry was investigated by specialist chemical analysis of selected soil samples carried out by I2 Environmental Laboratories, an approved supplier in accordance with the requirements of TT quality system and UKAS and MCERTS accredited for a range of chemical analyses. The testing was scheduled by TT and is summarised in Table 5 for soil samples. The test results are included in Appendix F.

Table 5-2 - Summary of environmental testing

Test suite	No.
<u>Soil Samples:</u> TT Suite B - Heavy metals including Chromium (Hexavalent), Boron (water soluble), Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc; - Inorganics – including pH, Water soluble Sulphate as SO₄ (2:1 Extract), Cyanide (Easily liberatable- low level);	21

Test suite	No.
• Speciated Petroleum Hydrocarbons (TPH CWG); • Speciated Polyaromatic Hydrocarbons (USEPA 16); • BTEX and MTBE; • Asbestos Screen; and, • Phenol.	
<u>Leachate Samples:</u> TT Suite A • Heavy metals including Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc; • Inorganics – including pH, Water soluble Sulphate as SO₄ (2:1 Extract), Cyanide (Easily liberatable- low level);	9
<u>Water Samples:</u> TT Suite C • Heavy metals including Chromium (Hexavalent), Boron (water soluble), Arsenic, Beryllium, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Vanadium and Zinc; • Inorganics – including pH, Water soluble Sulphate as SO₄ (2:1 Extract), Cyanide (Easily liberatable- low level); • Speciated Petroleum Hydrocarbons (TPH CWG); • Speciated Polyaromatic Hydrocarbons (USEPA 16); • BTEX and MTBE; • Phenol.	4

6.0 GROUNDWATER AND GAS MONITORING

6.1 GROUNDWATER MONITORING

Groundwater levels were monitored on six occasions following the completion of the ground investigation, between 28th January and April 2025. The monitoring data is presented in Appendix F.

Table 6-1- Summary of groundwater levels

Location	Base of borehole (m bgl)	Depth to water (m bgl)					
		28/01/25	10/02/25	25/02/25	21/03/25	28/03/25	28/03/25
BH01	4.50	0.16	1.20	0.35	1.33	1.23	1.30
BH02	3.80	0.63	2.06	0.71	2.24	2.27	2.22
BH03	3.00	1.37	2.83	1.08	DRY	2.93	2.95
BH04	8.00	6.09	7.42	6.13	DRY	7.85	7.85
WS01	0.80	0.16	0.38	Well flooded to surface	0.65	0.61	0.65
WS03	1.00	0.43	DRY	DRY	DRY	DRY	DRY
WS04	1.10	DRY	DRY	DRY	DRY	DRY	DRY

6.2 GROUND GAS MONITORING

Ground gas levels were monitored on six occasions following the completion of the ground investigation, between 28th January and April 2024. The monitoring data is presented in Appendix F and discussed in more detail in Section 13.

Table 6-2- Summary of ground gas levels from monitoring Round 1

Location	Max. Methane (peak) (% vol)	Max. Carbon Dioxide (peak) (% vol)	Min. Oxygen (steady) (% vol)	Max. Carbon Monoxide (steady) (ppm)	Max. Hydrogen Sulphide (steady) (ppm)	Max. Borehole flow (peak) (l/h)
BH01	Well flooded					
BH02	0.1	0.1	10.9	1	<1	-2.0
BH03	0.1	0.2	15.5	1	<1	-0.9
BH04	0.1	3.1	7.6	2	<1	0.4
WS01	Well flooded					

Location	Max. Methane (peak) (% vol)	Max. Carbon Dioxide (peak) (% vol)	Min. Oxygen (steady) (% vol)	Max. Carbon Monoxide (steady) (ppm)	Max. Hydrogen Sulphide (steady) (ppm)	Max. Borehole flow (peak) (l/h)
WS03	Well flooded					
WS05	0.1	1.8	14.4	<1	<1	0.3

The monitoring rounds were undertaken during atmospheric pressure conditions ranging from 1005mb to 1020mb. A review of atmospheric pressure graphs on weatheronline.co.uk indicates that monitoring was undertaken during periods of falling, steady and rising atmospheric pressure.

In addition, the ground gas monitoring results indicate hydrogen sulphide concentrations of <1ppm across all monitoring rounds. Maximum concentrations of carbon monoxide of 2ppm was recorded.

7.0 SOIL INFILTRATION TESTING

7.1 BACKGROUND

On 7th January 2019, the Welsh Government introduced Schedule 3 of the Flood and Water Management Act 2010 which requires new developments to consider the feasibility of Sustainable Drainage Systems (SuDS) at the design stage. New developments over 100m² or including more than one property must obtain approval of the drainage system from the SuDS Approval Body (SAB) prior to the commencement of construction.

To support the assessment study, preliminary soil infiltration testing has been undertaken as part of the site investigation to provide information on the potential infiltration rates within the sub-strata on the site.

Soil infiltration tests have been undertaken in line with BRE 365 (2016) methodology and any deviations from this approach are documented within the following section. Where possible, locations and depths of test pits were determined based on the proposed drainage design.

7.2 SOIL INFILTRATION TESTS

Three soil infiltration tests were undertaken within a machine excavated trial pit as summarised in the following table.

Table 7-1 Summary of Soil Infiltration Test Locations

Test Location	Depth to Base (m bgl)	Target strata
SA01	Abandoned	
SA02	1.50	Weathered bedrock deposits
SA03	Abandoned	
SA04	1.00	Made Ground
SA06	1.50	Superficial deposits

Three repeat fills were undertaken within the test locations over a period of 3 days. Test locations were securely fenced and covered until the testing period was completed and excavations backfilled on completion.

The results of the soil infiltration tests are presented in the following table. Full test results are included in Appendix C of this report.

Table 7-2 Summary of Soil Infiltration Test Results

Test Location	Soil Infiltration Rate (m/s)		
	Test 1	Test 2	Test 3
SA01	Abandoned		
SA02	FAIL	FAIL	FAIL

SA03	Abandoned		
SA04	FAIL	FAIL	FAIL
SA06	6.63×10^{-6}	5.58×10^{-6}	5.24×10^{-6}

7.3 GROUND CONDITIONS

7.3.1 Depth to Groundwater

Due to the nature of where the soil infiltration testing was being undertaken, a trial pit was not excavated adjacent to the test location in order to identify the groundwater level.

Based on the findings of the fieldworks and post completion monitoring, it is anticipated that groundwater is at 2.0m bgl or shallower. It should be noted that groundwater levels can vary seasonally and year on year.

7.3.2 Strata Type

Testing was undertaken within the weathered bedrock in SA02, Made Ground in SA04 and superficial deposits in SA06. Full draft logs of the exploratory pits are included in Appendix B.

7.3.3 Ground Contamination

Significant ground contamination was not identified as part of the ground investigation, a contamination assessment is presented in Sections 4.1.1 and 13.0.

7.4 CONSTRAINTS AND LIMITATIONS

The information presented above is intended to assess the feasibility of soakaway drainage in order to support the development of the drainage strategy. Further testing, groundwater monitoring and ground investigation may be required to support a full SAB application or to inform the development of the final design process.

Ground conditions can vary throughout the year, including the location of the groundwater table. Consideration should be given to the potential effects of seasonal variation when reviewing the data above and the presence of any contamination within the Made Ground. It should be noted that due to the nature of the site being hard standing the entirety of the site was dry at the time of investigation.

8.0 GEOTECHNICAL ASSESSMENT

8.1 GROUND CONDITIONS

The site is typically underlain by shallow bedrock immediately below the topsoil, toward the western edge of the playing fields Made Ground was encountered associated with the formation (Cut and fill) of the playing fields, also along the western edge of the fields, very dense glacial deposits were encountered indicating that they extend further east than the BGS mapping indicates.

8.2 SOIL PROPERTIES

The ranges of the various soil properties measured are discussed below, to aid in the selection of design values. However, the appropriate choice of characteristic and design values will depend on the particular analysis and design philosophy used and should be selected by the designer.

Where characteristic values are given, these are reasonably conservative estimates of a measured or assessed property that may be used to represent the overall behaviour of the material. Design values are similar but also take into account the ground-structure interaction for a given structure so need to be selected by the designer. It is recommended, however, that design values used do not exceed the characteristic values given in this report.

8.2.1 B1 – Glacial Deposits

Generally coarse-grained Glacial deposits were identified immediately below the Made Ground or topsoil within the western portion of the site. A summary is presented in the table below.

Table 8-1 - Summary of test results within the coarse-grained Glacial deposits

	No. of results	Range (min-max)	Average	Lower quartile	Upper quartile	Characteristic value+
SPT N Values	8	29 – 50	45	44	50	44
Angle of Shearing Resistance ϕ (°)*	8	36 – 41	40	40	41	40

Notes:

+ suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using;

* Estimated from a correlation from Peck, Hansen and Thornburn, Foundation Engineering, Wiley, 2nd ed., (1974)⁽⁶⁾

Based on the above, it is recommended that the following values are taken as design/characteristic values for this material:

- Angle of shearing resistance, ϕ 40°

8.2.2 C2 – Bedrock (Brithdir)

Bedrock deposits were identified immediately below the topsoil/weathered bedrock or Glacial deposits. A summary of the laboratory testing is presented in the table below.

Table 8-2 - Summary of test results within the Bedrock deposits

	No. of results	Range (min-max)	Average	Characteristic value+
Compressive strength tests (MPa)*	1	30.50	-	30.50
Point Load Value	3	0.26 – 3.52	1.70	1.0
Point Load Is50*	3	0.33 – 4.21	2.0	1.0
UCS determined from Point Load+	3	9 - 100	50	30

Notes:

* Is50 = P (Failure Load in lbf) x D_e (equivalent core diameter);

+ (K) Is(50) Where (K) is the conversion factor by Broch & Franklin (1972)

+ suggested characteristic values are appropriate for most normal applications but designers should satisfy themselves that they are suitable for the specific application and design method they are using.

Based on the above, it is recommended that the following values are taken as design/characteristic values for this material:

- Compressive Strength 30 MPa

8.3 SUMMARY OF CHARACTERISTIC MATERIAL PARAMETERS

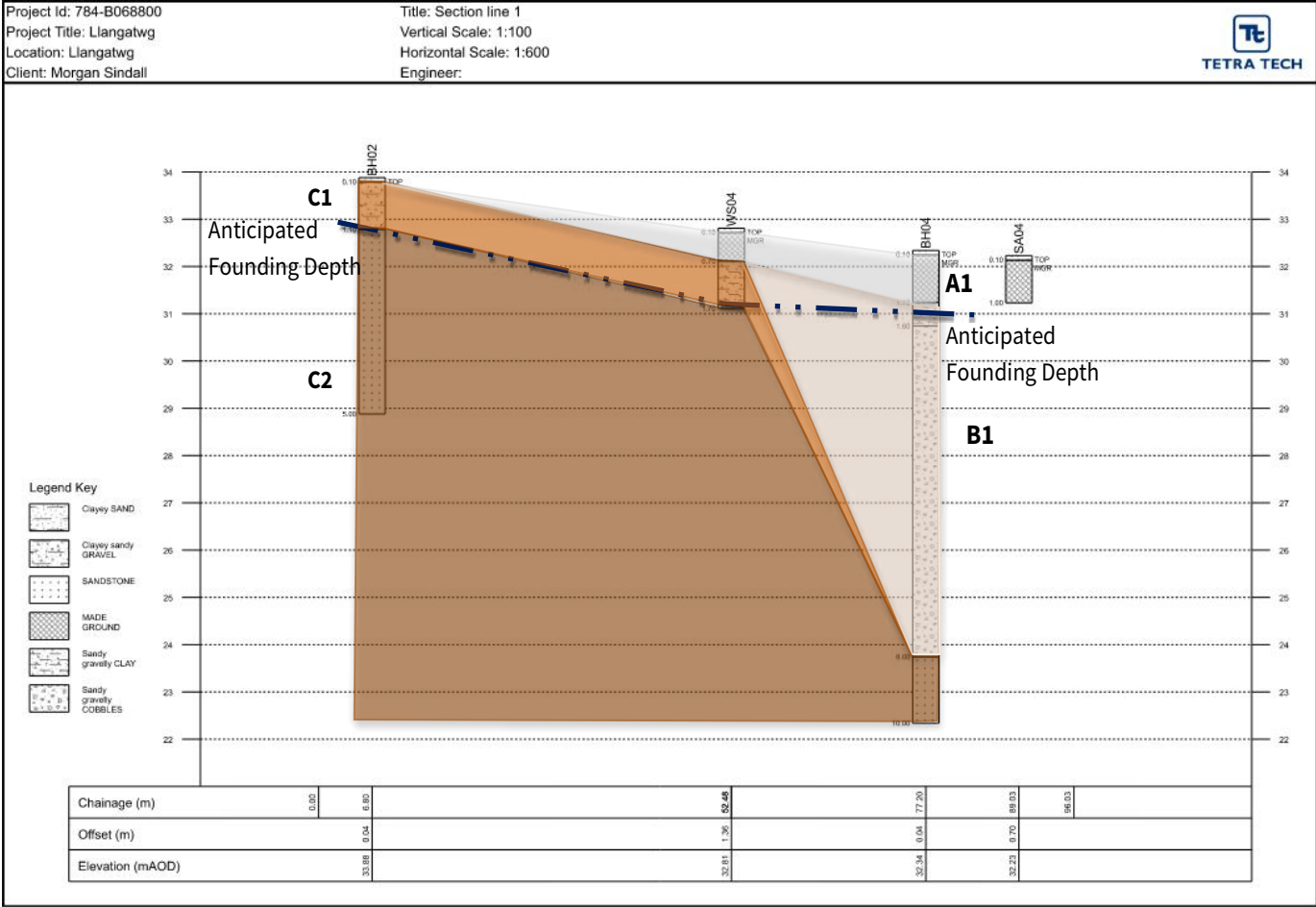
Table 8-3 - Characteristic Material Parameters

	Unit	Parameter (Unit)	Characteristic Value	Rationale
Glacial Deposits	B1	Unit Weight (kN/m ³)	19	Conservative value
		Angle of Friction ϕ' (°)	40	Conservative value based on SPT, correlations and lab testing
		Unit Weight (kN/m ³)	26	Conservative value based on lab testing

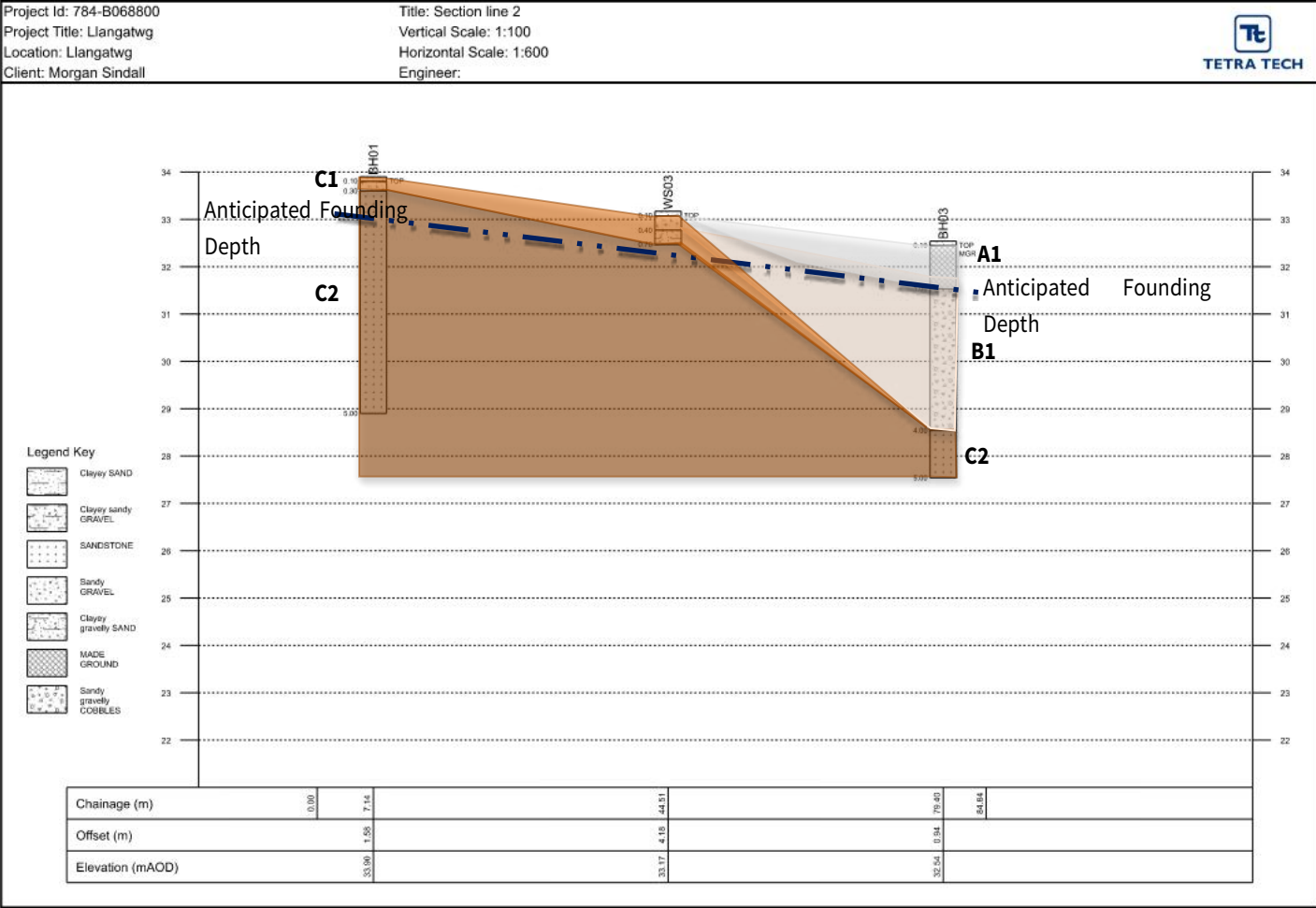
C2	Unconfined compressive strength (MPa / MN/m2)	30	Value based on lab testing
-----------	---	----	----------------------------

Insert 1 – Preliminary Plan with Proposed New School Layout

Section 1



Section 2



9.0 PRELIMINARY GEOTECHNICAL DESIGN CONSIDERATIONS

9.1 PROPOSED DEVELOPMENT

Final footing dimensions, founding depths, and bearing capacities remain the responsibility of the Client's Designer. The results detailed herein should not be utilised in detailed design as loads on the foundations have not been considered as these were not available at the time of writing the report.

It should be noted that the design of foundations should consider the risk of the migration of any possible ground gas or contaminants in soils or groundwaters or surface waters.

It is understood that the proposed development will involve the construction of a new multi-storey school building.

9.2 EARTHWORKS

Given the current levels of the site, significant earthworks (cut and fill) is not anticipated at this stage.

9.3 FOUNDATIONS

Based on the ground conditions it is considered that a traditional pad or strip foundations, placed within shallow natural deposits (Either very dense glacial or Brithdir Sandstone) using conventional methods suggested by Hansen⁽¹⁾, may be Designed, in accordance with Eurocode 7 BS EN1997-1 (ULS DA1-2, partial factor of 1.25 for ϕ'), to an allowable net bearing pressure, R_d , of 900kPa / kN/m² (Note: No loadings for the structure have been supplied so the degree of utilisation, Λ_{GEO} , has not been assessed).

Based on the information above, and the material parameters presented in Section 8, traditional pad or strips founded at approximately 0.75 to 1.20m bgl should result in settlement less than 25mm. Settlements of foundations within coarse-grained material were estimated using the Burland and Burbidge method⁽²⁾. Where deeper Made Ground exists, foundations should be taken deeper until natural ground is encountered or alternatively replaced with compacted engineered granular fill.

Foundation excavations should be inspected by a suitably experienced engineer or inspector to ensure the founding material is suitable natural deposits. Any soft, loose or otherwise unsuitable material should be excavated and replaced by compacted granular backfill or lean concrete.

Construction elsewhere on the site would require further ground investigation.

9.4 FLOOR SLABS

Floor slabs may be ground bearing to combined dead and live loads of 20kNm². Any topsoil should be stripped and localised Made Ground excavated and replaced with compacted granular fill. The formation should be proof rolled and inspected by a suitably qualified engineer. Any material such as Made Ground,

¹ Hansen, A General Formula for Bearing Capacity, Danish Geotechnical Institute Bulletin No. 11, 1961. Also, Danish Geotechnical Institute Bulletin No. 28, 1968; and Code of Practice for Foundation Engineering, Danish Geotechnical Institute Bulletin No. 32, 1978.

² Settlements of Foundations on Sand and Gravel, J.B Burland and M.C Burbidge, Proceedings of the Institute of Civil Engineers, Vol 78, 1985.

soft clay, deleterious material containing weak or degradable contaminants, or other unsuitable material, should be excavated and replaced by well-compacted granular fill.

Specialist ground improvement methods may allow for the localised improvement of soils and may ultimately offer solutions to the issues detailed above to enable the construction of a ground bearing floors slab.

9.5 CHEMICAL ATTACK ON BURIED CONCRETE

Chemical tests undertaken on representative samples from the site show levels of water-soluble sulphates and generally slightly alkaline conditions. Based on these conditions, it is recommended that for foundations the Design Sulphate Class for the site, as defined in BRE Special Digest 1, be taken as DS-1, and the Aggressive Chemical Environment for Concrete (ACEC) site classification be taken as AC-1.

9.6 TEMPORARY WORKS

Battering or side protection will be needed where man-entry into excavations is required, especially for excavations deeper than 1.2m.

Shallow ground water strikes were not recorded during the intrusive investigation across the soils on the site.

It is possible that perched groundwater may be encountered within the Made Ground.

Therefore, deeper excavations (>1m) may require groundwater control which would need to be implemented in accordance with C750³.

9.7 PAVEMENTS

Given the test results obtained and the very variable nature of the near surface deposits it is recommended that a preliminary conservative value of 6% is adopted for pavement design at the site.

Proof rolling of the formation level will be required, and any loose or soft spots should be removed and replaced with an engineer fill, in accordance with a suitable specification. The formation level will also need to be protected during inclement weather from deterioration.

Prior to placement of the founding material and the construction of the road pavement, the sub-formation and formation will need to be inspected and checked in accordance with a suitable specification to ensure the ground conditions are as expected. All testing should be carried out in accordance with DMRB CS 229 to confirm that the ground conditions at the time of construction are consistent with the previous design parameters.

9.8 DRAINAGE

Soakaway testing within the shallow glacial deposits at SA06 has yielded soil infiltration values of the magnitude 10^{-6} m/s with three tests undertaken at this location, all other soakaway testing at the site failed due to shallow bedrock and/or groundwater.

Testing indicates that soakaway drainage would not be suitable for the development.

³ Groundwater control: design and practice (second edition) (CIRIA750)

10.0 GEOTECHNICAL RISK REGISTER

10.1 INTRODUCTION

The following Geotechnical Risk Register (Risk Matrix

Table 10-2) has been considered with regard to the details of other construction related risks known at this time. The risks have been evaluated using the risk evaluation matrix suggested in CD622 'Managing Geotechnical Risk, which is reproduced as Table 10-1.

For the purposes of this report, risk has been assessed with reference to 'probability', 'impact' and 'risk rating'. Risk rating $I = \text{Probability (P)} \times \text{Impact (I)}$ as detailed in Table 10-1.

Table 10-1 - Risk Evaluation Matrix

Probability (P)		Impact (I)				Risk Rating (R = P x I)	Response to Risk	
Very Likely	5	Very High	5	Potential to halt project	OR	Potential for major claim or similar	17 to 25	Unacceptable: act now to prevent
Likely	4	High	4	Significant delay on overall project		Major impact on cost	13 to 16	Unacceptable: act now to prevent
Probable	3	Medium	3	Major delay on this task, significant impact on overall project unlikely		Significant impact on cost	9 to 12	Early attention required
Unlikely	2	Low	2	Minor delay on this task, significant impact on overall project unlikely		Minor impact on cost	5 to 8	Regular attention required
Negligible	1	Very Low	1	No significant impact on task or project		Negligible impact on cost	1 to 4	Monitor

10.2 RISK MATRIX

Table 10-2 - Geotechnical Risk Register

Identified Geotechnical Hazard	Consequence	Risk before control			Risk Level	Control Measures	Residual Risk			Risk Level
		P	I	R			P	I	R	
Striking unrecorded services (including drainage)	Delay to programme of works and associated cost implication.	4	4	16	High	Buried services are present across the site and surrounding areas the Contractor should obtain from the Employer the latest statutory service plans and positively identify all services prior to commencing any excavations. Any works undertaken in the vicinity of existing buried services shall be undertaken in accordance with the statutory undertakers' requirements and the recommendations of HSG 47 'avoiding danger from underground services'.	3	4	12	Medium
Lack of groundwater information	Conservative and inefficient design Uncertainty as to requirement for dewatering or excavation stability	4	4	16	High	Design to assume ground water level is equal to ~2.50m below ground level. Design to assume excavations will require support. Design to consider need for ground water control	1	4	4	Negligible
Differential settlement due to the variable Made Ground deposits at site	Loss of serviceability to structures Repairs required, entailing costs and legal preceding	4	4	16	High	Foundation subgrade material to be of a uniform soil with uniform mechanical properties Excavations and foundation sub-grade to be inspected and approved by qualified foundation engineer. Contractor to make allowance for over excavation of foundation and replacement of overburden with imported structural fill.	1	4	4	Negligible
Poor ground conditions (e.g: soft ground, running sands, excessive)	Poor ground Conditions may result in further time and cost of installing a gravity wall due to the requirement for shoring temporary	4	4	16	High	Excavations and earthworks to be overseen by a qualified person who can identify poor ground conditions and advise on remedial measures or appropriate actions. Designer and client to consider to the use of ground improvement to enable safe site work.	1	4	4	Negligible

Identified Geotechnical Hazard	Consequence	Risk before control			Risk Level	Control Measures	Residual Risk			Risk Level
		P	I	R			P	I	R	
groundwater ingress, etc.)	works or the creation of lifting or piling platforms.					Include contractors and sub-contractors at early stage of project and brief them on any possible poor ground conditions encountered.				
Site workers exposed to contamination or reduced quality Made Ground	Illness or death of site operatives. Delays to site works. Requirement for further contamination assessment.	3	3	9	Medium	Food and drink to be consumed in designated areas. Uphold a strict hygiene routine on site prior to smoking, eating or drinking. Site operatives issued with appropriate PPE under CDM regulations.	2	3	6	Low
Soft sub-soil conditions	Toppling of equipment, damage to plant, injury or death of workers. Excessive differential settlement of foundations	4	5	20	Very high	Ground conditions on site to be inspected by a qualified engineer and soft ground to be subsequently identified so that they may be avoided, excavated and replaced, or treated. Contractor to adopt safe method of working. Location of heavy plant and crane bases away from edges of excavations. Accurate understanding of soft soil from GI to plan working platforms. Appropriate design to be undertaken to minimise/eliminate risk from excessive/differential settlement. Designer to specify the removal of any soft ground encountered at formation/foundation levels. Designer to specify lift platforms, as required.	1	5	5	Low

Identified Geotechnical Hazard	Consequence	Risk before control			Risk Level	Control Measures	Residual Risk			Risk Level
		P	I	R			P	I	R	
Hard or dense strata	Programme and cost implications due to shallow refusal of sheet piles	4	5	20	Very High	Specialist piling contractor to be consulted regarding ground conditions, pile type and length.	3	3	9	Medium
Aggressive chemical ground conditions	Chemical attack on buried concrete, weakening of structure, structural failure of foundations	4	4	16	High	Design to consider soil aggressivity classification DS-1 and AC-1.	1	4	4	Negligible

11.0 GEOTECHNICAL DESIGN

This section has been produced in accordance with Highways England's 'Management of Geotechnical Risk' (CD622) and meets the requirements of Eurocode 7 (BS EN 1997-1:2004+A1:2013) Geotechnical Design. The report uses information contained within the scheme Ground Investigation Report and presents geotechnical design relevant to the proposed scheme. This Geotechnical Design Report (GDR) covers the design for the new school.

This scheme has been classified as a Geotechnical Category 2 scheme, as described within BS-EN1997 – 1:2004 (Eurocode 7). Geotechnical Category 2 projects include conventional geotechnical structures with no exceptional risk or difficult ground or soil loading conditions.

11.1 MATERIAL PROPERTIES

Table 11-1 Derivation of geotechnical parameters

Parameter	Symbol	Unit	Coarse Soil	Fine Soil
Weight density	$\gamma\gamma$	(kN/m ³)	Lab testing	Lab testing
Angle of shearing resistance	$\gamma\phi'$	°	SPT Correlation (Peck <i>et al</i> – 1974)	Plasticity correlation (Eqn 7 in BS8002:2015)
Undrained shear strength	γ_{cu}	kPa	-	Triaxial/hand vane Testing, SPT correlation (Stroud, 1975)

Table 11-2 Parameters Used in the Assessment

Stratum	$\gamma\gamma$ (kN/m ³)	$\gamma\phi'$ (°)	γ_{cu}	δ_b^*
Glacial Deposits (Coarse Grained)	19	40	-	27°
Weathered Bedrock Deposits (Coarse Grained)	22	40	-	27°
Bedrock (kPa)	26	-	30,000	20,000 kPa

* Usually take as $\frac{2}{3}\phi$ of soil/soil or soil/concrete interface

Table 11-3: Partial factors for soil parameters

Soil parameter	Symbol	Partial FoS
Angle of shearing resistance ^a	$\gamma\phi'$	1.25
Effective cohesion	$\gamma c'$	1.25
Undrained shear strength	γ_{cu}	1.4
Unconfined strength	γ_{qu}	1.4
Weight density	$\gamma\gamma$	1
^a factor applied to $\tan \phi'$		

11.2 FOUNDATIONS

The bearing capacity of all spread foundations founded on soils (Coarse grained Deposits) were carried out using hand calculations. The bearing capacity of the spread foundations within coarse grained soils were assessed using conventional methods suggested by Hansen⁽¹⁾.

The bearing capacity of the underlying coarse-grained glacial deposits has been assessed and foundation design undertaken based on column actions provided (Max 885kN/m² for pad (PF5) size 1.5m² founded at 0.80m bgl) by the structural engineering team (Curtins) (Note: only permanent loadings have been assessed).

The calculations show that the designed shallow pad foundations are suitable given the ground conditions and structural loadings.

Based on the ground conditions it is considered that a traditional pad foundations, placed within shallow natural deposits (Either very dense glacial or weathered Brithdir Sandstone) using conventional methods suggested by Hansen⁽¹⁾, may be Designed, in accordance with Eurocode 7 BS EN1997-1 (ULS DA1-2, partial factor of 1.25 for ϕ'), to an allowable net bearing pressure, R_d , of 870kPa / kN/m² (Note: loadings for the structure have been supplied so the degree of utilisation, Λ_{GEO} , has been assessed below).

$$885\text{kN max load (PF5) over a } 1.5\text{m}^2 \text{ Pad} = 394\text{kN/m}^2$$

$$E_d = 1 \times 394 = 394\text{kN/m}^2$$

$$R_d = 870 \text{ kN/m}^2 \text{ therefore } R_d > E_d \text{ therefore ULS is verified with 45\% utilisation.}$$

11.3 SETTLEMENT

The calculations show that the designed shallow pad foundations are suitable given the ground conditions and structural loadings. Settlements of foundations within coarse-grained material were estimated using the Burland and Burbidge method⁽²⁾.

11.4 SPRING STIFFNESS

Spring stiffness or "k" value, refers to the resistance of soil to deformation under load, often modelled as a spring. It's essentially the force required to compress or stretch the soil by a given amount, measured in units of force per unit length (e.g., kN/m³). This concept is used to simulate the behaviour of soil in structural models, particularly for foundations and retaining walls.

Based on the following correlation by Bowles⁽⁴⁾:

$$K_s = 120 \times q \times \text{FoS}$$

$$\text{Where: } K_s = \text{kN/m}^3 \text{ or kN/m}^2/\text{m}$$

$$q = \text{Net bearing capacity}$$

$$\text{FoS} = \text{Factor of Safety (Usually taken as 3 to give an allowable bearing capacity)}$$

⁴ Foundation Analysis and Design - 5th Edition (McGraw-Hill)

Therefore, from the above equation; $K_s = 120 \times 870 \text{ (Allowable BC)} \times 3 = 313,200 \text{ kN/m}^3$

Therefore, from the above equation; $K_s = 120 \times 400 \text{ (~Max Load)} \times 3 = 144,000 \text{ kN/m}^3$

Therefore, from the above equation; $K_s = 120 \times 50 \text{ (GB Slab)} \times 3 = 18,000 \text{ kN/m}^3$

These correlate well with Terzaghi's⁽⁵⁾ typical values of K_s , as presented in the table below;

Table 11-4 Typical Values of K_s for Cohesionless Soils

	Loose	Medium	Dense
$K_s - \text{kN/m}^3 \text{ (dry/damp)}$	5,000 to 20,000	20,000 to 90,000	90,000 to 300,000
$K_s - \text{kN/m}^3 \text{ (recommended)}$	12,000	40,000	150,000
$K_s - \text{kN/m}^3 \text{ (submerged)}$	8,000	25,000	100,000

⁵ Terzaghi, K. (1995). Evaluation of coefficients of subgrade reaction. Geotechnique, Vol. 5, No. 4,

12.0 GROUND CONTAMINATION ASSESSMENT – HUMAN HEALTH

12.1 INTRODUCTION

The UK Contaminated Land Regime (CLR) allows for a tiered approach to the assessment of ground contamination which is designed to allow increasingly site-specific assessment. In order to assess the potential risk posed by contaminants contained within the soils at the study area a generic quantitative risk assessment (gQRA) has been undertaken by comparing recorded concentrations of chemical constituents in soil with Generic Assessment Criteria (GAC) to identify whether, at the concentrations recorded, the presence of the constituent has the potential to adversely affect the health of site users (a Tier 1 assessment). GAC are set at levels where potential exposure is deemed to be within acceptable limits.

If the recorded concentrations of a particular constituent are below the GAC then the risk is generally considered to be acceptable and further assessment / or mitigation measures are not required. Where a substance is recorded at concentrations higher than GAC this does not necessarily indicate that a particular risk is present, however, it does typically signify the requirement to undertake further assessment in line with the UK tiered risk assessment framework.

12.2 ASSESSMENT CRITERIA

12.2.1 Generic Assessment Criteria

The following GAC for soils have been utilised for the screening process, in order of preference:

- CL:AIRE published C4SL (DEFRA, 2014);
- CIEH/LQM published S4UL (LQM/CIEH, 2015);
- Tetra Tech internal Tier 1 Screening Criteria (issue 15) derived using the derivation tool CLEA version 1.06, in line with the current UK Contaminated Land Regime.

C4SL are currently available for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead⁶. The C4SL were originally developed to support the categorisation of sites in accordance with Part 2A are also, based on DEFRA guidance, considered suitable for use during the assessment of sites as part of the planning process.

Where C4SLs are not available, 'Suitable for Use Levels' (S4UL) developed by CIEH/LQM have been used. The S4UL provide GAC based on minimal or tolerable risk intended to be protective of human health for individual or mixtures of substances. It is considered conservative and appropriate to use these values for contaminants for which C4SL are unavailable. GAC for volatile and semi-volatile organic compounds (VOC and SVOC) not presented in the S4UL document are sourced from CL:AIRE (CL:AIRE, January 2010).

Where no published screening values are available Tetra Tech have derived their own values (easily liberatable cyanide).

The CLEA model states that "For most exposure pathways, the contamination is assumed to be at or within one metre of the surface" (Environment Agency, 2009). It is considered that at depths greater than 1.0m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving

⁶ Arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI, lead assuming 6% SOM (1% SOM C4SL also published for benzene).

inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. The same screening concentrations have been used for all depths at this stage, though it is noted that these are highly conservative for depths below 1.00m bgl.

12.2.2 Proposed End Use

Screening criteria have been developed for the following land use scenarios:

- Residential with plant uptake;
- Residential without plant uptake;
- Allotments;
- Public open space (park and residential);
- Commercial / Industrial.

The proposed development consists of the construction of a new school complex on the site of the current school. There are no specific screening criteria for a school setting, as such a public open space (residential) end use has been adopted for the screening process as this is considered to be the most representative exposure scenario, whilst maintaining a conservative approach.

12.2.3 Soil Organic Matter

For organic contaminants, the generic soil screening values have been derived for a range of concentrations of soil organic matter (1%, 2.5%, 6%). In order to provide a conservative assessment, the GAC derived for a 1% SOM have been adopted.

12.3 TIER 1 – SOIL SCREENING

A total of 21 soil samples collected from across the site were submitted for chemical laboratory analysis. Full copies of laboratory certificates for all soil analysis are included in Appendix G.

Comparison of the chemical analysis results with the generic assessment criteria for a public open space (resi), a singular exceedance of lead is identified as summarised below.

Table 12-1 - Summary of Constituents of Concern

Constituent of Concern	No. of Samples	Min	Max	SSV	Exceedances	
					No. of exceedances	Location
Lead	21	13	880	630	1	SA04, 1.0m

The exceedance is recorded in a sample obtained from an area of Made Ground in the south-eastern part of the site, with anthropogenic materials recorded within the soils. It is also noted that the POS (park) screening value for lead is 1,300mg/kg.

12.4 ASBESTOS

The samples sent for laboratory testing were also scheduled for asbestos screens. Asbestos containing materials were not identified in any of the samples.

13.0 GROUND CONTAMINATION ASSESSMENT – WIDER ENVIRONMENT

13.1 INTRODUCTION

The potential for contaminated groundwater on site to adversely affect controlled water receptors (groundwater and surface water bodies) has been assessed at this stage by direct comparison of analytical data from the Tetra Tech ground investigation with relevant Water Quality Standards (WQS).

Similarly, the potential for soil contamination to impact controlled waters has been assessed by comparing analytical data from soil derived leachate tests directly against WQS.

13.2 ASSESSMENT CRITERIA

In light of the environmental setting of the site under consideration. The following water quality standards have been adopted, in order of preference.

- Water Framework Directive (WFD),
- Environmental Quality Standards (EQS);⁷
- WHO 2008 - Petroleum Products in Drinking Water (WHO 2008)
- UK Drinking Water Standards⁸.

13.3 TIER 1 SCREENING ASSESSMENT – LEACHATE

Nine soil derived leachate samples were obtained from the site and the samples analysed for the suite of determinants outlined above. The results were screened against a suite of determinants outlined in Section 13.2.

The following table summarises the determinants which have been identified at concentrations in excess of the relevant WQS screening criteria.

Table 13-1 – Summary of Exceedances within Leachate Samples

Determinant	Units	Maximum	Minimum	Screening Value	Exceedances	
					No.	Location
Arsenic	µg/l	13	<1	10	1	HP04 0.2-0.8

⁷ Where WFD 2015 are not presented revoked WFD 2010 standards are used

⁸ WHO 2005; WHO 2008; UK Water Supply Regulations 2010 and 1989 Regulations. Priority given to UK drinking water standards

Determinant	Units	Maximum	Minimum	Screening Value	Exceedances	
					No.	Location
Copper	µg/l	7.4	<0.7	1	7	HP04 0.2-0.8 SA01 0.35m SA02 0.4m SA04 0.5m SA06 0.5m BH03 0.5m WS03 0.5m
Lead	µg/l	17	1.2	1.2	8	HP04 0.2-0.8 SA01 0.35m SA02 0.4m SA04 0.5m SA06 0.5m BH03 0.5m WS03 0.5m WS02 0.5m
Zinc	µg/l	26	1.6	10.9+ABC (3.4) = 14.3	3	HP04 0.2-0.8 SA02 0.4m WS03 0.5m
<i>* Inland surface water EQS 2015</i> # LOD in lieu of EQS \$ Freshwater EQS ABC Ambient background concentration						

As seen in the table above, a number of heavy metals are recorded in excess of the adopted screening criteria. The exceedances are recorded within samples obtained from both the Made Ground and underlying natural strata.

The recorded concentrations are considered further within the risk assessment presented in Section 14.0.

13.4 TIER 1 SCREENING ASSESSMENT – GROUNDWATER

Four groundwater samples were collected from the monitoring boreholes installed as part of the ground investigation. The following table provides a summary of the groundwater conditions at the time of monitoring.

Monitoring Location	Response zone (mbgl)		Depth to groundwater (mbgl)	Strata
	Top	Base		
BH01	0.5	4.5	4.0	Brithdir Sandstone
BH02	0.5	4.5	2.0	Brithdir Sandstone
BH03	1.0	3.0	1.5	Superficial Strata

BH04	2.0	8.0	6.5	Superficial Strata
------	-----	-----	-----	--------------------

The results were screened against a suite of determinants outlined in Section 13.2. The following table summarises the determinants which have been identified at concentrations in excess of the relevant WQS screening criteria.

Determinant	Units	Maximum	Minimum	Screening Value	Exceedances	
					No.	Location
Cadmium	µg/l	0.12	0.04	0.09	2	BH01 BH03
Copper	µg/l	3.6	2.5	1	4	BH01, BH02, BH03, BH04
Nickel	µg/l	19	2.9	4	2	BH01 BH03

* Inland surface water EQS 2015

LOD in lieu of EQS

\$ Freshwater EQS

ABC Ambient background concentration

Elevated concentrations of heavy metals have been recorded within the groundwater samples obtained from the monitoring boreholes on the site. The recorded concentrations are considered further in the following sections.

13.5 SUMMARY

Elevated concentrations of heavy metals have been recorded within both soil derived leachate and groundwater samples from the site. Soil derived leachate samples were obtained from both Made Ground and natural strata with no significant variations in data obtained from the two strata. Groundwater samples were obtained from water bodies within natural strata below the site. When this is taken into account, along with the limited extent of anthropogenic materials within the Made Ground it is therefore considered likely that the recorded concentrations reflect the site setting.

It is noted that hydrocarbons and PAH compounds in groundwater have not been recorded above the laboratory limit of detection.

14.0 PRELIMINARY GROUND GAS ASSESSMENT

14.1 INTRODUCTION

One return ground gas monitoring visits were undertaken on the 30th April 2024. Full factual site records of the gas monitoring results are presented in Appendix XX and summarised in Section 6.2.

14.1.1 Ground Gas Monitoring

Ground gases are monitored within boreholes on the site recording the following parameters.

- Concentrations of ground gases;
 - Methane (%v/v);
 - Carbon dioxide (%v/v);
 - Oxygen (%v/v);
 - Carbon monoxide (ppm);
 - Hydrogen sulphide (ppm);
- Borehole flow rate (l/hr);
- Depth to groundwater;
- Atmospheric pressure trends;

Where groundwater levels are noted to be above the screened sections of the boreholes the data is not considered to be representative of the ground gas regime and are therefore not used within the risk assessment process.

Atmospheric pressure trends are recorded on site during the monitoring process, but are also noted in the preceding three days, and one day after each monitoring visit. Falls in atmospheric pressure are generally considered to indicate a higher potential for ground gas migration from the sub surface and as such monitoring during periods of falling pressure are considered to represent worst case scenarios as outlined in the CL:AIRE Technical Bulletin TB17 (CL:AIRE, August 2018).

14.1.2 Ground Gas Risk Assessment Methodology

The key reference document which has been used to undertake the semi-quantitative land gas assessment presented in this report is CIRIA C665 (CIRIA, 2007). This provides a framework for assessment of land gas risk to buildings/structures with foundations (i.e. houses and/or commercial properties).

The risk assessment process is based on a Source-Pathway-Receptor Conceptual Site Model Methodology, with consideration given to the potential sources likely to be present on the site and the ground gas monitoring regime designed to reflect the scale of the source potential.

The collected data has been used for the purposes of undertaking a semi-quantitative assessment in accordance with the CIRIA 665 methodology. The calculation used to calculate the gas screening value (GSV) for the site, together with the relevant definition of units, is as follows:

$$\text{GSV (litres of gas/hr)} = \text{borehole flow rate (l/hr)} \times \text{gas concentration (volume/100)}$$

The calculated GSV values are used to determine the Characteristic Situation (CS) for the site in terms of methane and carbon dioxide, based on the conditions outlined in Table 13-2 below.

CS classification is applicable to all buildings, with the exception of low-rise housing with a ventilated underfloor void, in these situations, the NHBC Traffic Light System is adopted. As such the CS classification system has been adopted for the proposed development.

Table 13-2 –GSV Classification (Modified Wilson and Card Methodology)

Characteristic Situation	Risk Classification	Gas Screening Value Threshold (l/hr)	Additional Considerations
1	Very Low Risk	<0.07	Methane concentration <1% Carbon dioxide <5%
2	Low Risk	<0.7	Borehole flow rate <70 l/hr
3	Moderate Risk	<3.5	-
4	Moderate to High Risk	<15	Quantitative risk assessment required to evaluate scope of protective measures
5	High Risk	<70	-
6	Very High Risk	>70	-

14.2 PRELIMINARY GROUND GAS RISK ASSESSMENT

14.2.1 Conceptual Site Model

The following sections outline the anticipated Source-Pathway- Receptor model associated with the proposed development on site.

Sources

The following potential sources have been identified on and off site.

- Made Ground deposits.

Pathways

The following potential pathways have been identified which may act as preferential pathways for ground gas migration:

- The underlying strata have been classified as sands and gravels with varying components of clays and silts. Therefore, there is potential for some horizontal and vertical migration of ground gas;
- Buried service runs and existing foundations, including sub-floor voids.

Receptors

Within the context of ground gases, the following enclosed structures are considered to represent potential receptors.

- The existing structure on the site
- Structures and enclosed areas within proposed development.

14.2.2 Risk Assessment – Methane and Carbon Dioxide

In order to assess the significance of ground gases at the site, measured concentrations and flow rates have been used to derive Gas Screening Values (GSVs). GSVs are the product of gas concentration and gas flow measured in a borehole and provide an indication of the flow of the particular gas in question out of the ground.

The following table summarises the monitoring data for the site, boreholes where the groundwater table is above the top of the slotted screen have been excluded from the table as these data points are not considered to be representative of ground gas conditions on the site. GSV values have not been calculated where negative flows have been recorded.

The table calculates GSV values for each monitoring point.

Table 13-3 – Initial GSV Calculations

Monitoring Round	Location	CH ₄ (% vol)	CO ₂ (% vol)	Flow	GSV CH ₄	GSV CO ₂	Characteristic Situation
R1	BH03	0.1	0.2	-0.90	-0.0009	-0.0018	-
	BH04	0.1	3.1	0.40	0.0004	0.0124	CS1
	WS04	0.1	1.8	0.30	0.0003	0.0054	CS1
R2	BH01	0.1	2.0	0.1	0.0001	0.002	CS1
	BH02	0.1	0.9	0.1	0.0001	0.0009	CS1
	BH03	0.1	2.9	0.1	0.0001	0.0029	CS1
	BH04	0.1	3.6	0.1	0.0001	0.0036	CS1
	WS03	0.1	1.2	0.1	0.0001	0.0012	CS1
	WS04	0.1	0.4	0.1	0.0001	0.0004	CS1
R3	BH02	0.1	1.6	0.30	0.0003	0.0048	CS1
	BH04	0.1	4.3	0.30	0.0003	0.0129	CS1
	WS03	0.1	1.2	0.20	0.0002	0.0024	CS1
	WS04	0.1	0.7	0.30	0.0003	0.0021	CS1
R4	BH01	0.1	1.8	0.5	0.0005	0.009	CS1
	BH02	0.1	1.6	0.40	0.0004	0.0064	CS1
	BH03	0.1	2.2	-0.15	-0.00015	-0.0033	-
	BH04	0.1	4.3	-0.12	-0.00012	-0.00516	-
	WS01	0.1	0.4	-0.84	-0.00084	-0.00336	-
	WS03	0.1	1.2	-2.25	-0.00225	-0.027	-
	WS04	0.1	0.7	-1.09	-0.00109	-0.00763	-

Monitoring Round	Location	CH ₄ (% vol)	CO ₂ (% vol)	Flow	GSV CH ₄	GSV CO ₂	Characteristic Situation
R5	BH01	0.1	6.1	0.1	0.0001	0.0061	CS2*
	BH02	0.1	5.1	0.1	0.0001	0.0051	CS2*
	WS03	0.1	2.1	0.1	0.0001	0.0021	CS1
	WS04	0.1	0.3	0.1	0.0001	0.0003	CS1
R6	BH01	0.1	4.2	0.1	0.0001	0.0042	CS1
	BH02	0.1	6.4	0.1	0.0001	0.0064	CS2*
	WS03	0.1	2.6	0.1	0.0001	0.0026	CS1
	WS04	0.1	0.4	0.1	0.0001	0.0004	CS1

These values have been compared with the Revised Wilson and Card Classification presented in Table 13-2.

The risk assessment process indicates the site is generally representative of Characteristic Situation 1 (Very Low Risk) based on the recorded concentrations of carbon dioxide and methane and maximum flow rates within the sub surface. However, a limited number of data points indicate concentrations of carbon dioxide in excess of the CS1 threshold of 5% (BH01 and BH02). The guidance documents indicate that if the threshold value is exceeded, consideration should be given to increasing the classification to CS2.

Based on the limited number of data points where this is recorded, the generally low flow rates and absence of significant source potential identified on the site or within the surrounding area, the classification of the site as CS1 has not been updated.

14.2.3 Carbon Monoxide and Hydrogen Sulphide

Maximum concentrations of carbon monoxide and hydrogen sulphide were recorded at 2pp and <1ppm respectively throughout the monitoring period. The recorded concentrations are considered to be suitably low to negate the requirement for additional risk assessment.

14.2.4 Atmospheric Pressure Trends

The monitoring was undertaken during a period of relatively high, stable atmospheric pressure and as such may not represent worst case conditions for the site.

14.3 SUMMARY AND DISCUSSION

The site has been classified as Characteristic Situation 1 (Very Low Risk) based on the worst-case recorded concentrations of carbon dioxide and methane and maximum flow rates. Site classification of a Characteristic Situation 1 indicates gas protection measures are not required within new developments.

15.0 WASTE CLASSIFICATION ASSESSMENT

15.1 INTRODUCTION

Waste classification is a two stage process, with the first step comprising a hazard assessment of the soil quality data in line with the guidance set out in the Environment Agency waste classification technical guidance WM3⁹ document. Once the hazardous properties of the materials are known, the second step is to assess the potential performance of the materials in a landfill, undertaken by considering the results of waste acceptance criteria (WAC) testing.

15.1.1 Waste Classification

The chemical analysis data obtained from the ground investigation has been used to make a preliminary assessment of whether soils from the study area would be classified as hazardous waste. The assessment provides an initial indication of the classification of the soils in the event that they are disposed to landfill. Note the decision as to whether soils are deemed to be hazardous waste ultimately rests with the receiving landfill.

The waste classification report is presented as Appendix E. The assessment was undertaken using HazWasteOnline, web-based software for waste classification. The software follows Environment Agency guidance and European regulations.

In making the assessment the following assumptions have been made:

- TPH are not derived from petrol or diesel. There was no visual or olfactory evidence of hydrocarbons observed during the ground investigation.

The 21 samples analysed as part of the ground investigation consisted of a mixture of natural strata and Made Ground hence all data has been included in the assessment.

The initial assessment identified a number samples that were classified as hazardous as a result of the presence of flammable liquids. After a review of the exploratory hole logs this hazardous property has been removed from all the samples where it was identified by the software as there was no visual or olfactory evidence of flammable liquids such as hydrocarbons observed during the ground investigation. The assessment sheets in Appendix E detail which samples this edit has been applied to.

The assessment process has confirmed that the majority of the samples are classified as non-hazardous, one sample originating from the Made Ground from SA04 identified as potentially hazardous due to the concentrations of zinc in the sample associated with hazard code HP14 Ecotoxic.

15.1.2 Waste Acceptance Criteria

Non-hazardous waste does not need WAC testing unless disposal to an inert landfill is being considered. If considering disposal of non-hazardous material at an inert landfill you need a full WAC suite.

If waste is characterised as hazardous then a hazardous WAC suite should be tested.

If disposal to an inert landfill is not being considered a 'hazardous WAC suite' should be scheduled.

⁹ Environment Agency 2018. Technical Guidance WM3: Guidance on the classification and assessment of waste (Version 1.1).

Waste Acceptance Criteria (WAC) testing was undertaken on three samples from natural strata and two samples from the Made Ground. Four of these samples were classified as non-hazardous during the HazWasteOnline assessment and one sample (SA04, 0.5m) was identified as hazardous due to the recorded concentrations of zinc.

The four samples designated and non-hazardous are noted to meet the acceptance criteria for an inert landfill site.

The one sample identified as hazardous, is noted to meet the acceptance criteria for a stable non-reactive hazardous waste in a non-hazardous landfill.

15.1.3 Waste Recommendations

Based on the HazWasteOnline and WAC testing assessments it would appear that if suitable segregation of different types of waste is put in place the natural strata and majority of the Made Ground has the potential to be classified as inert.

The deeper area of Made Ground around SA04 would benefit from further testing, however current testing indicates this material would be suitable for disposal as stable non-reactive hazardous waste in a non-hazardous landfill.

Prior to disposal the characteristics of any excavated soils will need final classification in consultation with the landfill sites and waste disposal contractors. Further testing and analysis may be required on the actual soil arisings which constitute the waste.

15.1.4 Materials Management

Any material excavated on site may be classified as waste and it is the responsibility of the holder of a material to form their own view on whether or not it is waste. This includes determining when waste that has been treated in some way can cease to be classed as waste for a particular purpose.

If site-won material is to be reused on site, or soils other than primary aggregate or aggregates produced under the WRAP Protocol, imported to site, a Materials Management Plan will be required, signed off by a Qualified Person as defined in the 'Development Industry Code of Practice' (CL:AIRE, 2011).

16.0 CONCEPTUAL SITE MODEL & PRELIMINARY GROUND CONTAMINATION RISK ASSESSMENT

16.1 OVERVIEW

The information presented in the previous sections of this report have been collated and evaluated to establish an initial qualitative risk assessment for the site. A conceptual model of the site has been generated based on information derived from this Phase 1 Geo-environmental Assessment, supplemented by information attained during the Tetra Tech site walkover.

The site has been considered with regard to current UK legislation and guidance, namely Part 2A of the Environmental Protection Act 1990 and the Contaminated Land (England) Regulations 2006, as amended, and in accordance with current UK good practice guidelines (for example BS10175:2011).

In general, ground contamination can occur through several causes, particularly from historical operations and activities. Contamination can result from either on-site sources or from on-site migration from off-site sources, leading to long term liabilities under recent legislation for any site owner.

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

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

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

16.2 CURRENT SITE USAGE AND PROPOSED DEVELOPMENT

The proposed development is for an extension to the current on site building as well as the construction of a number benches within the seating area to the east of the river.

16.3 CONCEPTUAL SITE MODEL

The key source, pathways and receptor model is outlined below within the context of potential development of the site.

16.3.1 Potential Sources of Contamination

The main potential sources of contamination on the site are associated with existing features as well as historical land uses on the site as summarised below.

On site Sources

- Made Ground associated with previous development on the site.
- Asbestos containing materials,

Off Site Sources

- Mobile contamination from Made Ground associated with previous development of wider site area.

16.3.2 Potential Contaminant Pathways

The following contaminant pathways are considered to potentially be active based on the current site use and proposed development:

Human Exposure Pathways

- Direct dermal contact or ingestion of soils, or inhalation of dust and/or vapours (i.e. human interaction with surface and sub-surface materials).

Environmental Pathways

- Leaching and horizontal or vertical migration through the unsaturated ground, either through permeable sub-surface materials and/or preferential pathways;
- Lateral and vertical migration of groundwater through permeable sub-surface materials and/ or preferential pathways;
- Leaching to surface water run-off/drainage;
- The migration and accumulation of gases or vapours through permeable sub-surface materials and/ or preferential pathways.

16.3.3 Potential Receptors at Risk

The following potential receptors have been identified:

Human Health

- Current site users (school complex);
- Future site users (school complex);
- Site workers during the redevelopment of the site;

Wider Environment

- Secondary A Aquifer;
- Surface waters (River Neath);

16.4 GROUND CONDITIONS RISK ASSESSMENT

The source, pathway, receptor linkages identified in the previous section are outlined and a qualitative risk assessment shown in the following tables.

The risk assessment considers the site within an area context and assesses potential risks to identified receptors in relation to the existing site setting and the proposed development. CIRIA C552 has been used to define the risk rating presented in the Qualitative Risk Assessment matrix, the methodology for which is presented in Appendix G.

Table 16-1 – CIRIA C552 Qualitative Risk Assessment

This matrix is based on CIRIA C552 risk evaluation methodology, definitions for risk ratings is presented in Appendix G.						
Source	Pathway	Receptor	Consequence of risk being realised	Probability of risk being realised	Risk Classification	Potential risk management requirements
Ground contamination associated with Made Ground	Inhalation, ingestion and direct dermal contact	Current site users	Medium	Low risk	Moderate / Low Risk	A sample from SA04 has been recorded at concentrations above the relevant screening value for a public open space (resi) end use but below the screening value for a public open space (park) end use. The exceedance is localised and recorded within an area of deeper Made Ground which is not present across the majority of the site. It is also noted that the proposed develop in this area consists of hardstanding and as such direct access to the shallow soils will be limited. In the event that this material is to be reused elsewhere on the site (under an appropriate MMP) or if the development plan is altered to include soft landscaping in this area further testing will be required to support the development. However, due to the nature of the historical development of the site, it is recommended that a reactive approach is adopted during the development phase to identify any previously unidentified contamination which may be encountered during the site works, especially within the area of Made Ground around SA04.
		Future site users		Low risk	Moderate / Low Risk	
		Construction workers		Low risk	Moderate / Low Risk	
				55		

						Additional risks to site workers are covered by the Health and Safety at Work Regulations and should be managed through tool box talks, good on site hygiene practices and appropriate PPE.
	Leaching and lateral migration of contaminants	Groundwater	Medium	Unlikely	Low risk	Based on the recorded concentrations in soil derived leachate and groundwater samples from the site, the risks to the wider environment are considered to be limited and are likely to reflect general conditions of the wider site area.
		Surface water		Unlikely	Low risk	
Asbestos	Inhalation	Current site users	Medium	Unlikely	Low risk	Asbestos containing materials have not been identified within samples obtained from the site ground investigation, however as with all brownfield sites the presence of asbestos containing materials cannot be discounted.
		Future site users		Unlikely	Low risk	
		Construction workers		Unlikely	Low risk	
Ground gas	Migration and accumulation in enclosed spaces Inhalation	Future site users	Severe	Low Likely	Moderate / Low Risk	Based on the ground gas monitoring has been undertaken to date, the site has been classified as Characteristic Situation 1 (Very Low Risk). A limited number of data points have indicated marginally elevated concentrations of carbon dioxide, however given the limited number of occurrences, the low flow rates and limited source potential, it is not considered necessary to revise the CS1 classification.

17.0 CONCLUSIONS AND RECOMMENDATIONS

17.1 CONCLUSIONS

17.1.1 Ground Contamination

With respect to the risks to human health, whilst a concentration of lead was recorded in excess of the adopted screening value for a Public Open space (resi) the actual anticipated exposure to sub surface soils is likely to be significantly reduced by the presence of hard standing within the proposed development. However, if the development plan is altered to include soft landscaping in this area further testing will be required to support the development. Confirmatory testing will also be required in the event that the Made Ground from the area around SA04 will be required for re-use in other areas of the site.

Due to the previous development of the site, it is recommended that a reactive approach is adopted during the development phase to identify any previously unidentified contamination which may be encountered during the site works.

Whilst elevated concentrations of heavy metals have been recorded in soil derived leachates and groundwater samples, the recorded concentrations and relatively aggressive nature of leachate testing procedures and limited extent of anthropogenic materials within the Made Ground indicate the concentrations are likely to be naturally occurring. Risks to controlled waters are likely to be limited.

17.1.2 Asbestos

Asbestos containing materials were not identified in site or during the subsequent laboratory testing.

17.1.3 Waste Classification

The chemical analysis data obtained from the ground investigation has been used to make a preliminary assessment of whether soils from the study area would be classified as hazardous waste. The assessment provides an initial indication of the classification of the soils in the event that they are disposed to landfill.

Twenty-one samples were analysed as part of the ground investigation. The assessment process has confirmed that the majority of samples are classified as non-hazardous with the exception of one sample from SA04 which was identified as potentially hazardous due to the concentrations of zinc in the sample associated with hazard code HP14 Ecotoxic

WAC testing of five samples indicates the material designated as non-hazardous may be suitable for disposal as inert waste.

The material sampled from SA04 may be suitable for disposal within a stable non-reactive hazardous waste cell within a non-hazardous waste landfill.

17.1.4 Ground gas

Based on the monitoring undertaken to date, the site is considered to be representative of Characteristic Situation 1 (Very Low Risk) and as such ground gas protection measures are not considered necessary.

17.1.5 Geotechnical

Based on the ground conditions it is considered that traditional pad or strip foundations, placed within the natural deposits using conventional methods suggested by Hansen, may be designed, in accordance with Eurocode 7 BS EN1997-1 (ULS DA1-2, partial factor of 1.25 for ϕ'), to an allowable net bearing pressure, R_d , of 900kPa.

Based on the information above, and the material parameters presented in the GIR, pad foundations founded within the natural deposits should result in settlements of less than 25mm.

For buried concrete the Design Sulphate Class for the site can be taken as DS-1 and the Aggressive Chemical Environment for Concrete (ACEC) site classification can be taken as AC-1.

It is recommended that a preliminary conservative value of 6% is adopted for pavement design.

Soakaway drainage is not considered feasible for the development.

18.0 NOTES

1. Standards

All boring operations, sampling of soils, *in situ* testing and geotechnical laboratory testing have been carried out in accordance with the recommendations of the British Standards BS 5930(2015)⁽¹⁾, BS 1377 (1990)⁽²⁾ and BS10175 (2001)⁽³⁾.

Soil and rock descriptions follow the recommendations of BS 593. Where descriptions or classifications are based on other documents (e.g. BS 8004 (1986) or CIRIA Project Report 11 (1993)), this is stated in the report text.

2. Site methods

Unless specifically stated otherwise, the following methods are used for exploratory holes.

- Holes described as cable percussive are bored using a light cable percussive rig. Standard penetration tests are carried out where appropriate, as shown in the logs. Disturbed and undisturbed samples are taken from the exploratory holes at the depths on the records.
- Window sampling generally uses the windowless sampling method, using a tracked Geotool.
- Dynamic probes are usually heavy dynamic probes, using the same tracked Geotool used for window sampling.

3. Definitions and abbreviations

The following terms are used in the exploratory hole logs

Samples

U	Undisturbed 102mm dia. sample
TW	Thin Walled undisturbed 102mm dia. sample
B	Bulk sample
D	Small disturbed sample
W	Water sample
CBR	California Bearing Ratio test or CBR value obtained from Mexiprobe test

In situ tests

S	Standard penetration test (SPT)
N	SPT N value (blows/300mm)
HP	Hand penetrometer – shear strength
SV	Hand shear vane – shear strength
VOC	Volatile organic compounds (ppm)
PID	Photo-ionisation detector – used to detect the presence of VOCs.

Core recovery and rock quality

TCR	Total core recovery (%)
SCR	Solid core recovery (%)
RQD	Rock quality designation (%)
FI	Fracture index
NR	No recovery
NI	Not intact

Rotary drilling sizes

Index letter	Nominal diameter (mm)	
	Borehole	Core
N	75	54
H	99	76
P	120	92
S	146	113

Water strikes

▽	Level of water strike
▼	Water level rose to this level (see Remarks at foot of log for details)

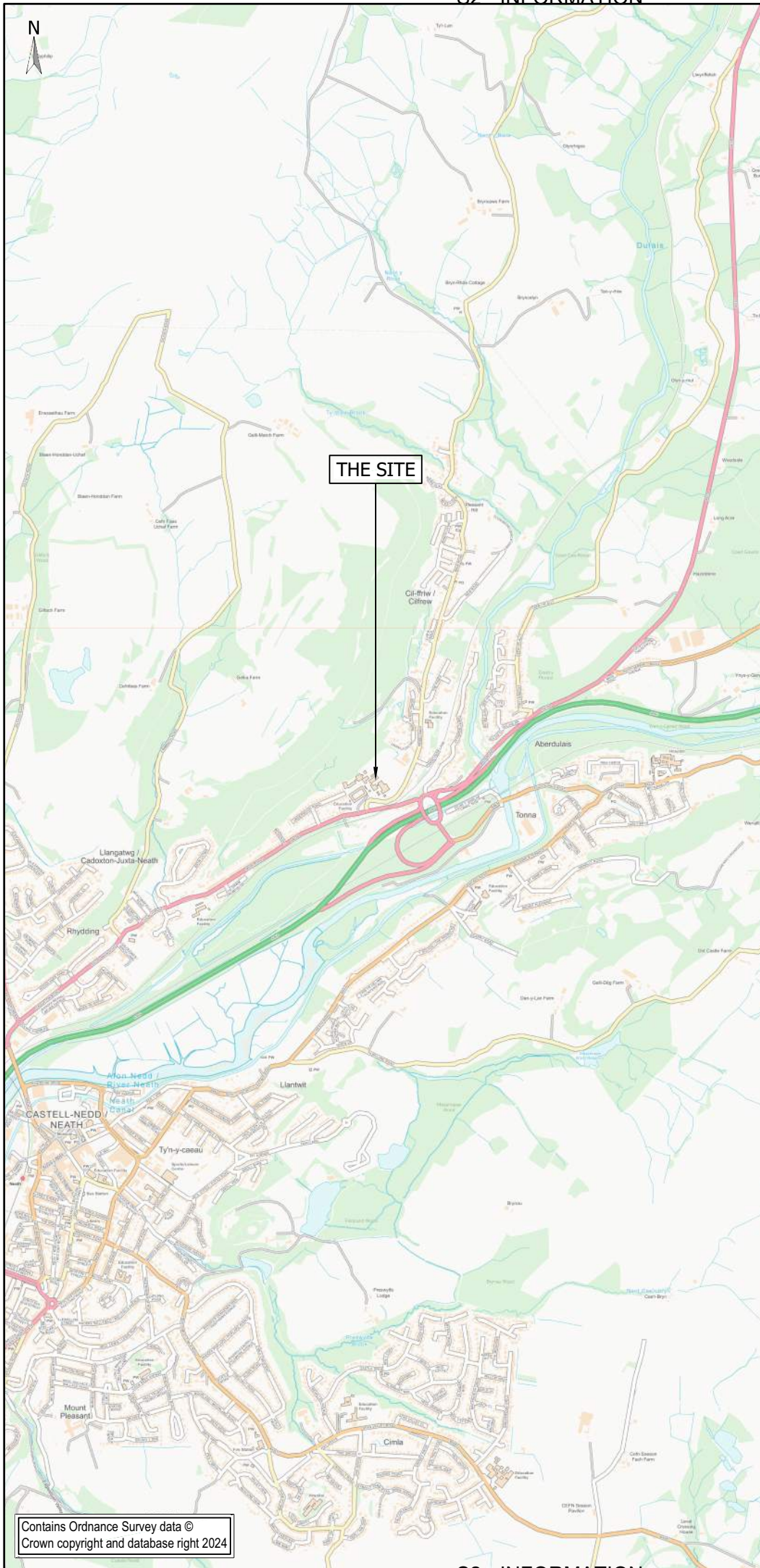
Depth means depth below existing ground level unless otherwise specified. Values specified in soil descriptions given in the exploratory hole logs are depths unless otherwise specified.

19.0 GLOSSARY

AOD	above Ordnance Datum
bgl	below ground level
BGS	British Geological Survey
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
C4SL	Category 4 Screening Levels
CIEH	Chartered Institute of Environmental Health
CLEA	Contaminated Land Exposure Assessment
CoC	Constituent of Concern
CSM	Conceptual Site Model
DEFRA	Department of Environment, food and Rural Affairs
DQRA	Detailed Quantitative Risk Assessment
DTS	Desktop Study
DRO	Diesel Range Organics
DWS	Drinking Water Standard
EA	Environment Agency (England)
EPH	Extractable Petroleum Hydrocarbons
EQS	Environmental Quality Standards
FOC	Fraction Organic Carbon
GPR	Ground Penetrating Radar
LOD	Limit of detection
LQM	Land Quality Management
NRW	Natural Resources Wales
OS	Ordnance Survey
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PPE	Personal Protection Equipment
ppm	parts per million
PRO	Petroleum Range Organics
SGV	Soil Guideline Values
SOM	Soil Organic Matter
SVOC	Semi-volatile organic compounds
TPH	Total Petroleum Hydrocarbon
TSV	Tier 1 Screening Values
VOC	Volatile Organic Carbon
VPH	Volatile Petroleum Hydrocarbons

FIGURES

Figure 1 – Site Location Plan



THE SITE

Contains Ordnance Survey data ©
Crown copyright and database right 2024

P01	PRELIMINARY FIRST ISSUE				02.09.2024	PP	JC	NEB	
Rev	Description				Date	Drn	Chk	App	
Document Control									
Issuing Office									
Tetra Tech Cardiff Atlantic House, Greenwood Close, Cardiff Gate Business Park, Cardiff, CF23 8RD Tel: +44 (0)29 2082 9200 www.tetratechneurope.com									
Client									
MORGAN SINDALL									
Project Name									
LLANGATWG									
Sheet Title									
SITE LOCATION PLAN									
TTE Project Number	Drawn By	Date	Checked By	Date	Approved By	Date	Scale @ A4	Suitability	
784-B068800	PP	02.09.24	JC	02.09.24	NEB	02.09.24	As Shown	S0	
Client Project Number	Originator	Volume/System	Level/Location	Type/Code	Role	Number	Revision		
B068800	- TTE	- 00	- XX	- DR	- U	- 0001			P01
© Copyright Tetra Tech									
TTE_MT_v4									

Figure 2 – Site Investigation Layout Plan



0 12.5 25 37.5 50 62.5 m
SCALE 1:1250

APPENDIX A: REPORT CONDITIONS

APPENDIX A – REPORT CONDITIONS**SITE INVESTIGATION**

This report is produced solely for the benefit of Morgan Sindall and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the site.

This report is based on a visual site inspection, reference to accessible referenced historical records, information supplied by those parties referenced in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented as the best that can be obtained without further extensive research. Where ground contamination is suspected but no physical site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to activities related to the site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, perhaps in higher concentrations, elsewhere on the site cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question as such bodies often have unpublished, more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Tetra Tech. In time improved practices or amended legislation may necessitate a re-assessment.

The assessment of ground conditions within this report is based upon the findings of the study undertaken. We have interpreted the ground conditions in between locations on the assumption that conditions do not vary significantly. However, no investigation can inspect each and every part of the site and therefore changes or variances in the physical and chemical site conditions as described in this report cannot be discounted.

The report is limited to those aspects of land contamination specifically reported on and is necessarily restricted and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents. The opinions expressed cannot be absolute due to the limitations of time and resources imposed by the agreed brief and the possibility of unrecorded previous use and abuse of the site and adjacent sites. The report concentrates on the site as defined in the report and provides an opinion on surrounding sites. If migrating pollution or contamination (past or present) exists further extensive research will be required before the effects can be better determined.

APPENDIX B: EXPLORATORY HOLE LOGS

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

Project: Llangatwg						Location Details						Status		Borehole Number					
Location: Llangatwg						Easting: 276814.87 Northing: 199283.55						DRAFT		BH04					
Client: Morgan Sindall						Level: 32.34mAOD Depth: 10.00m													
						Logger: JM Type: DS+RC													
						Inclination: 90°								Sheet 2 of 2					
Method, Plant and Crew					Diameter		Casing		Drilling Progress by Time					Scale: 1:50					
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Date	Time	Depth (m)	Casing (m)	Water (m)	Checked By:	PV				
0.00	1.20	Inspection Pit	Hand digging tools.	CJ's										Approved By:	SR				
1.20	1.60	Dynamic Windowless Sampling	Comacchio	CJ's										Start Date:	07/01/2025				
1.60	5.00	Rotary Core	Comacchio	CJ's										Finish Date:	10/01/2025				
5.00	5.50	Rotary Open Hole	Comacchio	CJ's															
5.50	7.00	Rotary Core	Comacchio	CJ's															
7.00	10.00	Rotary Open Hole	Comacchio	CJ's															
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples, Tests and Rotary Coring							
EOH at 10.00m - Scheduled Depth.												Depth (m)	Ref	Core Run	FI	TCR	SCR	RQD	Tests / Results
																			SPT(C) 10.00m, N=50 (25 for 125mm/50 for 90mm)
																		11	
																		12	
																		13	
																		14	
																		15	
																		16	
																		17	
																		18	
																		19	
																		20	
Observations / Remarks							Sampling Runs				Drilling Fluid				Hammer Information				
*Denotes drillers description based on limited returns							From (m)	To (m)	Diameter (mm)	Recovery %	From (m)	To (m)	Return Min %	Colour	Type	Serial No.	Energy Ratio %		
											Groundwater				Project Number				
							Strike (m)	Casing (m)	Sealed (m)	Time (min)	Rose To (m)	Remarks	784-B068800						

S2 - INFORMATION

Project: Llangatwg						Location Details						Status		Borehole Number				
Location: Llangatwg						Easting: Northing:						DRAFT		HP01				
Client: Morgan Sindall						Level: Depth: 0.80m												
						Logger: Type: HA												
						Inclination: °								Sheet 1 of 1				
Method, Plant and Crew					Diameter		Casing		Groundwater						Scale: 1:50			
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: PV			
															Approved By: SR			
																		Start Date: 03/01/2025
																		Finish Date: 03/01/2025
Strata Description						Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing							
											Depth (m)	Ref	Tests / Results					
Topsoil (TOPSOIL)							0.10					0.10 - 0.80	ES1					
Brown slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular sandstone. (POSSIBLE WEATHERED BRITHDIR SANDSTONE)							0.80											
EOH at 0.80m - Scheduled Depth.															1			
															2			
															3			
															4			
															5			
															6			
															7			
															8			
															9			
															10			
Observations / Remarks						Sampling Runs						Hammer Information						
						From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %						
						Project Number												
												784-B068800						

S2 - INFORMATION

Project: Llangatwg						Location Details						Status		Borehole Number				
Location: Llangatwg						Easting: Northing:						DRAFT		HP02				
Client: Morgan Sindall						Level: Depth: 0.80m												
						Logger: Type: HA												
						Inclination: °								Sheet 1 of 1				
Method, Plant and Crew					Diameter		Casing		Groundwater						Scale: 1:50			
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: PV			
															Approved By: SR			
																		Start Date: 03/01/2025
																		Finish Date: 03/01/2025
Strata Description						Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing							
											Depth (m)	Ref	Tests / Results					
Topsoil (TOPSOIL)							0.15					0.10 - 0.80	ES1					
Brown slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular sandstone. (GLACIOFLUVIAL SHEET DEPOSITS).							0.80											
EOH at 0.80m - Scheduled Depth.																		
																1		
																2		
																3		
																4		
																5		
																6		
																7		
																8		
																9		
																10		
Observations / Remarks										Sampling Runs				Hammer Information				
										From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %		
										Project Number								
												784-B068800						

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

Project: Llangatwg						Location Details						Status		Borehole Number				
Location: Llangatwg						Easting: Northing:						DRAFT		HP04				
Client: Morgan Sindall						Level: Depth: 0.80m												
						Logger: Type: HA												
						Inclination: °								Sheet 1 of 1				
Method, Plant and Crew					Diameter		Casing		Groundwater						Scale: 1:50			
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: PV			
															Approved By: SR			
															Start Date: 03/01/2025			
															Finish Date: 03/01/2025			
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing						
												Depth (m)	Ref	Tests / Results				
Topsoil (TOPSOIL)								0.10					0.10 - 0.80	ES1				
MADE GROUND: Brown slightly clayey sandy GRAVEL. Sand is fine to coarse. Gravel is fine to coarse subangular sandstone, brick and ash.																		
EOH at 0.80m - Scheduled Depth.								0.80										
Observations / Remarks												Sampling Runs			Hammer Information			
												From (m)	To (m)	Diam (mm)	Recovery %	Remarks	Serial No.	Energy Ratio %
												Project Number						
												784-B068800						

S2 - INFORMATION

[illegible]

S2 - INFORMATION

S2 - INFORMATION

[illegible]

S2 - INFORMATION

S2 - INFORMATION

[illegible]

S2 - INFORMATION

S2 - INFORMATION

Tt TETRA TECH		Project: Llangatwg		Location: Llangatwg		Client: Morgan Sindall		Location Details			Status		Pit Number		
								Easting: 276618.81 Northing: 199181.63			DRAFT		SA06		
								Level: 26.14mAOD Depth: 1.50m							
										Logger: TR Type: TP			Sheet 1 of 1		
MORGAN SINDALL		Hole Information				Groundwater						Scale: 1:25			
		Pit Dimensions		Orientation: °		Strike (m)		Rose To (m)		After (mins)		Remarks		Checked By: PV	
		0.70m 1.40m		Shoring: None Stability: Moderate Plant: JCB 3CX.										Approved By: SR Start Date: 15/01/2025 Finish Date: 17/01/2025	
Strata Description				Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Backfill	Samples and Testing						
Brown slightly clayey SAND with frequent rootlets. Sand is fine to coarse. TOP Greyish brown slightly clayey sandy GRAVEL with high cobble and low boulder content. Sand is fine to coarse. Gravel is fine to coarse subrounded to rounded of sandstone. Cobbles are subrounded to rounded of sandstone. Boulders are of sandstone. (GLACIOFLUVIAL SHEET DEPOSITS). Firm to stiff orangish brown and light brown slightly gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of sandstone. Cobbles are subrounded of sandstone. (GLACIOFLUVIAL SHEET DEPOSITS).					0.10	26.04			0.10 - 0.60	B1					
					0.60	25.54			0.50	ES1					
									0.60 - 1.50	B2					
EOH at 1.50m - Scheduled Depth.					1.50	24.64			1.20	ES2					
Observations / Remarks										Atlantic House, Greenwood Close, Gate Business Park, Pontprennau, Cardiff, CF23 8RD 029 2082 9200					
										Project Number 784-B068800					

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

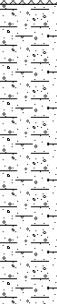
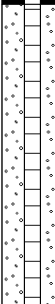
S2 - INFORMATION

1

S2 - INFORMATION

S2 - INFORMATION

S2 - INFORMATION

Project: Llangatwg Location: Llangatwg Client: Morgan Sindall						Location Details						Status DRAFT		Borehole Number			
						Easting: 276830.51 Northing: 199303.19 Level: 32.81mAOD Depth: 1.70m Logger: JM Type: WLS Inclination: 90°								WS04			
Method, Plant and Crew					Diameter		Casing		Groundwater							Scale: 1:25	
From (m)	To (m)	Type	Plant Used	Crew	Depth (m)	Diam (mm)	Depth(m)	Diam (mm)	Strike (m)	Casing (m)	Sealed (m)	Rose To (m)	Time (mins)	Remarks	Checked By: PV		
0.00 1.20	1.20 1.70	Inspection Pit Dynamic Windowless Sampling	Hand digging tools. Dart WS rig.	SWGT SWGT											Approved By: SR		
															Start Date: 16/01/2025		
															Finish Date: 16/01/2025		
Strata Description							Legend	Depth (m)	Reduced Level (mAOD)	Water Level (m)	Inst / Backfill	Samples and Testing					
												Depth (m)	Ref	Tests / Results			
Brown slightly clayey SAND with frequent rootlets. Sand is fine to coarse. TOP MADE GROUND: Brown slightly clayey gravelly SAND with high cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of concrete and sandstone. Cobbles are angular to subangular of concrete and sandstone. MGR								0.10	32.71			0.10 - 0.70	B1	SPT(C) 1.20m, N=17 (2,1/1,3,6,7)			
Firm to stiff brown slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of sandstone. (WEATHERED BRITHDIR SANDSTONE).								0.70	32.11			0.70 - 1.70	B2				
EOH at 1.70m - WS refusal.								1.70	31.11								SPT(C) 1.70m, N=50 (7,6/50 for 255mm)

S2 - INFORMATION

- 1
- 2
- 3
- 4
- 5

APPENDIX C: SOIL INFILTRATION TEST

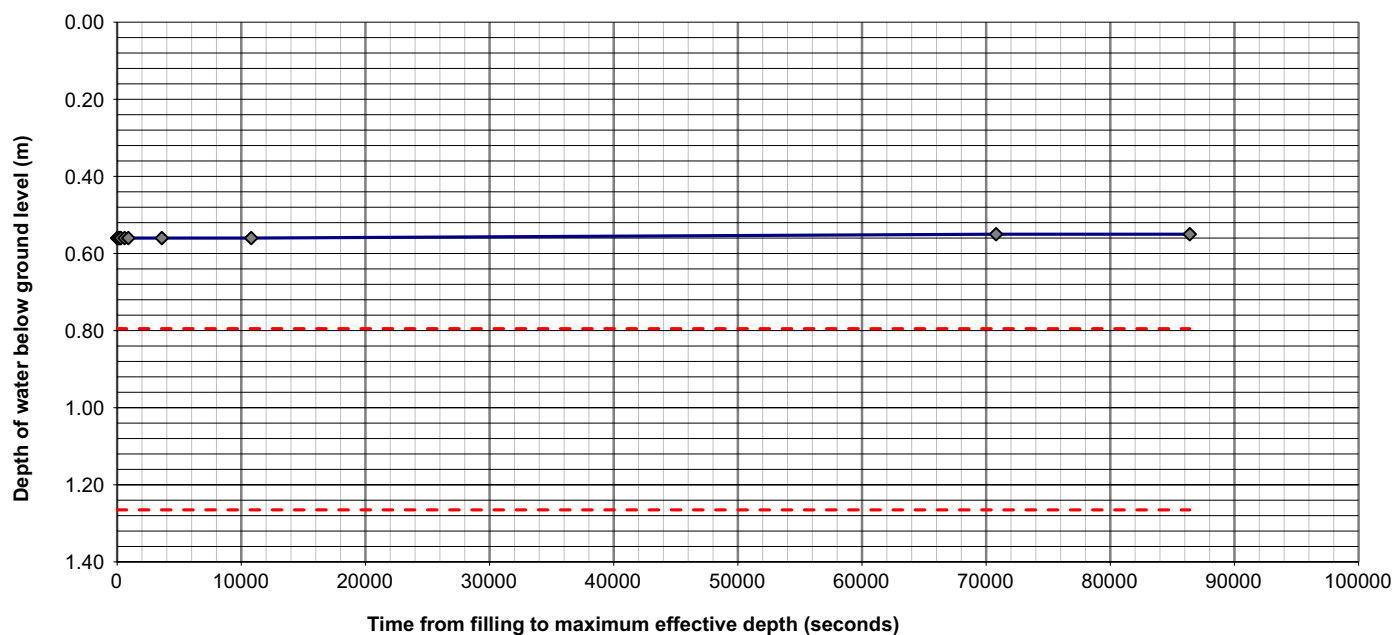
Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE:	07/01/2025
PROJECT No:	B068800
PROJECT NAME:	Llangatwg
CLIENT:	Morgan Sindall
TRIAL PIT ID:	SA02
TEST NUMBER:	1

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.30	Pit construction			
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.			
			PIT DEPTH (m):	1.50				
	0.00	0.560	INPUT PARAMETERS:					
60	1.00	0.560	Total volume of pit		(m ³)	0.73		
120	2.00	0.560	Pit volume between 75% and 25% depths = L x W x ½D		(m ³)	0.37		
180	3.00	0.560	Effective depth of Pit		(m)	0.94		
240	4.00	0.560	Proportion of pit volume occupied by gravel solids		(0-1)	0.00		
300	5.00	0.560	Maximum potential volume of Water		(m ³)	0.73		
600	10.00	0.560	Level of water in pit at 75% effective depth (p ₇₅)		(m)	0.24		
900	15.00	0.560	Level of water in pit at 25% effective depth (p ₂₅)		(m)	0.71		
3600	60.00	0.560						
10800	180.00	0.560	Effective volume between 75% & 25% depth V _{p75-25} = V x P _g		(m ³)	0.37		
70800	1180.00	0.550	Surface area of pit up to 50% effective depth (A _{p50})		(m ²)	2.57		
86400	1440.00	0.550						
			Time at 75% effective depth (p ₇₅)		(s)	#N/A		
			Time at 25% effective depth (p ₂₅)		(s)	#N/A		
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A		
			OUTPUT:					
			SOIL INFILTRATION RATE (f)		V _{p75 - 25}	(m/s)	#N/A	
					A _{p50} X T _{p75 - 25}			
			WATER INPUT:		500 l 3			
			GEOLOGY OF TEST SECTION:					
			BASE STRATA: Light grey mottled orange very sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of sandstone. Cobbles are subangluar of sandstone.					
	</							

Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE: 08/01/2025

PROJECT No: B068800

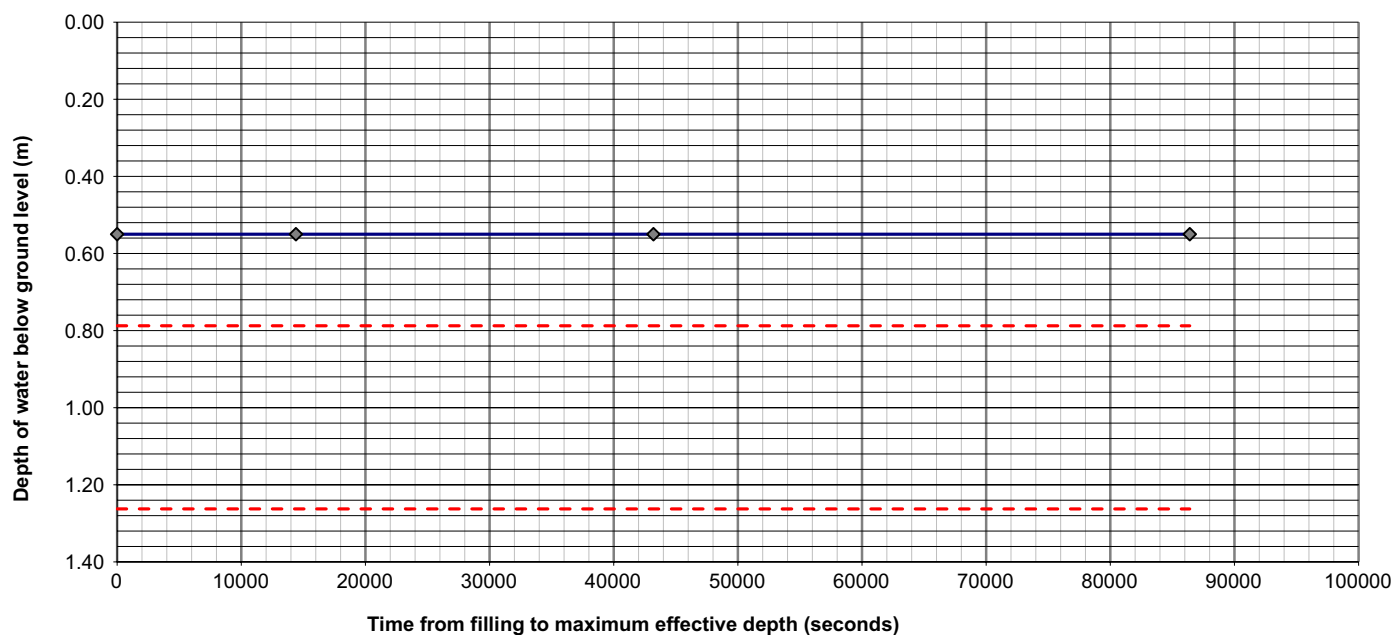
PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

TRIAL PIT ID: SA02

TEST NUMBER: 2

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.30	Pit construction			
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.			
			PIT DEPTH (m):	1.50				
	0.00	0.550	INPUT PARAMETERS:					
14400	240.00	0.550	Total volume of pit			(m³)	0.74	
43200	720.00	0.550	Pit volume between 75% and 25% depths = L x W x ½D			(m³)	0.37	
86400	1440.00	0.550	Effective depth of Pit			(m)	0.95	
			Proportion of pit volume occupied by gravel solids			(0-1)	0.00	
			Maximum potential volume of Water			(m³)	0.74	
			Level of water in pit at 75% effective depth (p75)			(m)	0.24	
			Level of water in pit at 25% effective depth (p25)			(m)	0.71	
			Effective volume between 75% & 25% depth Vp75-25 = V x Pg			(m³)	0.37	
			Surface area of pit up to 50% effective depth (Ap50)			(m²)	2.59	
			Time at 75% effective depth (p75)			(s)	#N/A	
			Time at 25% effective depth (p25)			(s)	#N/A	
			Time for outflow for 75% and 25% effective depth (Tp75-25)			(s)	#N/A	
			OUTPUT:					
			SOIL INFILTRATION RATE (f)		Vp75 - 25		(m/s)	#N/A
					Ap50 X Tp75 - 25			
			WATER INPUT: 0 1 3					
			GEOLOGY OF TEST SECTION:					
			BASE STRATA: Light grey mottled orange very sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of sandstone. Cobbles are subangluar of sandstone.					
			Compiled by:			JM		
			Checked by:			PV		

After BRE Digest 365. Soakaway Design, 2016

Page 1 of 1

Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE: 09/01/2025

PROJECT No: B068800

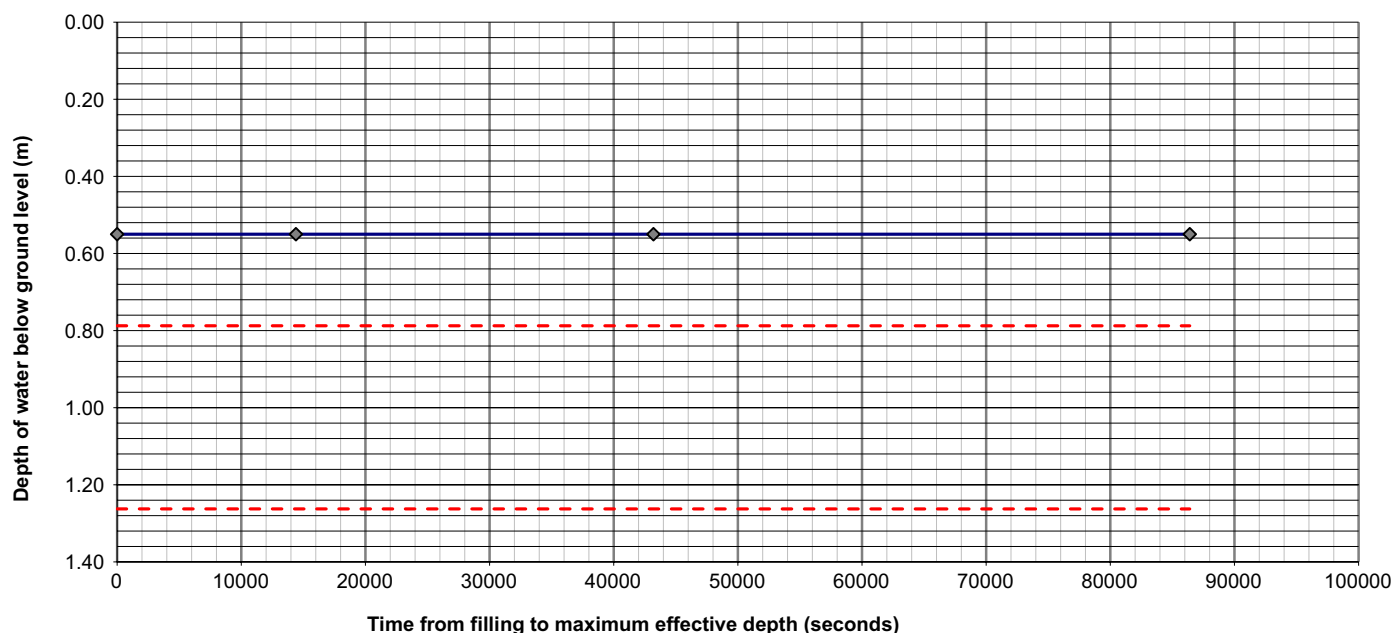
PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

TRIAL PIT ID: SA02

TEST NUMBER: 3

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.30	Pit construction	
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.	
			PIT DEPTH (m):	1.50		
	0.00	0.550	INPUT PARAMETERS:			
14400	240.00	0.550	Total volume of pit		(m³)	0.74
43200	720.00	0.550	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.37
86400	1440.00	0.550	Effective depth of Pit		(m)	0.95
			Proportion of pit volume occupied by gravel solids		(0-1)	0.00
			Maximum potential volume of Water		(m³)	0.74
			Level of water in pit at 75% effective depth (p75)		(m)	0.24
			Level of water in pit at 25% effective depth (p25)		(m)	0.71
			Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.37
			Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.59
			Time at 75% effective depth (p75)		(s)	#N/A
			Time at 25% effective depth (p25)		(s)	#N/A
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A
			OUTPUT:			
			SOIL INFILTRATION RATE (f)		Vp75 - 25	(m/s) #N/A
					Ap50 X Tp75 - 25	
			WATER INPUT:		0 1 3	
			GEOLOGY OF TEST SECTION:			
			BASE STRATA: Light grey mottled orange very sandy gravelly CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of sandstone. Cobbles are subangluar of sandstone.			
			Compiled by:		JM	
			Checked by:		PV	

After BRE Digest 365. Soakaway Design. 2016

Page 1 of 1

Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE: 07/01/2025

PROJECT No: B068800

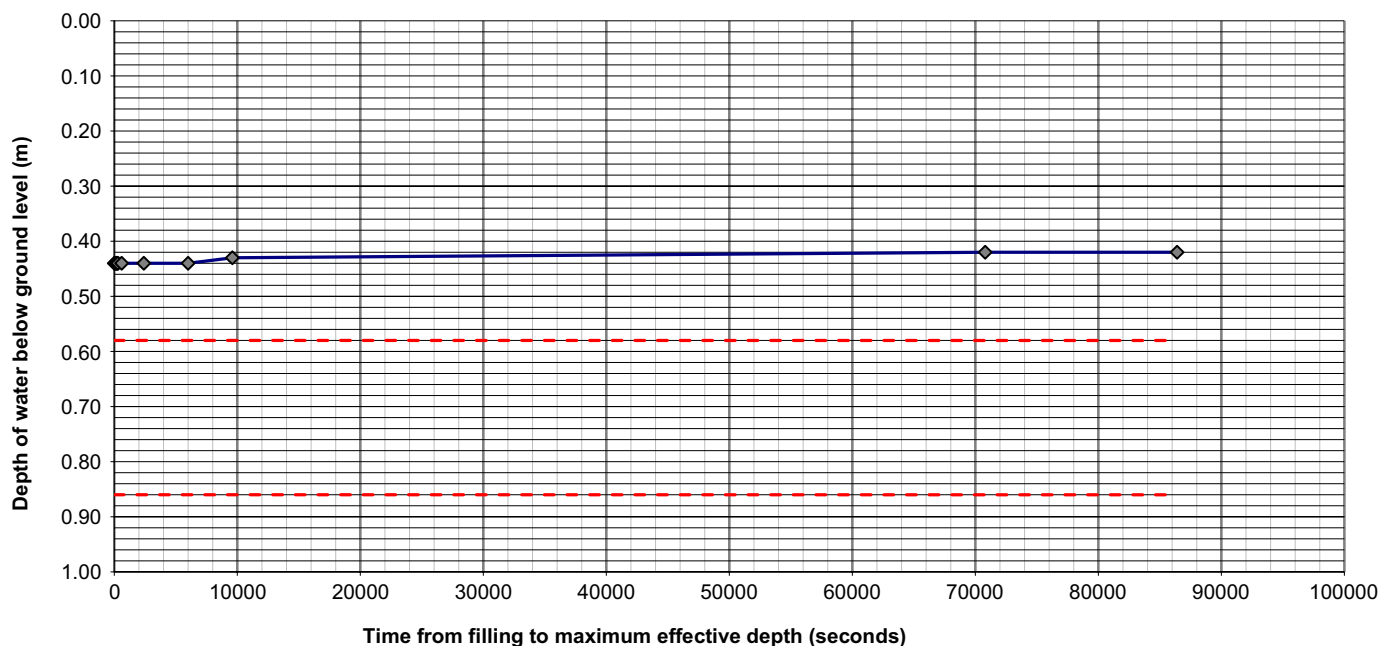
PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

TRIAL PIT ID: SA04

TEST NUMBER: 1

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.50	Pit construction			
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.			
			PIT DEPTH (m):	1.00				
			INPUT PARAMETERS:					
			Total volume of pit		(m ³)	0.50		
60	1.00	0.440	Pit volume between 75% and 25% depths = L x W x ½D		(m ³)	0.25		
120	2.00	0.440	Effective depth of Pit		(m)	0.56		
180	3.00	0.440	Proportion of pit volume occupied by gravel solids		(0-1)	0.00		
240	4.00	0.440	Maximum potential volume of Water		(m ³)	0.50		
300	5.00	0.440	Level of water in pit at 75% effective depth (p ₇₅)		(m)	0.14		
600	10.00	0.440	Level of water in pit at 25% effective depth (p ₂₅)		(m)	0.42		
2400	40.00	0.440						
6000	100.00	0.440	Effective volume between 75% & 25% depth V _{p75-25} = V x P _g		(m ³)	0.25		
9600	160.00	0.430	Surface area of pit up to 50% effective depth (A _{p50})		(m ²)	2.08		
70800	1180.00	0.420						
86400	1440.00	0.420						
			Time at 75% effective depth (p ₇₅)		(s)	#N/A		
			Time at 25% effective depth (p ₂₅)		(s)	#N/A		
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A		
			OUTPUT:					
			SOIL INFILTRATION RATE (f)		V _{p75 - 25}		(m/s)	#N/A
					A _{p50} X T _{p75 - 25}			
			WATER INPUT:		500		l	3
			GEOLOGY OF TEST SECTION:					
			Greyish brown slightly clayey sandy GRAVEL with high cobble and boulder content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of brick, coal and sandstone. Cobbles are angular to subangular of brick, coal and sandstone. Boulders are of concrete, metal and sandstone.					

			Compiled by:	JM
			Checked by:	PV
After BRE Digest 365, Soakaway Design, 2016			Page 1 of 1	

Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE: 08/01/2025

PROJECT No: B068800

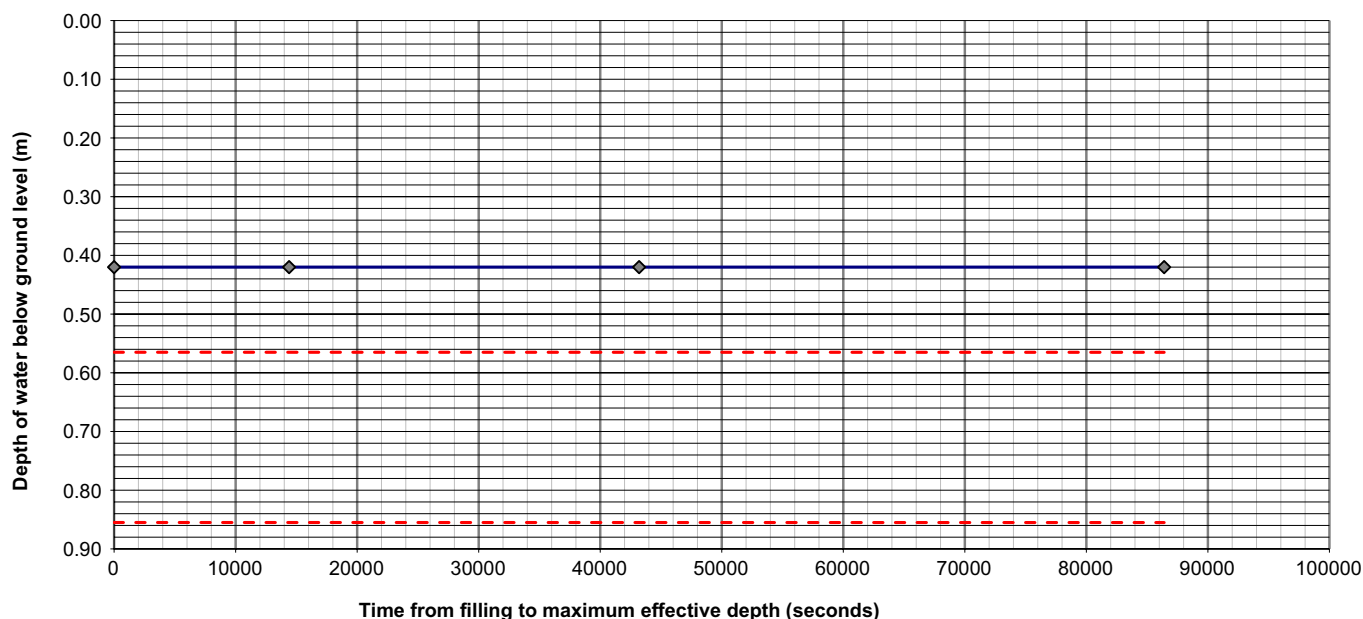
PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

TRIAL PIT ID: SA04

TEST NUMBER: 2

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.50	Pit construction		
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.		
			PIT DEPTH (m):	1.00			
	0.00	0.420	INPUT PARAMETERS:				
14400	240.00	0.420	Total volume of pit		(m³)	0.52	
43200	720.00	0.420	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.26	
86400	1440.00	0.420	Effective depth of Pit		(m)	0.58	
			Proportion of pit volume occupied by gravel solids		(0-1)	0.00	
			Maximum potential volume of Water		(m³)	0.52	
			Level of water in pit at 75% effective depth (p75)		(m)	0.15	
			Level of water in pit at 25% effective depth (p25)		(m)	0.44	
			Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.26	
			Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.12	
			Time at 75% effective depth (p75)		(s)	#N/A	
			Time at 25% effective depth (p25)		(s)	#N/A	
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A	
			OUTPUT:				
			SOIL INFILTRATION RATE (f)		Vp75 - 25	(m/s)	#N/A
					Ap50 X Tp75 - 25		
			WATER INPUT:		0 1 3		
			GEOLOGY OF TEST SECTION:				
			Greyish brown slightly clayey sandy GRAVEL with high cobble and boulder content. Sand is fine to coarse. Gravel is fine to coarse angular to subangular of brick, coal and sandstone. Cobbles are angular to subangular of brick, coal and sandstone. Boulders are of concrete, metal and sandstone.				
			Compiled by: JM				
			Checked by: PV				

After BRE Digest 365, Soakaway Design, 2016

Page 1 of 1

Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE: 09/01/2025

PROJECT No: B068800

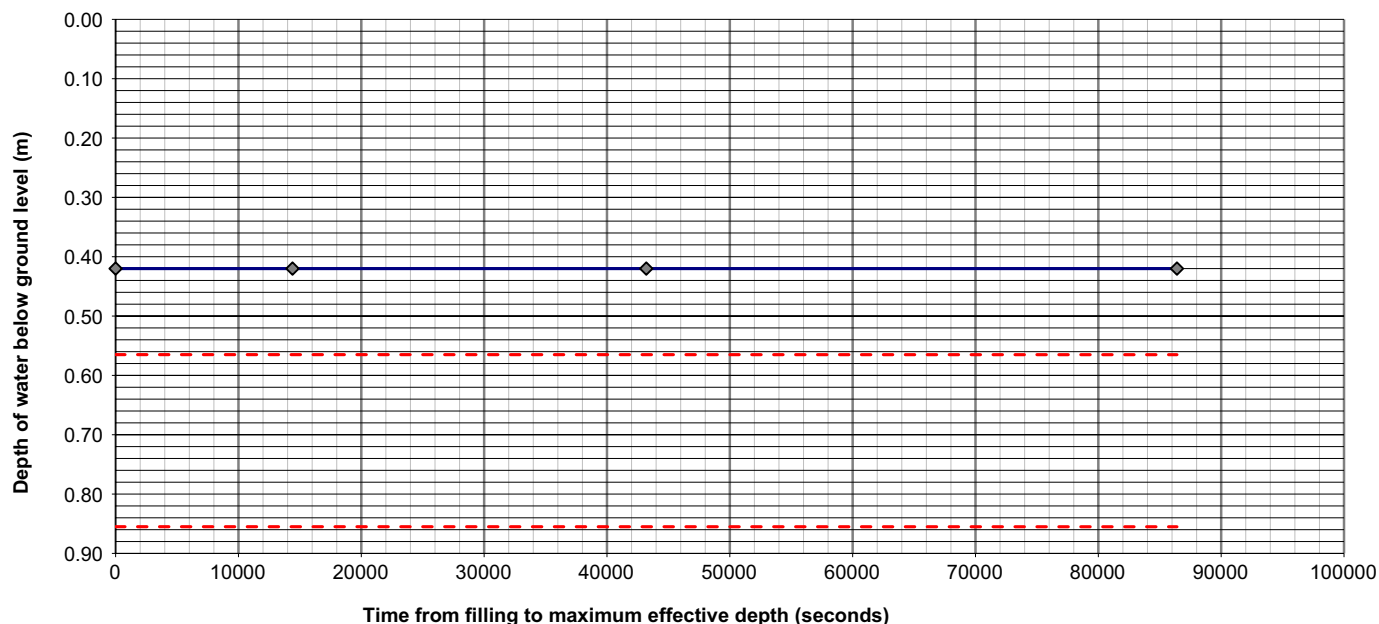
PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

TRIAL PIT ID: SA04

TEST NUMBER: 3

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.50	Pit construction	
			PIT WIDTH (m):	0.60	Machine excavated with manual dips.	
			PIT DEPTH (m):	1.00		
	0.00	0.420	INPUT PARAMETERS:			
14400	240.00	0.420	Total volume of pit		(m³)	0.52
43200	720.00	0.420	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.26
86400	1440.00	0.420	Effective depth of Pit		(m)	0.58
			Proportion of pit volume occupied by gravel solids		(0-1)	0.00
			Maximum potential volume of Water		(m³)	0.52
			Level of water in pit at 75% effective depth (p75)		(m)	0.15
			Level of water in pit at 25% effective depth (p25)		(m)	0.44
			Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.26
			Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.12
			Time at 75% effective depth (p75)		(s)	#N/A
			Time at 25% effective depth (p25)		(s)	#N/A
			Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	#N/A
			OUTPUT:			
			SOIL INFILTRATION RATE (f)	Vp75 - 25	(m/s)	#N/A
				Ap50 x Tp75 - 25		
			WATER INPUT:		0 1 3	
			GEOLOGY OF TEST SECTION:			
			Greyish brown slightly clayey sandy GRAVEL with high cobble and boulder content. Sand is fine to coarse.			
			Gravel is fine to coarse angular to subangular of brick, coal and sandstone. Cobbles are angular to subangular of brick, coal and sandstone. Boulders are of concrete, metal and sandstone.			

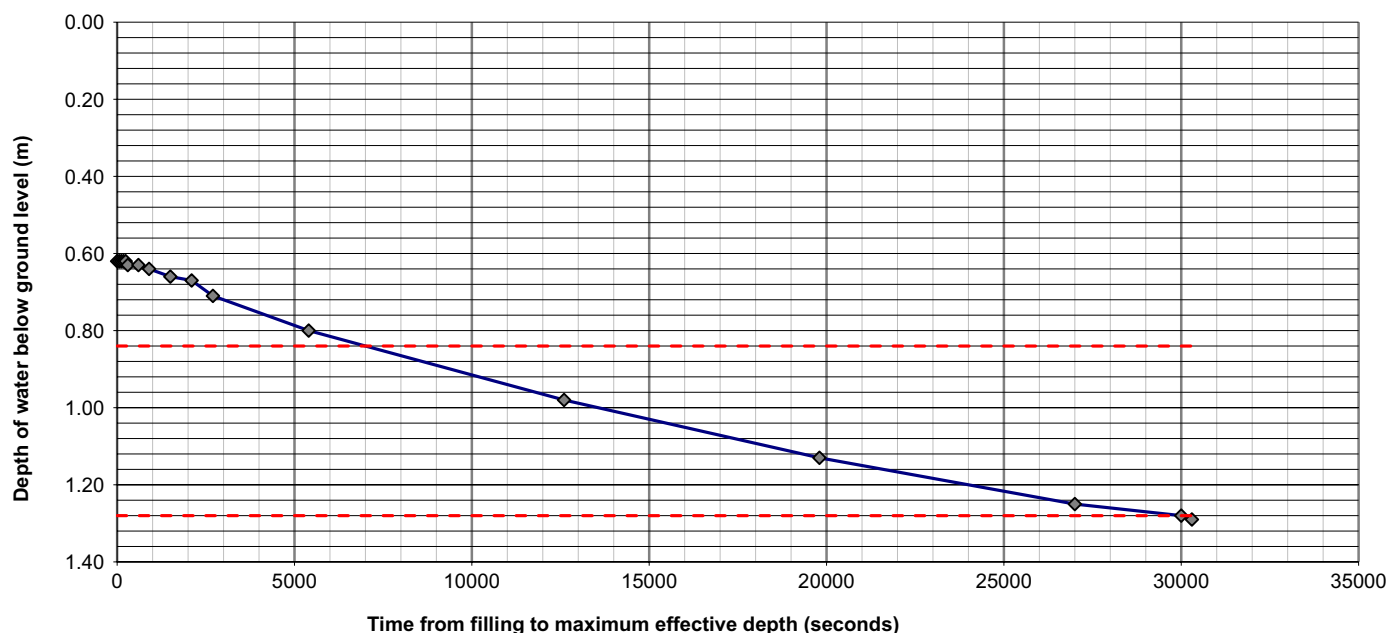
Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE:	15/01/2025
PROJECT No:	B068800
PROJECT NAME:	Llangatwg
CLIENT:	Morgan Sindall
TRIAL PIT ID:	SA06
TEST NUMBER:	1

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.40	Pit construction	
			PIT WIDTH (m):	0.70	Machine excavated with manual dips and logger dips.	
			PIT DEPTH (m):	1.50		
	0.00	0.620	INPUT PARAMETERS:			
60	1.00	0.620	Total volume of pit		(m³)	0.86
120	2.00	0.620	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.43
180	3.00	0.620	Effective depth of Pit		(m)	0.88
240	4.00	0.620	Proportion of pit volume occupied by gravel solids		(0-1)	0.00
300	5.00	0.630	Maximum potential volume of Water		(m³)	0.86
600	10.00	0.630	Level of water in pit at 75% effective depth (p75)		(m)	0.22
900	15.00	0.640	Level of water in pit at 25% effective depth (p25)		(m)	0.66
1500	25.00	0.660				
2100	35.00	0.670	Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.43
2700	45.00	0.710	Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.83
5400	90.00	0.800				
12600	210.00	0.980	Time at 75% effective depth (p75)		(s)	7001
19800	330.00	1.130	Time at 25% effective depth (p25)		(s)	30000
27000	450.00	1.250	Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	22999
30000	500.00	1.280	OUTPUT:			
30300	505.00	1.290	SOIL INFILTRATION RATE (f)	Vp75 - 25	(m/s)	6.63E-06
				Ap50 X Tp75 - 25		
			WATER INPUT: 500 l 3			
			GEOLOGY OF TEST SECTION:			
			Firm to stiff orangish brown and light brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of sandstone. Cobbles are subrounded of sandstone.			
			Compiled by: JM			
			Checked by: PV			

After BRE Digest 365, Soakaway Design, 2016

Page 1 of 1

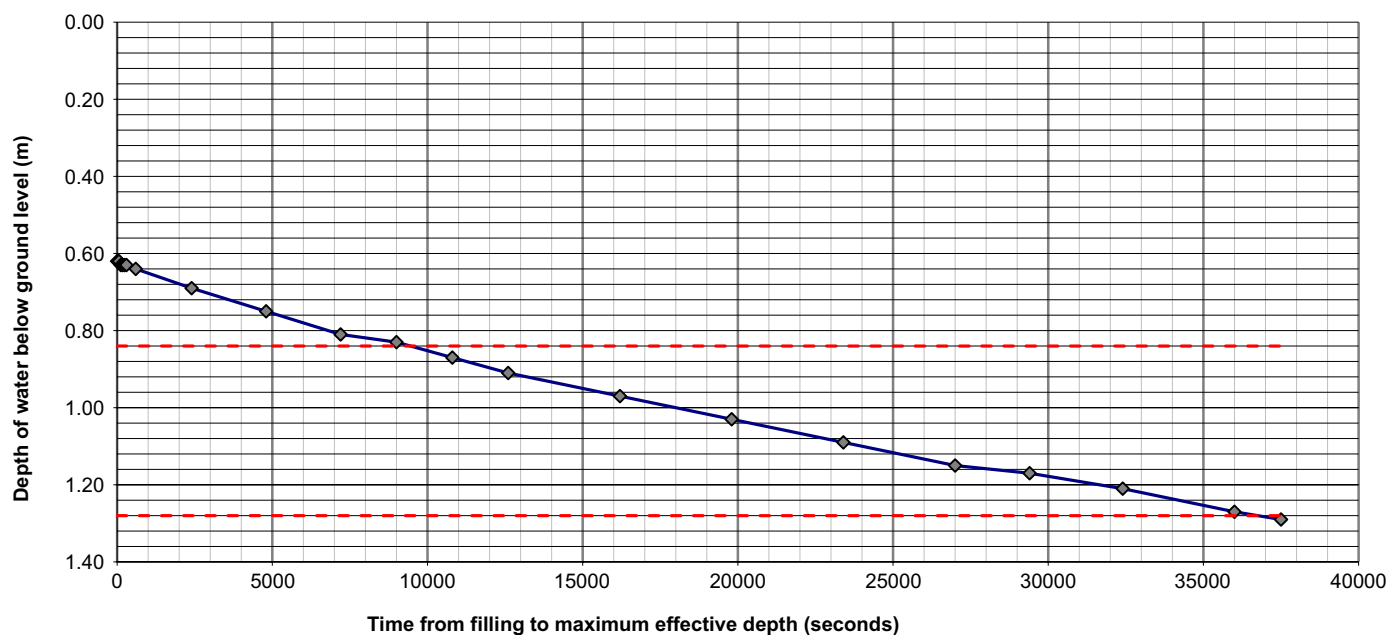
Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE:	15/01/2025
PROJECT No:	B068800
PROJECT NAME:	Llangatwg
CLIENT:	Morgan Sindall
TRIAL PIT ID:	SA06
TEST NUMBER:	2

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.40	Pit construction		
			PIT WIDTH (m):	0.70	Machine excavated with manual dips and logger dips.		
			PIT DEPTH (m):	1.50			
	0.00	0.620	INPUT PARAMETERS:				
60	1.00	0.620	Total volume of pit		(m³)	0.86	
120	2.00	0.630	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.43	
180	3.00	0.630	Effective depth of Pit		(m)	0.88	
240	4.00	0.630	Proportion of pit volume occupied by gravel solids		(0-1)	0.00	
300	5.00	0.630	Maximum potential volume of Water		(m³)	0.86	
600	10.00	0.640	Level of water in pit at 75% effective depth (p75)		(m)	0.22	
2400	40.00	0.690	Level of water in pit at 25% effective depth (p25)		(m)	0.66	
4800	80.00	0.750					
7200	120.00	0.810	Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.43	
9000	150.00	0.830	Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.83	
10800	180.00	0.870					
12600	210.00	0.910	Time at 75% effective depth (p75)		(s)	9451	
16200	270.00	0.970	Time at 25% effective depth (p25)		(s)	36754	
19800	330.00	1.030	Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	27303	
23400	390.00	1.090	OUTPUT:				
27000	450.00	1.150	SOIL INFILTRATION RATE (f)		Vp75 - 25	(m/s)	5.58E-06
29400	490.00	1.170			Ap50 x Tp75 - 25		
32400	540.00	1.210					
36000	600.00	1.270	WATER INPUT:		500	l	3
37500	625.00	1.290	GEOLOGY OF TEST SECTION:				
			Firm to stiff orangish brown and light brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of sandstone. Cobbles are subrounded of sandstone.				
			Compiled by: JM				
			Checked by: PV				

After BRE Digest 365, Soakaway Design, 2016

Page 1 of 1

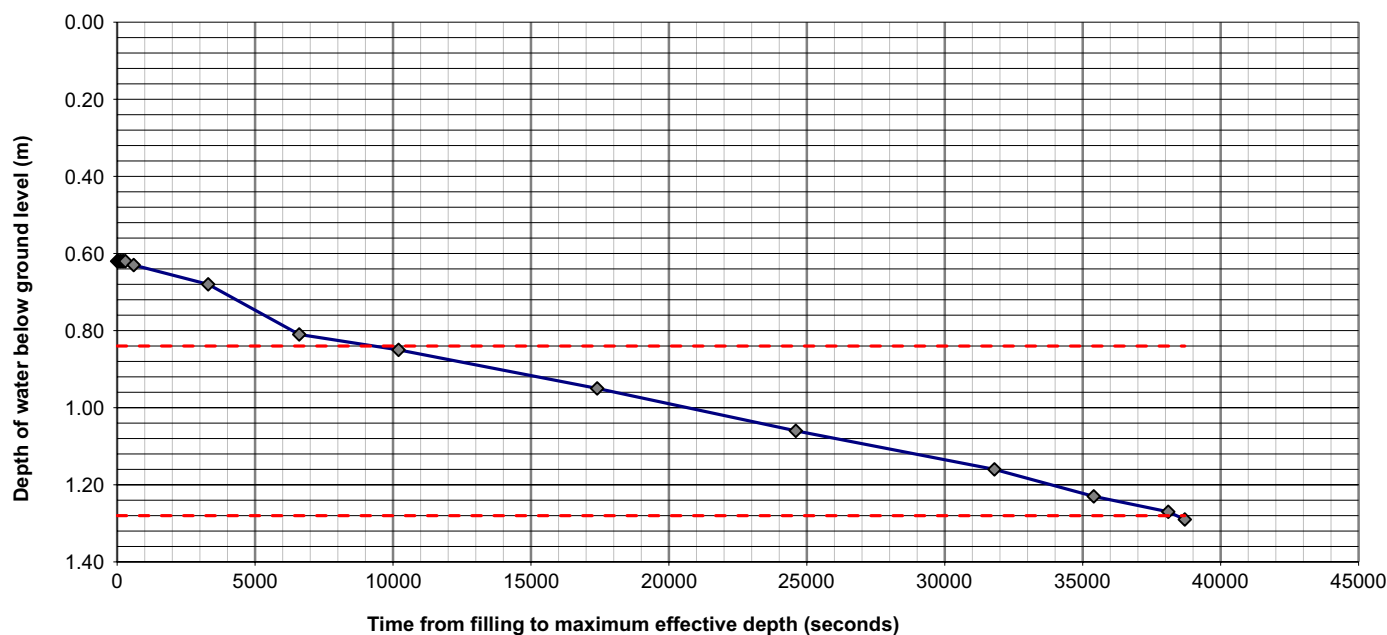
Tetra Tech

Atlantic House, Greenwood Close, Cardiff Gate Business Park,
Pontprennau, Cardiff, CF23 8RD.
Environmental Consultancy
Ground Engineering Services



DATE:	16/01/2025
PROJECT No:	B068800
PROJECT NAME:	Llangatwg
CLIENT:	Morgan Sindall
TRIAL PIT ID:	SA06
TEST NUMBER:	3

SOAKAWAY TEST - SOIL INFILTRATION RATE/PERMEABILITY CALCULATION



Time Elapsed (s)	Time Elapsed (mins)	Distance to water surface from ground level (m)	PIT LENGTH (m):	1.40	Pit construction	
			PIT WIDTH (m):	0.70	Machine excavated with manual dips and logger dips.	
			PIT DEPTH (m):	1.50		
	0.00	0.620	INPUT PARAMETERS:			
60	1.00	0.620	Total volume of pit		(m³)	0.86
120	2.00	0.620	Pit volume between 75% and 25% depths = L x W x ½D		(m³)	0.43
180	3.00	0.620	Effective depth of Pit		(m)	0.88
240	4.00	0.620	Proportion of pit volume occupied by gravel solids		(0-1)	0.00
300	5.00	0.620	Maximum potential volume of Water		(m³)	0.86
600	10.00	0.630	Level of water in pit at 75% effective depth (p75)		(m)	0.22
3300	55.00	0.680	Level of water in pit at 25% effective depth (p25)		(m)	0.66
6600	110.00	0.810				
10200	170.00	0.850	Effective volume between 75% & 25% depth Vp75-25 = V x Pg		(m³)	0.43
17400	290.00	0.950	Surface area of pit up to 50% effective depth (Ap50)		(m²)	2.83
24600	410.00	1.060				
31800	530.00	1.160	Time at 75% effective depth (p75)		(s)	9307
35400	590.00	1.230	Time at 25% effective depth (p25)		(s)	38402
38100	635.00	1.270	Time for outflow for 75% and 25% effective depth (Tp75-25)		(s)	29095
38700	645.00	1.290	OUTPUT:			
			SOIL INFILTRATION RATE (f)	Vp75 - 25	(m/s)	5.24E-06
				Ap50 x Tp75 - 25		
			WATER INPUT: 500 l 3			
			GEOLOGY OF TEST SECTION:			
			Firm to stiff orangish brown and light brown slightly gravelly sandy CLAY with medium cobble content. Sand is fine to coarse. Gravel is fine to coarse subangular to subrounded of sandstone. Cobbles are subrounded of sandstone.			
			Compiled by: JM			
			Checked by: PV			

After BRE Dqest 365, Soakaway Design, 2016

Page 1 of 1

APPENDIX D: CBR TEST DATA

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: BH01

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: BH01

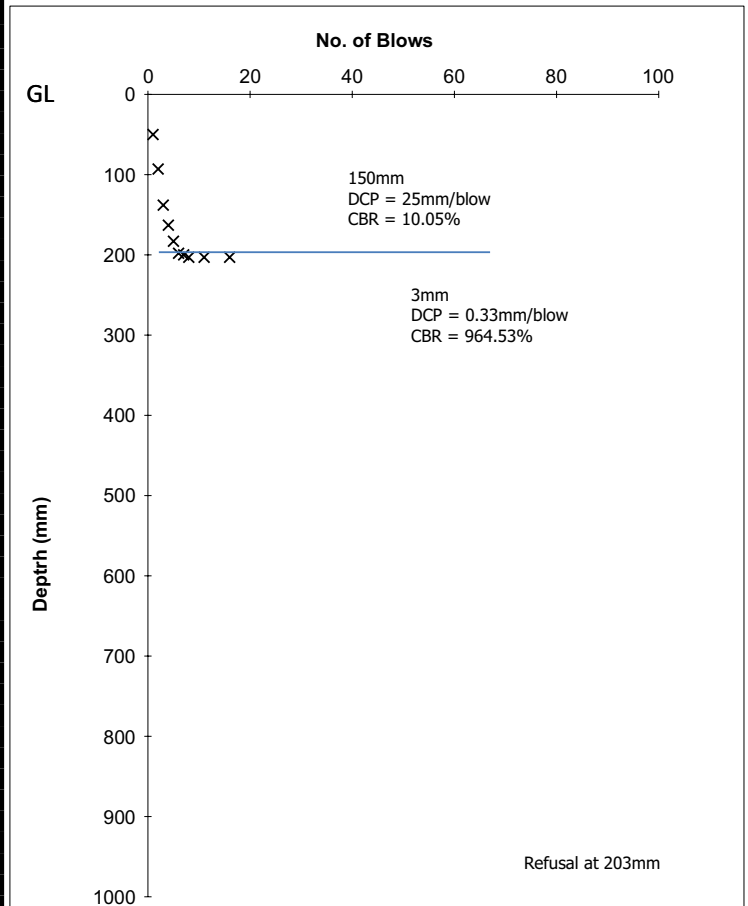
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
50	1	182	50				
43	2	225	93				
45	3	270	138				
25	4	295	163				
20	5	315	183				
15	6	330	198				
2	7	332	200				
3	8	335	203				
	11	335	203				
0	16	335	203				
-335	11		-132				
	12		-132				
	13		-132				
	14		-132				
	15		-132				
	16		-132				
	17		-132				
	18		-132				
	19		-132				
	20		-132				
	21		-132				
	22		-132				
	23		-132				
	24		-132				
	25		-132				
	26		-132				
	27		-132				
	28		-132				
	29		-132				
	30		-132				
	31		-132				
	32		-132				
	33		-132				
	34		-132				
	35		-132				
	36		-132				
	37		-132				
	38		-132				
	39		-132				
	40		-132				
	41		-132				
	42		-132				
	43		-132				
	44		-132				
	45		-132				
	46		-132				
	47		-132				
	48		-132				
	49		-132				
	50		-132				

Test started at: 0 m below ground level

Zero Reading: 132 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: BH02

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: BH02

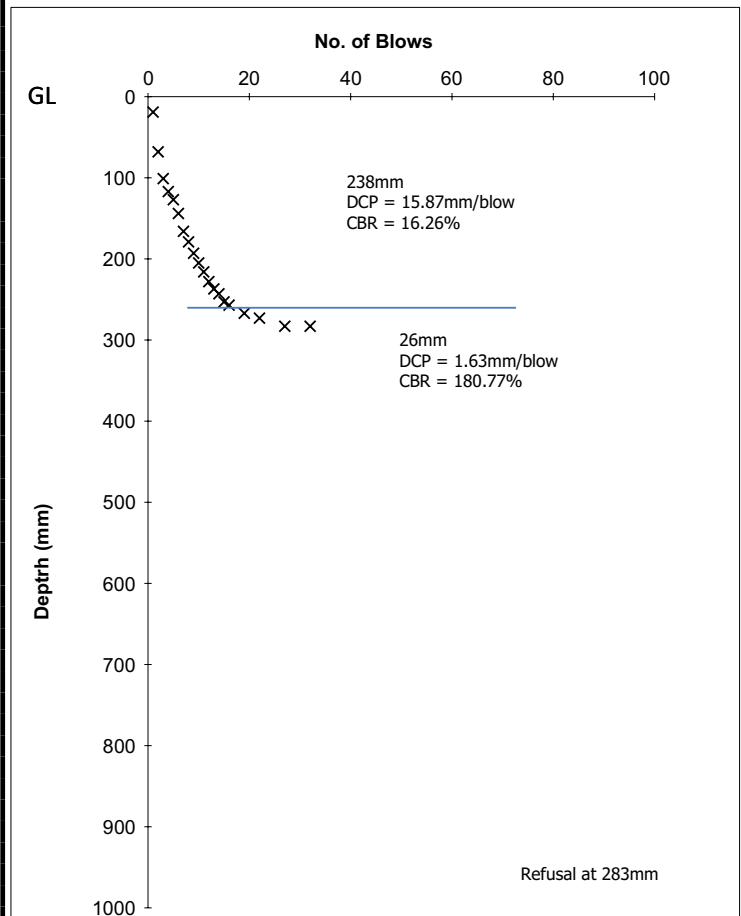
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
19	1	146	19				
49	2	195	68				
33	3	228	101				
16	4	244	117				
10	5	254	127				
17	6	271	144				
22	7	293	166				
13	8	306	179				
14	9	320	193				
12	10	332	205				
11	11	343	216				
12	12	355	228				
9	13	364	237				
6	14	370	243				
10	15	380	253				
4	16	384	257				
10	19	394	267				
6	22	400	273				
10	27	410	283				
0	32	410	283				
-410	21		-127				
	22		-127				
	23		-127				
	24		-127				
	25		-127				
	26		-127				
	27		-127				
	28		-127				
	29		-127				
	30		-127				
	31		-127				
	32		-127				
	33		-127				
	34		-127				
	35		-127				
	36		-127				
	37		-127				
	38		-127				
	39		-127				
	40		-127				
	41		-127				
	42		-127				
	43		-127				
	44		-127				
	45		-127				
	46		-127				
	47		-127				
	48		-127				
	49		-127				
	50		-127				

Test started at: 0 m below ground level

Zero Reading: 127 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: BH03

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: BH03

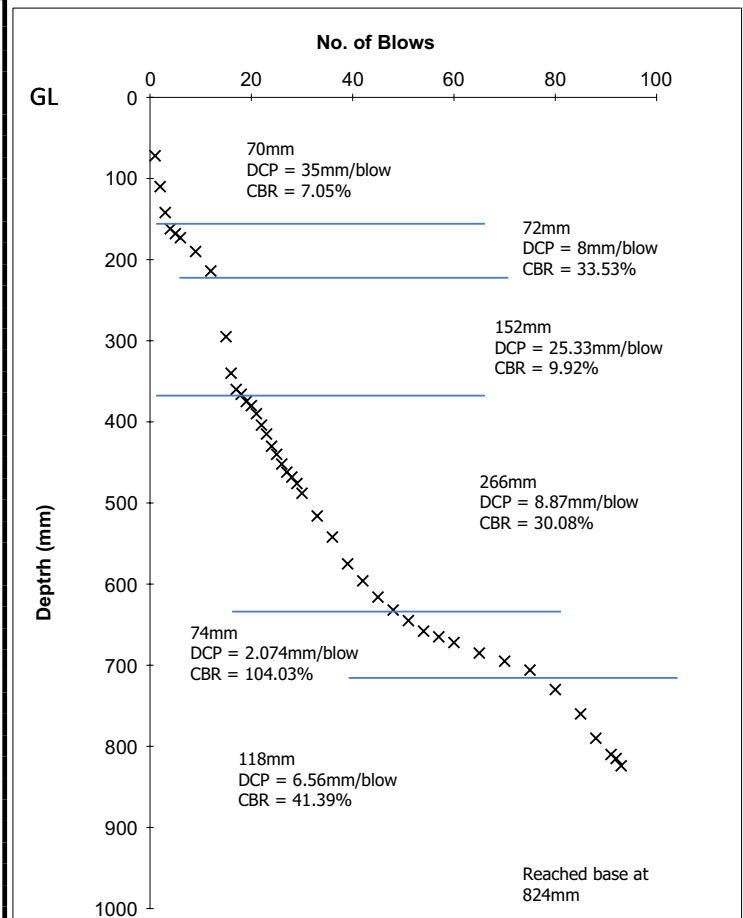
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
72	1	192	72				
38	2	230	110				
32	3	262	142				
20	4	282	162				
6	5	288	168				
5	6	293	173				
17	9	310	190				
24	12	334	214				
81	15	415	295				
45	16	460	340				
20	17	480	360				
6	18	486	366				
9	19	495	375				
5	20	500	380				
10	21	510	390				
14	22	524	404				
11	23	535	415				
15	24	550	430				
10	25	560	440				
12	26	572	452				
10	27	582	462				
6	28	588	468				
8	29	596	476				
12	30	608	488				
28	33	636	516				
26	36	662	542				
33	39	695	575				
21	42	716	596				
20	45	736	616				
16	48	752	632				
13	51	765	645				
13	54	778	658				
7	57	785	665				
7	60	792	672				
13	65	805	685				
10	70	815	695				
11	75	826	706				
24	80	850	730				
30	85	880	760				
30	88	910	790				
20	91	930	810				
5	92	935	815				
9	93	944	824				
-944	44		-120				
	45		-120				
	46		-120				
	47		-120				
	48		-120				
	49		-120				
	50		-120				

Test started at: 0 m below ground level

Zero Reading: 120 mm

Zero reading = start depth below ground surface



Data compiled by: JM

Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: BH04

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: BH04

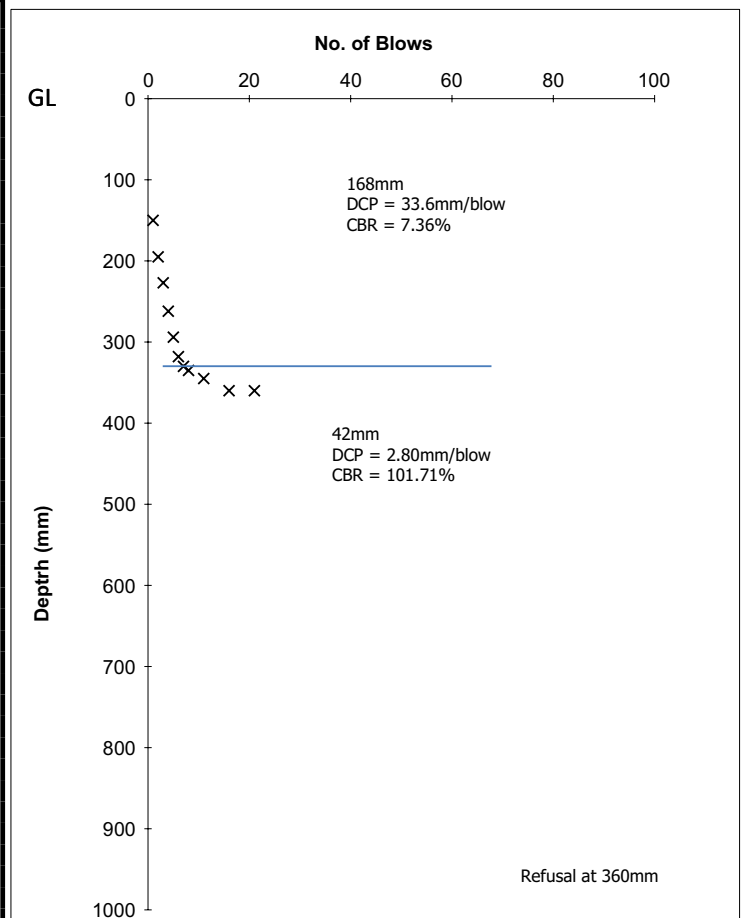
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
150	1	250	150				
45	2	295	195				
32	3	327	227				
35	4	362	262				
32	5	394	294				
24	6	418	318				
12	7	430	330				
5	8	435	335				
10	11	445	345				
15	16	460	360				
0	21	460	360				
-460	12		-100				
	13		-100				
	14		-100				
	15		-100				
	16		-100				
	17		-100				
	18		-100				
	19		-100				
	20		-100				
	21		-100				
	22		-100				
	23		-100				
	24		-100				
	25		-100				
	26		-100				
	27		-100				
	28		-100				
	29		-100				
	30		-100				
	31		-100				
	32		-100				
	33		-100				
	34		-100				
	35		-100				
	36		-100				
	37		-100				
	38		-100				
	39		-100				
	40		-100				
	41		-100				
	42		-100				
	43		-100				
	44		-100				
	45		-100				
	46		-100				
	47		-100				
	48		-100				
	49		-100				
	50		-100				

Test started at: 0 m below ground level

Zero Reading: 100 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment**TETRA TECH**

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD

Tel: 02920 829200

Fax: 02920 455321

Environmental Consultancy

Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: SA01

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: SA01

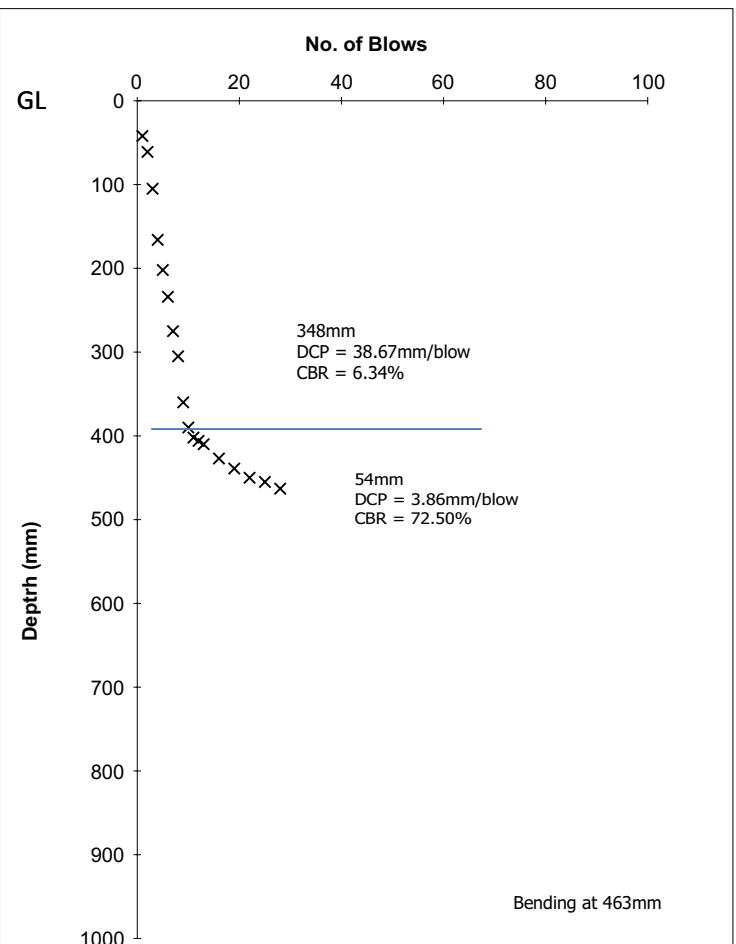
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
42	1	187	42				
19	2	206	61				
44	3	250	105				
61	4	311	166				
36	5	347	202				
32	6	379	234				
41	7	420	275				
30	8	450	305				
55	9	505	360				
30	10	535	390				
12	11	547	402				
4	12	551	406				
4	13	555	410				
17	16	572	427				
12	19	584	439				
11	22	595	450				
5	25	600	455				
8	28	608	463				
-608	19		-145				
	20		-145				
	21		-145				
	22		-145				
	23		-145				
	24		-145				
	25		-145				
	26		-145				
	27		-145				
	28		-145				
	29		-145				
	30		-145				
	31		-145				
	32		-145				
	33		-145				
	34		-145				
	35		-145				
	36		-145				
	37		-145				
	38		-145				
	39		-145				
	40		-145				
	41		-145				
	42		-145				
	43		-145				
	44		-145				
	45		-145				
	46		-145				
	47		-145				
	48		-145				
	49		-145				
	50		-145				

Test started at: 0 m below ground level

Zero Reading: 145 mm

Zero reading = start depth below ground surface



Data compiled by: JM

Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: SA02

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: SA02

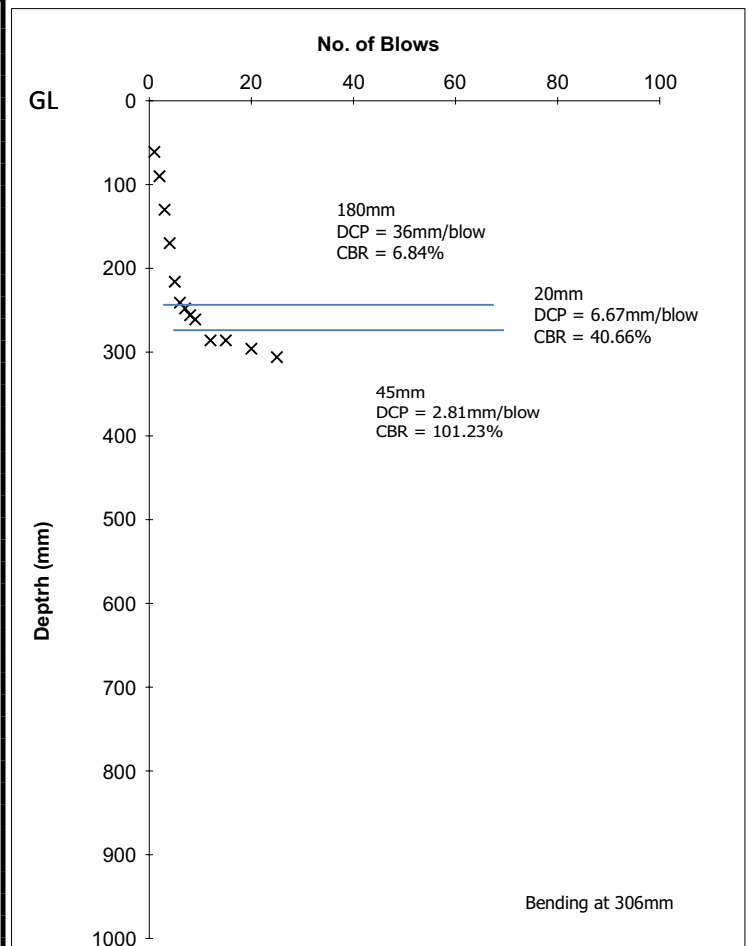
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
61	1	155	61				
29	2	184	90				
40	3	224	130				
40	4	264	170				
46	5	310	216				
25	6	335	241				
7	7	342	248				
8	8	350	256				
5	9	355	261				
25	12	380	286				
	15	380	286				
10	20	390	296				
10	25	400	306				
-400	14		-94				
	15		-94				
	16		-94				
	17		-94				
	18		-94				
	19		-94				
	20		-94				
	21		-94				
	22		-94				
	23		-94				
	24		-94				
	25		-94				
	26		-94				
	27		-94				
	28		-94				
	29		-94				
	30		-94				
	31		-94				
	32		-94				
	33		-94				
	34		-94				
	35		-94				
	36		-94				
	37		-94				
	38		-94				
	39		-94				
	40		-94				
	41		-94				
	42		-94				
	43		-94				
	44		-94				
	45		-94				
	46		-94				
	47		-94				
	48		-94				
	49		-94				
	50		-94				

Test started at: 0 m below ground level

Zero Reading: 94 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: SA03

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: SA03

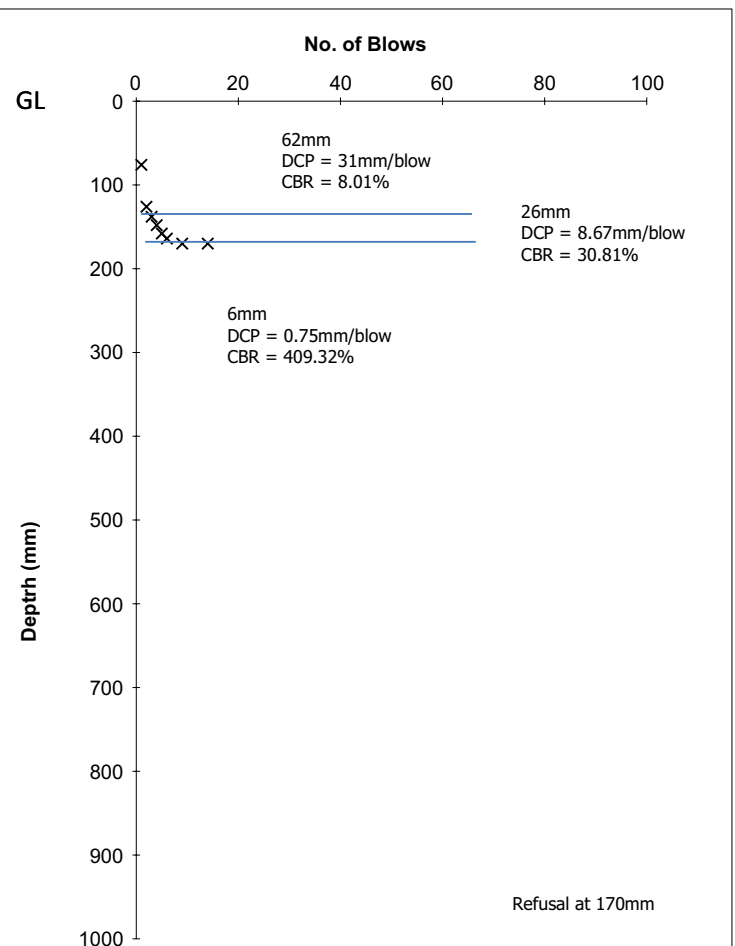
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
76	1	148	76				
50	2	198	126				
12	3	210	138				
10	4	220	148				
10	5	230	158				
6	6	236	164				
6	9	242	170				
0	14	242	170				
-242	9		-72				
	10		-72				
	11		-72				
	12		-72				
	13		-72				
	14		-72				
	15		-72				
	16		-72				
	17		-72				
	18		-72				
	19		-72				
	20		-72				
	21		-72				
	22		-72				
	23		-72				
	24		-72				
	25		-72				
	26		-72				
	27		-72				
	28		-72				
	29		-72				
	30		-72				
	31		-72				
	32		-72				
	33		-72				
	34		-72				
	35		-72				
	36		-72				
	37		-72				
	38		-72				
	39		-72				
	40		-72				
	41		-72				
	42		-72				
	43		-72				
	44		-72				
	45		-72				
	46		-72				
	47		-72				
	48		-72				
	49		-72				
	50		-72				

Test started at: 0 m below ground level

Zero Reading: 72 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: SA04

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10}(\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: SA04

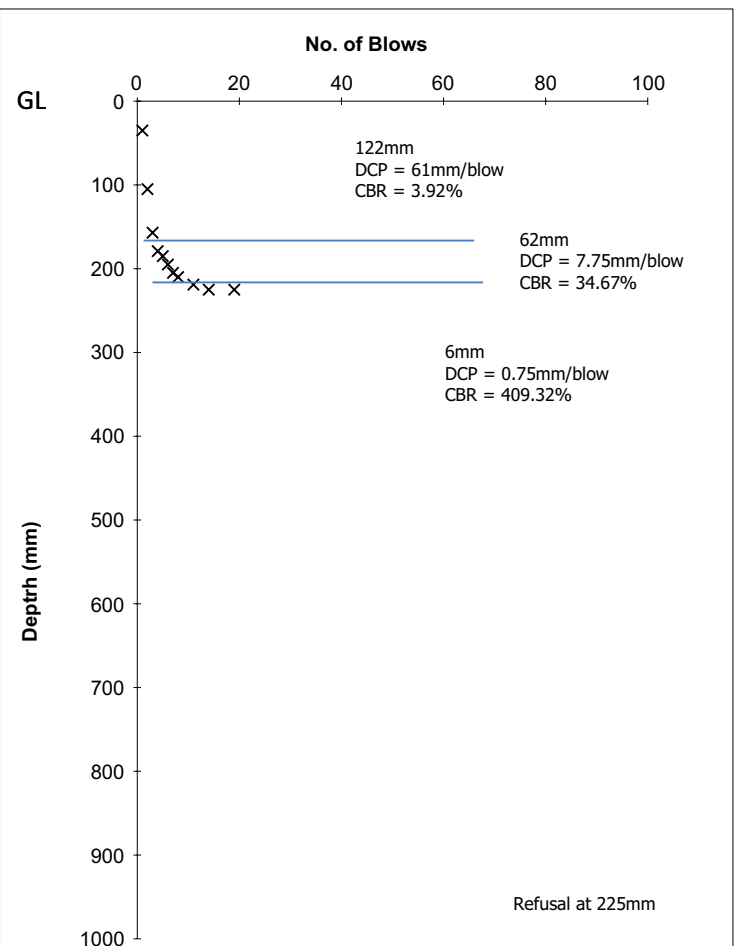
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
35	1	190	35				
70	2	260	105				
52	3	312	157				
22	4	334	179				
6	5	340	185				
10	6	350	195				
10	7	360	205				
5	8	365	210				
9	11	374	219				
6	14	380	225				
0	19	380	225				
-380	12		-155				
	13		-155				
	14		-155				
	15		-155				
	16		-155				
	17		-155				
	18		-155				
	19		-155				
	20		-155				
	21		-155				
	22		-155				
	23		-155				
	24		-155				
	25		-155				
	26		-155				
	27		-155				
	28		-155				
	29		-155				
	30		-155				
	31		-155				
	32		-155				
	33		-155				
	34		-155				
	35		-155				
	36		-155				
	37		-155				
	38		-155				
	39		-155				
	40		-155				
	41		-155				
	42		-155				
	43		-155				
	44		-155				
	45		-155				
	46		-155				
	47		-155				
	48		-155				
	49		-155				
	50		-155				

Test started at: 0 m below ground level

Zero Reading: 155 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment



Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD

Tel: 02920 829200

Fax: 02920 455321

Environmental Consultancy

Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: SA06

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: SA06

Date:

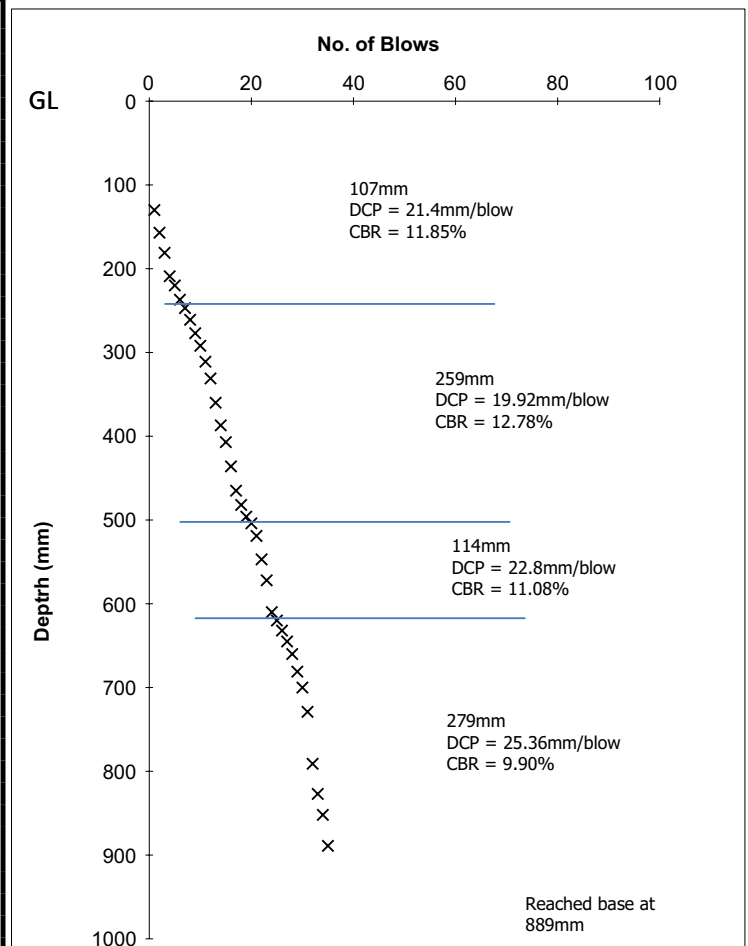
17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
130	1	203	130				
27	2	230	157				
24	3	254	181				
28	4	282	209				
11	5	293	220				
17	6	310	237				
10	7	320	247				
14	8	334	261				
16	9	350	277				
15	10	365	292				
19	11	384	311				
20	12	404	331				
29	13	433	360				
27	14	460	387				
20	15	480	407				
29	16	509	436				
29	17	538	465				
17	18	555	482				
14	19	569	496				
8	20	577	504				
15	21	592	519				
28	22	620	547				
25	23	645	572				
38	24	683	610				
10	25	693	620				
12	26	705	632				
13	27	718	645				
15	28	733	660				
21	29	754	681				
19	30	773	700				
29	31	802	729				
62	32	864	791				
36	33	900	827				
25	34	925	852				
37	35	962	889				
-962	36		-73				
	37		-73				
	38		-73				
	39		-73				
	40		-73				
	41		-73				
	42		-73				
	43		-73				
	44		-73				
	45		-73				
	46		-73				
	47		-73				
	48		-73				
	49		-73				
	50		-73				

Test started at: 0 m below ground level

Zero Reading: 73 mm

Zero reading = start depth below ground surface



Data compiled by: JM

Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: WS01

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: WS01

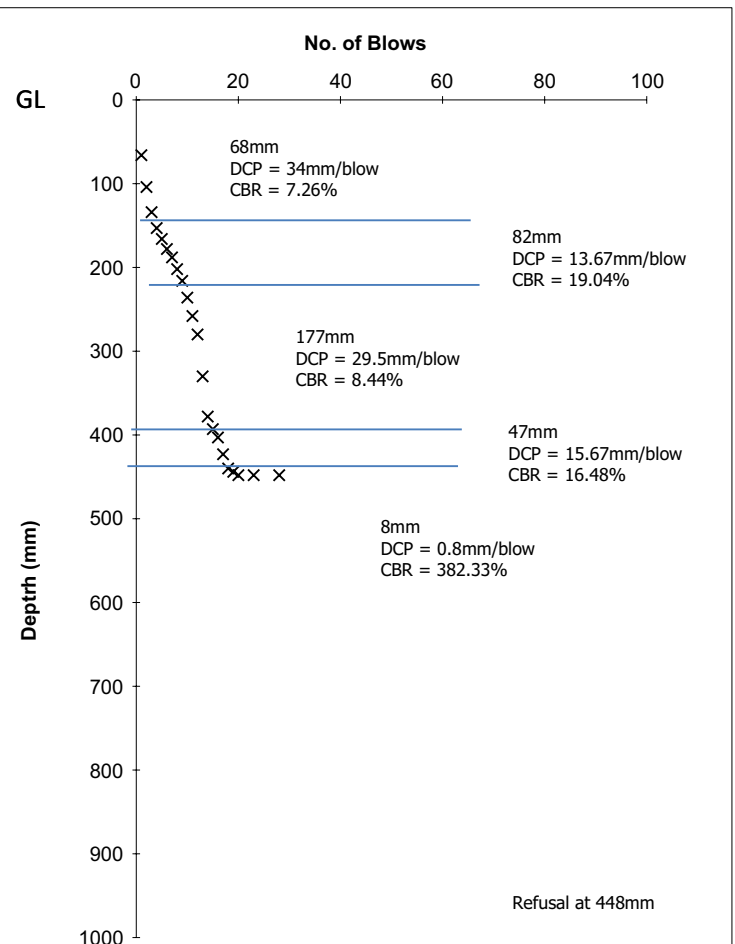
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
66	1	198	66				
38	2	236	104				
30	3	266	134				
19	4	285	153				
13	5	298	166				
12	6	310	178				
10	7	320	188				
14	8	334	202				
14	9	348	216				
20	10	368	236				
22	11	390	258				
22	12	412	280				
50	13	462	330				
48	14	510	378				
15	15	525	393				
10	16	535	403				
20	17	555	423				
17	18	572	440				
4	19	576	444				
4	20	580	448				
	23	580	448				
0	28	580	448				
-580	23		-132				
	24		-132				
	25		-132				
	26		-132				
	27		-132				
	28		-132				
	29		-132				
	30		-132				
	31		-132				
	32		-132				
	33		-132				
	34		-132				
	35		-132				
	36		-132				
	37		-132				
	38		-132				
	39		-132				
	40		-132				
	41		-132				
	42		-132				
	43		-132				
	44		-132				
	45		-132				
	46		-132				
	47		-132				
	48		-132				
	49		-132				
	50		-132				

Test started at: 0 m below ground level

Zero Reading: 132 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD

Tel: 02920 829200

Fax: 02920 455321

Environmental Consultancy

Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: WS02

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: WS02

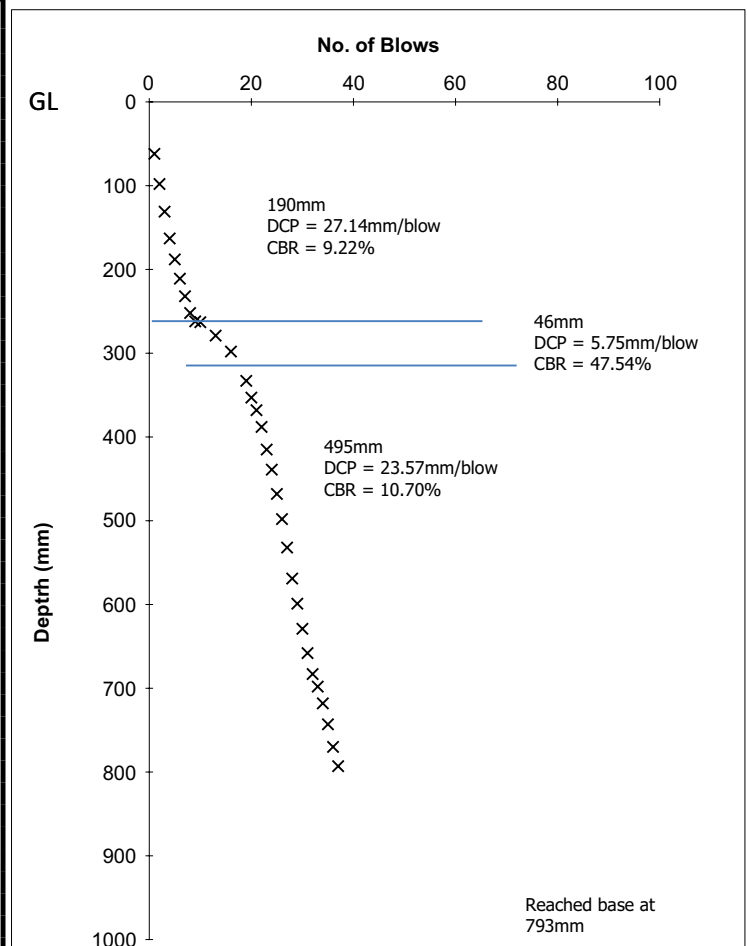
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
62	1	214	62				
36	2	250	98				
33	3	283	131				
32	4	315	163				
25	5	340	188				
23	6	363	211				
21	7	384	232				
20	8	404	252				
10	9	414	262				
1	10	415	263				
16	13	431	279				
19	16	450	298				
35	19	485	333				
20	20	505	353				
15	21	520	368				
20	22	540	388				
27	23	567	415				
24	24	591	439				
29	25	620	468				
30	26	650	498				
34	27	684	532				
37	28	721	569				
30	29	751	599				
30	30	781	629				
29	31	810	658				
25	32	835	683				
15	33	850	698				
20	34	870	718				
25	35	895	743				
27	36	922	770				
23	37	945	793				
-945	32		-152				
	33		-152				
	34		-152				
	35		-152				
	36		-152				
	37		-152				
	38		-152				
	39		-152				
	40		-152				
	41		-152				
	42		-152				
	43		-152				
	44		-152				
	45		-152				
	46		-152				
	47		-152				
	48		-152				
	49		-152				
	50		-152				

Test started at: 0 m below ground level

Zero Reading: 152 mm

Zero reading = start depth below ground surface



Data compiled by: JM
Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD

Tel: 02920 829200

Fax: 02920 455321

Environmental Consultancy

Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: WS03

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: WS03

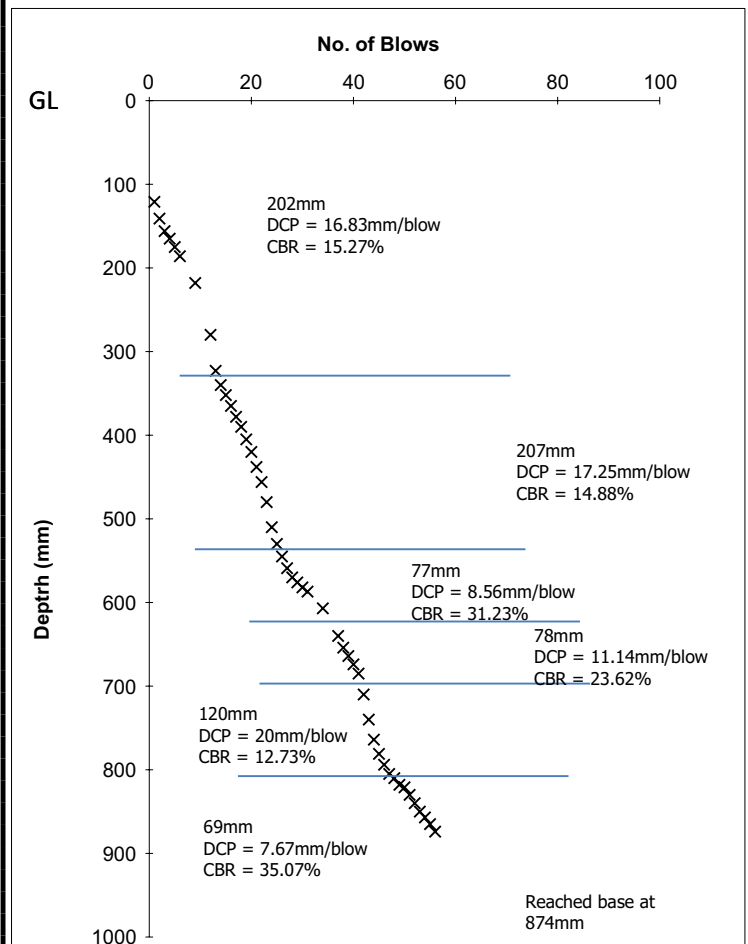
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
121	1	191	121				
20	2	211	141				
15	3	226	156				
9	4	235	165				
10	5	245	175				
11	6	256	186				
32	9	288	218				
62	12	350	280				
43	13	393	323				
17	14	410	340				
12	15	422	352				
13	16	435	365				
13	17	448	378				
12	18	460	390				
15	19	475	405				
15	20	490	420				
18	21	508	438				
18	22	526	456				
24	23	550	480				
30	24	580	510				
20	25	600	530				
15	26	615	545				
14	27	629	559				
11	28	640	570				
6	29	646	576				
6	30	652	582				
5	31	657	587				
20	34	677	607				
33	37	710	640				
14	38	724	654				
10	39	734	664				
10	40	744	674				
11	41	755	685				
25	42	780	710				
30	43	810	740				
24	44	834	764				
17	45	851	781				
13	46	864	794				
11	47	875	805				
5	48	880	810				
8	49	888	818				
3	50	891	821				
9	51	900	830				
10	52	910	840				
10	53	920	850				
7	54	927	857				
8	55	935	865				
9	56	944	874				
-944	49		-70				
	50		-70				

Test started at: 0 m below ground level

Zero Reading: 70 mm

Zero reading = start depth below ground surface



Data compiled by: JM

Data checked by: PV

Tetra Tech Environment



TETRA TECH

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD

Tel: 02920 829200

Fax: 02920 455321

Environmental Consultancy

Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: WS04

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: WS04

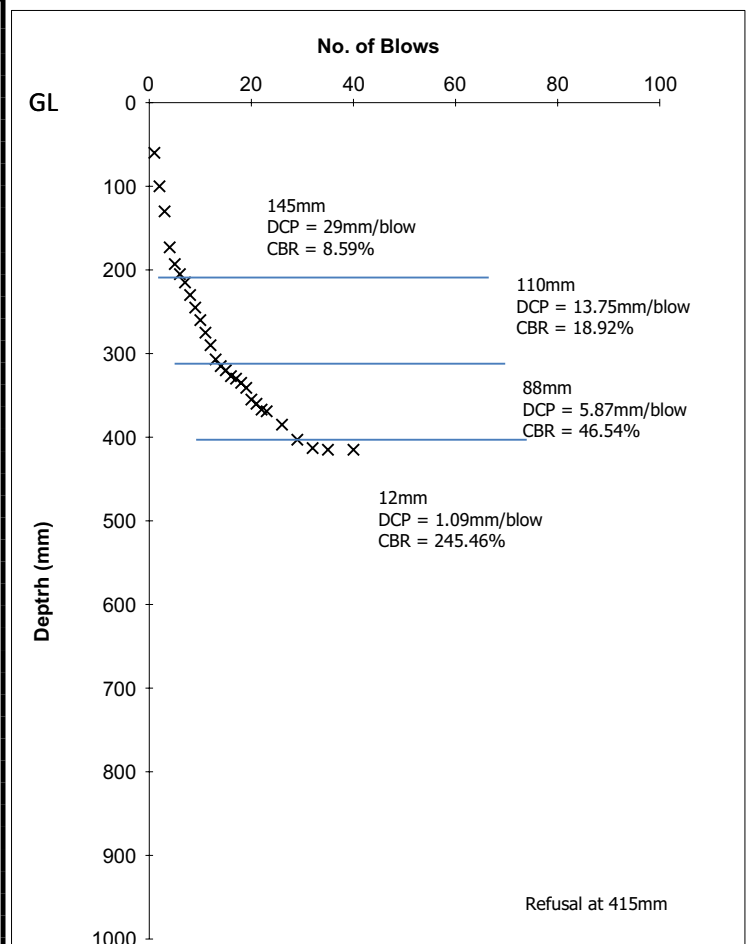
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
60	1	165	60				
40	2	205	100				
30	3	235	130				
43	4	278	173				
20	5	298	193				
12	6	310	205				
10	7	320	215				
15	8	335	230				
15	9	350	245				
15	10	365	260				
15	11	380	275				
15	12	395	290				
17	13	412	307				
8	14	420	315				
5	15	425	320				
7	16	432	327				
3	17	435	330				
5	18	440	335				
6	19	446	341				
14	20	460	355				
5	21	465	360				
7	22	472	367				
2	23	474	369				
16	26	490	385				
18	29	508	403				
10	32	518	413				
2	35	520	415				
0	40	520	415				
-520	29		-105				
	30		-105				
	31		-105				
	32		-105				
	33		-105				
	34		-105				
	35		-105				
	36		-105				
	37		-105				
	38		-105				
	39		-105				
	40		-105				
	41		-105				
	42		-105				
	43		-105				
	44		-105				
	45		-105				
	46		-105				
	47		-105				
	48		-105				
	49		-105				
	50		-105				

Test started at: 0 m below ground level

Zero Reading: 105 mm

Zero reading = start depth below ground surface



Data compiled by: JM

Data checked by: PV

Tetra Tech Environment

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Pontprennau, Cardiff, CF23 8RD
 Tel: 02920 829200
 Fax: 02920 455321
 Environmental Consultancy
 Ground Engineering Services

PROJECT No.: 784-B068800

PROJECT NAME: Llangatwg

CLIENT: Morgan Sindall

FIGURE No.: WS05

DCP-CBR Corellation

$$\text{Log}_{10}(\text{CBR}) = 2.48 - 1.057 \times \text{Log}_{10} (\text{mm/blow})$$

DCP -Modulus E Corellation

$$E = 17.6 (\text{CBR})^{0.64} \text{ MPa}$$

In situ CBR by TRL Probe

Reference: TRL1

Position: WS05

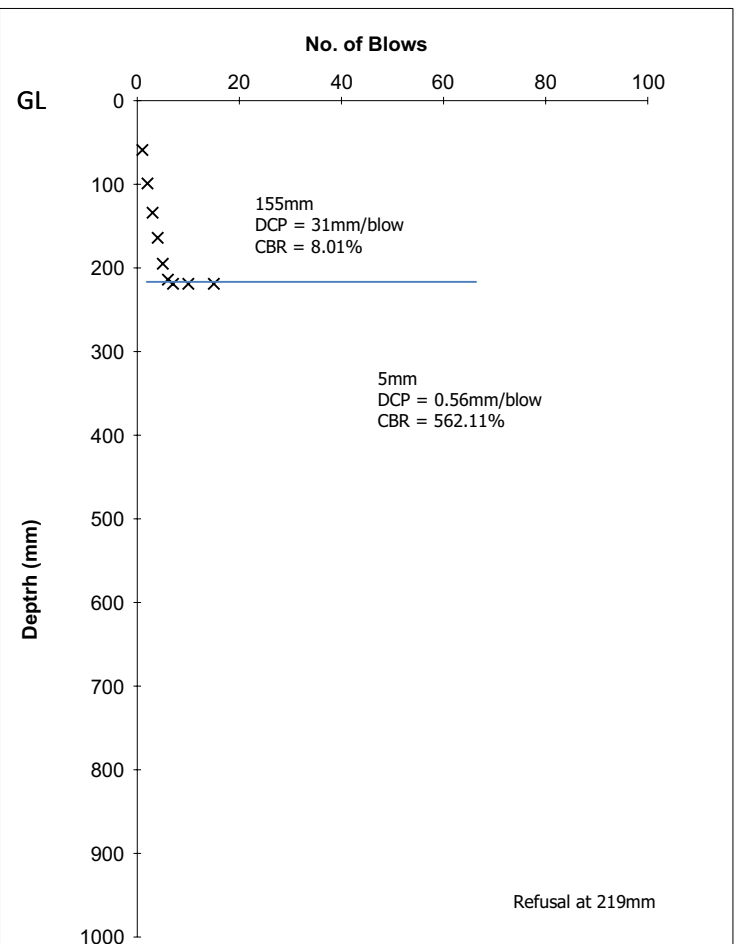
Date: 17 January 2025

mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)	mm per blow	Σ Blows	Reading on Scale (mm)	Depth from Ground Level (mm)
59	1	195	59				
40	2	235	99				
35	3	270	134				
30	4	300	164				
31	5	331	195				
19	6	350	214				
5	7	355	219				
	10	355	219				
0	15	355	219				
-355	10		-136				
	11		-136				
	12		-136				
	13		-136				
	14		-136				
	15		-136				
	16		-136				
	17		-136				
	18		-136				
	19		-136				
	20		-136				
	21		-136				
	22		-136				
	23		-136				
	24		-136				
	25		-136				
	26		-136				
	27		-136				
	28		-136				
	29		-136				
	30		-136				
	31		-136				
	32		-136				
	33		-136				
	34		-136				
	35		-136				
	36		-136				
	37		-136				
	38		-136				
	39		-136				
	40		-136				
	41		-136				
	42		-136				
	43		-136				
	44		-136				
	45		-136				
	46		-136				
	47		-136				
	48		-136				
	49		-136				
	50		-136				

Test started at: 0 m below ground level

Zero Reading: 136 mm

Zero reading = start depth below ground surface



Data compiled by: JM
 Data checked by: PV

APPENDIX E: GEOTECHNICAL LABORATORY TEST RESULTS



Laboratory Report



Contract Number: 76767

Client Ref: **B068800**Date Received: **27-01-2025**

Client PO:

Date Completed: **14-02-2025**Report Date: **14-02-2025**Client: **Tetra Tech**

This report has been checked and approved by:

Contract Title: **Llangatwg**For the attention of: **Paul Vincent**

Brendan Evans
Office Administrator

Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	7
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	7
Particle Size Distribution BS EN ISO 17892-4 : 5.1 - * UKAS	7
BRE Suite A Greenfield Site (pyrite absent) includes pH and water soluble sulphate Sub-contracted Test	14

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)

[illegible]



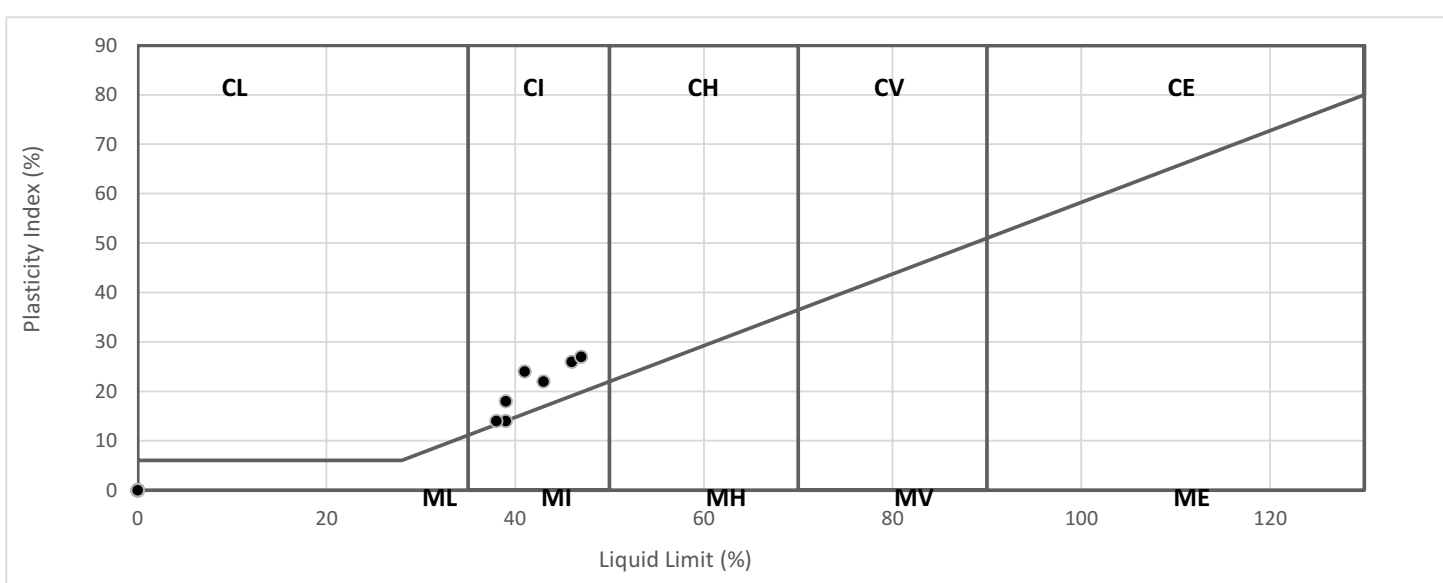
**NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND
PLASTICITY INDEX
(BS 1377:1990 - Part 2 : 4.3 & 5.3)**

Contract Number	76767	
Project Name	Llangatwg	
Date Tested	30/01/2025	

[illegible]

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

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION

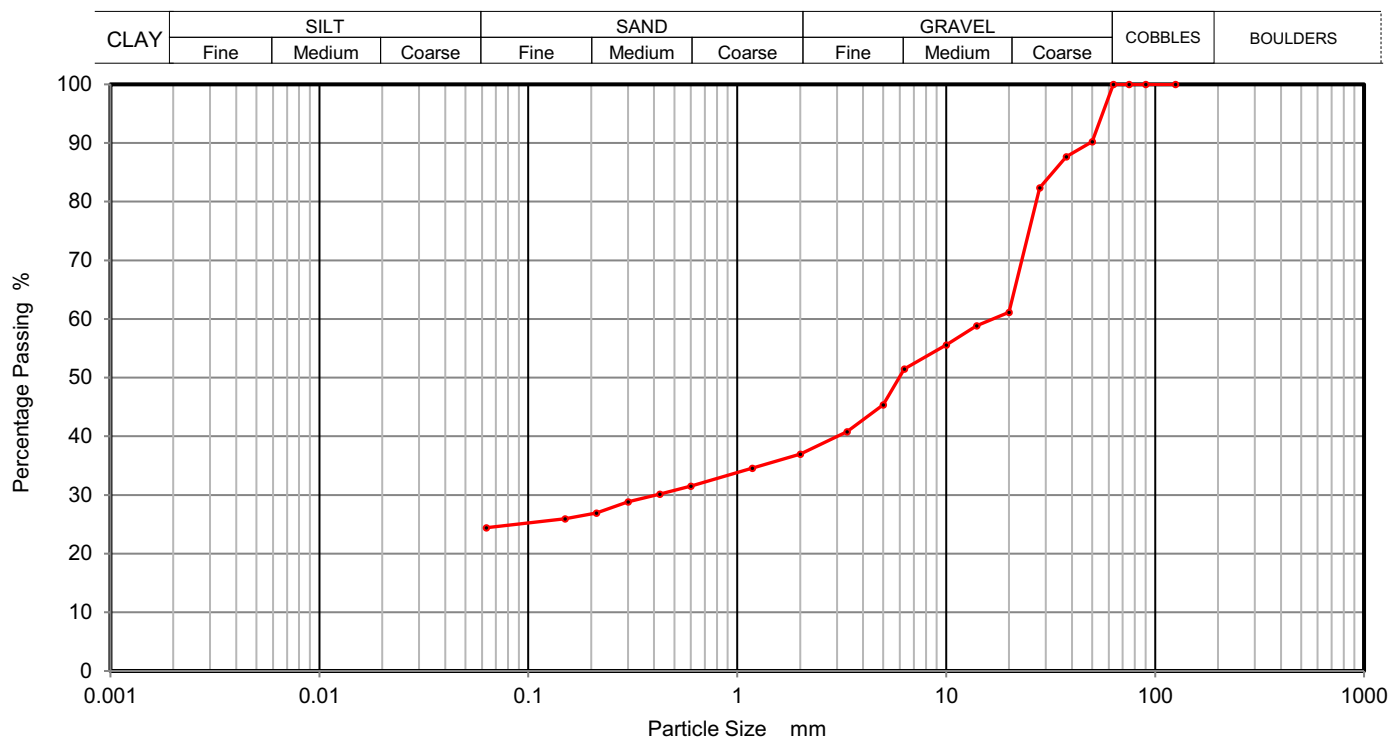


Operator

Owain Davies



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

Contract Number **76767**Borehole/Pit No. **BH04**Project Name **Llangatwg**Sample No. **1**Sample Description **Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL**Depth Top **1.10**Depth Base **1.60**Date Tested **01/02/2025**Sample Type **B**

Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	90		
37.5	88		
28	82		
20	61		
14	59		
10	56		
6.3	51		
5	45		
3.35	41		
2	37		
1.18	35		
0.63	32		
0.425	30		
0.30	29		
0.20	27		
0.15	26		
0.063	24		

Sample Proportions	% dry mass
Cobbles	0
Gravel	63
Sand	13
Silt and Clay	24

Remarks

Preparation and testing in accordance with BS17892 unless noted below

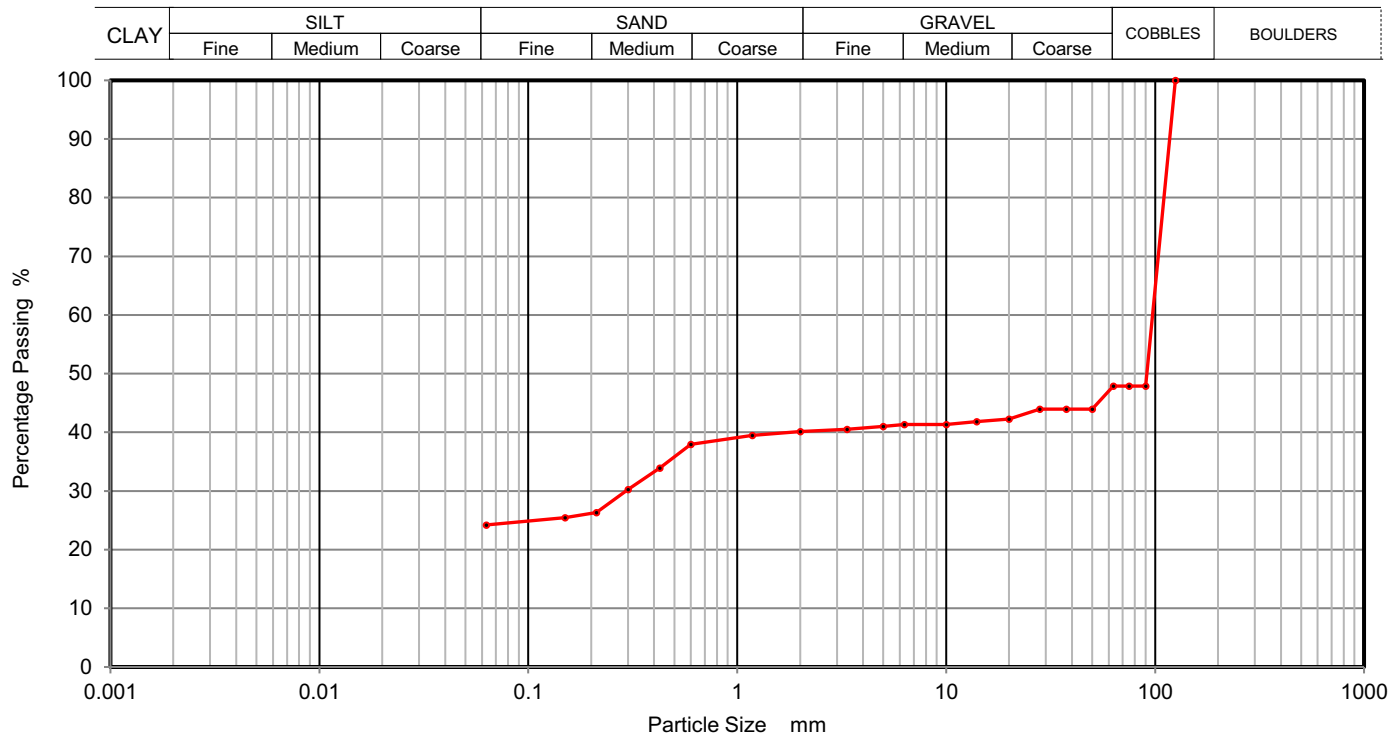
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	SA01
Project Name	Llangatwg	Sample No.	1
Sample Description	Brown fine to coarse gravelly fine to coarse sandy SILT/CLAY (mainly cobbles)	Depth Top	0.10
		Depth Base	0.50
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	48		
75	48		
63	48		
50	44		
37.5	44		
28	44		
20	42		
14	42		
10	41		
6.3	41		
5	41		
3.35	41		
2	40		
1.18	39		
0.63	38		
0.425	34		
0.30	30		
0.20	26		
0.15	25		
0.063	24		

Sample Proportions	% dry mass
Cobbles	52
Gravel	8
Sand	16
Silt and Clay	24

Remarks

Preparation and testing in accordance with BS17892 unless noted below

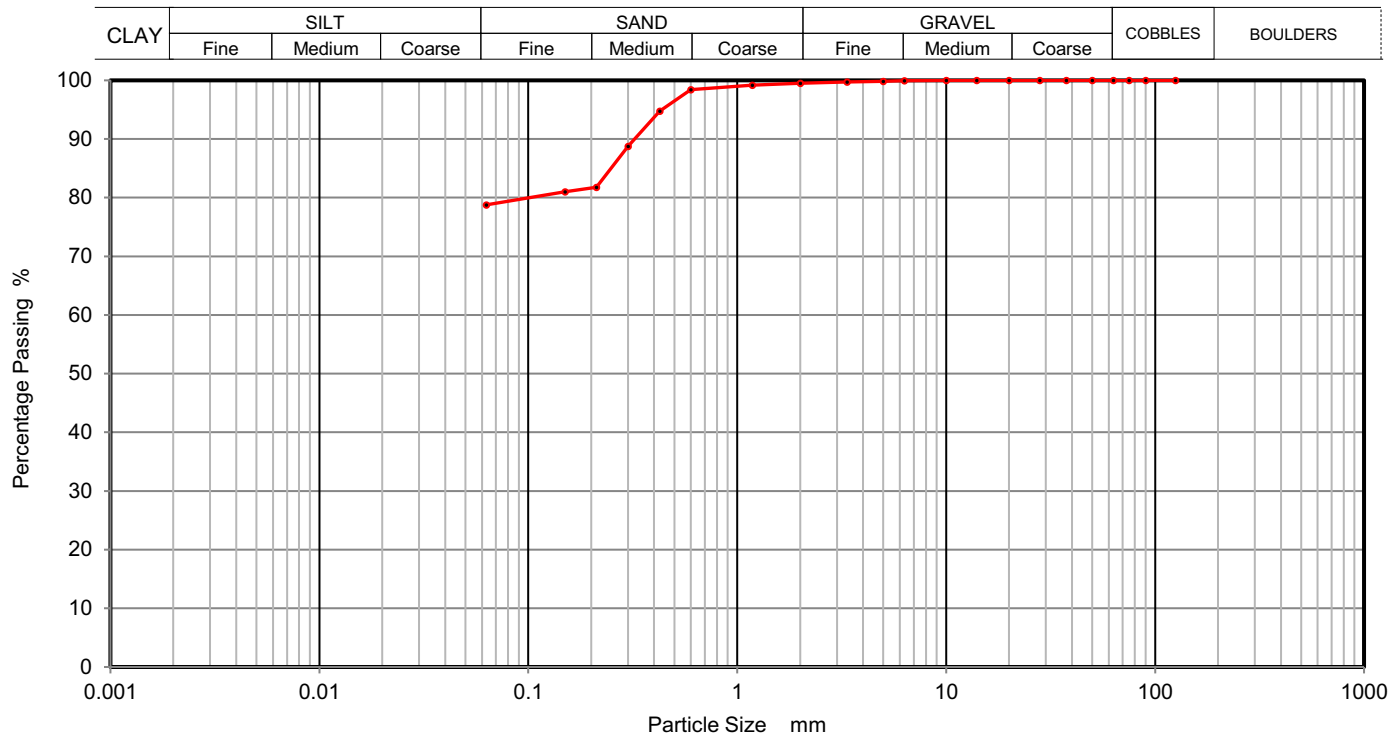
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	SA02
Project Name	Llangatwg	Sample No.	2
Sample Description	Brown slightly fine to medium gravelly fine to coarse sandy SILT/CLAY	Depth Top	0.50
		Depth Base	1.30
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	100		
14	100		
10	100		
6.3	100		
5	100		
3.35	100		
2	99		
1.18	99		
0.63	98		
0.425	95		
0.30	89		
0.20	82		
0.15	81		
0.063	79		

Sample Proportions	% dry mass
Cobbles	0
Gravel	1
Sand	20
Silt and Clay	79

Remarks

Preparation and testing in accordance with BS17892 unless noted below

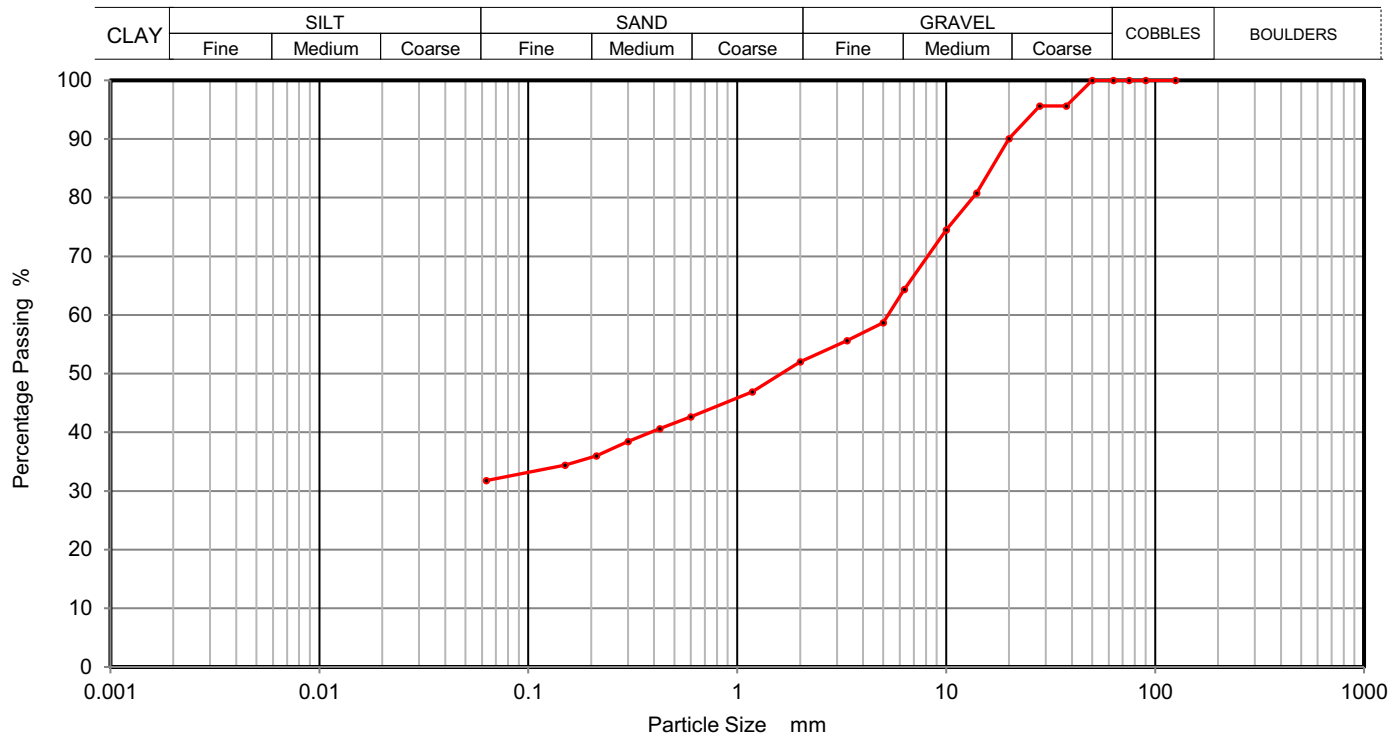
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	SA06
Project Name	Llangatwg	Sample No.	2
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL	Depth Top	0.50
		Depth Base	1.30
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	96		
20	90		
14	81		
10	74		
6.3	64		
5	59		
3.35	56		
2	52		
1.18	47		
0.63	43		
0.425	41		
0.30	38		
0.20	36		
0.15	34		
0.063	32		

Sample Proportions	% dry mass
Cobbles	0
Gravel	48
Sand	20
Silt and Clay	32

Remarks

Preparation and testing in accordance with BS17892 unless noted below

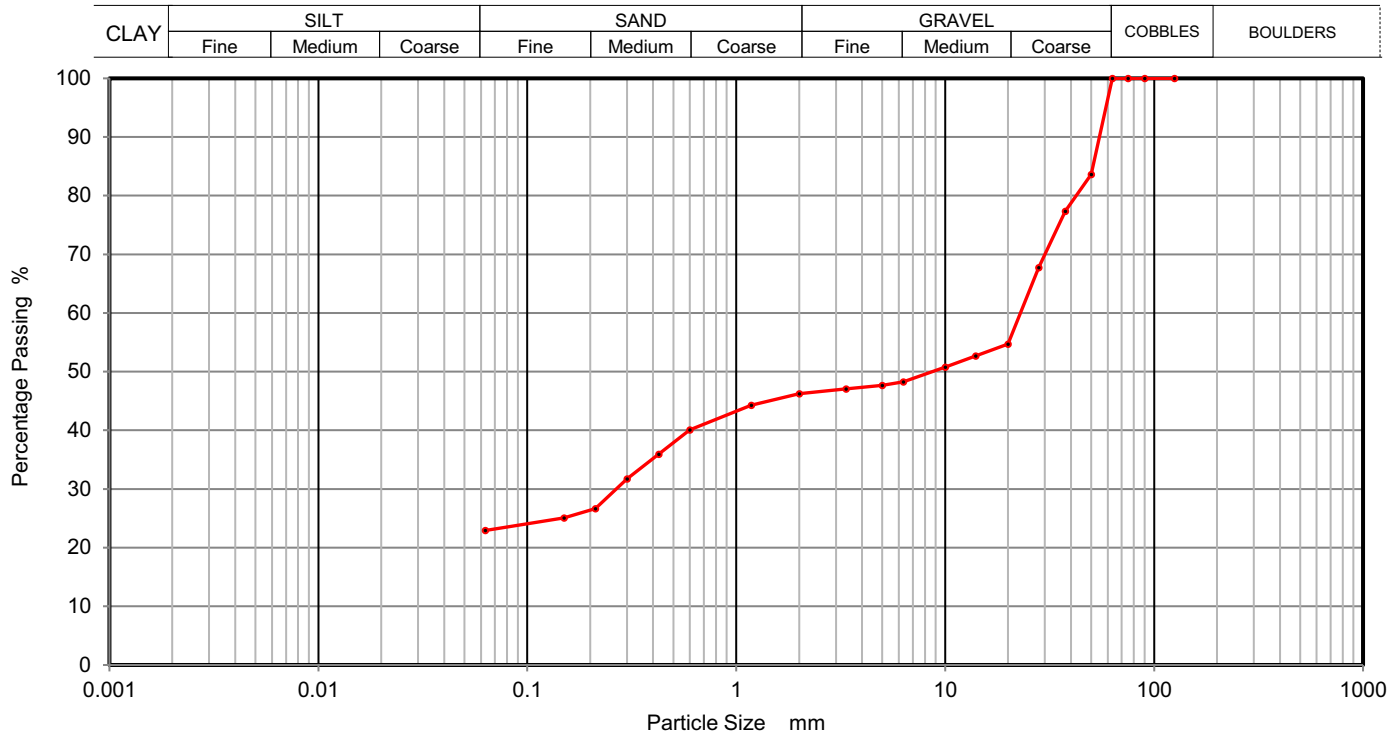
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	WS02
Project Name	Llangatwg	Sample No.	2
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL	Depth Top	1.00
		Depth Base	1.70
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	84		
37.5	77		
28	68		
20	55		
14	53		
10	51		
6.3	48		
5	48		
3.35	47		
2	46		
1.18	44		
0.63	40		
0.425	36		
0.30	32		
0.20	27		
0.15	25		
0.063	23		

Sample Proportions	% dry mass
Cobbles	0
Gravel	54
Sand	23
Silt and Clay	23

Remarks

Preparation and testing in accordance with BS17892 unless noted below

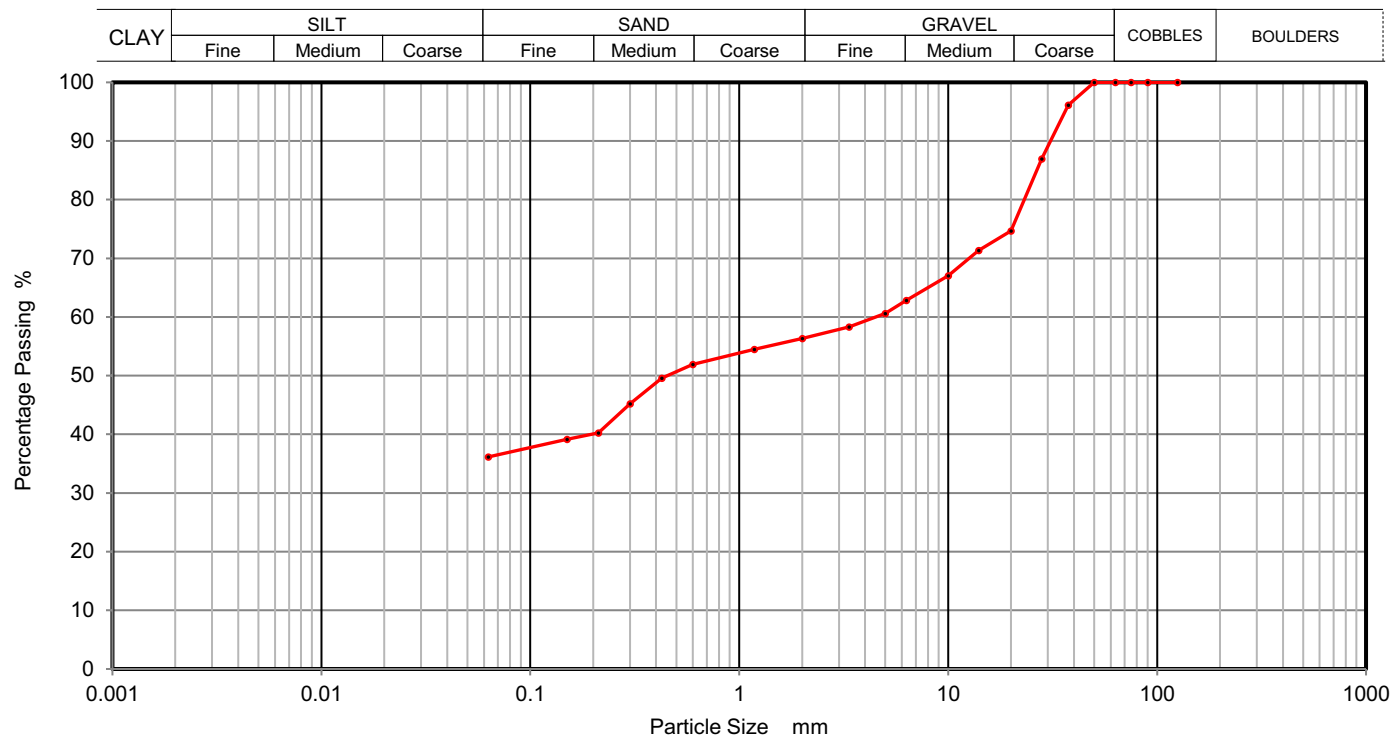
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	WS04
Project Name	Llangatwg	Sample No.	2
Sample Description	Brown fine to coarse sandy fine to coarse gravelly SILT/CLAY	Depth Top	0.70
		Depth Base	1.70
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	87		
20	75		
14	71		
10	67		
6.3	63		
5	61		
3.35	58		
2	56		
1.18	54		
0.63	52		
0.425	50		
0.30	45		
0.20	40		
0.15	39		
0.063	36		

Sample Proportions	% dry mass
Cobbles	0
Gravel	44
Sand	20
Silt and Clay	36

Remarks

Preparation and testing in accordance with BS17892 unless noted below

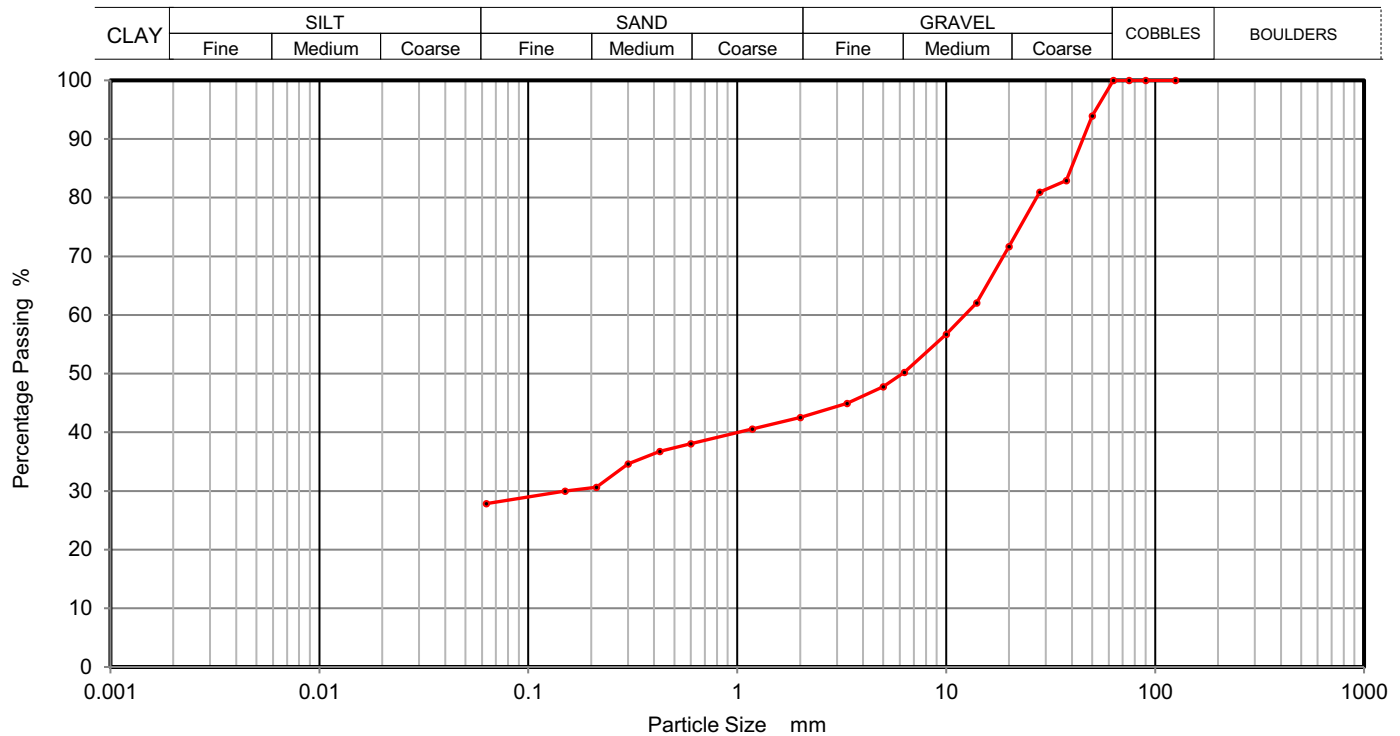
Operator

Cameron T.



PARTICLE SIZE DISTRIBUTION
BS EN ISO 17892-4:2016
Wet Sieve, Clause 5.2

 GEOTECHNICAL SITE & TESTING LABORATORIES	PARTICLE SIZE DISTRIBUTION BS EN ISO 17892-4:2016 Wet Sieve, Clause 5.2	Contract Number	76767
		Borehole/Pit No.	WS05
Project Name	Llangatwg	Sample No.	2
Sample Description	Brown fine to coarse sandy silty/clayey fine to coarse GRAVEL	Depth Top	1.00
		Depth Base	1.80
Date Tested	01/02/2025	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	94		
37.5	83		
28	81		
20	72		
14	62		
10	57		
6.3	50		
5	48		
3.35	45		
2	43		
1.18	41		
0.63	38		
0.425	37		
0.30	35		
0.20	31		
0.15	30		
0.063	28		

Sample Proportions	% dry mass
Cobbles	0
Gravel	57
Sand	15
Silt and Clay	28

Remarks

Preparation and testing in accordance with BS17892 unless noted below

Operator

Cameron T.

**GSTL**

Unit 3-4 Heol Aur
Dafen Ind Estate
Dafen
SA14 8QN

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: L25/01054/GSL - 25-56632

Your Project Reference:	LLANGATWG 784-B068800		
Your Order Number:	76767	Samples Received / Instructed:	03/02/2025 / 03/02/2025
Report Issue Number:	1	Sample Tested:	03/02 to 11/02/2025
Samples Analysed:	14 sample(s)	Report issued:	11/02/2025

Signed

James Gane
Analytical Services Manager
CTS

Notes:**General**

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

This report shall not be reproduce except in full

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

Date of Issue: 21.01.2025

Issued by: J. Gane

Issue No: 4

Rev No: 23



L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

 7 - 11 Harding Street
 Leicester
 LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference			445481	445482	445483	445484	445485	445486
Client Sample ID			1	1	1	1	1	2
Client Sample Location			BH01	BH02	BH03	BH04	SA01	SA02
Client Sample Type			B	B	B	B	B	B
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			0.10	0.10	0.10	1.10	0.10	0.50
Depth - Bottom (m)			0.30	1.10	1.00	1.60	0.50	1.30
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	Units	Accreditation						
Water soluble sulphate (as SO ₄)	(mg/l)	u	110	86	70	61	24	19
pH Value	pH Units	MCERTS	6.9	7.3	7.1	6.9	5.8	6.3



L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

 7 - 11 Harding Street
 Leicester
 LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference			445487	445488	445489	445490	445491	445492
Client Sample ID			1	1	1	1	2	1
Client Sample Location			SA03	SA04	SA06	WS02	WS02	WS04
Client Sample Type			B	B	B	B	B	B
Client Sample Number			-	-	-	-	-	-
Depth - Top (m)			0.10	0.10	0.10	0.10	1.00	0.10
Depth - Bottom (m)			0.35	1.00	0.60	0.90	1.70	0.70
Date of Sampling			-	-	-	-	-	-
Time of Sampling			-	-	-	-	-	-
Sample Matrix			Clay	Clay	Clay	Clay	Clay	Clay
Determinant	Units	Accreditation						
Water soluble sulphate (as SO ₄)	(mg/l)	u	33	240	34	54	< 10	37
pH Value	pH Units	MCERTS	6.4	6.7	7.6	7.4	6.9	7.2



L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

 7 - 11 Harding Street
 Leicester
 LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference			445493	445494
Client Sample ID			2	2
Client Sample Location			WS04	WS05
Client Sample Type			B	B
Client Sample Number			-	-
Depth - Top (m)			0.70	1.00
Depth - Bottom (m)			1.70	1.80
Date of Sampling			-	-
Time of Sampling			-	-
Sample Matrix			Clay	Clay
Determinant	Units	Accreditation		
Water soluble sulphate (as SO ₄)	(mg/l)	u	19	40
pH Value	pH Units	MCERTS	7.4	7.1



L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

Sample Descriptions

7 - 11 Harding Street
Leicester
LE1 4DH

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
445481	1	BH01	B	-	Dark brown gravelly slightly sandy silty clay with occasional organic matter	-	-	97
445482	1	BH02	B	-	Dark brown gravelly slightly sandy silty clay with occasional organic matter	-	-	76
445483	1	BH03	B	-	Dark brown gravelly slightly sandy silty clay with rare rootlets	-	-	59
445484	1	BH04	B	-	Dark brown gravelly slightly sandy silty clay with rare rootlets	-	-	84
445485	1	SA01	B	-	Greyish yellowish brown slightly gravelly sandy silty clay	-	-	100
445486	2	SA02	B	-	Greyish brown slightly gravelly slightly sandy silty clay	-	-	100
445487	1	SA03	B	-	Dark brown gravelly slightly sandy silty clay with rare rootlets	-	-	93
445488	1	SA04	B	-	Dark brown gravelly slightly sandy silty clay with rare rootlets	-	-	93
445489	1	SA06	B	-	Dark brown gravelly slightly sandy silty clay with rare rootlets	-	-	89
445490	1	WS02	B	-	Dark brown gravelly slightly sandy silty clay with rare organic matter	-	-	94
445491	2	WS02	B	-	Light greyish brown slightly gravelly slightly sandy silty clay	-	-	77
445492	1	WS04	B	-	Dark brown gravelly slightly sandy silty clay with rare organic matter	-	-	53
445493	2	WS04	B	-	Brown slightly gravelly slightly sandy silty clay	-	-	100
445494	2	WS05	B	-	Brown slightly gravelly slightly sandy silty clay with rare organic matter	-	-	72



L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

 7 - 11 Harding Street
 Leicester
 LE1 4DH

Sample Comments

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
445481	1	BH01	B	-	
445482	1	BH02	B	-	
445483	1	BH03	B	-	
445484	1	BH04	B	-	
445485	1	SA01	B	-	
445486	2	SA02	B	-	
445487	1	SA03	B	-	
445488	1	SA04	B	-	
445489	1	SA06	B	-	
445490	1	WS02	B	-	
445491	2	WS02	B	-	
445492	1	WS04	B	-	
445493	2	WS04	B	-	
445494	2	WS05	B	-	



7 - 11 Harding Street
Leicester
LE1 4DH

L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis



7 - 11 Harding Street
Leicester
LE1 4DH

L25/01054/GSL - 25-56632

Project Reference - LLANGATWG 784-B068800

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

W - No time of sampling provided for water sample

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
445481	1	BH01	B	-		A
445482	1	BOH2	B	-		A
445483	1	BH03	B	-		A
445484	1	BH04	B	-		A
445485	1	SA01	B	-		A
445486	2	SA02	B	-		A
445487	1	SA03	B	-		A
445488	1	SA04	B	-		A
445489	1	SA06	B	-		A
445490	1	WS02	B	-		A
445491	2	WS02	B	-		A
445492	1	WS04	B	-		A
445493	2	WS04	B	-		A
445494	2	WS05	B	-		A



Laboratory Report



Contract Number: 77029

Client Ref: **784-B068800**Client PO: **7018773**Date Received: **06-02-2025**Date Completed: **28-02-2025**Report Date: **28-02-2025**Client: **Tetra Tech**

This report has been checked and approved by:

Contract Title: **Llangatwg**For the attention of: **Paul Vincent**

Brendan Evans
Office Administrator

Description	Qty
Determination of Point Load Value Axial or Diametrical including WC *Please note GSTL is not accredited for the water content of rock* ISRM Suggested Method for Point Load Strength - * UKAS	3
Uniaxial Compressive Strength of Rock inc sample prep 54-165mm diameter cores ISRM Suggested Method for determining uniaxial compressive strength - @ Non Accredited Test	1
BRE Suite A Greenfield Site (pyrite absent) includes pH and water soluble sulphate Sub-contracted Test	2

Notes: Observations and Interpretations are outside the UKAS Accreditation

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This test report/certificate shall not be reproduced except in full, without the approval of GEO Site & Testing Services Ltd. Any opinions or interpretations stated - within this report/certificate are excluded from the laboratories UKAS accreditation.

Approved Signatories:

Brendan Evans (Office Administrator) - Darren Bourne (Quality Senior Technician) - Paul Evans (Director)

Richard John (Quality/Technical Manager) - Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager)

Wayne Honey (HR & HSE Manager)



Point Load Test

The complete ISRM suggested methods for rock characterization, testing and monitoring 1974-2006 Determining Point Load Strength

Contract Number	77029	
Project Name	Llangatwg	
Sample Type	Core	
Date Tested	07/02/2025	
	*Please note that GSTL is not accredited for the water content of rock	

*Please note that GSTL is not accredited for the water content of rock

[illegible]

<u>Key</u>	<u>Reported As</u>
Width	(W) mm
Platen Separation	(D) mm
Failure Load	(P) kN
Equivalent Diameter	(De) mm
Point Load	(Is) MPa
Size Factor	(F)
Point Load Index	(Is(50)) MPa
Moisture Content	%
Description	SC

Operator

Julian Jones

Contract Number	77029	
Project Name	Llangatwg	
Sample Preperation	Sawing and Grinding	
Date Tested	07/02/2025	

[illegible]

<u>Key</u>	<u>Reported As</u>
Diameter	mm
Length	mm
Initial Mass	g
Moisture Content	%
Bulk Density	Mg/m ³
Dry Density	Mg/m ³
Load Failure	kN
Maximum Strength	MPa

Julian. J

**GSTL**

Unit 3-4 Heol Aur
Dafen Ind Estate
Dafen
SA14 8QN

7 - 11 Harding Street
Leicester
LE1 4DH

Analytical Test Report: L25/01948/GSL - 25-58176

Your Project Reference:	LLANGATWG 784-B068800		
Your Order Number:	77029	Samples Received / Instructed:	20/02/2025 / 20/02/2025
Report Issue Number:	1	Sample Tested:	20/02 to 28/02/2025
Samples Analysed:	2 sample(s)	Report issued:	28/02/2025

Signed

James Gane
Analytical Services Manager
CTS

Notes:**General**

Please refer to Methodologies page for details pertaining to the analytical methods undertaken.

Samples will be retained for 14 days after issue of this report unless otherwise requested.

Moisture Content was determined in accordance with CTS method statement MS - CL - Sample Prep, oven dried at <30°C.

Moisture Content is reported as a percentage of the dry mass of soil, this calculation is in accordance with BS1377, Part 2, 1990, Clause 3.2

Where specification limits are included these are for guidance only. Where a measured value has been highlighted this is not implying acceptance or failure and certainty of measurement values have not been taken into account.

Uncertainty of measurement values are available on request.

Samples were supplied by customer, results apply to the samples as received.

Deviating Samples

On receipt samples are compared against our sample holding and handling protocols, where any deviations have been noted these are reported on our deviating sample page (if present)

Accreditation Key

This report shall not be reproduce except in full

UKAS = UKAS Accreditation, MCERTS = MCERTS Accreditation, u = Unaccredited, subUKAS - Subcontracted to a laboratory UKAS accredited for this test, subMCERTS - Subcontracted to a laboratory MCERTS accredited for this test

MCERTS Accreditation only covers the SAND, CLAY and LOAM matrices

UKAS accreditation on waters only covers the Ground water and Surface water matrices

Date of Issue: 27.02.25

Issued by: J. Gane

Issue No: 4

Rev No: 24



L25/01948/GSL - 25-58176

Project Reference - LLANGATWG 784-B068800

 7 - 11 Harding Street
 Leicester
 LE1 4DH

Analytical Test Results - Chemical Analysis

Lab Reference			456914	456915
Client Sample ID			-	-
Client Sample Location			BH01	BH02
Client Sample Type			C	C
Client Sample Number			-	-
Depth - Top (m)			1.22	1.63
Depth - Bottom (m)			1.30	1.67
Date of Sampling			-	-
Time of Sampling			-	-
Sample Matrix			Other	Other
Determinant	Units	Accreditation		
Water soluble sulphate (as SO ₄)	(mg/l)	u	13	15
pH Value	pH Units	MCERTS	7.6	7.7



L25/01948/GSL - 25-58176

Project Reference - LLANGATWG 784-B068800

Sample Descriptions

7 - 11 Harding Street
Leicester
LE1 4DH

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Description	Moisture Content (%)	Stone Content (%)	Passing 2mm test sieve (%)
456914	-	BH01	C	-	Mottled grey brown gravel	-	-	100
456915	-	BH02	C	-	Mottled grey brown gravel	-	-	100



L25/01948/GSL - 25-58176

Project Reference - LLANGATWG 784-B068800

Sample Comments

7 - 11 Harding Street
Leicester
LE1 4DH

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Comments
456914	-	BH01	C	-	
456915	-	BH02	C	-	



7 - 11 Harding Street
Leicester
LE1 4DH

L25/01948/GSL - 25-58176

Project Reference - LLANGATWG 784-B068800

Analysis Methodologies

Test Code	Test Name / Reference	Sample condition for analysis	Sample Preparation	Test Details
ANIONSS	MS - CL - Anions by Aquakem (2:1Extract)	Oven dried	Passing 2mm test sieve	Determination of Anions (inc Sulphate, chloride etc.) in soils by Aquakem. Analysis is based on a 2:1 water to soil extraction ratio
PHS	MS - CL - pH in Soils	As received	Passing 10mm test sieve	Determination of pH in soils using a pH probe (using a 1:3 soil to water extraction)
SAMPLEPREP	MS - CL - Sample Preparation	-	-	Preparation of samples (including determination of moisture content) to allow for subsequent analysis



7 - 11 Harding Street
Leicester
LE1 4DH

L25/01948/GSL - 25-58176

Project Reference - LLANGATWG 784-B068800

Sample Deviations

Deviations are listed below against each sample and associated test method, where deviation(s) are noted it means data may not be representative of the sample at the time of sampling and it is possible that results provided may be compromised.

Observations on receipt

A - No date of sampling provided

W - No time of sampling provided for water sample

C - Received in inappropriate container

H - Contains headspace

T - Temperature on receipt exceeds storage temperature

R - Sample(s) received with less than 96 hours for testing to commence/complete, any result formally classed as deviating will be marked with an X against the applicable test (i.e. RX)

Observations whilst in laboratory

X - Exceeds sampling to extraction or analysis timescales

Lab Reference	Client Sample ID	Client Sample Location	Client Sample Type	Client Sample Number	Test	Deviations
456914	-	BH01	C	-		A
456915	-	BH02	C	-		A

APPENDIX F: CHEMICAL LABORATORY TEST RESULTS



Tetra Tech.
Atlantic House
Greenwood Close
Cardiff Gate Bussines Park
Pontprennau
Cardiff
CF23 8RD

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

e: paul.vincent@tetrattech.com

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

Analytical Report Number : 25-002726

Project / Site name:	Llangatwg	Samples received on:	21/01/2025
Your job number:	B068800	Samples instructed on/ Analysis started on:	21/01/2025
Your order number:	7018400	Analysis completed by:	30/01/2025
Report Issue Number:	1	Report issued on:	30/01/2025
Samples Analysed:	21 soil samples - 9 leachate samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
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
	air	- once the analysis is complete

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

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430864	430865	430866	430867	430868
Sample Reference				HP01	HP02	HP03	HP04	SA01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.20-0.80	0.20-0.80	0.20-0.80	0.20-0.80	0.35
Date Sampled				14/01/2025	14/01/2025	14/01/2025	14/01/2025	07/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	47.4	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	18	15	26	20	18
Total mass of sample received	kg	0.1	NONE	0.8	0.8	0.9	0.9	0.9

Asbestos

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

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.7	7.5	6.2	7.7	7.2
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.035	0.021	0.032	0.025	0.011

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.06	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.1	0.08	0.4	0.31	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.09	0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.18	0.15	1.1	0.58	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.14	0.13	0.9	0.45	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.11	0.1	0.61	0.35	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.2	0.14	0.61	0.51	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.2	0.16	0.75	0.56	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.1	< 0.05	0.31	0.22	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.14	0.09	0.63	0.37	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.08	0.05	0.28	0.19	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.07	0.06	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.09	0.06	0.27	0.21	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.33	0.96	6.1	3.85	< 0.80
-----------------------------	-------	-----	-----------	------	------	-----	------	--------



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430864	430865	430866	430867	430868
Sample Reference				HP01	HP02	HP03	HP04	SA01
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.20-0.80	0.20-0.80	0.20-0.80	0.20-0.80	0.35
Date Sampled				14/01/2025	14/01/2025	14/01/2025	14/01/2025	07/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	50	42	30	47	18
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.62	0.46	0.5	0.81	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	0.8	0.9	0.7	0.8	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.8	1.5	1.4	1.9	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	2.3	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	14	14	26	18	17
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	15	15	28	18	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	80	61	180	95	26
Lead (aqua regia extractable)	mg/kg	1	MCERTS	120	190	92	400	27
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	15	24	24	25
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	21	20	20	28	23
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	240	450	290	740	79

Petroleum Hydrocarbons

TPH (>EC5 - EC10) HS_10_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (EC10 - EC40) EH_CU_10_TOTAL	mg/kg	10	MCERTS	< 10	< 10	18	18	< 10

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430869	430870	430871	430872	430873
Sample Reference				SA02	SA02	SA03	SA04	SA04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.40	1.00	0.25	0.50	1.00
Date Sampled				07/01/2025	07/01/2025	07/01/2025	07/01/2025	07/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	8.4	< 0.1	22.6	< 0.1	31.6
Moisture Content	%	0.01	NONE	16	19	18	18	13
Total mass of sample received	kg	0.1	NONE	0.8	0.9	0.9	0.9	1

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	MJN	MJN	MJN	MJN	DOC

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.8	7.2	7.2	8	7.8
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.021	0.037	0.025	0.016	0.013

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.06	0.06
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.34	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.52	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.14	0.09	0.13	5.7	0.29
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	1.5	0.08
Fluoranthene	mg/kg	0.05	MCERTS	0.41	0.17	0.18	6.3	0.56
Pyrene	mg/kg	0.05	MCERTS	0.31	0.13	0.16	4.6	0.45
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.27	0.08	0.09	2.7	0.35
Chrysene	mg/kg	0.05	MCERTS	0.34	0.12	0.15	2.7	0.41
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.37	0.14	0.16	2.6	0.44
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	0.18	0.06	0.05	1.4	0.21
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.27	0.08	0.1	2.3	0.31
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.13	< 0.05	0.07	1.1	0.16
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	0.26	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.14	< 0.05	< 0.05	1.1	0.15

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	2.57	0.88	1.1	33.1	3.46
-----------------------------	-------	-----	-----------	------	------	-----	------	------



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430869	430870	430871	430872	430873
Sample Reference				SA02	SA02	SA03	SA04	SA04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.40	1.00	0.25	0.50	1.00
Date Sampled				07/01/2025	07/01/2025	07/01/2025	07/01/2025	07/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	39	36	50	40	28
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.63	0.54	0.75	0.69	0.68
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.8	0.7	0.9	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.3	2.2	1.7	2.7	1.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	19	14	21	18	19
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20	15	22	18	19
Copper (aqua regia extractable)	mg/kg	1	MCERTS	58	95	72	60	44
Lead (aqua regia extractable)	mg/kg	1	MCERTS	59	79	76	880	170
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	23	18	27	26	22
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	1.1	< 1.0	1.5	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	29	19	36	30	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	130	180	180	1700	370

Petroleum Hydrocarbons

TPH (>EC5 - EC10) HS_10_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (EC10 - EC40) EH_CU_10_TOTAL	mg/kg	10	MCERTS	< 10	29	< 10	30	< 10

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430874	430875	430876	430877	430878
Sample Reference				BH04	SA06	SA06	BH02	BH03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				1.50	0.50	1.20	0.50	0.50
Date Sampled				07/01/2025	15/01/2025	15/01/2025	14/01/2025	10/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	3	< 0.1	< 0.1	32.8	38.2
Moisture Content	%	0.01	NONE	19	18	15	9.2	10
Total mass of sample received	kg	0.1	NONE	0.8	0.9	0.9	0.9	0.9

Asbestos

Asbestos in Soil Detected/Not Detected	Type	N/A	ISO 17025	Not-detected	Not-detected	Not-detected	Not-detected	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	DOC	DOC	DOC	DOC	MJN

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.7	7.3	7.2	7.7	7.4
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.012	0.021	0.0094	0.0096	0.012

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	0.08	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	< 0.05	0.35	< 0.05	< 0.05	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	< 0.05	0.29	< 0.05	< 0.05	< 0.05
Pyrene	mg/kg	0.05	MCERTS	< 0.05	0.23	< 0.05	< 0.05	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05	0.13	< 0.05	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	< 0.05	0.25	< 0.05	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.17	< 0.05	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	0.06	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	0.11	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	1.73	< 0.80	< 0.80	< 0.80
-----------------------------	-------	-----	-----------	--------	------	--------	--------	--------



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430874	430875	430876	430877	430878
Sample Reference				BH04	SA06	SA06	BH02	BH03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				1.50	0.50	1.20	0.50	0.50
Date Sampled				07/01/2025	15/01/2025	15/01/2025	14/01/2025	10/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	12	46	17	12	15
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.47	0.78	0.7	0.66	0.75
Boron (water soluble)	mg/kg	0.2	MCERTS	0.6	0.7	0.6	0.4	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	20	18	19	15	17
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	18	20	15	18
Copper (aqua regia extractable)	mg/kg	1	MCERTS	21	67	27	21	28
Lead (aqua regia extractable)	mg/kg	1	MCERTS	21	61	25	16	25
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	13	19	15	24	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	33	33	37	22	26
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	60	120	69	71	78

Petroleum Hydrocarbons

TPH (>EC5 - EC10) HS_10_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (EC10 - EC40) EH_CU_10_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430879	430880	430881	430882	430883
Sample Reference				BH01	BH02	WS03	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.25	1.00	0.50	0.40	1.50
Date Sampled				10/01/2025	14/01/2025	16/01/2025	16/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Stone Content	%	0.1	NONE	25.8	29	< 0.1	31.4	< 0.1
Moisture Content	%	0.01	NONE	17	9.5	14	18	20
Total mass of sample received	kg	0.1	NONE	0.9	0.8	0.8	0.7	0.9

Asbestos

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

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.1	7.7	7.6	7.1	6.9
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.022	0.011	0.0091	0.021	0.0075

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.11	< 0.05	0.09	0.1	< 0.05
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.1	< 0.05	0.1	0.12	< 0.05
Pyrene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.07	0.11	< 0.05
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.06	< 0.05	< 0.05	0.07	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.1	< 0.05	< 0.05	0.13	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.1	< 0.05	< 0.05	0.15	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	< 0.80	< 0.80	< 0.80	< 0.80	< 0.80
-----------------------------	-------	-----	-----------	--------	--------	--------	--------	--------



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430879	430880	430881	430882	430883
Sample Reference				BH01	BH02	WS03	WS01	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.25	1.00	0.50	0.40	1.50
Date Sampled				10/01/2025	14/01/2025	16/01/2025	16/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	50	13	12	40	7.2
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.74	0.74	0.59	0.7	0.45
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	0.5	0.4	0.6	0.5
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	0.4	2	< 0.2
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8
Chromium (III)	mg/kg	1	NONE	21	15	19	17	19
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	15	19	18	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	73	22	23	59	10
Lead (aqua regia extractable)	mg/kg	1	MCERTS	63	16	66	68	13
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	< 0.3	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	22	26	23	20
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	31	23	25	34	24
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	69	340	230	44

Petroleum Hydrocarbons

TPH (>EC5 - EC10) HS_10_TOTAL	mg/kg	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
TPH (EC10 - EC40) EH_CU_10_TOTAL	mg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				431749
Sample Reference				WS02
Sample Number				None Supplied
Water Matrix				N/A
Depth (m)				0.50
Date Sampled				16/01/2025
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Stone Content	%	0.1	NONE	45.3
Moisture Content	%	0.01	NONE	14
Total mass of sample received	kg	0.1	NONE	0.8

Asbestos

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

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7
Free Cyanide	mg/kg	1	MCERTS	< 1.0
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.015

Total Phenols

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

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05
Fluorene	mg/kg	0.05	MCERTS	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	0.22
Anthracene	mg/kg	0.05	MCERTS	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	0.37
Pyrene	mg/kg	0.05	MCERTS	0.32
Benzo(a)anthracene	mg/kg	0.05	MCERTS	< 0.05
Chrysene	mg/kg	0.05	MCERTS	0.15
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	0.17
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.11
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.06
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.07

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	ISO 17025	1.47
-----------------------------	-------	-----	-----------	------



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				431749
Sample Reference				WS02
Sample Number				None Supplied
Water Matrix				N/A
Depth (m)				0.50
Date Sampled				16/01/2025
Time Taken				None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status	

Heavy Metals / Metalloids

Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	28
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.58
Boron (water soluble)	mg/kg	0.2	MCERTS	0.9
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	1.1
Chromium (hexavalent)	mg/kg	1.8	MCERTS	< 1.8
Chromium (III)	mg/kg	1	NONE	19
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	20
Copper (aqua regia extractable)	mg/kg	1	MCERTS	65
Lead (aqua regia extractable)	mg/kg	1	MCERTS	49
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	21
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	24
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170

Petroleum Hydrocarbons

TPH (>EC5 - EC10) HS_10_TOTAL	mg/kg	1	NONE	< 1.0
-------------------------------	-------	---	------	-------

TPH (EC10 - EC40) EH_CU_10_TOTAL	mg/kg	10	MCERTS	56
----------------------------------	-------	----	--------	----

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430867	430868	430869	430872	430874
Sample Reference				HP04	SA01	SA02	SA04	BH04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.20-0.80	0.35	0.40	0.50	1.50
Date Sampled				14/01/2025	07/01/2025	07/01/2025	07/01/2025	07/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Test Limit of detection	Test Accreditation Status		

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	8.6	8.3	7.1	8	7.7
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10	< 10
Sulphate as SO ₄	mg/l	0.045	ISO 17025	3.67	6.83	2.73	6.38	2.31
Ammoniacal Nitrogen as N	µg/l	15	NONE	44	32	40	40	49

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	13	1.1	6.1	1.2	1.4
Boron (dissolved)	µg/l	10	ISO 17025	11	17	17	20	15
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.6	4.5	3.3	1.8	0.8
Copper (dissolved)	µg/l	0.7	ISO 17025	7.4	1.6	7.3	1.4	< 0.7
Lead (dissolved)	µg/l	1	ISO 17025	17	1.3	8.2	3.6	1.2
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	2.4	3.1	3.4	0.9	< 0.3
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	26	8.8	13	2.4	8

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



Analytical Report Number: 25-002726

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430875	430878	430881	431749
Sample Reference				SA06	BH03	WS03	WS02
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A
Depth (m)				0.50	0.50	0.50	0.50
Date Sampled				15/01/2025	10/01/2025	16/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)	Units	Test Limit of detection	Test Accreditation Status				

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.7	7.5	7.5	7.4
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
Sulphate as SO ₄	mg/l	0.045	ISO 17025	1.71	1.48	1.87	21.2
Ammoniacal Nitrogen as N	µg/l	15	NONE	31	37	35	< 15

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	3.8	< 1.0	< 1.0	1.4
Boron (dissolved)	µg/l	10	ISO 17025	15	15	15	25
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08	< 0.08
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.8	2.8	2.2	1.7
Copper (dissolved)	µg/l	0.7	ISO 17025	5.4	2	5.1	< 0.7
Lead (dissolved)	µg/l	1	ISO 17025	4.4	2.4	1.7	2.8
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	0.9	0.8	4	0.7
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0	< 4.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	8.9	6.9	12	1.6

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



Analytical Report Number : 25-002726

Project / Site name: Llangatwg

* 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 *
430864	HP01	None Supplied	0.20-0.80	Brown loam and clay with gravel and vegetation
430865	HP02	None Supplied	0.20-0.80	Brown loam and clay with gravel and vegetation
430866	HP03	None Supplied	0.20-0.80	Brown loam and clay with gravel and vegetation
430867	HP04	None Supplied	0.20-0.80	Brown loam and sand with gravel and vegetation
430868	SA01	None Supplied	0.35	Brown clay and loam with gravel and vegetation
430869	SA02	None Supplied	0.4	Brown loam and clay with gravel and vegetation
430870	SA02	None Supplied	1	Brown clay and loam with gravel and vegetation
430871	SA03	None Supplied	0.25	Brown loam and clay with gravel and vegetation
430872	SA04	None Supplied	0.5	Brown loam and clay with gravel and vegetation
430873	SA04	None Supplied	1	Brown loam and clay with gravel and vegetation
430874	BH04	None Supplied	1.5	Brown clay and loam with vegetation and stones
430875	SA06	None Supplied	0.5	Brown loam with gravel
430876	SA06	None Supplied	1.2	Brown clay and sand
430877	BH02	None Supplied	0.5	Brown clay and loam with gravel and vegetation
430878	BH03	None Supplied	0.5	Brown clay and loam with vegetation and stones
430879	BH01	None Supplied	0.25	Brown loam and sand with gravel and vegetation
430880	BH02	None Supplied	1	Brown clay and loam with gravel and vegetation
430881	WS03	None Supplied	0.5	Brown clay and loam with gravel
430882	WS01	None Supplied	0.4	Brown loam and clay with gravel and vegetation
430883	WS02	None Supplied	1.5	Brown clay and sand
431749	WS02	None Supplied	0.5	Brown clay and sand with gravel and stones



Analytical Report Number : 25-002726

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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, 2021	A001B	D	ISO 17025
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
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.	L019B	D	NONE
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	L038B	D	MCERTS
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	L038B	D	MCERTS
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	L039B	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088-PL	D/W	MCERTS
Chromium III in soil	In-house method by calculation from total Cr and Cr VI	In-house method by calculation	L080-PL/L130B	W	NONE
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in NaOH and addition of 1,5 diphenylcarbazine followed by colorimetry	In-house method	L080-PL	W	MCERTS
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	MCERTS
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	L080-PL	W	MCERTS
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	L080-PL	W	ISO 17025
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



Analytical Report Number : 25-002726

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20°C in leachate (automated)	Determination of pH in leachate by electrometric measurement	In-house method	L099-PL	W	ISO 17025
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	L082B	W	NONE
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate	In-house method	L009B	D	MCERTS

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.

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.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

Sample Deviation Report



Analytical Report Number : 25-002726

Project / Site name: Llangatwg

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH01	N/A	S	430879	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH01	N/A	S	430879	c	Free cyanide in soil	L080-PL	c
BH01	N/A	S	430879	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH01	N/A	S	430879	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH02	N/A	S	430877	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH02	N/A	S	430877	c	Free cyanide in soil	L080-PL	c
BH02	N/A	S	430877	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH02	N/A	S	430877	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH02	N/A	S	430880	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH02	N/A	S	430880	c	Free cyanide in soil	L080-PL	c
BH02	N/A	S	430880	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH02	N/A	S	430880	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH03	N/A	S	430878	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH03	N/A	S	430878	c	Free cyanide in soil	L080-PL	c
BH03	N/A	S	430878	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH03	N/A	S	430878	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH04	N/A	S	430874	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH04	N/A	S	430874	c	Free cyanide in soil	L080-PL	c
BH04	N/A	S	430874	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH04	N/A	S	430874	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
HP01	N/A	S	430864	c	BTEX and/or Volatile organic compounds in soil	L073B	c
HP01	N/A	S	430864	c	Free cyanide in soil	L080-PL	c
HP01	N/A	S	430864	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
HP01	N/A	S	430864	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
HP02	N/A	S	430865	c	BTEX and/or Volatile organic compounds in soil	L073B	c
HP02	N/A	S	430865	c	Free cyanide in soil	L080-PL	c
HP02	N/A	S	430865	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
HP02	N/A	S	430865	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
HP03	N/A	S	430866	c	BTEX and/or Volatile organic compounds in soil	L073B	c
HP03	N/A	S	430866	c	Free cyanide in soil	L080-PL	c
HP03	N/A	S	430866	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
HP03	N/A	S	430866	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
HP04	N/A	S	430867	c	BTEX and/or Volatile organic compounds in soil	L073B	c
HP04	N/A	S	430867	c	Free cyanide in soil	L080-PL	c
HP04	N/A	S	430867	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
HP04	N/A	S	430867	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA01	N/A	S	430868	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA01	N/A	S	430868	c	Free cyanide in soil	L080-PL	c
SA01	N/A	S	430868	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA01	N/A	S	430868	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA02	N/A	S	430869	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA02	N/A	S	430869	c	Free cyanide in soil	L080-PL	c
SA02	N/A	S	430869	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA02	N/A	S	430869	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA02	N/A	S	430870	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA02	N/A	S	430870	c	Free cyanide in soil	L080-PL	c
SA02	N/A	S	430870	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA02	N/A	S	430870	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA03	N/A	S	430871	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA03	N/A	S	430871	c	Free cyanide in soil	L080-PL	c
SA03	N/A	S	430871	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA03	N/A	S	430871	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA04	N/A	S	430872	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA04	N/A	S	430872	c	Free cyanide in soil	L080-PL	c
SA04	N/A	S	430872	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA04	N/A	S	430872	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA04	N/A	S	430873	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA04	N/A	S	430873	c	Free cyanide in soil	L080-PL	c

Sample Deviation Report



Analytical Report Number : 25-002726

Project / Site name: Llangatwg

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
SA04	N/A	S	430873	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA04	N/A	S	430873	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
WS01	N/A	S	430882	b	BTEX and/or Volatile organic compounds in soil	L073B	b
WS01	N/A	S	430882	b	Monohydric phenols in soil	L080-PL	b
WS01	N/A	S	430882	b	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	b
WS01	N/A	S	430882	b	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	b



Tetra Tech.
Atlantic House
Greenwood Close
Cardiff Gate Business Park
Pontprennau
Cardiff
CF23 8RD

e: paul.vincent@tetrattech.com

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 : 25-002731

Project / Site name:	Llangatwg	Samples received on:	21/01/2025
Your job number:	B068800	Samples instructed on/ Analysis started on:	21/01/2025
Your order number:	7015293	Analysis completed by:	27/01/2025
Report Issue Number:	1	Report issued on:	27/01/2025
Samples Analysed:	5 soil samples - 5 leachate samples		

Signed:

Matthew O'Connell
Key Account Manager
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
air	- once the analysis is complete

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

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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: 25-002731
 Project / Site name: Llangatwg
 Your Order No: 7015293

Lab Sample Number				430909	430910	430911	430912	430913
Sample Reference				SA04	BH04	SA06	BH03	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.50	1.50	0.50	0.50	0.50
Date Sampled				07/01/2025	07/01/2025	15/01/2025	10/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

Stone Content	%	0.1	NONE	< 0.1	3	< 0.1	38.2	< 0.1
Moisture Content	%	0.01	NONE	18	19	18	10	14
Total mass of sample received	kg	0.1	NONE	0.9	0.8	0.9	0.9	0.8

General Inorganics

pH (L005B)	pH Units	N/A	MCERTS	7.2	7.2	7.3	7.6	7.2
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.6	1.2	2.1	1.2	0.9
Loss on Ignition @ 450°C	%	0.2	MCERTS	4.5	3.8	7.2	3.8	2.9
Acid Neutralisation Capacity	mmol/kg	-9999	NONE	0.81	1.1	0.81	1.1	0.51

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.08	< 0.05	0.08	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.79	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	1.1	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	12	< 0.05	0.35	< 0.05	0.09
Anthracene	mg/kg	0.05	MCERTS	3	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	15	< 0.05	0.29	< 0.05	0.1
Pyrene	mg/kg	0.05	MCERTS	11	< 0.05	0.23	< 0.05	0.07
Benzo(a)anthracene	mg/kg	0.05	MCERTS	5.3	< 0.05	0.13	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	6.1	< 0.05	0.25	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	5.2	< 0.05	0.17	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	2.5	< 0.05	0.06	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	4	< 0.05	0.11	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.8	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.52	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.6	< 0.05	0.05	< 0.05	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	69.8	< 0.85	1.73	< 0.85	< 0.85
-------------------	-------	------	------	------	--------	------	--------	--------

Petroleum Hydrocarbons

Mineral Oil (EC10 - EC40) BH_CU_ID_AL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
--	-------	----	------	------	------	------	------	------

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Total BTEX	µg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
------------	-------	----	--------	------	------	------	------	------



Analytical Report Number: 25-002731

Project / Site name: Llangatwg

Your Order No: 7015293

Lab Sample Number				430909	430910	430911	430912	430913
Sample Reference				SA04	BH04	SA06	BH03	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.50	1.50	0.50	0.50	0.50
Date Sampled				07/01/2025	07/01/2025	15/01/2025	10/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Total PCBs	mg/kg	0.007	MCERTS	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
------------	-------	-------	--------	---------	---------	---------	---------	---------

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



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:		25-002731					
					Client: TETRATECH		
Location		Llangatwg			Landfill Waste Acceptance Criteria Limits Inert Waste Landfill Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill Hazardous Waste Landfill		
Lab Reference (Sample Number)		430909					
Sampling Date		07/01/2025					
Sample ID		SA04					
Depth (m)		0.50					
Solid Waste Analysis							
TOC (%)**		1.6			3%	5%	6%
Loss on Ignition (%) **		4.5			--	--	10%
BTEX (µg/kg) **		< 10			6000	--	--
Sum of PCBs (mg/kg) **		< 0.007			1	--	--
Mineral Oil (mg/kg) BH,LD,CU,AL		< 10			500	--	--
Total PAH (WAC-17) (mg/kg)		69.8			100	--	--
pH (units)**		7.2			--	>6	--
Acid Neutralisation Capacity (mmol / kg)		0.81			--	To be evaluated	To be evaluated
Eluate Analysis		10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)		mg/l			mg/kg		
					using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *		0.00159		0.0159	0.5	2	25
Barium *		0.0151		0.151	20	100	300
Cadmium *		< 0.000100		< 0.00100	0.04	1	5
Chromium *		0.0020		0.020	0.5	10	70
Copper *		0.0030		0.030	2	50	100
Mercury *		< 0.000500		< 0.00500	0.01	0.2	2
Molybdenum *		0.00260		0.0260	0.5	10	30
Nickel *		0.0021		0.021	0.4	10	40
Lead *		0.0025		0.025	0.5	10	50
Antimony *		< 0.0017		< 0.017	0.06	0.7	5
Selenium *		< 0.0040		< 0.040	0.1	0.5	7
Zinc *		0.0052		0.052	4	50	200
Chloride *		8.9		89	800	15000	25000
Fluoride*		0.74		7.4	10	150	500
Sulphate *		7.8		78	1000	20000	50000
TDS*		77		770	4000	60000	100000
Phenol Index (Monohydric Phenols) *		< 0.010		< 0.10	1	-	-
DOC		12.5		125	500	800	1000
Leach Test Information							
Stone Content (%)		< 0.1					
Sample Mass (kg)		0.9					
Dry Matter (%)		82					
Moisture (%)		18					
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.
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**

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:		25-002731					
					Client: TETRATECH		
Location		Llangatwg			Landfill Waste Acceptance Criteria		
Lab Reference (Sample Number)		430910					
Sampling Date		07/01/2025			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID		BH04					
Depth (m)		1.50					
Solid Waste Analysis							
TOC (%)**		1.2			3%	5%	6%
Loss on Ignition (%) **		3.8			--	--	10%
BTEX (µg/kg) **		< 10			6000	--	--
Sum of PCBs (mg/kg) **		< 0.007			1	--	--
Mineral Oil (mg/kg) EH,1D,CU,AL		< 10			500	--	--
Total PAH (WAC-17) (mg/kg)		< 0.85			100	--	--
pH (units)**		7.2			--	>6	--
Acid Neutralisation Capacity (mmol / kg)		1.1			--	To be evaluated	To be evaluated
Eluate Analysis		10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)		mg/l			mg/kg		
					using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *		0.00127		0.0127	0.5	2	25
Barium *		0.00464		0.0464	20	100	300
Cadmium *		< 0.000100		< 0.00100	0.04	1	5
Chromium *		0.0017		0.017	0.5	10	70
Copper *		0.0019		0.019	2	50	100
Mercury *		< 0.000500		< 0.00500	0.01	0.2	2
Molybdenum *		0.000952		0.00952	0.5	10	30
Nickel *		0.0024		0.024	0.4	10	40
Lead *		0.0012		0.012	0.5	10	50
Antimony *		< 0.0017		< 0.017	0.06	0.7	5
Selenium *		< 0.0040		< 0.040	0.1	0.5	7
Zinc *		0.0031		0.031	4	50	200
Chloride *		20		200	800	15000	25000
Fluoride*		0.76		7.6	10	150	500
Sulphate *		5.7		57	1000	20000	50000
TDS*		40		400	4000	60000	100000
Phenol Index (Monohydric Phenols) *		< 0.010		< 0.10	1	-	-
DOC		22.1		221	500	800	1000
Leach Test Information							
Stone Content (%)		3.0					
Sample Mass (kg)		0.8					
Dry Matter (%)		81					
Moisture (%)		19					
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = MCFERTS 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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.



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:		25-002731					
					Client: TETRATECH		
Location		Llangatwg			Landfill Waste Acceptance Criteria		
Lab Reference (Sample Number)		430911					
Sampling Date		15/01/2025			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID		SA06					
Depth (m)		0.50					
Solid Waste Analysis							
TOC (%)**		2.1			3%	5%	6%
Loss on Ignition (%) **		7.2			--	--	10%
BTEX (µg/kg) **		< 10			6000	--	--
Sum of PCBs (mg/kg) **		< 0.007			1	--	--
Mineral Oil (mg/kg) EH,1D,CU,AL		< 10			500	--	--
Total PAH (WAC-17) (mg/kg)		1.73			100	--	--
pH (units)**		7.3			--	>6	--
Acid Neutralisation Capacity (mmol / kg)		0.81			--	To be evaluated	To be evaluated
Eluate Analysis		10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)		mg/l			mg/kg		
					using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *		0.00552		0.0552	0.5	2	25
Barium *		0.0165		0.165	20	100	300
Cadmium *		< 0.000100		< 0.00100	0.04	1	5
Chromium *		0.0017		0.017	0.5	10	70
Copper *		0.0075		0.075	2	50	100
Mercury *		< 0.000500		< 0.00500	0.01	0.2	2
Molybdenum *		0.00296		0.0296	0.5	10	30
Nickel *		0.0022		0.022	0.4	10	40
Lead *		0.0037		0.037	0.5	10	50
Antimony *		< 0.0017		< 0.017	0.06	0.7	5
Selenium *		< 0.0040		< 0.040	0.1	0.5	7
Zinc *		0.0076		0.076	4	50	200
Chloride *		18		180	800	15000	25000
Fluoride*		1.0		10	10	150	500
Sulphate *		4.7		47	1000	20000	50000
TDS*		45		450	4000	60000	100000
Phenol Index (Monohydric Phenols) *		< 0.010		< 0.10	1	-	-
DOC		20.6		206	500	800	1000
Leach Test Information							
Stone Content (%)		< 0.1					
Sample Mass (kg)		0.9					
Dry Matter (%)		82					
Moisture (%)		18					
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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.



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	25-002731						
					Client: TETRATECH		
Location	Llangatwg				Landfill Waste Acceptance Criteria		
Lab Reference (Sample Number)	430912						
Sampling Date	10/01/2025				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH03						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	1.2				3%	5%	6%
Loss on Ignition (%) **	3.8				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH,10,CU,AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.6				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	1.1				--	To be evaluated	To be evaluated
Eluate Analysis	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)		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)							
Arsenic *	0.00175			0.0175	0.5	2	25
Barium *	0.00321			0.0321	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0017			0.017	0.5	10	70
Copper *	0.0014			0.014	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.000466			0.00466	0.5	10	30
Nickel *	0.0070			0.070	0.4	10	40
Lead *	0.0022			0.022	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0031			0.031	4	50	200
Chloride *	15			150	800	15000	25000
Fluoride*	0.47			4.7	10	150	500
Sulphate *	3.5			35	1000	20000	50000
TDS*	19			190	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	17.0			170	500	800	1000
Leach Test Information							
Stone Content (%)	38.2						
Sample Mass (kg)	0.9						
Dry Matter (%)	90						
Moisture (%)	10						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.
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.



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	25-002731						
					Client: TETRATECH		
Location	Llangatwg				Landfill Waste Acceptance Criteria		
Lab Reference (Sample Number)	430913						
Sampling Date	16/01/2025				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS03						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	2.9				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH,10,CU,AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.2				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.51				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.00114			0.0114	0.5	2	25
Barium *	0.00595			0.0595	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0016			0.016	0.5	10	70
Copper *	0.0017			0.017	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.000574			0.00574	0.5	10	30
Nickel *	0.00095			0.0095	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0030			0.030	4	50	200
Chloride *	16			160	800	15000	25000
Fluoride*	0.86			8.6	10	150	500
Sulphate *	3.4			34	1000	20000	50000
TDS*	37			370	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	16.2			162	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.8						
Dry Matter (%)	86						
Moisture (%)	14						
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					** = MCFRTS 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.
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 : 25-002731
Project / Site name: Llangatwg

* 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 *
430909	SA04	None Supplied	0.5	Brown loam and clay with gravel and vegetation
430910	BH04	None Supplied	1.5	Brown clay and loam with vegetation and stones
430911	SA06	None Supplied	0.5	Brown loam with gravel
430912	BH03	None Supplied	0.5	Brown clay and loam with vegetation and stones
430913	WS03	None Supplied	0.5	Brown clay and loam with gravel



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20°C in soil	Determination of pH in soil by addition of water followed by electrometric measurement	In-house method	L005B	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 (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
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.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031B	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1 ratio 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	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
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	L039B	W	ISO 17025
Sample Preparation		In-house method	L043B	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe	In-house method based on Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046B	W	NONE
Loss on ignition of soil @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	In-house method	L047-PL	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088-PL	D/W	NONE
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



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025

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.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution



Sample Deviation Report



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH03	N/A	S	430912	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH03	N/A	S	430912	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH03	N/A	S	430912	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH04	N/A	S	430910	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH04	N/A	S	430910	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH04	N/A	S	430910	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA04	N/A	S	430909	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA04	N/A	S	430909	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA04	N/A	S	430909	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c



Tetra Tech.
Atlantic House
Greenwood Close
Cardiff Gate Business Park
Pontprennau
Cardiff
CF23 8RD

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

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

e: paul.vincent@tetrattech.com

Analytical Report Number : 25-002731

Replaces Analytical Report Number: 25-002731, issue no. 1
Result correction by laboratory.
Speciated PAHs results for sample 430909 corrected by laboratory.

Project / Site name:	Llangatwg	Samples received on:	21/01/2025
Your job number:	B068800	Samples instructed on/ Analysis started on:	21/01/2025
Your order number:	7018400	Analysis completed by:	30/01/2025
Report Issue Number:	2	Report issued on:	03/02/2025
Samples Analysed:	5 soil samples - 5 leachate samples		

Signed:

Joanna Wawrzeczko
Senior 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
	air	- once the analysis is complete

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

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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: 25-002731

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430909	430910	430911	430912	430913
Sample Reference				SA04	BH04	SA06	BH03	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.50	1.50	0.50	0.50	0.50
Date Sampled				07/01/2025	07/01/2025	15/01/2025	10/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Test Limit of detection	Test Accreditation Status		

Stone Content	%	0.1	NONE	< 0.1	3	< 0.1	38.2	< 0.1
Moisture Content	%	0.01	NONE	18	19	18	10	14
Total mass of sample received	kg	0.1	NONE	0.9	0.8	0.9	0.9	0.8

General Inorganics

pH (L005B)	pH Units	N/A	MCERTS	7.2	7.2	7.3	7.6	7.2
Total Organic Carbon (TOC) - Automated	%	0.1	MCERTS	1.6	1.2	2.1	1.2	0.9
Loss on Ignition @ 450°C	%	0.2	MCERTS	4.5	3.8	7.2	3.8	2.9
Acid Neutralisation Capacity	mmol/kg	>999	NONE	0.81	1.1	0.81	1.1	0.51

Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	0.06	< 0.05	0.08	< 0.05	< 0.05
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	0.34	< 0.05	< 0.05	< 0.05	< 0.05
Fluorene	mg/kg	0.05	MCERTS	0.52	< 0.05	< 0.05	< 0.05	< 0.05
Phenanthrene	mg/kg	0.05	MCERTS	5.7	< 0.05	0.35	< 0.05	0.09
Anthracene	mg/kg	0.05	MCERTS	1.5	< 0.05	< 0.05	< 0.05	< 0.05
Fluoranthene	mg/kg	0.05	MCERTS	6.3	< 0.05	0.29	< 0.05	0.1
Pyrene	mg/kg	0.05	MCERTS	4.6	< 0.05	0.23	< 0.05	0.07
Benzo(a)anthracene	mg/kg	0.05	MCERTS	2.7	< 0.05	0.13	< 0.05	< 0.05
Chrysene	mg/kg	0.05	MCERTS	2.7	< 0.05	0.25	< 0.05	< 0.05
Benzo(b)fluoranthene	mg/kg	0.05	ISO 17025	2.6	< 0.05	0.17	< 0.05	< 0.05
Benzo(k)fluoranthene	mg/kg	0.05	ISO 17025	1.4	< 0.05	0.06	< 0.05	< 0.05
Benzo(a)pyrene	mg/kg	0.05	MCERTS	2.3	< 0.05	0.11	< 0.05	< 0.05
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	1.1	< 0.05	< 0.05	< 0.05	< 0.05
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.26	< 0.05	< 0.05	< 0.05	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	1.1	< 0.05	0.05	< 0.05	< 0.05
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05

Total PAH

Total WAC-17 PAHs	mg/kg	0.85	NONE	33.1	< 0.85	1.73	< 0.85	< 0.85
-------------------	-------	------	------	------	--------	------	--------	--------

Petroleum Hydrocarbons

Mineral Oil (EC10 - EC40) BH_CU_ID_AL	mg/kg	10	NONE	< 10	< 10	< 10	< 10	< 10
--	-------	----	------	------	------	------	------	------

VOCs

Benzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Toluene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Ethylbenzene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
p & m-Xylene	µg/kg	8	MCERTS	< 8.0	< 8.0	< 8.0	< 8.0	< 8.0
o-Xylene	µg/kg	5	MCERTS	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Total BTEX	µg/kg	10	MCERTS	< 10	< 10	< 10	< 10	< 10
------------	-------	----	--------	------	------	------	------	------



Analytical Report Number: 25-002731

Project / Site name: Llangatwg

Your Order No: 7018400

Lab Sample Number				430909	430910	430911	430912	430913
Sample Reference				SA04	BH04	SA06	BH03	WS03
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				0.50	1.50	0.50	0.50	0.50
Date Sampled				07/01/2025	07/01/2025	15/01/2025	10/01/2025	16/01/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					

PCBs by GC-MS

PCB Congener 28	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 52	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 101	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 118	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 138	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 153	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
PCB Congener 180	mg/kg	0.001	MCERTS	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Total PCBs	mg/kg	0.007	MCERTS	< 0.007	< 0.007	< 0.007	< 0.007	< 0.007
------------	-------	-------	--------	---------	---------	---------	---------	---------

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



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	25-002731					
				Client: TETRATECH		
Location	Llangatwg					
Lab Reference (Sample Number)	430909			Landfill Waste Acceptance Criteria		
Sampling Date	07/01/2025			Limits		
Sample ID	SA04			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.50					
Solid Waste Analysis						
TOC (%)**	1.6			3%	5%	6%
Loss on Ignition (%) **	4.5			--	--	10%
BTEX (µg/kg) **	< 10			6000	--	--
Sum of PCBs (mg/kg) **	< 0.007			1	--	--
Mineral Oil (mg/kg) BH,LD,CU,AL	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	33.1			100	--	--
pH (units)**	7.2			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.81			--	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 *	0.00159		0.0159	0.5	2	25
Barium *	0.0151		0.151	20	100	300
Cadmium *	< 0.000100		< 0.00100	0.04	1	5
Chromium *	0.0020		0.020	0.5	10	70
Copper *	0.0030		0.030	2	50	100
Mercury *	< 0.000500		< 0.00500	0.01	0.2	2
Molybdenum *	0.00260		0.0260	0.5	10	30
Nickel *	0.0021		0.021	0.4	10	40
Lead *	0.0025		0.025	0.5	10	50
Antimony *	< 0.0017		< 0.017	0.06	0.7	5
Selenium *	< 0.0040		< 0.040	0.1	0.5	7
Zinc *	0.0052		0.052	4	50	200
Chloride *	8.9		89	800	15000	25000
Fluoride*	0.74		7.4	10	150	500
Sulphate *	7.8		78	1000	20000	50000
TDS*	77		770	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010		< 0.10	1	-	-
DOC	12.5		125	500	800	1000
Leach Test Information						
Stone Content (%)	< 0.1					
Sample Mass (kg)	0.9					
Dry Matter (%)	82					
Moisture (%)	18					
Results are expressed on a dry weight basis, after correction for moisture content where applicable.						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation						
** = UKAS accredited (liquid eluate analysis only)						
** = 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.
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.



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:		25-002731					
					Client: TETRATECH		
Location		Llangatwg					
Lab Reference (Sample Number)		430910			Landfill Waste Acceptance Criteria		
Sampling Date		07/01/2025			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID		BH04					
Depth (m)		1.50					
Solid Waste Analysis							
TOC (%)**		1.2			3%	5%	6%
Loss on Ignition (%) **		3.8			--	--	10%
BTEX (µg/kg) **		< 10			6000	--	--
Sum of PCBs (mg/kg) **		< 0.007			1	--	--
Mineral Oil (mg/kg) EH, LD, CU, AL		< 10			500	--	--
Total PAH (WAC-17) (mg/kg)		< 0.85			100	--	--
pH (units)**		7.2			--	>6	--
Acid Neutralisation Capacity (mmol / kg)		1.1			--	To be evaluated	To be evaluated
Eluate Analysis		10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)		mg/l			mg/kg		
					using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *		0.00127		0.0127	0.5	2	25
Barium *		0.00464		0.0464	20	100	300
Cadmium *		< 0.000100		< 0.00100	0.04	1	5
Chromium *		0.0017		0.017	0.5	10	70
Copper *		0.0019		0.019	2	50	100
Mercury *		< 0.000500		< 0.00500	0.01	0.2	2
Molybdenum *		0.000952		0.00952	0.5	10	30
Nickel *		0.0024		0.024	0.4	10	40
Lead *		0.0012		0.012	0.5	10	50
Antimony *		< 0.0017		< 0.017	0.06	0.7	5
Selenium *		< 0.0040		< 0.040	0.1	0.5	7
Zinc *		0.0031		0.031	4	50	200
Chloride *		20		200	800	15000	25000
Fluoride*		0.76		7.6	10	150	500
Sulphate *		5.7		57	1000	20000	50000
TDS*		40		400	4000	60000	100000
Phenol Index (Monohydric Phenols) *		< 0.010		< 0.10	1	-	-
DOC		22.1		221	500	800	1000
Leach Test Information							
Stone Content (%)		3.0					
Sample Mass (kg)		0.8					
Dry Matter (%)		81					
Moisture (%)		19					
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = MCFERTS 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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**

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:		25-002731					
					Client: TETRATECH		
Location		Llangatwg					
Lab Reference (Sample Number)		430911			Landfill Waste Acceptance Criteria		
Sampling Date		15/01/2025			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID		SA06					
Depth (m)		0.50					
Solid Waste Analysis							
TOC (%)**	2.1				3%	5%	6%
Loss on Ignition (%) **	7.2				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH, LD, CU, AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	1.73				100	--	--
pH (units)**	7.3				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.81				--	To be evaluated	To be evaluated
Eluate Analysis	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)		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)							
Arsenic *	0.00552			0.0552	0.5	2	25
Barium *	0.0165			0.165	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0017			0.017	0.5	10	70
Copper *	0.0075			0.075	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.00296			0.0296	0.5	10	30
Nickel *	0.0022			0.022	0.4	10	40
Lead *	0.0037			0.037	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0076			0.076	4	50	200
Chloride *	18			180	800	15000	25000
Fluoride*	1.0			10	10	150	500
Sulphate *	4.7			47	1000	20000	50000
TDS*	45			450	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	20.6			206	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.9						
Dry Matter (%)	82						
Moisture (%)	18						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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**

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	25-002731						
					Client: TETRATECH		
Location	Llangatwg						
Lab Reference (Sample Number)	430912				Landfill Waste Acceptance Criteria		
Sampling Date	10/01/2025				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	BH03						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	1.2				3%	5%	6%
Loss on Ignition (%) **	3.8				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH, LD, CU, AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.6				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	1.1				--	To be evaluated	To be evaluated
Eluate Analysis	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)		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)							
Arsenic *	0.00175			0.0175	0.5	2	25
Barium *	0.00321			0.0321	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0017			0.017	0.5	10	70
Copper *	0.0014			0.014	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.000466			0.00466	0.5	10	30
Nickel *	0.0070			0.070	0.4	10	40
Lead *	0.0022			0.022	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0031			0.031	4	50	200
Chloride *	15			150	800	15000	25000
Fluoride*	0.47			4.7	10	150	500
Sulphate *	3.5			35	1000	20000	50000
TDS*	19			190	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	17.0			170	500	800	1000
Leach Test Information							
Stone Content (%)	38.2						
Sample Mass (kg)	0.9						
Dry Matter (%)	90						
Moisture (%)	10						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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.



4041



Environmental Science

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results							
Report No:	25-002731						
					Client: TETRATECH		
Location	Llangatwg						
Lab Reference (Sample Number)	430913				Landfill Waste Acceptance Criteria		
Sampling Date	16/01/2025				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS03						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	2.9				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	< 0.007				1	--	--
Mineral Oil (mg/kg) EH, LD, CU, AL	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85				100	--	--
pH (units)**	7.2				--	>6	--
Acid Neutralisation Capacity (mmol / kg)	0.51				--	To be evaluated	To be evaluated
Eluate Analysis	10:1			10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l			mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.00114			0.0114	0.5	2	25
Barium *	0.00595			0.0595	20	100	300
Cadmium *	< 0.000100			< 0.00100	0.04	1	5
Chromium *	0.0016			0.016	0.5	10	70
Copper *	0.0017			0.017	2	50	100
Mercury *	< 0.000500			< 0.00500	0.01	0.2	2
Molybdenum *	0.000574			0.00574	0.5	10	30
Nickel *	0.00095			0.0095	0.4	10	40
Lead *	< 0.0010			< 0.010	0.5	10	50
Antimony *	< 0.0017			< 0.017	0.06	0.7	5
Selenium *	< 0.0040			< 0.040	0.1	0.5	7
Zinc *	0.0030			0.030	4	50	200
Chloride *	16			160	800	15000	25000
Fluoride*	0.86			8.6	10	150	500
Sulphate *	3.4			34	1000	20000	50000
TDS*	37			370	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010			< 0.10	1	-	-
DOC	16.2			162	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	0.8						
Dry Matter (%)	86						
Moisture (%)	14						
Results are expressed on a dry weight basis, after correction for moisture content where applicable.							
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation							
** = UKAS accredited (liquid eluate analysis only)							
** = MCFERTS 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.

Where colour coding is used on this report, this is for guidance purposes only. This does not constitute a statement of conformity of pass or fail.

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 : 25-002731
Project / Site name: Llangatwg

* 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 *
430909	SA04	None Supplied	0.5	Brown loam and clay with gravel and vegetation
430910	BH04	None Supplied	1.5	Brown clay and loam with vegetation and stones
430911	SA06	None Supplied	0.5	Brown loam with gravel
430912	BH03	None Supplied	0.5	Brown clay and loam with vegetation and stones
430913	WS03	None Supplied	0.5	Brown clay and loam with gravel



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
pH at 20°C in soil	Determination of pH in soil by addition of water followed by electrometric measurement	In-house method	L005B	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 (Walkley Black Method)	In-house method	L009B	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
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.	L019B	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with hexane followed by GC-MS	In-house method based on USEPA 8082	L027B	D	MCERTS
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by electrometric measurement	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L031B	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1 ratio 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	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved organic carbon in leachate by TOC/DOC NDIR Analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	NONE
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	L039B	W	ISO 17025
Sample Preparation		In-house method	L043B	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe	In-house method based on Guidance on Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046B	W	NONE
Loss on ignition of soil @ 450°C	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	In-house method	L047-PL	D	MCERTS
Speciated PAHs and/or Semi-volatile organic compounds in soil	Determination of semi-volatile organic compounds (including PAH) in soil by extraction in dichloromethane and hexane followed by GC-MS	In-house method based on USEPA 8270	L064B	D	MCERTS
BTEX and/or Volatile organic compounds in soil	Determination of volatile organic compounds in soil by headspace GC-MS	In-house method based on USEPA 8260	L073B	W	MCERTS
Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	Determination of total petroleum hydrocarbons in soil by GC-FID/GC-MS HS	In-house method	L076B/L088-PL	D/W	NONE
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



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025

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.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution



Sample Deviation Report



Analytical Report Number : 25-002731

Project / Site name: Llangatwg

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH03	N/A	S	430912	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH03	N/A	S	430912	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH03	N/A	S	430912	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
BH04	N/A	S	430910	c	BTEX and/or Volatile organic compounds in soil	L073B	c
BH04	N/A	S	430910	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
BH04	N/A	S	430910	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c
SA04	N/A	S	430909	c	BTEX and/or Volatile organic compounds in soil	L073B	c
SA04	N/A	S	430909	c	Speciated PAHs and/or Semi-volatile organic compounds in soil	L064B	c
SA04	N/A	S	430909	c	Total petroleum hydrocarbons by GC-FID/GC-MS HS in soil	L076B/L088-PL	c



4041

Tetra Tech.
5th Floor
Longscross Court
47 Newport Road
Cardiff
CF24 0AD

t: 07825 552006

e: paul.vincent@tetrattech.com
james.craddock@tetrattech.com



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 : 25-010084

Project / Site name:	Llangatwg	Samples received on:	27/02/2025
Your job number:	B068800	Samples instructed on/ Analysis started on:	28/02/2025
Your order number:	7015293	Analysis completed by:	07/03/2025
Report Issue Number:	1	Report issued on:	07/03/2025
Samples Analysed:	4 water samples		

Signed: _____

Anna Goc
PL Head of Reporting Team
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
air - once the analysis is complete

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

Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

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: 25-010084

Project / Site name: Llangatwg

Your Order No: 7015293

Lab Sample Number				468246	468247	468248	468249
Sample Reference				BH01	BH02	BH03	BH04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				4.00	2.00	1.50	6.50
Date Sampled				26/02/2025	26/02/2025	26/02/2025	26/02/2025
Time Taken				1230	1100	1200	1130
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status				

General Inorganics

pH (L099)	pH Units	N/A	ISO 17025	7.1	7.1	7.1	6.8
Total Cyanide	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
Sulphate as SO ₄	mg/l	0.045	ISO 17025	9.08	10.4	3.99	6.1
Chloride	mg/l	0.15	ISO 17025	16	16	12	12
Ammoniacal Nitrogen as NH ₃	µg/l	15	ISO 17025	130	< 15	< 15	< 15
Ammoniacal Nitrogen as NH ₄ ⁺	µg/l	15	ISO 17025	140	< 15	< 15	< 15
Dissolved Organic Carbon (DOC)	mg/l	0.1	ISO 17025	8.22	2.58	1.17	1.35
Nitrate as N	mg/l	0.01	ISO 17025	< 0.01	0.96	1.03	1.05
Nitrate as NO ₃	mg/l	0.05	ISO 17025	< 0.05	4.25	4.55	4.65
Nitrite as NO ₂	mgCaCO ₃ /l	3	ISO 17025	19	7.1	34	< 5.0
Alkalinity as CaCO ₃				140	250	180	160

Total Phenols

Total Phenols (Monohydric) Low Level	µg/l	1	NONE	< 1.0	< 1.0	< 1.0	< 1.0
--------------------------------------	------	---	------	-------	-------	-------	-------

Speciated PAHs

Naphthalene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Acenaphthylene	µg/l	0.01	ISO 17025	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}
Acenaphthene	µg/l	0.01	ISO 17025	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}
Fluorene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Phenanthrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Fluoranthene	µg/l	0.01	ISO 17025	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}
Pyrene	µg/l	0.01	ISO 17025	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}	< 0.01 ^{##}
Benzo(a)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Chrysene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(b)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(k)fluoranthene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(a)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Indeno(1,2,3-cd)pyrene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Dibenz(a,h)anthracene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01
Benzo(ghi)perylene	µg/l	0.01	ISO 17025	< 0.01	< 0.01	< 0.01	< 0.01

Total PAH

Total EPA-16 PAHs	µg/l	0.16	ISO 17025	< 0.16	< 0.16	< 0.16	< 0.16
-------------------	------	------	-----------	--------	--------	--------	--------



4041



Analytical Report Number: 25-010084

Project / Site name: Llangatwg

Your Order No: 7015293

Lab Sample Number				468246	468247	468248	468249
Sample Reference				BH01	BH02	BH03	BH04
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				Ground water	Ground water	Ground water	Ground water
Depth (m)				4.00	2.00	1.50	6.50
Date Sampled				26/02/2025	26/02/2025	26/02/2025	26/02/2025
Time Taken				1230	1100	1200	1130
Analytical Parameter (Water Analysis)	Units	Test Limit of detection	Test Accreditation Status				

Heavy Metals / Metalloids

Antimony (dissolved)	µg/l	0.4	ISO 17025	0.5	< 0.4	< 0.4	< 0.4
Arsenic (dissolved)	µg/l	0.15	ISO 17025	0.26	0.21	0.22	< 0.15
Barium (dissolved)	µg/l	0.06	ISO 17025	48	51	34	24
Beryllium (dissolved)	µg/l	0.1	ISO 17025	< 0.1	< 0.1	< 0.1	< 0.1
Cadmium (dissolved)	µg/l	0.02	ISO 17025	0.12	0.04	0.11	0.06
Chromium (dissolved)	µg/l	0.2	ISO 17025	0.3	0.6	0.7	0.7
Copper (dissolved)	µg/l	0.5	ISO 17025	2.8	2.5	2.8	3.6
Lead (dissolved)	µg/l	0.2	ISO 17025	< 0.2	< 0.2	0.2	< 0.2
Mercury (dissolved)	µg/l	0.05	NONE	< 0.05	< 0.05	0.07	< 0.05
Molybdenum (dissolved)	µg/l	0.05	ISO 17025	0.75	0.21	0.43	0.25
Nickel (dissolved)	µg/l	0.5	ISO 17025	7.9	3.1	19	2.9
Selenium (dissolved)	µg/l	0.6	ISO 17025	< 0.6	1	< 0.6	1.2
Zinc (dissolved)	µg/l	0.5	ISO 17025	3.8	3.6	4.9	6

Boron (dissolved)	µg/l	10	ISO 17025	15	17	12	14
-------------------	------	----	-----------	----	----	----	----

Petroleum Hydrocarbons

TPH - Aliphatic >EC5 - EC6 _{HS_1D_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC6 - EC8 _{HS_1D_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC8 - EC10 _{HS_1D_AL}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aliphatic >EC10 - EC12 _{EH_2D_AL_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC12 - EC16 _{EH_2D_AL_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC16 - EC21 _{EH_2D_AL_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aliphatic >EC21 - EC35 _{EH_2D_AL_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
Total TPH Aliphatic >EC10 - EC35 _{EH_2D_AL_#1_#2}	µg/l	10	NONE	< 10	< 10	< 10	< 10

TPH - Aromatic >EC5 - EC7 _{HS_1D_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC7 - EC8 _{HS_1D_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC8 - EC10 _{HS_1D_AR}	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
TPH - Aromatic >EC10 - EC12 _{EH_2D_AR_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aromatic >EC12 - EC16 _{EH_2D_AR_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aromatic >EC16 - EC21 _{EH_2D_AR_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
TPH - Aromatic >EC21 - EC35 _{EH_2D_AR_#1_#2}	µg/l	10	ISO 17025	< 10	< 10	< 10	< 10
Total TPH Aromatic >EC10 - EC35 _{EH_2D_AR_#1_#2}	µg/l	10	NONE	< 10	< 10	< 10	< 10

VOCs

MTBE (Methyl Tertiary Butyl Ether)	µg/l	3	ISO 17025	< 3.0	< 3.0	< 3.0	< 3.0
Benzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
p & m-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0	< 1.0

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



4041

**Analytical Report Number : 25-010084****Project / Site name: Llangatwg****Water matrix abbreviations:****Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI 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 water by ICP-MS (dissolved)	Determination of metals in water by acidification followed by ICP-MS. Accredited matrices: SW, PW, GW, except B - SW, GW, Hg - SW, PW, Al - SW, PW	In-house method based on USEPA Method 6020 & 200.8 for the determination of trace elements in water by ICP-MS	L012B	W	ISO 17025
Dissolved Organic Carbon in water	Determination of dissolved organic carbon in water by TOC/DOC NDIR Analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037B	W	ISO 17025
Metals in water by ICP-OES (dissolved)	Determination of metals in water by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, FSE, LL; PrW, DI PrW (Al, Cu, Fe, Zn)	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025
BTEX and/or Volatile Organic Compounds in water	Determination of volatile organic compounds in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method based on USEPA 8260	L073B	W	ISO 17025
Nitrate as N in water	Determination of nitrate by reaction with sodium salicylate followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08	L078-PL	W	ISO 17025
Nitrite in water	Determination of nitrite in water by addition of sulphanilamide and NED followed by colorimetry using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Nitrate in water	Determination of nitrate by reaction with sodium salicylate followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08	L078-PL	W	ISO 17025
Monohydric phenols (low level) in water	Determination of phenols in water by continuous flow analyser	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	NONE
Total cyanide in water	Determination of total cyanide in water by distillation followed by colorimetry. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Alkalinity of water (discrete analyser)	Determination of alkalinity of water by colorimetry using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on MEWAM & USEPA Method 310.2	L082B	W	NONE
Chloride in water	Determination of chloride in water by colorimetry using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house based on MEWAM Method ISBN 0117516260	L082B	W	ISO 17025
Ammonia as NH ₃ in water	Determination of ammonium/ammonia/ammoniacal nitrogen by the colorimetric salicylate/nitroprusside method using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Ammonium as NH ₄ in water	Determination of ammonium/ammonia/ammoniacal nitrogen by the colorimetric salicylate/nitroprusside method using discrete analyser. Accredited matrices: SW, PW, GW, FSE, LL	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082B	W	ISO 17025
Total Petroleum Hydrocarbons in water by HS-GC-MS	Determination of total petroleum hydrocarbons in water by headspace GC-MS. Accredited matrices: SW, PW, GW	In-house method	L088-PL	W	ISO 17025
pH of water at 20°C (automated)	Determination of pH of water by electrochemical measurement. Accredited matrices: SW, PW, GW, FSE, LL	In-house method	L099-PL	W	ISO 17025



Analytical Report Number : 25-010084

Project / Site name: Llangatwg

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Total Petroleum Hydrocarbons with carbon banding in water by GCxGC-FID	Determination of total petroleum hydrocarbons in water by GCxGC FID with carbon banding aliphatic and aromatic C10-C35. Accredited matrices: SW, PW, GW	In-house method	L101B	W	ISO 17025
Speciated PAHs and/or Semi-volatile organic compounds in water	Determination of semi-volatile organic compounds (including PAHs) in water by extraction in dichloromethane followed by GC-MS. Accredited matrices (PAHs): SW, PW, GW	In-house method based on USEPA 8270	L102B	W	ISO 17025
Sulphate in water	Determination of sulphate in water after filtration by acidification followed by ICP-OES. Accredited matrices: SW, PW, GW, PrW, DI PrW, FSE, LL	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil	L039B	W	ISO 17025

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.

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 - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

- Quality control parameter has a high recovery (outside of limit); however the associated result is below the reporting limit, other checks applied prior to reporting the data have been accepted. The result should be considered as being deviating and may be compromised.

APPENDIX G: CIRIA C552 RISK METHODOLOGY

The following tables are derived from CIRIA C552 and have been used to define the risk rating presented in the Qualitative Risk Assessment matrix.

Classification of consequence

Classification	Definition
Severe	Short term (acute) risk to human health likely to result in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. Short term risk of pollution (note; Water Resources Act contains no scope for considering significant pollution) of sensitive water resource. Catastrophic damage to building/property. A short-term risk to a particular ecosystem, or organism forming part of such ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Medium	Chronic damage to human health ('significant harm', as defined In DETR, 2000). Pollution of sensitive water resources (note; Water Resources Act contains no scope for considering significant pollution). A significant change in a particular ecosystem, or an organism forming part of such an ecosystem. (Note the definitions of ecological systems within the Draft Circular on Contaminated Land DETR, 2000).
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services ('significant harm', as defined In DETR, 2000). Damage to sensitive buildings/structures/services or the environment.
Minor	Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc). Easily repairable effects of damage to buildings, structures and services.

Classification of probability

Classification	Definition
High likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period that such an event would take place, and is even less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

Matrix of consequence against probability to gain a risk classification

		Consequence			
		Severe	Medium	Mild	Minor
Probability	High Likelihood	Very High Risk	High Risk	Moderate Risk	Moderate/Low Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Low Risk
	Low likelihood	Moderate Risk	Moderate/Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate/Low Risk	Low Risk	Very Low Risk	Very Low Risk

APPENDIX H: GROUNDWATER AND GROUND GAS MONITORING RESULTS



Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

28/01/25
 JM

Rain

EQUIPMENT USED

Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Apr-23
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS

Exploratory Hole No	Peak		Steady								Time	Remarks
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)		
BH01	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt		WELL FLOODED
BH02	0.1	0.1	0.1	0.1	10.9	88.8	nt	0	nt	1		
BH03	0.1	0.2	0.1	0.2	15.5	84.1	nt	0	nt	1		
BH04	0.1	3.1	0.1	3.1	7.6	89.2	nt	0	nt	2		
WS01	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt		WELL FLOODED
WS03	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt		WELL FLOODED
WS04	0.1	1.8	0.1	1.8	14.4	83.7	nt	0	nt	0		

LANDGAS - PHYSICAL PARAMETERS

Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH01	981	8.0	nt	nt	nt	nt	WELL FLOODED
BH02	981	8.0	-2.00	-2.00	-0.43	-0.43	
BH03	981	8.0	-0.90	-0.90	0.05	0.05	
BH04	981	8.0	0.40	0.40	-0.10	-0.10	
WS01	981	8.0	nt	nt	nt	nt	WELL FLOODED
WS03	981	8.0	nt	nt	nt	nt	WELL FLOODED
WS04	981	8.0	0.30	0.30	0.12	0.12	

AMBIENT ATMOSPHERIC CONDITIONS

Parameter	Before Monitoring	After Monitoring	ATMOSPHERIC PRESSURE CONDITIONS	
CH ₄ (% vol)	0.1	0.1	3 days prior (m bar)	1006
CO ₂ (% vol)	0.2	0.2	2 days prior (m bar)	985
O ₂ (% vol)	21.3	21.3	1 day prior (m bar)	977
PID (ppm)	nt	nt	during (m bar) am,midday,pm	973, 981, 984
Atmos Press. (m bar)	981	981	1 day post (m bar)	

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS

Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω · cm)	Temp (°C)	
BH01	0.16	4.50	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	0.63	3.80	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	1.37	3.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	6.09	8.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	0.16	0.80	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS03	0.43	1.00	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	DRY	1.70	nd	nd	nt	nt	nt	nt	nt	nt	nt	nt	

Notes

nt = not tested
 nd = not detected

Data Compiled by: JM
 Data Checked by: PV



Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

10/02/25
 TR

Cloudy

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Apr-23
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	Remarks
BH01	0.0	2.0	0.0	2.0	15.4	82.6	nt	0	nt	0		
BH02	0.0	0.9	0.0	0.9	13.6	85.5	nt	0	nt	0		
BH03	0.0	2.9	0.0	2.9	6.0	91.1	nt	0	nt	1		
BH04	0.0	3.6	0.0	3.6	10.7	85.7	nt	0	nt	0		
WS01	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt		FLOODED
WS03	0.0	1.2	0.0	1.2	18.6	80.2	nt	0	nt	0		
WS04	0.0	0.4	0.0	0.4	20.8	78.8	nt	0	nt	0		

LANDGAS - PHYSICAL PARAMETERS							
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH01	1021	6.0	0.0	0.0	0.92	0.92	
BH02	1021	6.0	0.0	0.0	-0.43	-0.43	
BH03	1021	6.0	0.0	0.0	-1.16	-1.16	
BH04	1021	6.0	0.0	0.0	-0.02	-0.02	
WS01	1021	6	nt	nt	nt	nt	
WS03	1021	6.0	0.0	0.0	-0.12	-0.12	
WS04	1021	6.0	0.0	0.0	0.00	0.00	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	877
CO ₂ (% vol)	0.2	0.2	2 days prior (m bar)	1019
O ₂ (% vol)	21.5	21.5	1 day prior (m bar)	882
PID (ppm)	nt	nt	during (m bar) am,midday,pm	
Atmos Press. (m bar)	1021	1021	1 day post (m bar)	

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω · cm)	Temp (°C)	
BH01	1.20	4.50	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	2.06	3.79	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	2.83	3.03	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	7.42	7.91	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	0.38	0.74	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS03	DRY	1.10	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	DRY	1.63	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	

Notes

nt = not tested
 nd = not detected

Data Compiled by: TR
 Data Checked by: PV



Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

25/02/25
 JC

Dry, Clear, Sunny

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Apr-23
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									Remarks
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	
BH01	0.0	1.8	0.0	1.8	9.6	88.4	nt	0	nt	0	10:18	Well flooded (pump failed after 75 seconds)
BH02	0.0	1.6	0.0	1.6	16.7	81.7	nt	0	nt	0	9:30	
BH03	0.0	2.2	0.0	0.7	19.3	80.1	nt	0	nt	0	9:00	Inside well flooded
BH04	0.0	4.3	0.0	4.3	8.2	87.5	nt	0	nt	0	11	
WS01	0.0	0.4	0.0	0.4	21.0	78	nt	0	nt	0	11.24	Well flooded
WS03	0.0	1.2	0.0	1.2	16.8	82	nt	0	nt	0	11.45	
WS04	0.0	0.7	0.0	0.7	21.3	78	nt	0	nt	0	12	

LANDGAS - PHYSICAL PARAMETERS							
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH01	1012	12.0	0.2	0.2	0.09	0.09	
BH02	1012	12.0	0.30	0.30	0.07	0.07	
BH03	1012	12.0	0.20	0.20	0.03	0.03	
BH04	1012	12.0	0.30	0.30	0.07	0.70	
WS01	1013	12.0	nt	nt	0.22	0.22	Pump failed for flow
WS03	1012	12.0	0.20	0.20	0.05	0.05	
WS04	1012	12.0	0.30	0.30	0.43	0.43	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	
CO ₂ (% vol)	0.2	0.2	2 days prior (m bar)	
O ₂ (% vol)	21.1	21.1	1 day prior (m bar)	
PID (ppm)	nt	nt	during (m bar) am,midday,pm	
Atmos Press. (m bar)	1012	1012	1 day post (m bar)	

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω·cm)	Temp (°C)	
BH01	0.35	4.50	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	WQM no connection
BH02	0.71	3.78	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	1.08	3.01	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	6.13	7.91	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	surface	0.72	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	SW seepage
WS03	dry	1.10	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	dry	1.63	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
 nd = not detected

Data Compiled by: JC
 Data Checked by: PV

Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

21/03/25
 JM

Clear

EQUIPMENT USED			
Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Apr-23
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS												
Exploratory Hole No	Peak		Steady									Remarks
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)	Time	
BH01	0.0	5.3	0.0	5.3	13.7	81.2	nt	0	nt	0		
BH02	0.0	4.7	0.0	4.7	8.6	86.8	nt	0	nt	0		
BH03	0.0	4.3	0.0	4.3	9.6	86.1	nt	0	nt	0		
BH04	0.0	2.5	0.0	2.5	14.9	82.6	nt	0	nt	0		
WS01	0.0	6.7	0.0	6.7	8.6	84.7	nt	0	nt	0		
WS03	0.0	1.7	0.0	1.7	15.8	82.5	nt	0	nt	0		
WS04	0.0	0.3	0.0	0.3	20.6	79.1	nt	0	nt	0		

LANDGAS - PHYSICAL PARAMETERS							
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH01	1004	12.0	0.5	0.5	0.70		
BH02	1004	12.0	0.40	0.40	-0.05	-0.05	
BH03	1004	12.0	-0.15	-0.15	0.50	0.50	
BH04	1004	12.0	-0.12	-0.12	0.50	0.50	
WS01	1004	12.0	-0.84	-0.84	0.50	0.50	
WS03	1004	12.0	-2.25	-2.25	0.30	0.30	
WS04	1004	12.0	-1.09	-1.09	0.30	0.30	

AMBIENT ATMOSPHERIC CONDITIONS			ATMOSPHERIC PRESSURE CONDITIONS	
Parameter	Before Monitoring	After Monitoring		
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	1020
CO ₂ (% vol)	0.2	0.2	2 days prior (m bar)	1019
O ₂ (% vol)	21.1	21.1	1 day prior (m bar)	1017
PID (ppm)	nt	nt	during (m bar) am,midday,pm	1004, 998, 997
Atmos Press. (m bar)	1004	1004	1 day post (m bar)	997

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω · cm)	Temp (°C)	
BH01	1.33	4.50	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	2.24	3.80	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	DRY	3.00	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	DRY	7.95	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	0.65	0.75	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS03	DRY	1.10	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	DRY	1.65	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	

Notes nt = not tested
 nd = not detected

Data Compiled by: JM
 Data Checked by: PV

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Cardiff, CF23 8RD



Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

28/03/25
 TR

Rain

EQUIPMENT USED													
Type		Make		Serial			Last Calibrated						
Gas Analyser		Landtec GA5000		G502044			Apr-23						
Interface Meter		Solinst		122-004988-1			n/a						
LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS													
Exploratory Hole No	Peak		Steady									Time	Remarks
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)			
BH01	0.0	6.1	0.0	6.1	16.3	77.6	nt	0	nt	0			
BH02	0.0	5.1	0.0	5.1	9.8	85	nt	0	nt	0			
BH03	0.0	4.5	0.0	4.5	10.8	84.7	nt	0	nt	0			
BH04	0.0	4.2	0.0	4.2	10.8	85	nt	0	nt	0			
WS01	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt			
WS03	0.0	2.1	0.0	2.1	16.2	81.7	nt	0	nt	0			
WS04	0.0	0.3	0.0	0.3	20.8	78.8	nt	0	nt	0			
LANDGAS - PHYSICAL PARAMETERS													
Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks						
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)							
BH01	1010	10	0	0	0.02	0.02							
BH02	1010	10	0	0	-0.05	-0.05							
BH03	1010	10	0	0	0.68	0.68							
BH04	1010	10	0	0	0	0							
WS01	1010	10	nt	nt	nt	nt							
WS03	1010	10	0	0	-0.14	-0.14							
WS04	1010	10	0	0	0.72	0.72							
AMBIENT ATMOSPHERIC CONDITIONS						ATMOSPHERIC PRESSURE CONDITIONS							
Parameter		Before Monitoring		After Monitoring									
CH ₄ (% vol)		0.0		0.0		3 days prior (m bar)			1024				
CO ₂ (% vol)		0.2		0.2		2 days prior (m bar)			1026				
O ₂ (% vol)		21.0		21.4		1 day prior (m bar)			1019				
PID (ppm)		nt		nt		during (m bar) am,midday,pm			1013, 1014, 1018				
Atmos Press. (m bar)		1010		1010		1 day post (m bar)			1021				
GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS													
Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω · cm)	Temp (°C)	
BH01	1.23	4.50	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	2.27	3.76	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	2.93	2.96	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	7.85	7.89	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	0.61	0.72	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS03	DRY	1.10	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	DRY	1.60	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
Notes nt = not tested nd = not detected													
Data Compiled by: TR													
Data Checked by: PV													

Tetra Tech

LANDGAS AND GROUNDWATER MONITORING RESULTS

Atlantic House, Greenwood Close, Cardiff Gate Business Park, Cardiff, CF23 8RD



TETRA TECH

Site Name: Llangatwg
Job No.: 784-B068800
Client: Moragn Sindall

Date Monitored:
Monitoring Engineer:
Weather:

08/04/25
 TR

Sun

EQUIPMENT USED

Type	Make	Serial	Last Calibrated
Gas Analyser	Landtec GA5000	G502044	Apr-23
Interface Meter	Solinst	122-004988-1	n/a

LANDGAS CONCENTRATIONS - INSTALLATION CONDITIONS

Exploratory Hole No	Peak		Steady								Time	Remarks
	CH ₄ (% vol)	CO ₂ (% vol)	CH ₄ (% vol)	CO ₂ (% vol)	O ₂ (% vol)	BAL (%)	PID (ppm)	H ₂ S (ppm)	HCN (ppm)	CO (ppm)		
BH01	0.0	4.2	0.0	4.2	17.0	78.8	nt	0	nt	0		
BH02	0.0	6.4	0.0	6.4	9.3	84.4	nt	0	nt	0		
BH03	0.0	5.4	0.0	5.4	11.9	82.7	nt	0	nt	0		
BH04	0.0	5.4	0.0	5.4	9.7	84.9	nt	0	nt	0		
WS01	0.0	8.8	0.0	8.8	14.0	77.3	nt	0	nt	0		
WS03	0.0	2.6	0.0	2.6	15.2	82.2	nt	0	nt	0		
WS04	0.0	0.4	0.0	0.4	20.6	79	nt	0	nt	0		

LANDGAS - PHYSICAL PARAMETERS

Exploratory Hole No	Atmos Pressure (m bar)	Atmos Temp (°C)	BH Flow		BH Pressure		Remarks
			Peak (L/hr)	Steady (L/hr)	Peak (mbar)	Steady (mbar)	
BH01	1022	12	0	0	-0.05	-0.05	
BH02	1022	12	0	0	0.68	0.68	
BH03	1022	12	0	0	0.05	0.05	
BH04	1022	12	0	0	0.07	0.07	
WS01	1022	12	0.1	0.1	0.78	0	
WS03	1022	12	0	0	0.49	0.49	
WS04	1022	12	0	0	0.87	0.87	

AMBIENT ATMOSPHERIC CONDITIONS

Parameter	Before Monitoring	After Monitoring	ATMOSPHERIC PRESSURE CONDITIONS	
CH ₄ (% vol)	0.0	0.0	3 days prior (m bar)	727
CO ₂ (% vol)	0.3	0.3	2 days prior (m bar)	1022
O ₂ (% vol)	21.3	20.8	1 day prior (m bar)	879
PID (ppm)	nt	nt	during (m bar) am,midday,pm	880, 1027,
Atmos Press. (m bar)	1022	1024	1 day post (m bar)	

GROUNDWATER / NAPL - PHYSIO-CHEMICAL PARAMETERS

Exploratory Hole No	Water Surface (mbgl)	Base Depth (mbgl)	LNAPL Surface (mbgl)	DNAPL Surface (mbgl)	Water Quality Indicators								Remarks
					ORP (mV)	SPC (µs/cm)	C (µs/cm)	Ph (value)	DO (mg/L)	Dissolved Solids (ppt)	Resistivity (Ω · cm)	Temp (°C)	
BH01	1.30	4.50	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH02	2.22	3.75	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH03	2.95	2.97	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
BH04	7.85	7.88	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS01	0.65	0.75	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS03	DRY	1.10	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	
WS04	DRY	1.63	nt	nt	nt	nt	nt	nt	nt	nt	nt	nt	

Notes

nt = not tested
 nd = not detected

Data Compiled by: TR
 Data Checked by: PV

APPENDIX I: GDR CALCULATIONS

S2 - INFORMATION

	Ref	Width	Length	Depth	No.	TOF level	Formation level	Approx Existing Level From	Formation depth below exist	Worst case GL ref	Braced bay	Self weight (kN)	Worst Case Column Loads - Unfactored [kN]					
													Permanent (Gk)	Variable (Qk)	(Downwind)	(Uplift)	Wind - direction X	Wind - direction Y
Perimeter Pad footings - Non-Braced	PF1	###	###	###	2	####	32	33.2	1.48	A6	No	15	85	20	5	-5	25	5
	PF2	###	###	###	6	####	32	32.3	0.57	T13	No	23.5	210	60	5	-5	15	10
	PF3	###	###	###	3	####	32	33.41	1.88	T3	No	31.25	225	145	10	-10	30	5
	PF4	###	###	###	8	####	32	32.28	0.55	K17	No	33.75	645	290	5	-10	30	10
	PF5	###	###	###	19	####	32	33.2	1.68	K6	No	45	885	510	5	-5	45	10
Internal Pad footings	PF1	###	###	###	4	####	32	32.4	0.6	C16	No	15	150	150	0	0	0	0
	PF4	###	###	###	11	####	32	32.4	0.6	K15	No	33.75	590	405	5	-5	5	5
	PF6	###	###	###	22	####	32	33.41	1.61	P3	No	46	820	550	10	-10	5	5
Pad footings - Braced	PF8	###	###	###	3	####	32	32.2	0.4	T16	Yes	60	240	75	260	-400	260	10
	PF11	###	###	###	36	####	32	32.35	0.55	Q15	Yes	93.75	380	230	525	-850	240	5
	PF12	###	###	###	10	####	32	33.63		G1	Yes	125	450	280	530	-640	515	220
Pad footings - Supporting two columns	PF7	###	###	###	1	####	32	33.18	1.65	Column 1	No	61.25	40	10	10	0	5	0
										Column 2			85	15	85	-25	5	0
	PF9	###	###	###	1	####	32	33.04	1.51	Column 1	No	80	425	175	25	-25	10	5
										Column 2			190	145	25	-25	10	5
	PF11	###	###	###	5	####	32	33.13	1.33	Column 1	Yes	93.75	135	35	0	0	0	0
										Column 2			250	165	410	-390	265	0
Lift pit base	Lift pit	###	###	###	1	####	31	33.2	1.9	n/a	n/a	153.5	PRELIMINARY DESIGN OF LIFT PIT BASE RESULT					
	Lift pit	###	###	###	1	####	31	32.33	1.03	n/a	n/a	195	PRELIMINARY DESIGN OF LIFT PIT BASE RESULT					
Trench footings (perimeter)	TF1	###	###	###		####	32			n/a	n/a	11.25	20	n/a	n/a	n/a	n/a	n/a
	TF2	###	###	###		####	32			n/a	n/a	15	20	n/a	n/a	n/a	n/a	n/a
	TF3	###	###	###		####	32			n/a	n/a	13.5	20	n/a	n/a	n/a	n/a	n/a
	TF4	###	###	###		####	32			n/a	n/a	18	20	n/a	n/a	n/a	n/a	n/a

S2 - INFORMATION

CALCULATION OF ULTIMATE BEARING CAPACITY - HANSEN'S METHOD

PROJECT TITLE Llangatwg (885kN 1.5m2 pad ULS)

DATA INPUT

Footing geometry	Footing width, B (m)	1.5	B must be ≤ L
	Footing length, L (m)	1.5	
	Founding depth, D (m)	0.8	
Ground conditions	Slope of ground, ψ (deg)	0	see page 2 for details.
	Soil bulk density, γ_b (kN/m ³)	20	
	Depth to water table (m)	2	
	Effective density for calculations, γ (kN/m ³)	19.9	
	Effective overburden press. at founding level, q' (kPa)	16	
Ground shear strength	Cohesion, c_u (kPa)		M2 - Partial FoS 1.4
	Angle of shearing resistance, ϕ (deg)	32	
	SPT N value		M2 - Partial FoS 1.25
	Calculated ϕ based on SPT(deg)		
	Angle of shearing res., ϕ , used in calculations (deg)	32.0	0.5585 = radians

CALCULATION OF HANSEN'S BEARING CAPACITY FACTORS

N_q	23.18	$= e^{\pi \tan \phi} \cdot \tan^2(45^\circ + (\phi/2))$
N_c	35.49	$= (2 + \pi) \text{ if } \phi=0; = (N_q - 1) \cot \phi \text{ if } \phi > 0$
N_γ	20.79	$= 1.5 \cdot (N_q - 1) \cdot \tan \phi$

CALCULATION OF HANSEN'S BEARING CAPACITY FACTORS

	(c)	(q)	(γ)
Shape factors, s_c, s_q, s_γ	1.65	1.62	0.60
$s_c = 1 + (B/L) \cdot (N_q/N_c)$	$s_q = 1 + (B/L) \tan \phi$	$s_\gamma = 1 - 0.4(B/L)$	
Depth factors, d_c, d_q, d_γ	1.20	1.14	1.00
$d_c = 1 + 0.4 \cdot \tan^{-1} D/B$	$d_q = 1 + 2 \tan \phi \cdot (1 - \sin \phi)^2 \tan^{-1} D/B$	$d_\gamma = 1.0$	
Ground slope factors, g_c, g_q, g_γ	1.00	1.00	1.00
$g_c = 1 - \psi^0/147^\circ$	$g_q = g_\gamma (1 - \tan \psi)^5$		

ULTIMATE BEARING CAPACITY

Hansen's bearing capacity equation: $q_{nu} = c N_c s_c d_c g_c + q' N_q s_q d_q g_q + 0.5 \gamma B N_\gamma s_\gamma d_\gamma g_\gamma$ (terms for inclined load and foundation base are omitted)

Shear strength term	0	$= c \cdot N_c \cdot s_c \cdot d_c \cdot g_c$
Overburden term	684	$= q' \cdot N_q \cdot s_q \cdot d_q \cdot g_q$
Footing width term	186	$= 0.5 \gamma B N_\gamma s_\gamma d_\gamma g_\gamma$
Ultimate net bearing capacity (kPa)	870	

FoS **A2 Permanent - Unfavourable** **1** **On Load**
Rd = 870 kN/m²

Therefore, Maximum column load = 394kN for a 1.5 m x 1.5 m pad.

Therefore, **Ed = 1.0 x 394 = 394 kN/m**
Rd > Ed therefore ULS is verified (utilisation = 45%)

CALCULATION OF ULTIMATE BEARING CAPACITY - HANSEN'S METHOD

BACKGROUND CALCULATIONS FOR ULTIMATE BEARING CAPACITY CALCULATION

The ultimate bearing capacity spreadsheet (sheet 1) includes calculations to determine a suitable bulk density to be used in the determination of ultimate bearing capacity, and has the provision to determine a value for the angle of shearing resistance, ϕ , based on SPT N values. These background calculations are given and described below.

CALCULATION FOR EFFECTIVE DENSITY

Foundation stability depends on the effective stresses within the soil in the wedge zone affected by failure (see sketch on 3-1, sheet 1). The rules are:

- where the water table is below the wedge zones, bulk density is used;
- where the water table is above the footing base, submerged density is used;
- where the water table lies within the wedge zones, an equivalent density, γ_e , part way between bulk and submerged, may be used by applying the following expression:

$$\gamma_e = (2H - d_w)(d_w/H^2)\gamma + (\gamma'/H^2)(H-d_w)^2$$

where H = depth of wedge zone = $0.5B \cdot \tan(45^\circ + \phi/2)$

d_w = depth of water below base of footing

γ and γ' = bulk and submerged densities, respectively

$(\gamma' = \gamma - \gamma_{\text{water}})$

For the problem in sheet 1:

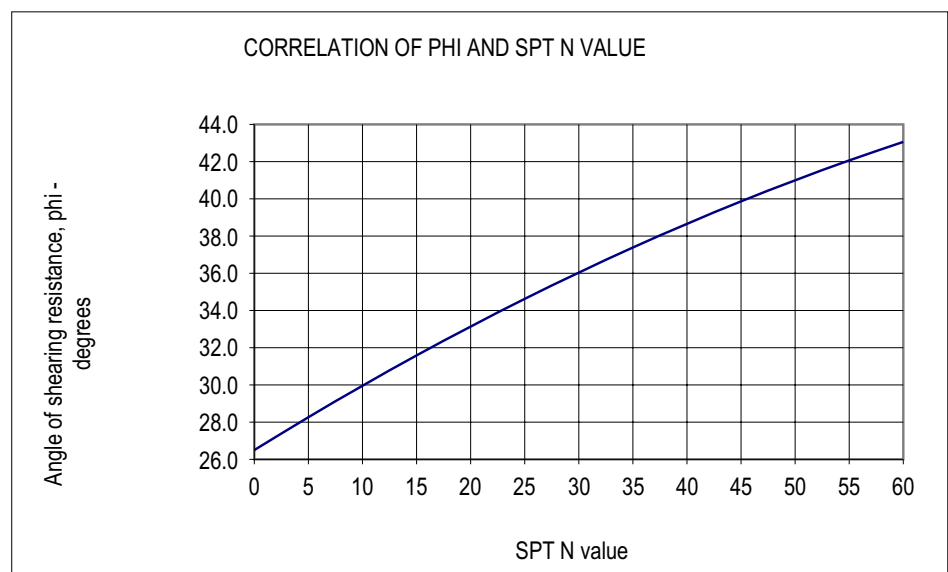
$H =$	1.353	$= 0.5B \cdot \tan(45^\circ + \phi/2)$
$d_w =$	1.200	If water depth > footing depth, = water depth - footing depth, otherwise = 0
	19.744	First half of expression: if $d_w > H$, = γ , otherwise = $(2H - d_w)(d_w/H^2)\gamma$
	0.130	Second half of expression: if $d_w > H$, 0 otherwise = $(\gamma'/H^2)(H-d_w)^2$
$\gamma_e =$	19.875	Effective density

Since the density value affects only the third term in the stability equation, which is zero for a purely cohesive soil and quite small for a granular soil, the its effect is small, and it would be sufficient to use bulk density where the water table is below half the footing depth below the footing and submerged density where it is above this.

PECK, HANSON AND THORNBURN'S CORRELATION BETWEEN SPT N VALUE AND PHI

Peck, Hansen and Thornburn's⁽¹⁾ chart for the correlation between SPT N values and angle of shearing resistance for sands and gravels is given below. This has been plotted by fitting a curve to match the graph, of $\phi = 25.5 + 0.36N + 0.0014N^2$. The resulting values of ϕ for various SPT N values are given in the table below, and plotted in the accompanying graph.

SPT N VALUE	PHI (DEG)
0	26.5
5	28.3
10	30.0
15	31.6
20	33.1
25	34.6
30	36.0
35	37.4
40	38.7
45	39.9
50	41.0
55	42.1
60	43.1



(1) Peck, Hansen and Thornburn, *Foundation Engineering*, Wiley, 2nd ed., 1974.

SETTLEMENT OF A FOOTING ON SAND OR GRAVEL

This spreadsheet allows estimates to be made of settlements beneath pad or strip foundations on sand or gravel.

The method, by Burland and Burbridge, is empirical, based on the performance of real structures, correlated with SPT values.

The settlement equation is: $s = f(s) \cdot f(l) \cdot f(t) [q^{-2/3} \cdot p] \cdot B^{0.7} I(c)$

where the symbols are as defined below:

N	SPT design value for the granular soil	44	
B	Width of foundation (m)	1.5	
L	Length of foundation (m)	1.5	for strip put large number ($\geq 10 \cdot B$)
q	Foundation pressure (kPa)	400	
p	Max. previous effective overburden pressure (kPa)		see note below

Note: $p = 0$ for normally consolidated soil at surface with no previous loading

f(s)	Shape factor, $= ((1.25L/B)/(L/B + 0.25))^2$	1.00
------	--	------

f(l)	Thickness of gravel layer beneath footing, H	deep	if $H > 2B$, you can simply put "deep"
	Depth of influence of footing, z - normally $10^{(0.74 \cdot \log B)}$	1.35	
	Layer depth influence factor, $f(l) = (H/z)/(2-H/z)$ (provided $H < z$) where H is the gravel layer thickness and z is the zone of influence of load, typically = 2B. For deep layers ($H > z$), $f(l) = 1$.	1.00	

f(t)	Time factor, $= 1 + R_3 + R \cdot \log(t/3)$ where t is time, years Where for static loads $R_3 = 0.3$ and $R = 0.2$ Instant settlement, $f(t) =$ For t=3 years, $f(t) =$ For t = 10 years, $f(t) =$ For t = 100 years, $f(t) =$	1.00
		1.30
		1.40
		1.60
	Other (specify if required) years	

		Best guess	Lower limit	Upper limit
I(c)	Influence factor, a =	2.2	1.778	2.98
	$= (10^{a - b \cdot \log N})/100$ b =	1.4	1.31	1.68
	I(c) =	0.0079	0.0042	0.0166

Settlement	Upper Range	Lower Range	Lower limit	Upper limit
Immediate settlement	6	4	2	9
After 3 years	8	5	3	11
After 10 years	9	6	3	12
After 100 years	10	7	4	14
After				