

Project Three Developments Limited

SWANSEA ROAD, MERTHYR TYDFIL

Site Slope Stability Assessment Report

12824/GNS/21/SSAR

CLIENT: Project Three Developments Limited

PROJECT: Swansea Road, Merthyr Tydfil

TITLE: Site Slope Stability Assessment Report

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1.0 INTRODUCTION

1.1 GENERAL

Project Three Developments Limited are proposing to develop a site at Swansea Road, Merthyr Tydfil for residential end-use.

Intégral Géotechnique (Wales) Limited have been appointed as the Geotechnical Engineers to undertake a slope stability assessment of the existing embankments to enable remedial measures to be designed.

This report presents the findings of the intrusive site investigation and gives recommendations for stabilising the existing slopes and embankments.

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1.2 PROPOSED DEVELOPMENT

The proposed development is likely to comprise residential housing, but details of the site layout and levels have not been decided yet.

1.3 SCOPE OF WORKS

The work instructed included a review of the previous site investigation reports for the site followed by the drilling of five shell and auger boreholes and the installation of groundwater level monitoring standpipes followed by groundwater level monitoring, slope stability analysis and reporting.

The site investigation included:

- The drilling of five supplemental shell and auger boreholes close to the crest of the existing embankments, with closely space in-situ testing
- Sampling of soil for laboratory geotechnical testing
- The installation of 3 No. groundwater level monitoring standpipes in boreholes BH1, BH2 and BH3

1.3 SCOPE OF WORKS (CONTINUED)

- Monitoring of groundwater levels in the standpipes installed in the boreholes during return visits to the site by a field technician.

1.4 LIMITATIONS

This document is intended to be a working document for further development in discussion with all concerned including the Local Planning Authority, Natural Resources Wales, and the NHBC as appropriate.

It should also be noted that vertical and lateral changes in ground conditions may be present between exploratory hole locations.

Access for the intrusive site investigation was limited in parts of the site, due to the presence of densely vegetated areas (mainly in the northwest) including stands of Japanese Knotweed (extensive in the northwest). The shell and auger drilling rig was also unable to access any areas of uneven ground.

A very overgrown water course runs along the foot of the steep embankment slopes on the east and southeast sides of the site. Due to its overgrown nature, it was not possible to access and inspect the state of this water course or to assess if there are any potential instability issues at the foot of the steep slopes.

This report is for the assessment of slope stability. It does not consider any other aspects of the project at this stage.

2.0 THE SITE

2.1 SITE LOCATION AND DESCRIPTION

The site is located in Merthyr Tydfil approximately 3km northwest of the town centre, at a National Grid Reference of 302530, 207060, see Figure 1.

The site is approximately triangular in shape and occupies an area of approximately 1.8 hectares. The site is bordered by Swansea Road to the north and existing housing to the east/southeast and west/southwest.

The site comprises an historical embankment of made ground / colliery spoil with an approximately level top, flanked by steep slopes to the north, east and southeast.

The embankment is located within an area that generally slopes in a north-easterly direction, such that the embankment reaches its maximum height of approximately 13m at the northeast corner.

The embankment top is generally flat at an approximate elevation of 290m AOD and is approximately level with the neighbouring land to the southwest of the site.

While the top of the embankment is generally level, it does include a large irregularly shaped elongated depression within the northeast part of the plateau top. The depression is up to approximately 2m deep and some 30 to 40m long (in a northeast-southeast direction) by up to 10 to 20m wide.

Most of the plateau top and the embankment slopes are grassed. However, the northwest part of the plateau top is very overgrown with many trees, shrubs and large stands of Japanese Knotweed. The latter extend down the adjacent embankment slope as far as the roadside pavement.

Smaller localised stands of Japanese Knotweed were also observed on the embankment slopes in the northeast, including near the small very overgrown water course at the northeast corner. Some trees and shrubs are also present locally across the plateau top and down the embankment slopes.

The embankment slopes in the northwest have estimated gradients of 1v in 2h or shallower. However, elsewhere, the northeast, east and south-east embankment slopes become progressively steeper, with estimated gradients of up to 1v in 1.4h.

2.1 SITE LOCATION AND DESCRIPTION (CONTINUED)

The vegetation cover on the northern and northeast embankment slopes appears to have helped/be helping to give some stability to these steep banks. However, large areas of what looks unstable, loose, dark grey colliery spoil material, with little established vegetation, are exposed across the southeast embankment slope, where the slopes are estimated to be as steep as approximately 1v in 1.4h. Google images from 2017 show the bank almost wholly grass vegetated with a shallow ribbed surface. Therefore, the form of the current slopes represent relatively recent deterioration. The shape of the failure would indicate localised translational slip along a planar slip surface.

A small water course is understood to issue from a pipe/culvert at the foot of the embankment, almost halfway along the site's southeast boundary. The water course drains north-eastwards along the foot of the embankment slope and is culverted underneath Swansea Road near the northeast corner of the site. Due to the very overgrown nature of the water course and the bottom parts of the steep embankment slopes, it was not possible to inspect these areas. Accordingly, it was not possible to see this water course or to assess whether the stream might be causing, or could potentially cause, instability issues at the toes of the steep embankments.

2.2 SITE OPERATIONS

There are no site operations, although the site is open to the public.

2.3 SURROUNDING LAND USE

Swansea Road lies immediately to the north and the site is surrounded by existing residential housing.

2.4 AVAILABLE SITE INVESTIGATION DATA

The site has previously been investigated by Intégral Géotechnique (Wales) Limited in 2007 and August 2017.

The following reports should be referenced to obtain a detailed appraisal of the site.

- 12034/PB/17/SI, Swansea Road, Merthyr Tydfil, Site Investigation Report dated August 2017.

2.4 AVAILABLE SITE INVESTIGATION DATA (CONTINUED)

The 2007 investigation consisted of a mining investigation, comprising the drilling and geologging of eight probeholes. In general, between 3.5m and 9m thickness of colliery spoil was encountered, generally increasing north-eastwards towards the existing slopes. The colliery spoil was generally found to be underlain by 1 to 2m of cohesive superficial deposits, overlying rock strata.

The probeholes generally encountered up to 5m thickness of ironstones and mudstones underneath the made ground embankment, at very shallow depths which typically ranged from approximately 5m to 15m.

At least four of the probeholes encountered evidence of unrecorded old workings within this ironstone bearing sequence of strata. The workings were encountered in the form of broken ground, but no voids were found.

The 2017 investigation comprised the excavation of 7 No. trial pits and the drilling of 3 No. windowless sample holes to investigate the shallow ground conditions. Soil infiltration testing was completed at a single trial pit location (TP1).

The trial pits and windowless sample boreholes generally encountered colliery spoil throughout their excavated / drilled depths (with the exception of at TP1 and TP2). At TP1 and TP2, both of which were positioned towards the south-western site boundary, suspected natural soil were encountered at depths of 2.6m and 3.1m bgl respectively.

3.0 THE SITE INVESTIGATION

3.1 FIELDWORKS

A supplemental intrusive site investigation was designed in accordance with BS5930:2015+A1:2020, the Code of Practice for Site Investigations and BS 10175:2011+A2:2017, the Code of Practice for Investigation of Potentially Contaminated Sites, and 'Development of Land Affected by Contamination: A Guide for Developers' prepared by Welsh Local Government Association (WLGA)/Natural Resources Wales (NRW) Land Contamination Working Group, 2017.

The supplemental site investigation works comprised the drilling of 5 No. shell and auger boreholes (referenced BH1 to BH5) to depths of between approximately 8.8m and 11.5m bgl. Closely spaced standard penetration tests were undertaken within each of the boreholes.

Representative soil samples were taken from the shell and auger boreholes for laboratory geotechnical testing and placed in the appropriate sample containers deemed suitable for the analysis required.

Groundwater monitoring standpipes were installed in three of the shell and auger boreholes (BH1, BH2 and BH3). It was originally planned to install groundwater level monitoring data loggers in the boreholes but there was insufficient groundwater in the standpipes for the data loggers to work satisfactorily. In the absence of data loggers, a field technician attended site on several occasions to monitor the groundwater levels in the standpipes.

The fieldworks were supervised by a qualified Geotechnical Engineer from Intégral Géotechnique (Wales) Limited who also logged the supplemental shell and auger boreholes and prepared their detailed engineering logs in accordance with the requirements of BS 5930:2015+A1:2020. The engineering logs provide descriptions of the materials encountered in accordance with BSEN ISO 14688-1 (2002) and 14689-1 (2003) for soils and rocks respectively.

The approximate locations of the 2007 rotary probeholes, the 2017 trial pits and windowless sample holes, and the 2021 shell and auger boreholes are shown in Figure 2, while their logs are presented in Appendices A, B, C and D.

3.2 FIELD OBSERVATIONS

Where the embankment is steepest there is evidence of relatively recent slope failure, with colliery spoil having been deposited down the existing embankment towards the adjoining houses. This process had left a scar on the existing slope and extensive colliery spoil exposed. The location of this slip is indicated in Figure 2. Photographs of the site and evidence of slope failure and slip are presented in Appendix E.

3.3 LABORATORY GEOTECHNICAL TESTING

Representative soil samples were taken from the shell and auger boreholes and sent to the UKAS accredited laboratories of Apex Testing Solutions for geotechnical testing. The samples were tested for Atterberg Limits, moisture content, and particle size distribution.

The geotechnical test results are presented in Appendix F.

3.4 GROUNDWATER LEVEL MONITORING

The groundwater levels within the three standpipes installed in the shell and auger boreholes BH1, BH2, and BH3 have been measured on three return visits to the site.

The results of the groundwater level monitoring are provided in Appendix G.

4.0 GROUND CONDITIONS

The ground conditions encountered within the trial pits, windowless sample boreholes, rotary boreholes, and latest shell and auger boreholes are summarised below in Table 1.

Table 1: Summary of Encountered Ground Conditions		
Depth (m)		Strata
From	To	
0.0	2.6/11.1	MADE GROUND: Colliery Spoil of very loose/loose/medium dense/dense grey/dark grey angular GRAVEL, GRAVEL and COBBLES of mudstone/siltstone/sandstone with occasional boulders, generally sparse matrix of silt/sand, spoil appears end-tipped and uncompacted
2.6/11.1	4.5/11.5	SUPERFICIAL DEPOSITS: In TP1 and TP2 brown/grey sandy silty CLAY /clayey silty SAND with some to many gravels and occasional cobbles. Supplemental boreholes encountered soft and soft to firm, yellow brown, and brown silty sandy slightly gravelly clays becoming firm to stiff with depth. Softened by a perched groundwater table.
4.5/11.5	15.0+/30.0+	COAL MEASURES STRATA: SANDSTONES, SILTSTONES and MUDSTONES with occasional ironstone layers, as proven in the rotary probeholes.

4.1 MADE GROUND / COLLIERY SPOIL

A variable thickness of made ground / colliery spoil underlies the site. The base of the colliery spoil was proven at depths of between approximately 2.6m bgl (at TP1) and 11.1m bgl (at BH2). Note that the greatest thicknesses of made ground / colliery spoil were recorded within the exploratory holes positioned towards the crests of the existing slopes.

The encountered made ground / colliery spoil typically comprised loose, locally medium dense, grey slightly silty slightly sandy gravel with occasional angular cobbles and rarely suspected boulders of mudstone and rarely siltstone. The gravel is fine to coarse angular of mudstone and rarely siltstone and sandstone.

Uncorrected SPT N values varied from 4 to 38. The peak values probably represent cobbles or boulders.

A plot of SPT N value vs depth is shown in Figure 3 and this shows little trend with depth. Average N values of 8 to 10 were recorded.

4.2 SUPERFICIAL DEPOSITS

Natural strata comprising soft, soft to firm, becoming firm to stiff grey mottled orange-brown slightly silty sandy slightly gravelly clays with occasional cobbles of subrounded sandstone were encountered at depths of approximately 6.3m to 11.1m bgl in the supplemental shell and auger boreholes. Suspected boulders are also present. The gravel is fine to coarse subrounded and subangular sandstone and to a lesser extent siltstone and mudstone. This horizon ranged in recorded thickness between 0.4m and 2.5m. In BH5 occasional cobbles of subangular and subrounded sandstone and siltstone were present. Gravel is fine to coarse subrounded and subangular sandstone.

Note that during the previous 2017 site investigation works, suspected natural superficial deposits were encountered at depths as shallow as 2.6m and 3.1m bgl at TP1 and TP2, positioned in the south-western area of the site.

Where encountered, the superficial soils were typically recorded to comprise soft and soft to firm grey and dark brown silty clay directly below the made ground / colliery spoil. The softening of these deposits is considered to be associated with perched groundwater.

Historical maps suggest that the original ground profile beneath the made ground / colliery spoil had an approximate gradient of about 1v:15h i.e., 5%. Therefore, the base of the overlying tipped colliery spoil materials is expected to be of a similar attitude.

It is possible to assess the consistency of cohesive materials from the results of Standard Penetration Tests (SPT's) using guidance in CIRIA Report 143 (1995). Using this guidance, the SPT N values are corrected to 60% of theoretical free-fall hammer energy to produce SPT N_{60} values. With N values of 4 typically, this confirms a soft / soft to firm classification i.e., undrained shear strengths of 40kN/m² would be typical.

The majority of cohesive materials encountered, whether it be localised made ground or superficial soils, contained varying amounts of cobbles and boulders. A large number of SPT's performed in these cohesive materials reached refusal at 50 blows, these artificially high values have been influenced by the presence of cobbles and boulders and are not representative of the overall consistency of the material. However, it is expected that shear strengths will rapidly increase as coarser glacial strata and the onset of bedrock is approached.

4.3 EMPIRICAL GEOTECHNICAL SOIL PARAMETERS

Published empirical data has been used to determine typical bulk density values for the material in question. Carter and Bentley (1991) present typical values for bulk density for various materials.

For the made ground/colliery spoil materials a value of 1.8Mg/m^3 is considered appropriate. For the soft clays a value of 1.8Mg/m^3 is considered appropriate, whilst 2.0Mg/m^3 is considered suitable for superficial deposits comprising firm and firm to stiff and gravelly clays.

Where measured or calculated peak effective angle of friction information is not available, there are numerous sources of published empirical data to help determine typical peak effective angle of friction for the material in question. Carter and Bentley (1991) present the following typical peak effective angles of friction for compacted clays and compacted sands and gravels which have been reproduced below.

Table 6.5: Typical peak effective angles of friction for compacted clays (after Table 6.3 in Cater and Bentley [1991])

Soil description	Peak effective angle of friction (ϕ')
Silty clays, sand-silt mix	34
Clayey sands, sand-clay mix	31
Silts and clayey silts	32
Clays of low plasticity	28
Clayey silts, elastic silts	25
Clays of high plasticity	19

Table 6.6: Typical peak effective angles of friction for compacted sands and gravels (after Table 6.5 in Cater and Bentley [1991])

Soil description	Peak effective angle of friction (ϕ')
Well-graded sand-gravel mixtures	>38
Poorly-graded sand gravel mixtures	>37
Silty gravels, poorly graded sand-gravel-silt	>34
Clayey gravels, poorly graded sand-gravel-clay	>31
Well-graded clean sand, gravelly sands	38
Poorly-graded clean sands, gravelly sands	37

Table D.1 of BS EN 1997-2:2007(E), which has been partially reproduced in Table 6.7 below, presents typical peak effective angles of friction for granular soils based on their density.

4.3 EMPIRICAL GEOTECHNICAL SOIL PARAMETERS (CONTINUED)

Table 6.7: Deriving typical peak effective angles of friction based on density (after Table D.1 of BS EN 1997-2:2007[E])

Density	Peak effective angle of friction* (ϕ')
Very loose	29 – 32
Loose	32 – 35
Medium dense	35 – 37
Dense	37 – 40
Very dense	40 – 42

*Values given are valid for sands. For silty soil a reduction of 3° should be made. For gravels 2° should be added.

Whilst peak effective angle of friction values will be in the order of 32 to 35 degrees for the tip materials, as they are effectively loose granular materials, the various literature references suggest for typical N_{60} values of 10, that angles of 28 to 32 degrees are applicable. Residual values of friction, where past strain effects have occurred, are expected to be in the range of 20 to 26 degrees for low plasticity, loose granular materials.

The peak shear strength of the made ground materials and superficial soils was assessed as:

$c' = 0 \text{ kN/m}^2$ and $\phi' = 28^\circ$ to 32° - Made ground/colliery spoil

$c' = 0 \text{ kN/m}^2$ and $\phi' = 20^\circ$ to 26° – Soft superficial clays

4.4 BEDROCK

Bedrock was not specifically encountered in the latest shell and auger boreholes but based on SPT refusals it is approximately 1.5 to 2.5m below the base of the tip materials.

The previous 2007 rotary probeholes recorded bedrock at depths of between 4.5m and 9.4m below existing ground level. The shell and auger boreholes indicated that the made ground and superficial soils extended to a maximum depth of 11.5m within close proximity to the existing slopes.

4.4 BEDROCK (CONTINUED)

When drilling the rotary boreholes in 2007, the driller generally recorded ironstone layers within the 5m to 10m of strata below rockhead, often within fractured/very fractured bands. The air flush and drilling returns were lost in four of the eight probeholes within this broken ground, which is considered to be associated with unrecorded possibly back stowed very old ironstone workings. The thickness of the suspected old workings appeared to vary between approximately 1.5m and 5m. None of the probeholes encountered any open voids.

4.5 GROUNDWATER

The original trial pits excavated in 2017 remained dry within the colliery spoil made ground. Only TP1 and TP2 were thought to have 'bottomed out' the made ground and both encountered moist suspected natural soils at approximately 2.5m to 3m depth.

The probeholes drilled in 2007 did not encounter any groundwater within the made ground or the superficial deposits.

PH2 and PH8 remained dry to the base of the probeholes.

The rest of the probeholes encountered evidence of groundwater within the bedrock, generally 10 to 15m below the rockhead i.e., below 20m depth.

The 5 No. shell and auger boreholes drilled in 2021 did not identify any groundwater strikes during the drilling process.

Water level monitoring of the recent standpipes installed in boreholes BH1, BH2 and BH3 indicates a perched water table resting on the superficial soils in BH2 and BH3. BH1 which extended to 9.05m depth was dry throughout the monitoring period. Within BH2 and BH3, over the period of observation, the head of water varied between 0.3 and 0.8m, with groundwater recorded at depths of between 10.19m and 10.41m in BH2 and BH3 respectively.

5.0 SLOPE STABILITY PARAMETERS AND ASSESSMENT

5.1 DETAILS OF PROPOSED DEVELOPMENT

The proposed development is likely to comprise residential housing, but details of the site layout and levels have not been decided yet.

5.2 EXISTING SLOPE STABILITY

The steepest existing slopes are currently at gradients of approximately 1v:1.4h (36 degrees). Slope faces show recent deterioration. The main faces are currently devoid of vegetative cover. Some lower-level slopes have shrub and limited tree cover.

Potential failure modes are planar shallow slips, deeper wedge type sliding and rotational failure.

In order to assess the current slope stability, modelling software developed by Oasys Ltd has been utilised.

Slope stability modelling has been undertaken based on the existing ground profile at Section A-A (the location of which are shown in Figure 2).

As part of the modelling process, the following assumptions have been made:

- Three strata have been considered: the existing made ground / colliery spoil, the underlying soft becoming firm cohesive deposits, and the underlying bedrock
- A perched groundwater table close to the made ground / natural ground interface has been assumed.

With regard to engineering properties of the soils, the following assumptions have been made:

- For modelling purposes, the minimum slip weight considered in the model has been adjusted in order to assess global slope stability;
- A peak effective friction angle of 28 degrees has been adopted for the existing made ground / colliery spoil deposits;
- A peak effective friction angle of 22 degrees has been adopted for the underlying cohesive deposits; and
- A peak effective friction angle of 40 degrees has been adopted for the underlying weathered bedrock deposits.

5.2 EXISTING SLOPE STABILITY (CONTINUED)

A slope stability model has been considered at Section A-A. The results are presented in Appendix H.

The following Factor of Safety has been calculated:

- Section A-A Factor of Safety 0.9

The results indicate an inadequate FOS, which is commensurate with the evidence of slope failure observed on site. A minimum FOS of 1.3 is required for permanent slopes. Consequently, slope remedial measures are required, and are considered below.

5.3 SLOPE REMEDIAL RECOMMENDATIONS

The slope stability assessment of the steep embankment slopes around the north, northeast and southeast edges of the site indicate an inadequate Factor of Safety (FOS) against failure.

In order to provide an adequate degree of protection against instability, the slopes should be regraded to a minimum gradient of 1v:2.5h.

In addition to the model derived for the existing slope, a second slope stability model has been generated for a regraded slope angle of 1v:2.5h (see Appendix I). The results indicate that regraded slopes at 1v:2.5h will have an adequate FOS against failure, of 1.3 (see Appendix I).

All slope materials require permanent protective coverings of grass and shrub cover.

As part of the slope design, it is recommended that the very overgrown water course at the foot of the southeast and east slopes is cleared, inspected and assessed, in order to establish if any associated improvements/precautions are required. The state of this very overgrown small watercourse could not be assessed at the time of undertaking the site investigation. Its relationship and proximity to the toe of the embankments is therefore unclear. It is not known whether the toe of the slope is being or might be affected by this water course.

Based on the survey data which has been made available, many of the existing embankment slopes are steeper than 1v in 2.5h. Re-profiling earthworks are therefore required in order to ensure that this gradient is not exceeded.

5.3 SLOPE REMEDIAL RECOMMENDATIONS (CONTINUED)

It is recommended that an updated topographic survey of the site is undertaken in order to ensure that the embankment slopes are re-profiled to appropriate gradients, where necessary.

The layout of the proposed buildings and roads will need to be adjusted a safe distance away from the re-profiled embankment edges, thereby avoiding any over-stressing of the slopes by the proposed buildings.

During the re-profiling of the northern embankment slopes careful attention should be paid to the former vicinity of the 'spout' which was recorded on the historical maps dating from 1919 to 1964. The absence of any later record may indicate that the issue was successfully addressed, possibly by installing some form of drainage.

Cut-off drains should be provided at the top and French drains at the bottom of any cut and/or fill slopes. In areas of cut and/or fill, the slopes should be topsoiled and seeded with grass, in order to minimise any future maintenance problems caused by surface water run-offs. Geotextile pocket membranes (geocell or similar) are recommended to be used to ensure topsoil does not slump down the slopes. Local slope drainage may also need to be provided.

If development layouts require steeper slopes, then strengthening and or forms of retention will be required. The options that could be considered include:

- Slope reprofiling and creation of an engineered or strengthened soil block;
- Creation of a strengthened block by soil nailing;
- Partial earthworks and providing a gabion or crib wall;
- Partial earthworks and providing a reinforced concrete wall

Checks will be necessary for global stability as well as local stability checks for the design of any proposed strengthening and/or retention schemes. In particular wall embedment should be well below the level of any soft or completely weathered materials and the level of any slip zones.

All retaining structures will need to be designed to take account of groundwater effects and water pressures.

The above recommendations will need to be reviewed and may need to be revised following confirmation of the proposed development layout and proposed site levels.

APPENDIX A

ROTARY PROBEHOLE LOGS (2007)

RECORD OF PROBEHOLE 1

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	
		MADE GROUND: Colliery Spoil	
6.5		Superficial Deposits (Clays)	
7.8		MUDSTONE with Siltstone Bands	
REMARKS 1. Descriptions based on driller's records. 2. Temporary plastic casing installed for geologging			Equipment: KLEMM Date drilled: 19.3.07 Casing depth (m): 8.0 Type of drilling: Open Hole Flushing medium: Air Groundwater: Water at 9.9m

RECORD OF PROBEHOLE 1

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
25.0		LIMESTONE	
27.5		MUDSTONE	
30.0			
REMARKS 1. Descriptions based on driller's records.			Equipment: KLEMM Date drilled: 19.3.07 Casing depth (m): 8.0 Type of drilling: Open Hole Flushing medium: Air Groundwater: Water at 9.9m

RECORD OF PROBEHOLE 2

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	Lost returns. Old workings
		MADE GROUND: Colliery Spoil	
4.5		Superficial Deposits (Clays)	
5.6		Very weak weathered MUDSTONE	
10.0		Broken Ground	
13.1		Very Soft Drilling	
15.0		End of probehole at 30.0m	

REMARKS

- Descriptions based on driller's records.
- Drilling rods become stuck at 15.0m due to lost air flush - borehole had to be aborted
- Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 20.3.07

Casing depth (m): 6.0

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Dry

RECORD OF PROBEHOLE 3

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	Lost returns, then regained. Old workings
		MADE GROUND: Colliery Spoil	
3.5		Superficial Deposits (Clays)	
5.0		MUDSTONE	
6.2		COAL	
6.7		MUDSTONE	
9.0		Broken Ground	
10.9		MUDSTONE	
19.9			

REMARKS

1. Descriptions based on driller's records.
2. Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 19.3.07

Casing depth (m): 5.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Damp at 20.0m

RECORD OF PROBEHOLE 3

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
30.0		MUDSTONE with siltstone bands	
		End of probehole at 30.0m	
REMARKS 1. Descriptions based on driller's records.			Equipment: KLEMM Date drilled: 19.3.07 Casing depth (m): 5.5 Type of drilling: Open Hole Flushing medium: Air Groundwater: Damp at 20.0m

RECORD OF PROBEHOLE 4

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	
		MADE GROUND: Colliery Spoil	
7.8		Superficial Deposits (Clays)	
9.4		Very fractured IRONSTONE and MUDSTONE	
12.1		SANDSTONE fractured	
19.0			

REMARKS

1. Descriptions based on driller's records.
2. Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 20.3.07

Casing depth (m): 12.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Inflow at 26.5m

RECORD OF PROBEHOLE 4

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
26.5		MUDSTONE with sandstone bands	
28.2		LIMESTONE	
30.0		MUDSTONE	
		End of probehole at 30.0m	

REMARKS

- Descriptions based on driller's records.
- Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 20.3.07

Casing depth (m): 12.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Inflow at 26.5m

RECORD OF PROBEHOLE 5

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	
		MADE GROUND: Colliery Spoil	
7.5		Superficial Deposits	
9.2		Very fractured IRONSTONE and MUDSTONE with clay traces	
13.0			

REMARKS

1. Descriptions based on driller's records.
2. Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 20.3.07

Casing depth (m): 12.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Damp at 9.8m Wet at 24.5m

RECORD OF PROBEHOLE 5

Client: George Wimpey South Wales

Project Number: 9851

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
30.0		MUDSTONE with sandstone bands	
		End of probehole at 30.0m	

REMARKS

1. Descriptions based on driller's records.

Equipment: KLEMM

Date drilled: 20.3.07

Casing depth (m): 12.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Damp at 9.8m Wet at 24.5m

RECORD OF PROBEHOLE 6

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	
		MADE GROUND: Colliery Spoil	
4.9		Superficial Deposits (Clays)	
5.6		IRONSTONE and MUDSTONE very fractured	
8.0		MUDSTONE	
17.7			

REMARKS

1. Descriptions based on driller's records.
2. Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 21.3.07

Casing depth (m): 9.0

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Wet at 18.5m Inflow at 24.1m

RECORD OF PROBEHOLE 6

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
30.0		MUDSTONE with sandstone bands	
		End of probehole at 30.0m	
REMARKS 1. Descriptions based on driller's records.			Equipment: KLEMM Date drilled: 21.3.07 Casing depth (m): 9.0 Type of drilling: Open Hole Flushing medium: Air Groundwater: Wet at 18.5m Inflow at 24.1m

RECORD OF PROBEHOLE 7

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	Lost returns, then regained. Old workings
		MADE GROUND: Colliery Spoil	
3.5		Superficial Deposits (Clays)	
4.5		IRONSTONE and MUDSTONE fractured	
6.1		MUDSTONE	
7.8		COAL	
8.5		MUDSTONE	
10.5		Broken Ground	
11.8		MUDSTONE	

REMARKS

1. Descriptions based on driller's records.
2. Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 21.3.07

Casing depth (m): 6.0

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Wet at 21.0m

RECORD OF PROBEHOLE 7

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
21.0			
		MUDSTONE with siltstone bands	
25.0		End of probehole at 25.0m	

REMARKS

1. Descriptions based on driller's records.

Equipment: KLEMM

Date drilled: 21.3.07

Casing depth (m): 6.0

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Wet at 21.0m

RECORD OF PROBEHOLE 8

Client: George Wimpey South Wales

Project Number: 9861

Site Name: Swansea Road, Merthyr Tydfil

Project Engineer: PB

Co-ordinates:

Ground Level (mOD):

Intégral
Géotechnique

50 Cathedral Road
Cardiff CF11 9LL
Tel: 029 2022 0462
Fax: 029 2034 0789
mail@integralgeotec.com

Depth (m)	Legend	Description	Comments
0.0		Ground Surface	Lost returns, then regained. Possible old workings
		MADE GROUND: Colliery Spoil	
7.1		Superficial Deposits (Clays)	
8.2		IRONSTONE and MUDSTONE broken	
10.5		IRONSTONE and MUDSTONE very broken	
14.1		MUDSTONE with siltstone bands	
20.0		End of probehole at 20.0m	

REMARKS

- Descriptions based on driller's records.
- Temporary plastic casing installed for geologging

Equipment: KLEMM

Date drilled: 21.3.07

Casing depth (m): 14.5

Type of drilling: Open Hole

Flushing medium: Air

Groundwater: Dry

APPENDIX B

TRIAL PIT LOGS (2017)

 Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com			Project Name: Swansea Road			Project No.: 12034		Trial Pit No.: TP1 Sheet 1 of 1	
Location: Merthyr Tydfil			Client: Pure Commercial Finance Limited			Logged By: PB		Scale: 1:25	
Equipment: JCB 3CX Mechanical Excavator			Coordinates:			Dimensions: 2.00m			
Date Excavated: 13/07/2017			Level:			Depth : 3.00m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
Depth (m)	Type	Results							
0.00 - 0.90	ES					MADE GROUND: Colliery spoil comprising loose to medium dense grey and dark grey silty sandy angular mudstone shaley gravels and occasional cobbles of siltstone/sandstone			
			2.60			POSSIBLE NATURAL GROUND: Soft becoming firm to stiff brown and grey clayey silty SAND/sandy silty CLAY with some to many gravels and occasional cobbles			
			3.00			End of Trialpit at 3.00 m			
Remarks: 1. Trial pit abandoned due to large pit collapses 2. Soakaway testing attempted but abandoned due to spoil collapsing in 3. Took a long time to excavate due to pit collapses			Groundwater: Very moist below 1.1m depth			Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			

 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com			Project Name: Swansea Road			Project No.: 12034		Trial Pit No.: TP2 Sheet 1 of 1	
Location: Merthyr Tydfil			Client: Pure Commercial Finance Limited			Logged By: PB		Scale 1:25	
Equipment: JCB 3CX Mechanical Excavator			Coordinates:			Dimensions 2.00m			
Date Excavated: 13/07/2017			Level:			Depth : 3.20m 4.00m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description			
Depth (m)	Type	Results							
0.00 - 0.70	ES					MADE GROUND: Colliery spoil comprising loose grey and dark grey slightly silty slightly sandy angular gravels mainly of shaley mudstone, with some siltstone/sandstone, some cobbles and occasional boulders, some to many cobbles and occasional to some boulders below 1.5m depth.			
						Possible buried topsoil at one end of the pit comprising soft brown sandy clayey silt between 3.0m and 3.1m depth			
			3.10			POSSIBLE NATURAL GROUND: Grey very sandy silty CLAY with some gravels			
			3.20			End of Trialpit at 3.20 m			
Remarks: 1. Trial pit 4m wide by the end of the dig 2. Took a long time to excavate due to continual collapses			Groundwater: Trial pit dry, but moist below 3.0m depth			Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			
			Stability: Sides very unstable and continuously collapsing						

 Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12034		Trial Pit No.: TP3 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Logged By: PB		Scale 1:25	
Equipment: JCB 3CX Mechanical Excavator		Coordinates:		Dimensions 2.00m			
Date Excavated: 13/07/2017		Level:		Depth : 2.80m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
0.00 - 1.00	ES		2.80			MADE GROUND: Colliery spoil comprising loose and very loose silty sandy angular gravels and cobbles of shaley mudstone with some siltstone and sandstone	
Remarks:			Groundwater: Trial pit dry			Key:	
1. Trial pit abandoned due to collapses 2. Trial pit 2m wide at the end of the excavation			Stability: Sides continually collapsing			D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample	
							

Intégral Géotechnique Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12034		Trial Pit No.: TP4 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Logged By: PB		Scale 1:25	
Equipment: JCB 3CX Mechanical Excavator		Coordinates:		Dimensions 2.00m			
Date Excavated: 13/07/2017		Level:		Depth : 2.70m			
Samples & In-situ Testing		Depth (m)	Level (m AOD)	Legend	Stratum Description		
Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
0.00 - 1.10	ES		2.70			MADE GROUND: Colliery spoil comprising loose and very loose slightly silty slightly sandy angular gravels and cobbles of mostly shaley mudstone, some siltstone and sandstone	
						End of Trialpit at 2.70 m	
Remarks: Trial pit abandoned due to collapses		Groundwater: Trial pit dry		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample			
		Stability: Sides very unstable and continually collapsing					

 Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12034		Trial Pit No.: TP5 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Logged By: PB		Scale 1:25	
Equipment: JCB 3CX Mechanical Excavator		Coordinates:		Dimensions 2.00m			
Date Excavated: 13/07/2017		Level:		Depth : 2.50m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results					
0.00 - 0.80	ES					MADE GROUND: Colliery spoil comprising very loose slightly silty slightly sandy angular gravels and some cobbles of mainly shaley mudstone with some siltstone and sandstone	
			2.50			End of Trialpit at 2.50 m	
Remarks: Trial pit abandoned due to collapses			Groundwater: Trial pit dry			Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample	
			Stability: Sides unstable and constantly collapsing				

Intégral Géotechnique Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12034		Trial Pit No.: TP6 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Logged By: PB		Scale 1:25	
Equipment: JCB 3CX Mechanical excavator		Coordinates:		Dimensions 2.00m			
Date Excavated: 13/07/2017		Level:		Depth : 2.50m			
Samples & In-situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
Depth (m)	Type	Results	Depth (m)	Level (m AOD)	Legend	Stratum Description	
0.00 - 0.90	ES					MADE GROUND: Colliery spoil comprising loose and very loose grey slightly silty slightly sandy angular gravels of mudstone and some cobbles of siltstone and sandstone	
			2.50			End of Trialpit at 2.50 m	
Remarks: Trial pit abandoned due to collapses			Groundwater: Trial pit dry			Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample W - Water sample	
			Stability: Sides very unstable and constantly collapsing				

APPENDIX C

WINDOWLESS SAMPLE LOGS (2017)

 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20607991 Fax. 029 20662176 mail@integraigeotec.com		Project Name: Swansea Road		Project No.: 12034		Borehole No.: WS1 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Coordinates:		Hole Type: WLS	
Equipment: Widowless Sampling Rig		Diameter of Casing:		Level:		Scale 1:50	
Diameter of Boring: 101mm		Depth of Casing:		Dates 13/07/2017 -		Logged By: PB	

Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 1.00	ES				Grass over MADE GROUND: Colliery spoil comprising loose/very loose slightly silty slightly sandy angular gravels of mudstone and occasional to some siltstone		
		1.00	C	N=4 (1,1/2,1,0,1)				1	
		2.00	C	N=7 (1,1/2,2,1,2)				2	
		3.00	C	N=7 (1,2/2,2,2,1)	3.00			3	
		3.50	C	N=10 (3,3/4,2,1,3)					
		4.00	C	N=17 (2,2/3,4,6,4)				4	
		4.50	C	N=9 (4,4/2,2,3,2)					
		5.00	C	N=13 (3,3/3,2,4,4)				5	
		5.50	C	N=25 (6,5/5,5,7,8)					
		6.00	C	N=46 (6,8/8,8,10,20)				6	
End of Borehole at 3.00 m								7	
								8	
								9	
								10	

Remarks: Gas monitoring standpipe installed to 2m depth		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)		W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation		
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 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20607991 Fax. 029 20662176 mail@integraigeotec.com		Project Name: Swansea Road		Project No.: 12034		Borehole No.: WS2 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Coordinates:		Hole Type: WLS	
Equipment: Windowless Sampling Rig		Diameter of Casing:		Level:		Scale 1:50	
Diameter of Boring: 101mm		Depth of Casing:		Dates 13/07/2017 -		Logged By: PB	

Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 1.00	ES				MADE GROUND: Colliery spoil comprising loose/very loose slightly silty slightly sandy angular gravels of mudstone and occasional to some siltstone End of Borehole at 3.00 m		
		1.00	C	N=3 (1,1/1,0,1,1)				1	
		2.00	C	N=6 (1,1/2,1,1,2)				2	
		3.00	C	N=9 (3,4/3,2,2,2)	3.00			3	
		3.50	C	N=8 (2,3/2,2,2,2)					
		4.00	C	N=12 (3,2/3,4,3,2)				4	
		4.50	C	N=14 (3,4/4,4,2,4)					
		5.00	C	N=13 (5,5/4,4,3,2)				5	
		5.50	C	N=17 (4,4/4,4,5,4)					
		6.00	C	N=19 (4,4/5,4,4,6)				6	
	6.50	C	N=35 (8,8/8,9,9,9)			7			
								8	
								9	
								10	

Remarks: Gas monitoring standpipe installed to 2m depth		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel: 029 20607991 Fax: 029 20662176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12034		Borehole No.: WS3 Sheet 1 of 1			
Location: Merthyr Tydfil		Client: Pure Commercial Finance Limited		Coordinates:		Hole Type: WLS			
Equipment: Windowless Sampling Rig		Diameter of Casing:		Level:		Scale 1:50			
Diameter of Boring: 101mm		Depth of Casing:		Dates 13/07/2017 -		Logged By: PB			
Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.00 - 0.90	ES		0.10			TOPSOIL: Firm dark brown clayey silt MADE GROUND: Colliery spoil comprising loose to medium dense brown grey slightly clayey silty sandy fine becoming medium angular gravels of mudstone	
		1.00	C	N=10 (2,1/2,2,3,3)	0.90			MADE GROUND: Colliery spoil comprising loose/very loose slightly silty slightly sandy angular gravels of mainly mudstone and some of siltstone	1
		2.00	C	N=11 (2,3/2,3,2,4)					2
		3.00	C	N=11 (3,2/3,3,3,2)	3.00			End of Borehole at 3.00 m	3
		3.50	C	N=10 (3,2/3,2,2,3)					
		4.00	C	N=14 (3,3/3,3,3,5)					4
		4.50	C	N=16 (4,4/4,4,4,4)					
		5.00	C	N=14 (4,3/4,3,4,3)					5
		5.50	C	N=17 (4,3/4,3,4,8)					
		6.00	C	N=22 (8,8/7,4,5,8)					6
		6.50	C	N=41 (6,5/7,10,10,14)					7
Remarks:		Gas monitoring standpipe installed to 2m depth							
		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone) W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation 							



APPENDIX D

SHELL & AUGER BOREHOLE LOGS (2021)

Intégral Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20607991 Fax. 029 20662176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12824		Borehole No.: BH1 Sheet 1 of 1				
Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP				
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50				
Diameter of Boring: 200mm		Depth of Casing: 9.00m		Dates 07/04/2021 - 07/04/2021		Logged By: GNS				
Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		1.00 1.00	B C	N=6 (1,1/1,1,2,2)				Loose and locally medium dense grey slightly silty slightly sandy gravel with occasional angular cobbles of mudstone and rarely siltstone. Gravel is fine to coarse angular mudstone and rarely siltstone and sandstone (MADE GROUND).	1	
		2.00 2.00	B C	8 (1,1/2,3,3)					2	
		3.00 3.00	B C	N=9 (2,1/1,2,3,3)					3	
		4.00 4.00	B C	N=6 (1,2/1,2,1,2)					4	
		5.00 5.00	B C	N=7 (1,2/1,2,2,2)					5	
		6.00 6.00	B C	N=11 (3,2/3,3,2,3)					6	
		7.00 7.00	B C	N=9 (1,2/3,2,2,2)					7	
		8.00 8.00	B C	N=14 (10,3/3,5,3,3)	7.80 8.20				Soft to firm grey mottled orange brown slightly silty sandy slightly gravelly CLAY with occasional cobbles of subrounded sandstone. Gravel is fine to coarse subrounded sandstone.	8
		9.00 9.00	B C	N=54 (9,21/17,10,14,13)	9.40				Firm and firm to stiff brown silty sandy slightly gravelly CLAY with occasional cobbles and suspected boulders of sandstone. Gravel is fine to coarse subrounded and subangular sandstone and siltstone.	9
End of Borehole at 9.40 m									10	
Remarks: 1. Chisel employed between 9.1m and 9.4m depth for 1 hour.						Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone) W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation				



 Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel: 029 20607991 Fax: 029 20662176 mail@integralgeotec.com		Project Name: Swansea Road		Project No.: 12824		Borehole No.: BH2 Sheet 1 of 2	
Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP	
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50	
Diameter of Boring: 200mm		Depth of Casing: 11.30m		Dates 08/04/2021 - 09/04/2021		Logged By: GNS	

Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00 1.00	B C	N=12 (2,1/2,3,3,4)			Loose, very loose and locally medium dense grey slightly silty slightly sandy gravel with occasional angular cobbles of mudstone and rarely siltstone. Gravel is fine to coarse angular mudstone and rarely siltstone and sandstone (MADE GROUND).	1	
		2.00 2.00	B C	N=11 (3,3/4,3,2,2)				2	
		3.00 3.00	B C	N=7 (1,1/1,2,2,2)				3	
		4.00 4.00	B C	N=4 (1,1/1,1,1,1)				4	
		5.00 5.00	B C	N=5 (1,2/1,2,1,1)				5	
		6.00 6.00	B C	N=10 (1,1/1,1,4,4)				6	
		7.00 7.00	B C	N=17 (3,6/5,4,3,5)				7	
		8.00 8.00	B C	N=9 (1,2/3,2,2,2)				8	
		9.00 9.00	B C	N=12 (1,3/5,3,2,2)				9	
		10.00	B					10	

Remarks: 1. Chisel employed between 11.3m and 11.5m depth for 1 hour.		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)		W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation		
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Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP	
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50	
Diameter of Boring: 200mm		Depth of Casing: 11.30m		Dates 08/04/2021 - 09/04/2021		Logged By: GNS	

Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00	C	N=8 (1,2/1,2,3,2)					
		11.00	B	51 (1,1/51 for 210mm)	11.10			Soft grey silty slightly sandy CLAY.	11
		11.00	C		11.30				
		11.50	B		11.50		Firm and firm to stiff brown silty sandy slightly gravelly CLAY with occasional cobbles and suspected boulders of sandstone. Gravel is fine to coarse subrounded and subangular sandstone and siltstone. End of Borehole at 11.50 m	12	
									13
									14
									15
									16
									17
									18
									19
									20

Remarks: 1. Chisel employed between 11.3m and 11.5m depth for 1 hour.		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)	W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation	
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Location: Merthyr Tydfil			Client: Project Three Developments Limited			Coordinates:		Hole Type: CP	
Equipment: Dando 2000			Diameter of Casing: 200mm			Level:		Scale 1:50	
Diameter of Boring: 200mm			Depth of Casing: 10.50m			Dates 13/04/2021 - 13/04/2021		Logged By: GNS	
Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00 1.00	B C	N=9 (1,2/3,2,2,2)				Loose and locally medium dense grey slightly silty slightly sandy gravel with occasional angular cobbles of mudstone and rarely siltstone. Gravel is fine to coarse angular mudstone and rarely siltstone and sandstone (MADE GROUND).	
		2.00 2.00	B C	N=14 (4,2/5,4,3,2)					
		3.00 3.00	B C	N=7 (1,2/1,2,2,2)					
		4.00 4.00	B C	N=15 (3,2/3,2,2,8)					
		5.00 5.00	B C	N=6 (3,1/1,2,1,2)					
		6.00 6.00	B C	N=8 (1,1/2,1,2,3)					
		7.00 7.00	B C	N=38 (1,6/5,10,11,12)					
		8.00 8.00	B C	N=13 (2,3/3,3,4,3)					
		9.00 9.00	B C	N=5 (3,2,1,1,1)					
		10.00	B						
Remarks: 1. Chisel employed between 10.5m and 10.8m depth for 1 hour.							Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone) W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation		



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Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP	
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50	
Diameter of Boring: 200mm		Depth of Casing: 10.50m		Dates 13/04/2021 - 13/04/2021		Logged By: GNS	

Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		10.00	C	N=4 (1,0/1,1,1,1)			 sandstone. - Borehole terminated on suspected boulder at 10.8m depth.		
		10.50	C	50 (25 for 30mm/50 for 55mm)					
					10.80			End of Borehole at 10.80 m	11
									12
									13
									14
									15
									16
									17
									18
									19
									20

Remarks: 1. Chisel employed between 10.5m and 10.8m depth for 1 hour.		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone)		W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation		
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Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP			
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50			
Diameter of Boring: 200mm		Depth of Casing: 8.50m		Dates 14/04/2021 - 14/04/2021		Logged By: GNS			
Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00 1.00	B C	N=14 (1,2/2,4,4,4)				Loose and locally medium dense grey slightly silty slightly sandy gravel with occasional angular cobbles of mudstone and rarely siltstone. Gravel is fine to coarse angular mudstone and rarely siltstone and sandstone (MADE GROUND).	1
		2.00 2.00	B C	N=12 (3,2/2,3,4,3)					2
		3.00 3.00	B C	N=8 (1,1/1,1,2,4)					3
		4.00 4.00	B C	N=8 (1,2/1,2,2,3)					4
		5.00 5.00	B C	N=22 (2,5/4,5,6,7)					5
		6.00 6.00	B C	N=23 (3,6/4,5,8,6)					6
		7.00 7.00	B C	N=4 (1,2/1,1,1,1)	7.20				7
					7.60			Soft yellow brown and grey silty sandy CLAY.	
		8.00 8.00	B C	N=17 (2,2/3,4,3,7)				Firm becoming firm to stiff brown silty sandy slightly gravelly CLAY with frequent cobbles and suspected boulders of subrounded and subangular sandstone. Gravel is fine to coarse subrounded and subangular sandstone and siltstone. - Borehole terminated on suspected boulder at 8.8m depth.	8
		8.80	C	50 (25 for 105mm/50 for 60mm)	8.80			End of Borehole at 8.80 m	9
Remarks: 1. Chisel employed between 8.5m and 8.8m depth for 1 hour.									
Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone) W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation									



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Location: Merthyr Tydfil		Client: Project Three Developments Limited		Coordinates:		Hole Type: CP			
Equipment: Dando 2000		Diameter of Casing: 200mm		Level:		Scale 1:50			
Diameter of Boring: 200mm		Depth of Casing: 8.40m		Dates 06/04/2021 - 07/04/2021		Logged By: GNS			
Well	Water Strikes	Samples & In situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		1.00 1.00	B C	N=7 (1,1/2,1,2,2)				Loose, very loose and locally medium dense grey slightly silty slightly sandy gravel with occasional angular cobbles of mudstone and rarely siltstone. Gravel is fine to coarse angular mudstone and rarely siltstone and sandstone (MADE GROUND).	1
		2.00 2.00	B C	N=7 (2,1/2,1,2,2)					2
		3.00 3.00	B C	N=6 (2,2/2,1,1,2)					3
		4.00 4.00	B C	N=8 (1,1/2,1,1,4)					4
		5.00 5.00	B C	N=5 (1,1/1,1,1,2)					5
		6.00 6.00	B C	N=3 (2,1/1,0,1,1)					6
		7.00 7.00	B C	N=9 (1,1/2,2,3,2)					7
		8.00 8.00	B C	N=40 (2,4/4,8,5,23)					8
		8.80	C	50 (25 for 30mm/50 for 20mm)					9
		Remarks:		Key: D - Small disturbed sample B - Bulk disturbed sample ES - Environmental soil sample SPT - Standard Penetration Test (split spoon) CPT - Standard Penetration Test (solid cone) W - Water sample U - Undisturbed sample TCR - Total Core Recovery SCR - Solid Core Recovery RQD - Rock Quality Designation					
1. Chisel employed between 8.4m and 8.8m depth for 1 hour.									

