

**Crabtree Walk, Trefechan,
Merthyr Tydfil.
WDL Homes**



WDL Homes

Making a house into your new home

Flood Consequences Assessment and Drainage Strategy Report

May 2019



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CONTENTS

1. INTRODUCTION	4
1.1 Background	4
1.2 Existing Site.....	4
1.3 Surface Water Features	5
1.4 Existing drainage.....	5
1.5 Geology and Hydrogeology.....	5
1.6 Development Proposals	5
2. FLOOD CONSEQUENCES ASSESSMENT	6
2.1 Legislation	6
2.2 Definition of Flood Risk	6
2.3 Flood Frequency	6
2.4 Flood Zone	7
2.5 Flood Risk Vulnerability Classification	7
2.6 Flood Risk Vulnerability Classification and Flood Zone Compatibility	7
2.7 Other Sources of Flooding	7
2.8 Summary of Existing Flood Risk	7
3. DRAINAGE STRATEGY	8
3.1 Surface Water Management Approach.....	8
3.2 Surface Water Management Strategy.....	9
3.3 Existing Foul Drainage	9
3.4 Proposed Foul Drainage	9
4. CONCLUSIONS.....	10
4.1 Summary	10
4.2 Conclusion.....	10

APPENDICES	
A	ENGINEERING LAYOUT
B	NRW FLOOD MAPS
C	SITE INVESTIGATION AND SOAKAWAY TEST RESULTS
D	WELSH WATER SEWER RECORDS



1. INTRODUCTION

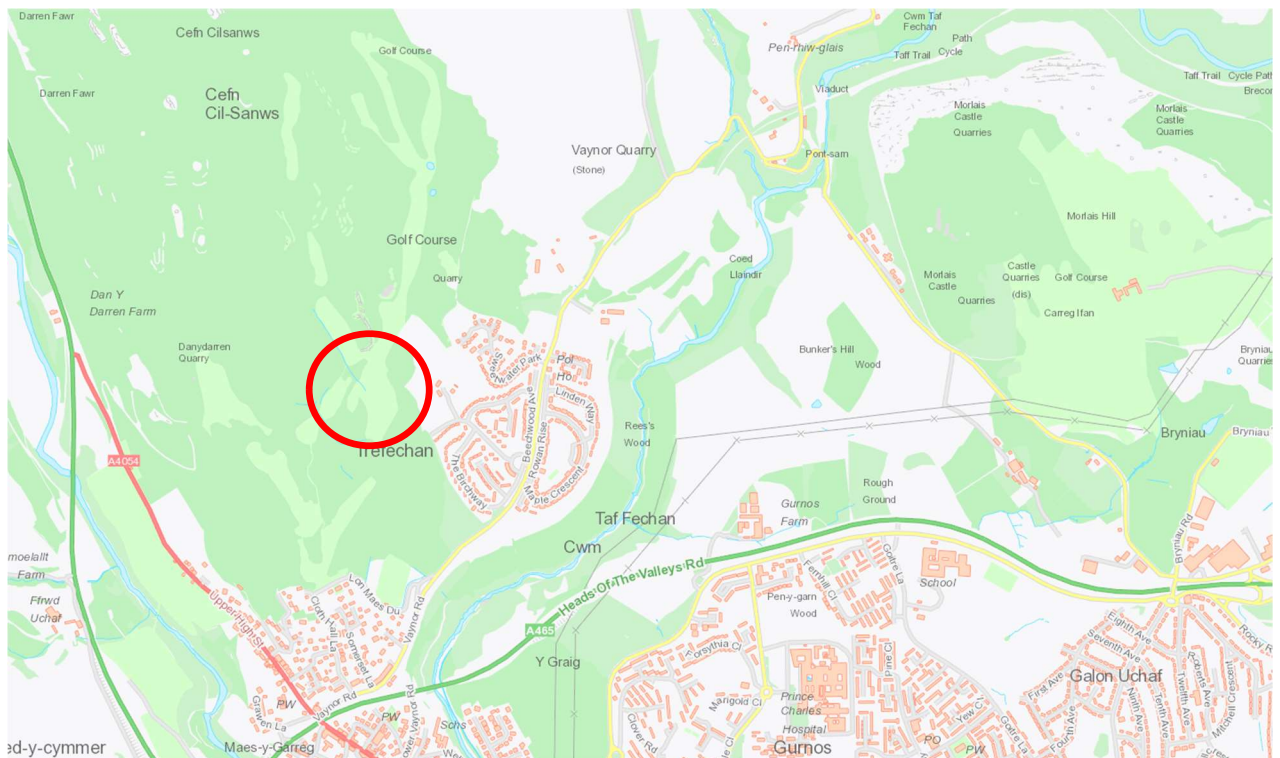
1.1 Background

- 1.1.1 PHG Consulting has been commissioned by WDL Homes to undertake a flood consequences assessment and drainage strategy report for proposed development off Crabtree Walk, Trefechan, Merthyr Tydfil.
- 1.1.2 The purpose of the report is to identify existing sources of flood risk to the site and ensure that surface and foul water drainage can be discharged from the site without affecting the downstream catchments detrimentally.
- 1.1.3 The report demonstrates how the drainage for the development will be discharged and how flows will be managed to prevent increased flood risk.

1.2 Existing Site

- 1.2.1 The site covers an area of approximately 3.2 ha and open rough ground with 2 existing properties located at National Grid Reference SO034090. It is bounded by Crabtree Walk to the south and THE Sweetwater development to the east. To the west and north is further open rough ground. The approximate site location is shown on figure 1 below.

Figure 1





- 1.2.2 The site topography slopes relatively steeply from the north to south. The average gradient is approximately 1 in 10. Ground levels vary from 315m AOD in the north to 285m in the south.

1.3 Surface Water Features

- 1.3.1 The site is generally open rough ground and greenfield. There are 2 occupied properties (Mira Monte and Caerllwyn) and evidence of historic farming in the area with dilapidated out-buildings across the site.
- 1.3.2 There are no visible watercourses or other features within the site.
- 1.3.3 The nearest main river to the development is the Taf Fechan which is located approximately 500m to the south east of the site.

1.4 Existing drainage

- 1.4.1 The existing occupied properties benefit from existing foul drainage that falls north to south before discharging into Crabtree Walk.
- 1.4.2 Welsh Water (DCWW) adopted sewer records show a 225mm diameter surface water sewer in Crabtree Walk and a further 150mm diameter foul water sewer. The DCWW map is included in Appendix D.

1.5 Geology and Hydrogeology

- 1.5.1 An intrusive site investigation (SI) was undertaken by Arup in November 2007 (Ref:123628).
- 1.5.2 Shallow soil infiltration testing was initially considered, but due to the site topography and concentration of existing development to the south this was discounted.
- 1.5.3 An alternative soakaway solution is to use deep boreholes as this would mitigate the risk of properties downstream. Appendix C shows the further SI works undertaken by Intergal Geotechnique in April 2019 (Ref:12411). This is shown in Appendix C and rates of percolations were calculated between 5×10^{-5} m/s and 2.09×10^{-3} m/s

1.6 Development Proposals

- 1.6.1 The proposal comprises the construction of up to 45 residential dwellings and associated infrastructure. The dwellings will include 3 and 4 bed units. The proposed Site Layout / Engineering Layout is included in Appendix A.



2. FLOOD CONSEQUENCES ASSESSMENT

2.1 Legislation

- 2.1.1 TAN 15 is the planning guidance used in Wales to assess flood risk. A requirement of TAN 15 is that developers making planning applications on sites that are potentially at risk from flooding should consult with Natural Resources Wales and produce a Flood Consequence Assessment (FCA) to support their proposals. This assessment has been conducted in accordance with TAN 15: Development and Flood Risk

2.2 Definition of Flood Risk

- 2.2.1 Flood risk is the product of the likelihood or chance of a flood occurring (flood frequency) and the consequence or impact of the flooding (flood consequence).

2.3 Flood Frequency

- 2.3.1 Flood frequency is identified in terms of the return period and annual probability. For example, a 1 in 100-year flood event has a 1% annual probability of occurring. Table 1 below provides a conversion between return periods and annual flood probabilities.

Table 1: Flood Probability Conversion Table

Return Period (years)	2	5	10	20	50	100	200	1000
Annual Flood Probability (%)	50	20	10	5	2	1	0.5	0.1



2.4 Flood Zone

- 2.4.1 The proposed development is located entirely within Zone A on Natural Resources Wales (NRW) flood maps so is at low risk of fluvial or tidal flooding.

2.5 Flood Risk Vulnerability Classification

- 2.5.1 The proposed development is residential so is classed as highly vulnerable in TAN 15.

2.6 Flood Risk Vulnerability Classification and Flood Zone Compatibility

- 2.6.1 As the development is located entirely within Zone A the proposed land use is appropriate.

2.7 Other Sources of Flooding

- 2.7.1 The site is generally well protected from overland flow by existing topography and surrounding built environment.
- 2.7.2 The NRW surface water flood map shows no routes around the development, but any exceedance flows would tend to run down the site towards Crabtree Walk and away from the site.

2.8 Summary of Existing Flood Risk

- 2.8.1 The proposed development site is considered to be at low risk of flooding from rivers, groundwater and overland flows. NRW Flood Maps is included in Appendix B.



3. DRAINAGE STRATEGY

3.1 Surface Water Management Approach

3.1.1 Surface water management proposals for the new development have been prepared to meet the following principles:

- Surface water runoff from the site will be restricted to the greenfield / urban QBar rate for all rainfall events up to and including the 100-year event with 40% increase in rainfall intensity to allow for climate change.
- No increase in flooding to people and property elsewhere as a result of the development;
- No surface water flooding within the proposed development in all rainfall events up to and including a 1 in 30-year return period storm;
- Overland flows within the site from rainfall events in exceedance of a 1 in 30-year return period storm are to be managed to minimise risk to people and property, up to the 1 in 100-year return period storm;
- The surface water management proposals are to be designed to allow for a 40% increase in rainfall intensity in the 1 in 100-year rainfall event in the next 100 years.
- All surface water drainage will need to adhere to the requirements of SAB (SuDS Approval Body). In this case Merthyr Tydfil County Borough Council (MTCBC).

3.1.2 In accordance with the Defra/EA guidance document 'Preliminary rainfall runoff management for developments' (Kellagher, 2012) and the SuDS Wales Design Guidance, the following approaches were considered (in order of preference):

1. Infiltration to ground via an adequate soakaway or soil infiltration.

3.1.3 Deep borehole site investigation has been undertaken by Integral Geotechnique. Good to excellent falling head measurements were recorded. The conclusion is that infiltration drainage is feasible.



3.2 Surface Water Management Strategy

- 3.2.1 Intrusive ground investigation has been undertaken at the site and confirms that infiltration drainage is feasible via deep boreholes located across the site.
- 3.2.2 Surface water from private and adoptable areas will discharge to borehole soakaways across the site.
- 3.2.3 The surface water runoff generated during the extreme rainfall events for up to and including the 1 in 100-year event, will be directed away from properties and other vulnerable areas of the development, and conveyed in to the attenuation. The attenuation will be designed for up to and including the 1 in 100-year storm event with 40% increase in rainfall intensity to allow for climate change.
- 3.2.4 Due to SAB the scheme will be required to manage surface water differently from more traditional developments (i.e. pipes and culverts). In order to adhere to current regulation all surface water is to be managed at source and at the surface as is reasonable. This will include the use of rain gardens, swales, porous paving, and ponds. By utilising these techniques water quality will be very high prior to any final discharge to ground.
- 3.2.5 This scheme will be progressed through the planning and detailed design stages in parallel to a pre-SAB and full SAB application process with MTCBC.
- 3.2.6 Surface water drainage strategy is included in the Engineering Layout in Appendix A.

3.3 Existing Foul Drainage

- 3.3.1 The site benefits from existing foul drainage to the south and east of the site.
- 3.3.2 DCWW mapping is included in Appendix D.

3.4 Proposed Foul Drainage

- 3.4.1 Based on site topography a gravity connection is achievable.
- 3.4.2 There is an existing foul sewer within Crabtree Walk and at the junction of Hawthorn Hill that the site will connect to via a Section 106 Notice with Welsh Water.
- 3.4.3 Should a connection here be unachievable due to access / invert levels there is a further foul sewer within The Birchway further south. All within the public highway.
- 3.4.4 Foul drainage will be to Sewers for Adoption 7th Edition and offered for adoption to Welsh Water via a Section 104 Agreement.



4. CONCLUSIONS

4.1 Summary

- 4.1.1 The proposed development site is assessed to be of low risk of flooding from all sources of flooding, including rivers, groundwater, surface water, reservoirs, sewers and overland flows.
- 4.1.2 The new development is located in the low risk Flood Zone A and is therefore justified.
- 4.1.3 Intrusive testing confirms that discharging surface water to ground by infiltration is feasible.
- 4.1.4 The surface water runoff generated during the extreme rainfall events for up to and including the 1 in 100-year event, will be directed away from properties and other vulnerable areas of the development, and conveyed into the attenuation structure. The attenuation storage structure will be designed for up to and including the 1 in 100-year storm event with 40% increase in rainfall intensity to allow for climate change.
- 4.1.5 Surface water management and design will be to the requirements of SAB.
- 4.1.6 Foul water will discharge from site via gravity to the local adopted system.

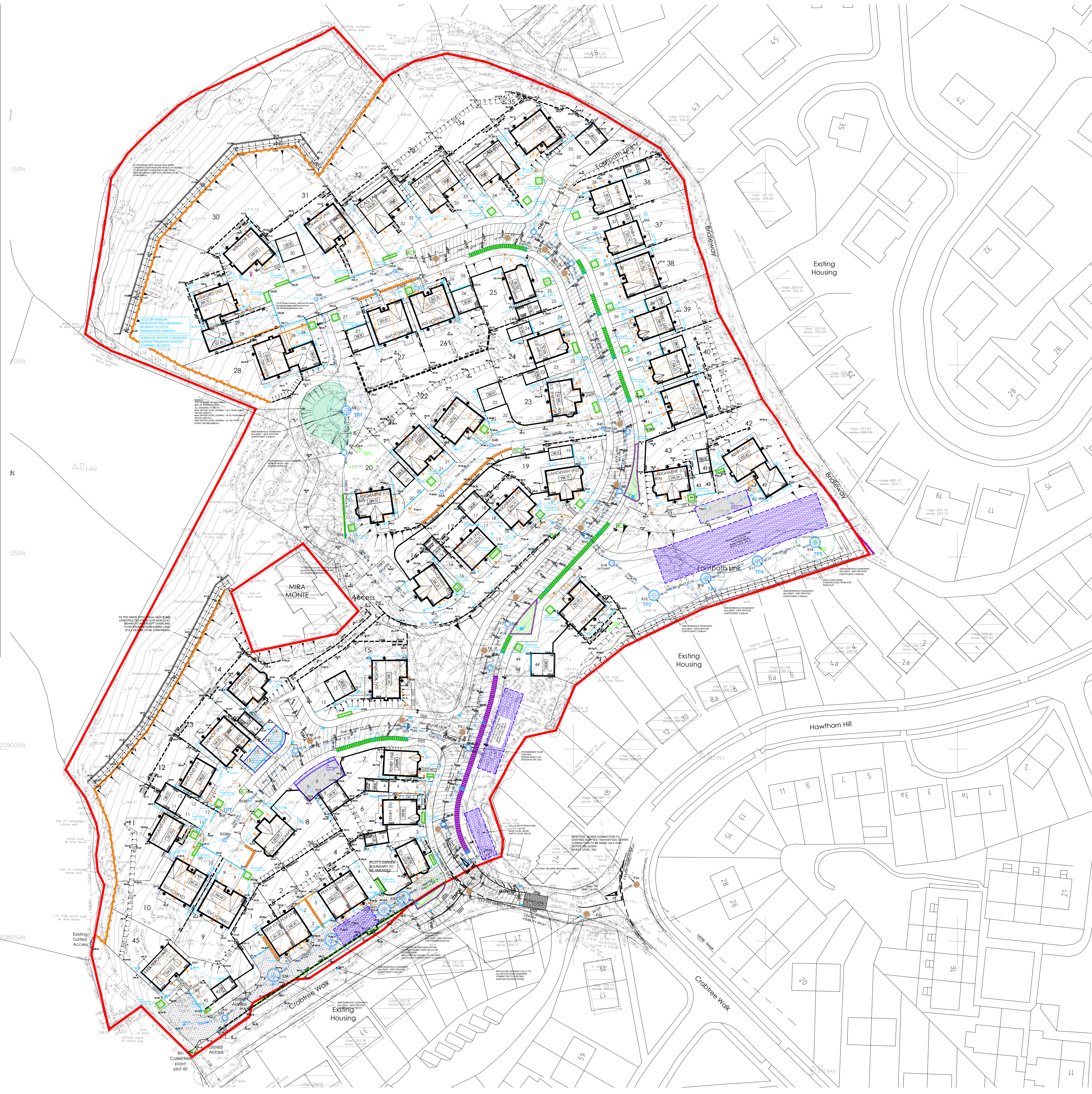
4.2 Conclusion

- 4.2.1 It is evident from the report that the development is not at risk of flooding and a surface and foul water drainage solution is available for the site.



APPENDIX A – ENGINEERING LAYOUT





E	09/12/20	Layout updated to SAB requirements - Highway put into crossfall, keratinisation linear features added and drainage updated to suit	MP	SD
D	27/07/20	New layout added, plots 25 & 42 amended	KF	TL
C	12/05/20	Surface water drainage amended	TOR	SD
B	30/04/20	Access drive adjacent to plot 45 removed	SD	TL
A	17/01/20	Pre-SAB application submission	PSD	SD
-	02/01/20	First issue	PBO	SD
REV.	DATE	DETAILS	BY	CHK
AMENDMENTS				
CLIENT:				
 WDL Homes Making a house into your new home				
 CONSULTING ENGINEERS PHG CONSULTING LTD 62A ALBANY ROAD CARDIFF CF24 3RR T : +44(0)29 2030 2621 E : enquiries@phg-consulting.com W : www.phg-consulting.co.uk  @PHG_consulting  www.linkedin.com/company/phg-consulting-engineers				
PROJECT:				
WDL Homes Trefechan				
DRAWING TITLE:				
Engineering Layout				
DRAWN:		STATUS:		SCALE:
TL	SDJ	Planning		1:500@A1
DATE:	JOB NO.	DWG. NO.	REV.	
Sept'19	1914	001-1	E	



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APPENDIX B –NRW FLOOD MAP



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APPENDIX C – SITE INVESTIGATION AND SOAKAWAY TEST RESULTS



CONSULTING
ENGINEERS

12411/PD

30 April 2019

WDL
Stuart Quarry
Chapel Road
Aberdare CF44 9JY

For the attention of Mr John Butcher

Dear Sirs,

Borehole Soakaway Testing, Crabtree Walk, Trefechan

Further to your recent instruction, we have now completed the falling head permeability testing at the above site, and enclose for your attention a copy of the results. We can report the following findings.

The site was previously investigated by Ove Arup & Partners and their findings given within their Desk Study and Trial Pitting Report No. 123628 dated 27th November 2007.

Site Works

We attended the site between the 8th and 12th April 2019 in order to carry out falling head permeability testing. A total of six rotary boreholes were drilled across the site. The locations of the boreholes are shown on Figure 1.

The rotary boreholes were drilled to a maximum depth of 32m below existing ground level (bgl). Each borehole was cased, to rock head, to a depth of between 2.7m or 9.0m. For each permeability test, the borehole was filled with water using a pumped 50mm supply from a 250gallon water bowser, and the falling water levels recorded.

Ground Conditions

The identified ground conditions comprised typically of grass/topsoil over clay. Limestone was encountered from typically 2.4 to 6.0m.

No groundwater was encountered within any of the boreholes drilled.

Copies of the borehole logs are included in Appendix A and their locations are shown in Figure 1.

Falling Head Permeability Results

The falling head tests were variable and copies of the soakaway test results are included within Appendix B. Each borehole result is summarised below.

BH1

No groundwater was encountered within borehole BH1 which was drilled to an approximate depth of 32.0m bgl. During the soakaway test a head of water could not be raised above 1.0m bgl. The water level then fell to approximately 9.60m after 5 mins and subsequently fell to 15.39m in 30minutes.

An infiltration rate of 6.1×10^{-5} m/s has been calculated BH1.

BH2

Groundwater was not encountered within borehole BH2 which was drilled to an approximate depth of 24.0m bgl. During the soakaway test a head of water was raised to the surface. The water level then fell to 6.12m bgl after 10mins and subsequently fell to 8.72m after 35minutes. The approximate rate of pumping water into the borehole was 40 litres per minute.

An infiltration rate of 5.0×10^{-5} m/s has been calculated for BH2.

BH3

Groundwater was not encountered within borehole BH3 which was drilled to an approximate depth of 15.5m bgl. During the soakaway test the water level could not be raised above 10.8m bgl and subsequently fell to 15.50m after 5mins. The approximate rate of pumping water into the borehole was 40 litres per minute.

An infiltration rate of 2.09×10^{-3} m/s has been calculated for the infiltration at depths between 10.8 and 15.5m.

BH3A

Groundwater was not encountered within borehole BH3 which was drilled to an approximate depth of 24.0m bgl. During the soakaway test the water level could not be raised above 12.63m bgl and subsequently fell to 14.7m after 10mins. The approximate rate of pumping water into the borehole was 40 litres per minute.

An infiltration rate of 7.04×10^{-5} m/s has been calculated for the infiltration at depths between 12.63 and 16.6m.

BH4

No groundwater was encountered within borehole BH4 which was drilled to an approximate depth of 24.0m bgl. During the soakaway test a head of water was raised to the surface. The water level then fell to approximately 6.20m after 1mins and subsequently fell to 13.07m after 35minutes.

An infiltration rate of 1.02×10^{-4} m/s has been calculated BH4. The approximate rate of pumping water into the borehole was 40 litres per minute.

BH5

Groundwater was not encountered within borehole BH5 which was drilled to an approximate depth of 24.0m bgl. During the soakaway test the water level could not be raised above 15.11m bgl and subsequently fell to 15.44m after 20mins. The approximate rate of pumping water into the borehole was 40 litres per minute.

The infiltration rate below 15.11m was negligible in BH5.

Conclusion

The ground conditions encountered on site typically consists of boulder clay grading into Limestone at typical depth of 2.4/6.0m. No groundwater was encountered within any of the boreholes.

The results of the borehole soakaways indicate that there is an area of potential fractured permeability within the Limestone strata typically between 10.8 and 15.11m bgl at boreholes BH3, BH3A and BH5. Each of these boreholes discharged water at a rate of 40 litres per minute. The soakaway results indicated that the Limestone fracturing is variable across the site is variable.

Based on the boreholes soakaways results, soakaways may be feasible within the fractured layers of the Limestone. The soakaways should be designed based on a worst case scenario. It is recommended that additional soakaway tests are undertaken following installation. During these installation works, consideration can be given to using a 75mm diameter pump with a discharge rate of 600 litres per minute.

The soil infiltration test results should be provided to a suitably qualified drainage engineer so that a soakaway design specific to the development can be completed and provided.

The detailed design of the borehole will need to robustly seal off the infiltration zone within the bedrock from the overlying boulder clay deposits. This is in order to avoid washout and collapse of the overlying clay deposits. All borehole soakaway chamber design details must include robust silt trap details. Moreover, a maintenance regime should be established for removal of silt from the silt traps. Once the borehole soakaways have been constructed it is essential that they are protected from uncontrolled flows of silt/clay or fine sand laden waters during the construction phase.

All sewers at the site must be adequately sealed and pressure tested to ensure that no leakage to pipe bedding occurs. This is of importance as the soils at the development may be susceptible to washout of fine materials leading to collapses within the deposits.

It is important that the design detail for the infiltration (soakaway) zone within the borehole is constructed to effectively prevent the ingress of fines from the surrounding bedrock. Typically, the borehole is constructed using a slotted/perforated well screen which allows the free flow of sediment free water. Normally it is advisable to flush the borehole of fines prior to installing the well screen.

We trust that the above is to your satisfaction. However, should you have any queries or require further information, please do not hesitate to contact us.

Yours faithfully,



D P Davies
For
Intégral Géotechnique (Wales) Limited

Enc

Appendix A

Borehole Logs

Intégral Géotechnique Intégral House, 7 Beudau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan			Project No.: 12411		Borehole No.: BH1 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes			Coordinates:		Hole Type: RO	
Equipment: Rotary Drilling Rig		Diameter of Casing:			Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:			Dates 08/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring					Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD	FI						
											Boulder Clay	1
							2.40				Limestone	2
												3
												4
												5
												6
												7
												8
												9
												10
												11
												12
							13.40					13
							14.00				Sandy bands	14
											Limestone	15
												16
												17
												18
												19
												20
												21
												22
												23
												24
												25
												26
												27
												28
												29
												30
												31
							32.00				End of Borehole at 32.00 m	32
												33
												34
												35
												36
												37
												38
												39
												40

Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out in borehole		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 Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan			Project No.: 12411		Borehole No.: BH2 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes			Coordinates:		Hole Type: RO	
Equipment: Rotary Drilling Rig		Diameter of Casing:			Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:			Dates 10/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD						
										Boulder Clay	1
						2.70					2
										Sandy clayey gravel with limestone boulders	3
											4
						6.00					5
										Limestone	6
						7.20					7
										Clay and Limestone	8
											9
						9.50					10
										Clay	11
						11.20					12
										Limestone	13
											14
											15
											16
											17
											18
											19
											20
											21
											22
											23
						24.00					24
										End of Borehole at 24.00 m	25
											26
											27
											28
											29
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											31
											32
											33
											34
											35
											36
											37
											38
											39
											40

Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out.		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 Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan		Project No.: 12411		Borehole No.: BH3 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes		Coordinates:		Hole Type: RO	
Equipment: Rotary Drilling Rig		Diameter of Casing:		Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:		Dates 09/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD						
										Clay	1
						3.20					2
										Weathered Limestone	3
											4
						6.40					5
										Limestone with clay bands	6
											7
											8
											9
											10
											11
											12
						13.40					13
						14.20				Sand	14
										Limestone	15
						15.50				End of Borehole at 15.50 m	16
											17
											18
											19
											20
											21
											22
											23
											24
											25
											26
											27
											28
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											40

Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out.		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 Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan		Project No.: 12411		Borehole No.: BH3A Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes		Coordinates:		Hole Type: RO	
Equipment: Rotary drilling rig		Diameter of Casing:		Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:		Dates 09/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD						
										Clay	1
						4.00					2
											3
										Boulder Clay	4
						6.00					5
										Limestone	6
											7
											8
											9
											10
						14.30					11
											12
											13
											14
						16.20				Sand Gravel and Clay	15
											16
										Limestone	17
						18.00					18
						18.60				Clay	19
										Limestone	20
											21
											22
											23
						24.00					24
										End of Borehole at 24.00 m	25
											26
											27
											28
											29
											30
											31
											32
											33
											34
											35
											36
											37
											38
											39
											40

Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out.		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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 Integral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan		Project No.: 12411		Borehole No.: BH4 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes		Coordinates:		Hole Type: RO	
Equipment: Rotary Drilling Rig		Diameter of Casing:		Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:		Dates 10/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD						
						1.20			 Fill		1
									 Clay		2
						3.40			 Limestone		3
											4
											5
											6
											7
											8
											9
											10
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						24.00				End of Borehole at 24.00 m	24
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Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out.		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 Géotechnique Intégral House, 7 Beddau Way Castlegate Business Park Caerphilly CF83 2AX Tel. 029 20807991 Fax. 029 20862176 mail@integralgeotec.com		Project Name: Crabtree Walk, Tefachan		Project No.: 12411		Borehole No.: BH5 Sheet 1 of 1	
Location: Merthyr Tydfil		Client: WDL Homes		Coordinates:		Hole Type: RO	
Equipment: Rotary Drilling Rig		Diameter of Casing:		Level:		Scale 1:200	
Diameter of Boring:		Depth of Casing:		Dates 11/04/2019 -		Logged By: Apex	

Well	Water Strikes	Rotary Coring				Depth (m)	Level (m AOD)	N Value	Legend	Stratum Description	
		Depth (m)	TCR	SCR	RQD						
						0.60				Fill	1
										Clay and Gravel	2
						2.30				Limestone	3
											4
											5
											6
											7
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											9
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						24.00				End of Borehole at 24.00 m	24
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Remarks: 1. Air flushing medium used. 2. Borehole dry. 3. Soakaway test carried out.		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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Appendix B

Falling Head Test Results

PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan	JOB No.	12411
TYPE	FALLING		
DATE		TIME	hrs
BOREHOLE NUMBER	BH1	TEST No.	1
Depth of borehole at start of test (mBGL) h_i	32.00 m		From top of casing
Depth of borehole at end of test (mBGL) h_e	32.00 m		From top of casing
Borehole diameter (m) D	0.110 m		OK
Piezometer diameter (m) d	m		
Filter Backfill	No		Pea gravel
Soil in casing (m) L	0.00 m		
L/D Ratio	263.6		
Hole in Soil below base of casing (m) L	29.00 m		
Depth of casing (mBGL) h_c	3.00 m		From top of casing
Height of casing above ground level h_{ac}	0.10 m		
Ground water level (mBGL) H_0	32.00 m		
Water level at start of test below top of casing h_0	1.00 m		
	$H_{0\text{ TEST}}$	32.10 m	

Elapsed Time		Depth of water below top of casing	Head of Water	Ratio
t (mins)	t (s)	h (m)	H = (H ₀ - h) (m)	H/H ₀
0	0	1.00	31.1	1.00
1	60	3.63	28.5	0.92
2	120	4.89	27.2	0.87
5	300	9.60	22.5	0.72
10	600	12.33	19.8	0.64
15	900	13.71	18.4	0.59
20	1200	14.36	17.7	0.57
25	1500	14.93	17.2	0.55
30	1800	15.39	16.7	0.54

TEST SECTION	
Length	L = 31.00 m
Area	A = 10.7223 m ²

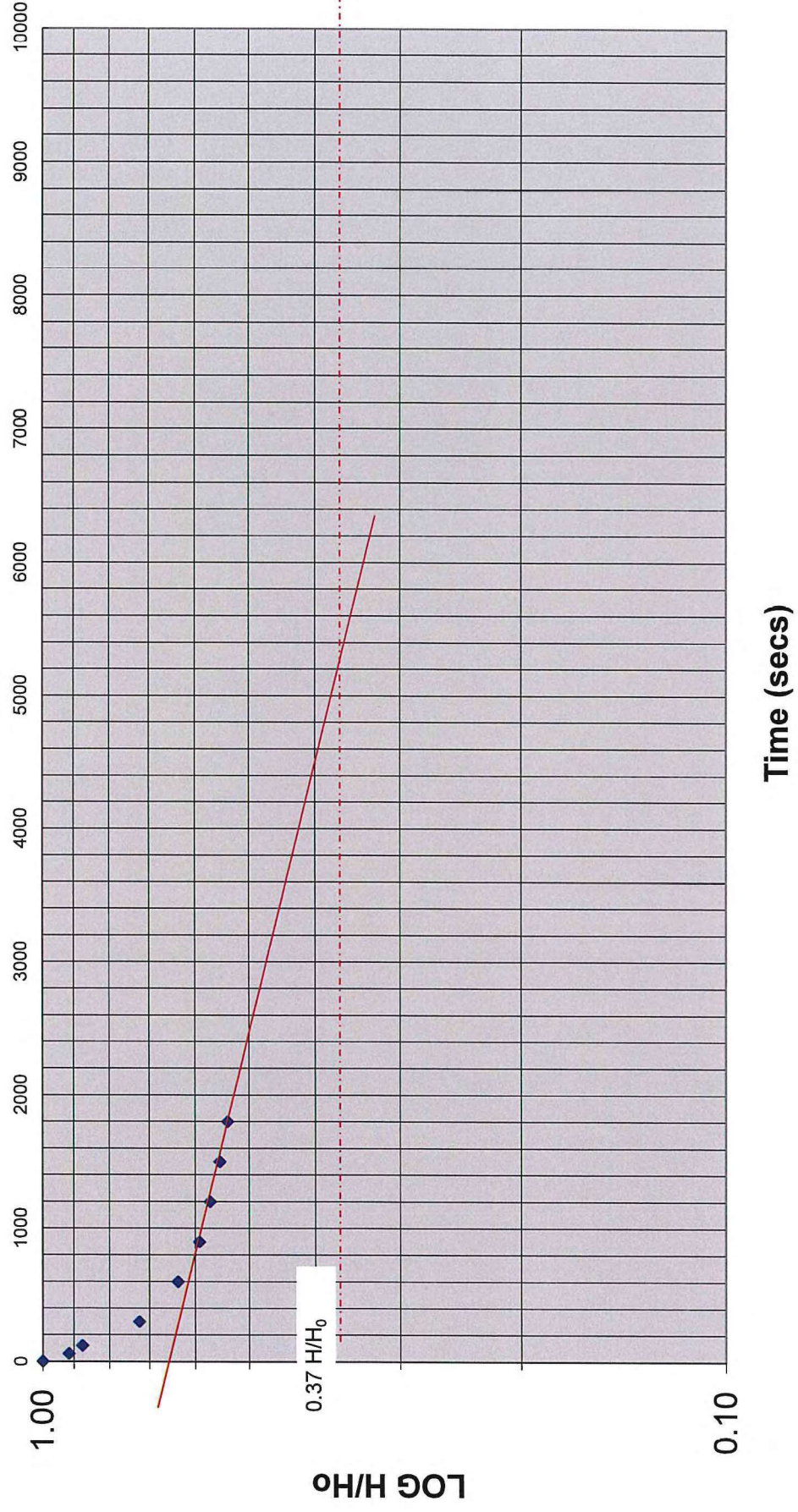
INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D^2 \cdot 32 \cdot T^2 / (L \cdot D)$
F =	33.34

TIME LAG	T = Time from start of test when $h = 0.37 h_0$
	See graph opposite
T =	5200 s

PERMEABILITY	
K = A / (F * T)	
K =	6.18E-05 m/s

COMMENTS	Water level rising during test period No Infiltration Observed, unable to calculate permeability
----------	---

Borehole BH1



PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan		JOB No.	12411
TYPE	FALLING			
DATE		TIME		
BOREHOLE NUMBER	BH2	TEST No.	1	
Depth of borehole at start of test (mBGL) h_i	24.00 m		From top of casing	
Depth of borehole at end of test (mBGL) h_e	24.00 m		From top of casing	
Borehole diameter (m) D	0.110 m		OK	
Piezometer diameter (m) d				
Filter Backfill	No		Pea gravel	
Soil in casing (m) L			m	
L/D Ratio	163.6			
Hole in Soil below base of casing (m) L	18.00 m			
Depth of casing (mBGL) h_c	6.00 m		From top of casing	
Height of casing above ground level h_{ac}	0.10 m			
Ground water level (mBGL) H_0	24.00 m			
Water level at start of test below top of casing h_0	0.00 m			
	H_0 TEST	24.10 m		

Elapsed Time t (mins)	t (s)	Depth of water below top of casing h (m)	Head of Water H = ($H_0 - h$) (m)	Ratio H/ H_0
0	0	0.00	24.1	1.00
1	60	2.42	21.7	0.90
2	120	4.29	19.8	0.82
5	300	5.19	18.9	0.78
10	600	6.12	18.0	0.75
15	900	7.05	17.1	0.71
20	1200	7.45	16.7	0.69
25	1500	8.15	16.0	0.66
30	1800	8.64	15.5	0.64
35	2100	8.72	15.4	0.64

TEST SECTION	
Length	L = 24.00 m
Area	A = 8.3033 m ²

INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D^2 \cdot 2.32 \cdot T^* (L/D)$
F =	22.38

TIME LAG	T = Time from start of test when $h = 0.37 h_0$
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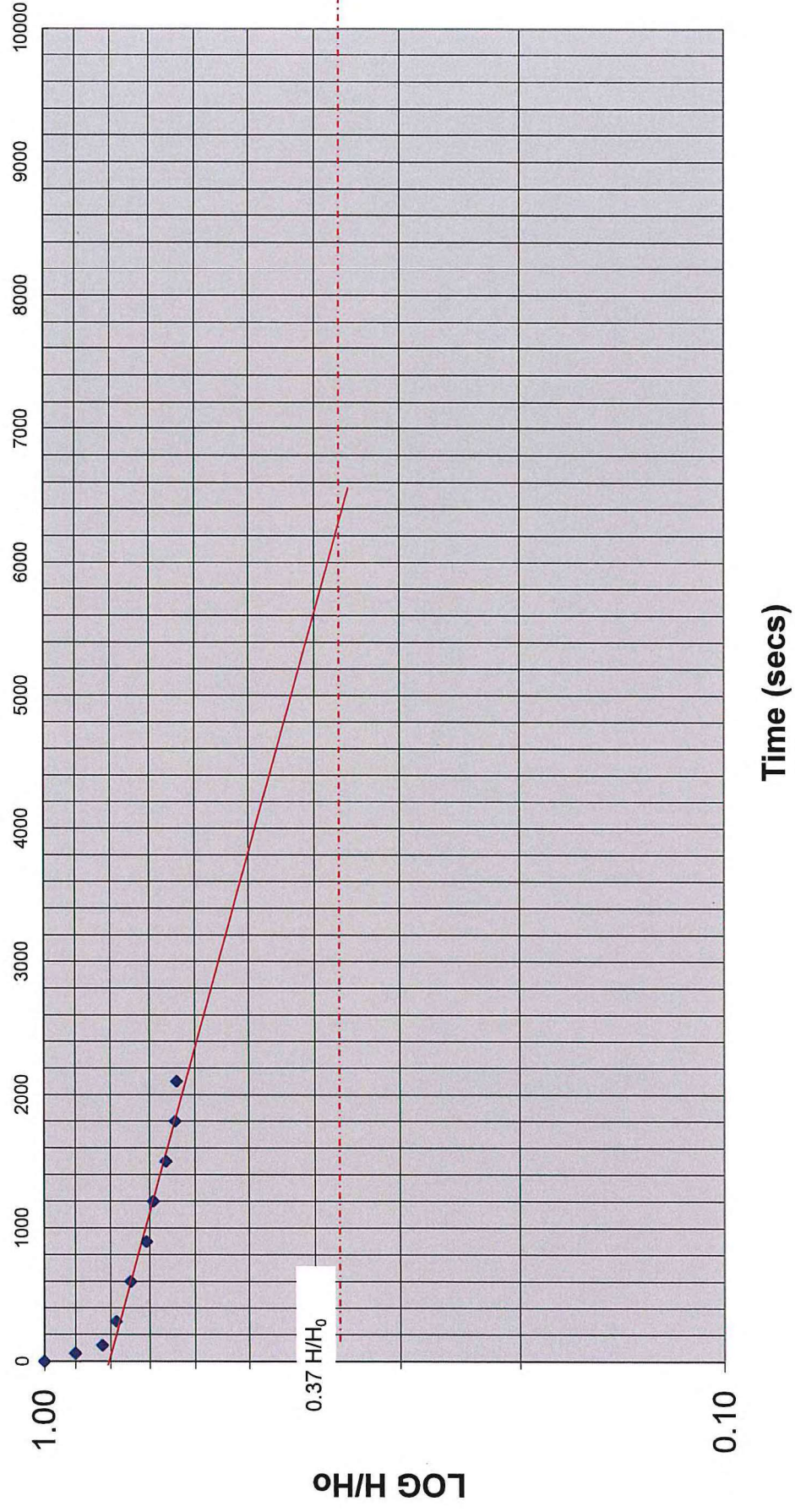
See graph opposite

T =	6400 s
-----	--------

PERMEABILITY	$K = A / (F \cdot T)$
K =	5.80E-05 m/s

COMMENTS

Borehole BH2



PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan	JOB No.	12411
TYPE	FALLING		
DATE		TIME	hrs
BOREHOLE NUMBER	BH3	TEST No.	1
Depth of borehole at start of test (mBGL) h_i	15.50 m		From top of casing
Depth of borehole at end of test (mBGL) h_e	15.50 m		From top of casing
Borehole diameter (m) D	0.110 m		OK
Piezometer diameter (m) d	m		
Filter Backfill	No		Pea gravel
Soil in casing (m) L	m		
L/D Ratio	59.1		
Hole in Soil below base of casing (m) L	6.50 m		
Depth of casing (mBGL) h_c	9.00 m		From top of casing
Height of casing above ground level h_{uc}	0.10 m		
Ground water level (mBGL) H_0	15.50 m		
Water level at start of test below top of casing h_0	10.80 m		
	H_0 TEST	15.60 m	

Elapsed Time		Depth of water below top of casing h (m)	Head of Water $H = (H_0 - h)$ (m)	Ratio H/H_0
t (mins)	t (s)			
0	0	10.80	4.8	1.00
1	60	12.60	3.0	0.63
2	120	14.70	0.9	0.19
5	300	15.50	0.1	0.02

TEST SECTION	
Length	L = 4.70 m
Area	A = 1.6337 m ²

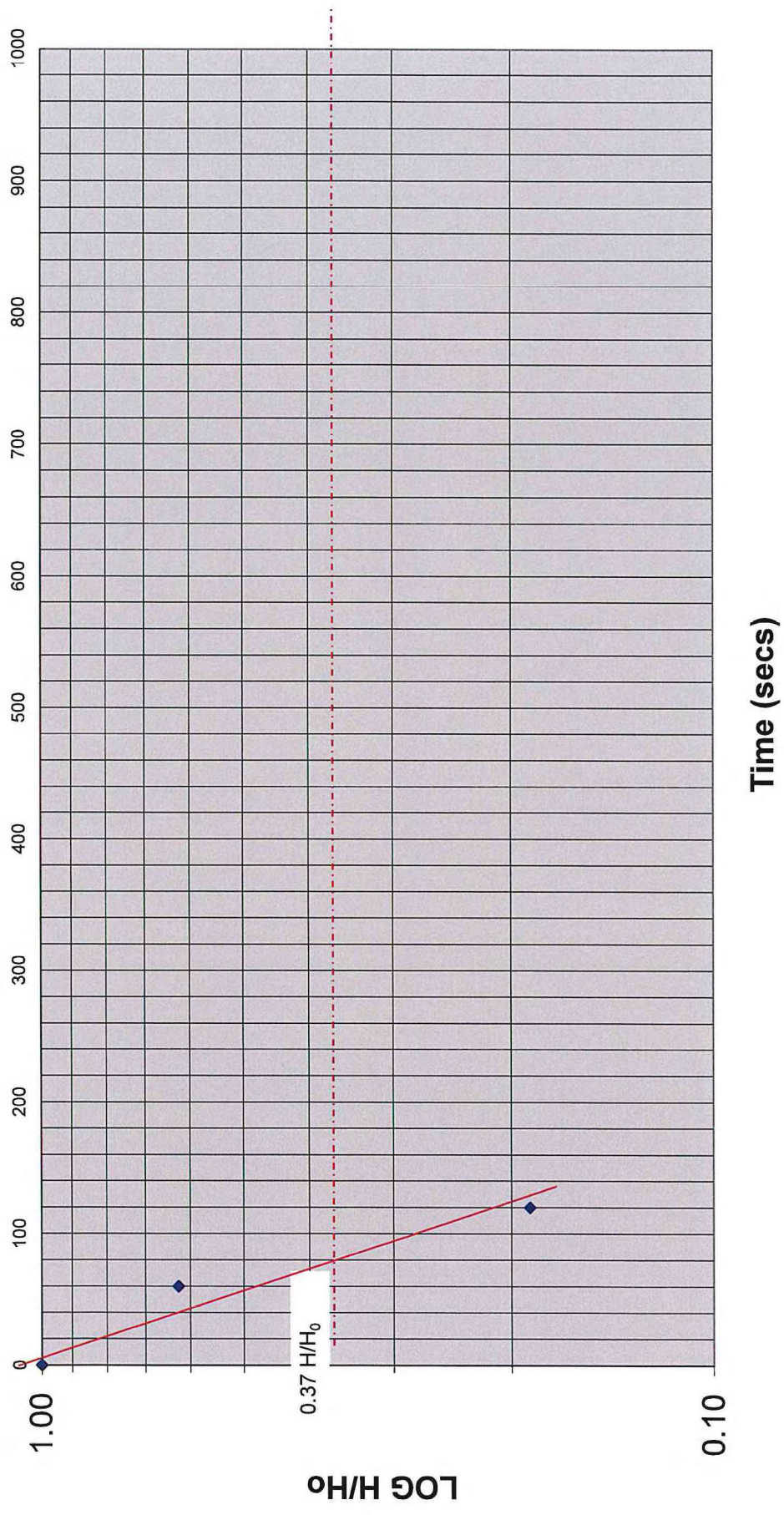
INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D^2 \cdot 32 \cdot T^2 \cdot (L/D)$
F =	9.78

TIME LAG	T = Time from start of test when $h = 0.37 h_0$
	See graph opposite
T =	80 s

PERMEABILITY	$K = A / (F \cdot T)$
K =	2.09E-03 m/s

COMMENTS

Borehole BH3



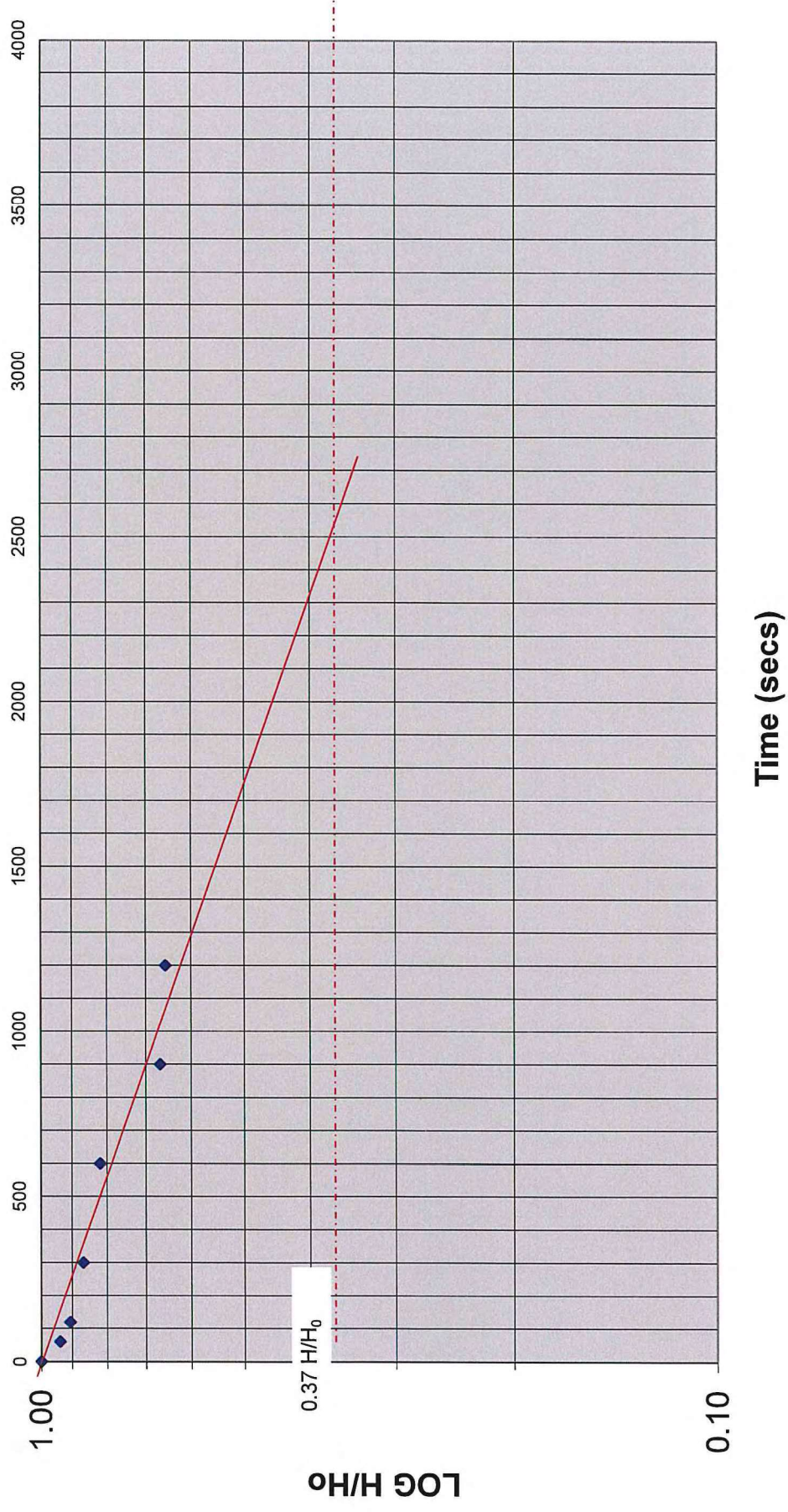
PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan		JOB No.	12411
TYPE	FALLING			
DATE		TIME	hrs	
BOREHOLE NUMBER	BH3A	TEST No.	1	
Depth of borehole at start of test (mBGL) h_1	24.00 m		From top of casing	
Depth of borehole at end of test (mBGL) h_2	24.00 m		From top of casing	
Borehole diameter (m) D	0.110 m		OK	
Piezometer diameter (m) d	m			
Filter Backfill	No		Pea gravel	
Soil in casing (m) L	m			
L/D Ratio	163.6			
Hole in Soil below base of casing (m) L	18.00 m			
Depth of casing (mBGL) h_c	6.00 m		From top of casing	
Height of casing above ground level h_{ac}	0.10 m			
Ground water level (mBGL) H_0	24.00 m			
Water level at start of test below top of casing h_o	12.63 m			
	H_0 TEST	24.10 m		

Elapsed Time	Depth of water below top of casing	Head of Water	Ratio
t (mins)	t (s)	h (m)	H = ($H_0 - h$) (m)
0	0	12.63	11.5
1	60	13.35	10.8
2	120	13.72	10.4
5	300	14.17	9.9
10	600	14.72	9.4
15	900	16.46	7.6
20	1200	16.60	7.5

TEST SECTION	
Length	L = 11.37 m
Area	A = 3.9387 m ²
INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D^2 \cdot 2.32 \cdot T^2 \cdot (L/D)$
F =	22.38
TIME LAG	T = Time from start of test when $h = 0.37 h_o$
	See graph opposite
T =	2500 s
PERMEABILITY	
K = A / (F * T)	
K =	7.04E-05 m/s
COMMENTS	

Borehole BH3A



PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan	JOB No.	12411
TYPE	FALLING		
DATE		TIME	hrs
BOREHOLE NUMBER	BH4	TEST No.	1
Depth of borehole at start of test (mBGL) h_i	24.00 m		From top of casing
Depth of borehole at end of test (mBGL) h_e	24.00 m		From top of casing
Borehole diameter (m) D	0.110 m		OK
Piezometer diameter (m) d	m		
Filter Backfill	No		Pea gravel
Soil in casing (m) L	m		
L/D Ratio	177.3		
Hole in Soil below base of casing (m) L	19.50 m		
Depth of casing (mBGL) h_c	4.50 m		From top of casing
Height of casing above ground level h_{ac}	0.10 m		
Ground water level (mBGL) H_0	24.00 m		
Water level at start of test below top of casing h_o	0.00 m		
	H_0 TEST	24.10 m	

Elapsed Time		Depth of water below top of casing	Head of Water	Ratio
t (mins)	t (s)	h (m)	H = (H_0 - h) (m)	H/ H_0
0	0	0.00	24.1	1.00
1	60	6.20	17.9	0.74
2	120	6.63	17.5	0.72
5	300	6.82	17.3	0.72
10	600	8.60	15.5	0.64
15	900	10.68	13.4	0.56
20	1200	11.57	12.5	0.52
25	1500	12.02	12.1	0.50
30	1800	12.57	11.5	0.48
35	2100	13.07	11.0	0.46

TEST SECTION	
Length	L = 24.00 m
Area	A = 8.3033 m ²

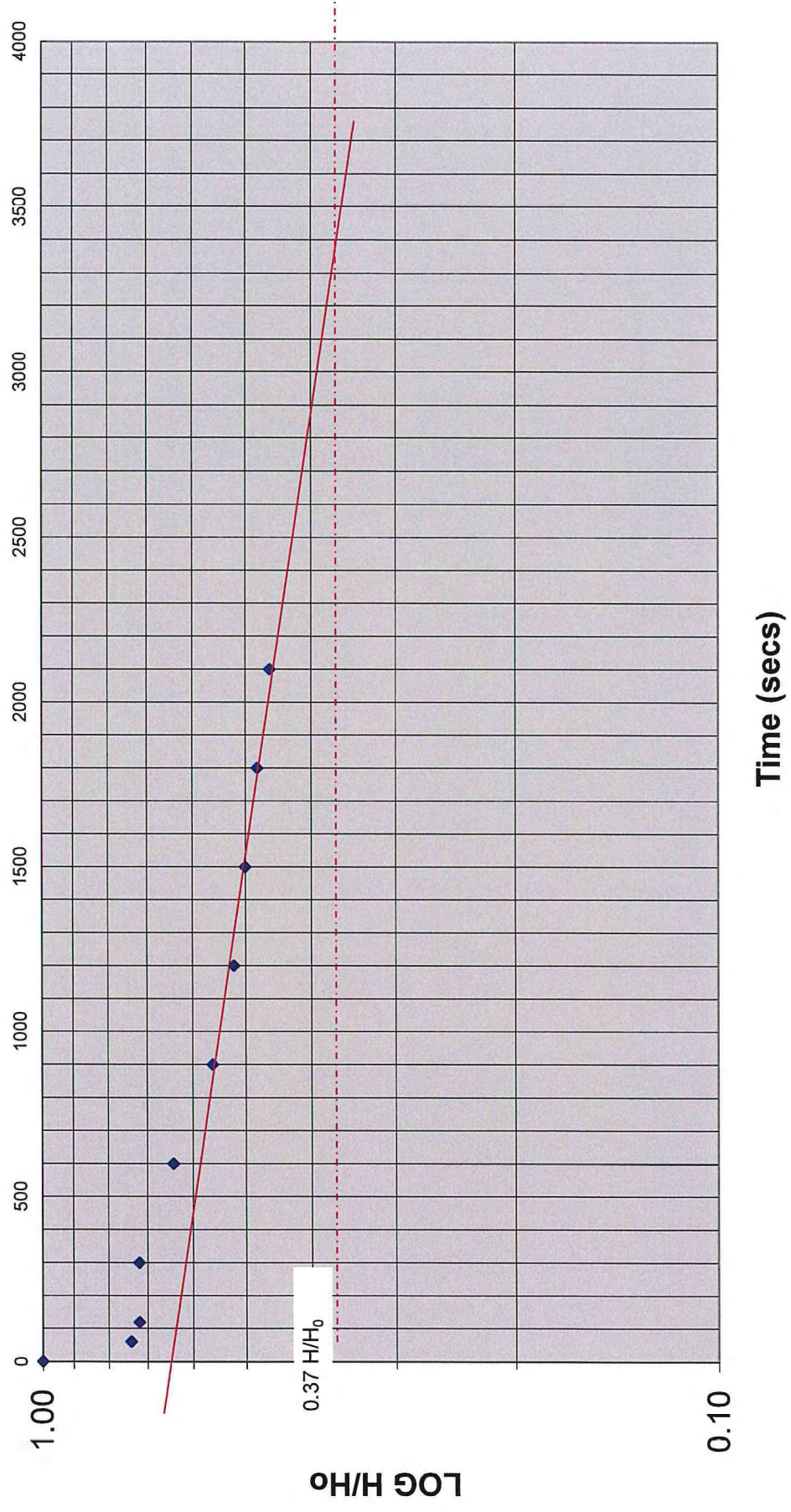
INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D \cdot 2.32 \cdot T^* (L/D)$
F =	23.92

TIME LAG	T = Time from start of test when $h = 0.37 h_o$
	See graph opposite
T =	3400 s

PERMEABILITY	$K = A / (F \cdot T)$
K =	1.02E-04 m/s

COMMENTS

Borehole BH4



PERMEABILITY TEST DATA

PROJECT	Crabtree Walk, Trefechan	JOB No.	12411
TYPE	FALLING		
DATE		TIME	hrs
BOREHOLE NUMBER	BH5	TEST No.	1
Depth of borehole at start of test (mBGL) h_i	24.00 m		From top of casing
Depth of borehole at end of test (mBGL) h_e	24.00 m		From top of casing
Borehole diameter (m) D	0.110 m		OK
Piezometer diameter (m) d	m		
Filter Backfill	No		Pea gravel
Soil in casing (m) L	m		
L/D Ratio	193.6		
Hole in Soil below base of casing (m) L	21.30 m		
Depth of casing (mBGL) h_c	2.70 m		From top of casing
Height of casing above ground level h_{ac}	0.10 m		
Ground water level (mBGL) H_0	24.00 m		
Water level at start of test below top of casing h_o	15.11 m		
	H_0 TEST	24.10 m	

Elapsed Time		Depth of water below top of casing	Head of Water	Ratio
t (mins)	t (s)	h (m)	H = (H_0 - h) (m)	H/H ₀
0	0	15.11	9.0	1.00
0.1	6	15.13	9.0	1.00
0.2	12	15.18	8.9	0.99
0.3	18	15.21	8.9	0.99
0.4	24	15.24	8.9	0.99
0.5	30	15.26	8.8	0.98
1	60	15.28	8.8	0.98
2	120	15.29	8.8	0.98
5	300	15.31	8.8	0.98
10	600	15.39	8.7	0.97
20	1200	15.44	8.7	0.96

TEST SECTION	
Length	L = 8.89 m
Area	A = 3.0817 m ²

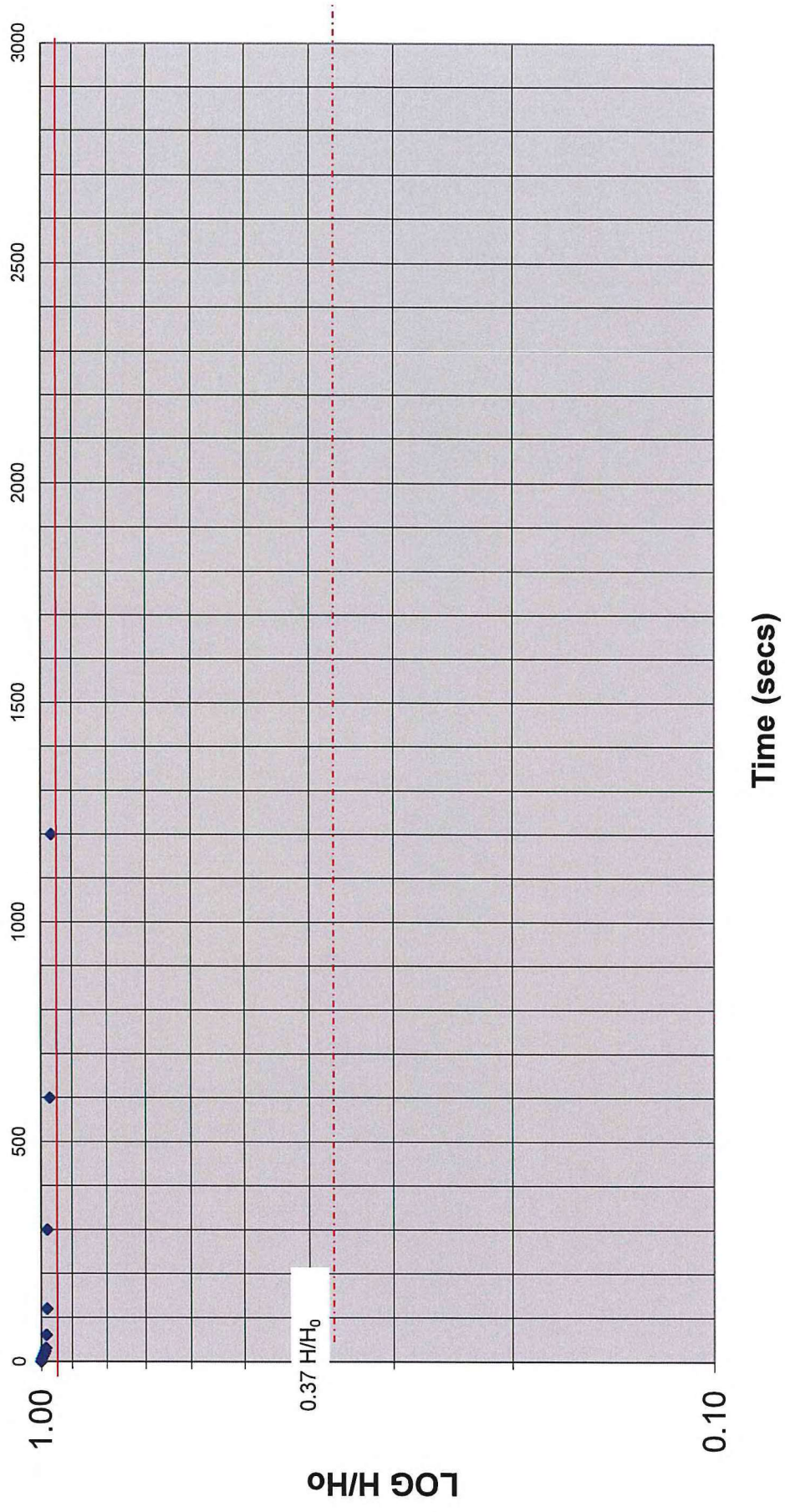
INTAKE FACTOR	Refer to BS 5930 Figure 7
Type	Special
F =	$D^2 \cdot 32 \cdot \pi^2 / (L \cdot D)$
F =	25.74

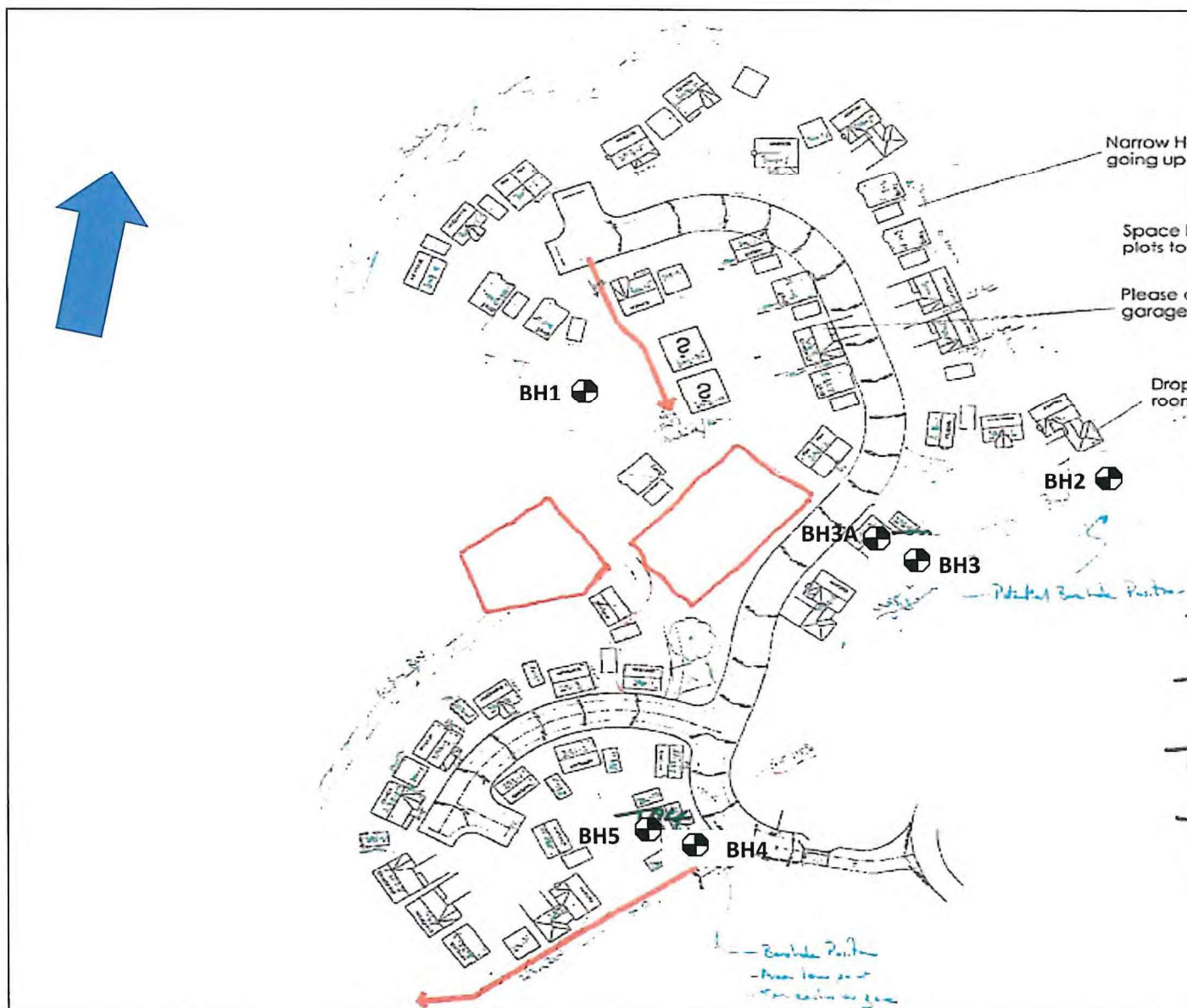
TIME LAG	T = Time from start of test when h = 0.37 h_o
	See graph opposite
T =	N/A s

PERMEABILITY	K = A / (F * T)
K =	#VALUE! m/s

COMMENTS	Negligible infiltration recorded
----------	----------------------------------

Borehole BH5





Legend

BH1  Approximate Borehole Location

Crown Copyright Reserved

FIGURE 1 - SITE LAYOUT

CRABTREE WALK TREFECHAN

Intégral
Géotechnique

Integral House
7 Beddau Way
Castlegate Business Park
Caerphilly
CF83 2AX
Tel: 029 2080 7991
Fax: 029 2086 2176



WDL Homes

Making a house into your new home

WDL Homes
Crabtree Walk, Trefechan
Flood Consequences Assessment and Drainage Strategy Report

APPENDIX D – WELSH WATER SEWER RECORDS



CONSULTING
ENGINEERS

Mr Stephen Davis
PHG Consulting Engineers
62 Albany Road
Cardiff
CF24 3RR

Date: 26/03/2019
Our Ref: PPA0003914

Dear Mr Davis

Grid Ref: 303447 209075

Site Address: Off Crabtree Walk, Trefechan, Merthyr Tydfil, CF48 2ES

Development: Residential comprising 50 dwellings

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

Firstly, we note that the proposal relates to 50 residential dwellings on Land at Crabtree Walk and acknowledge that the site comprises of a potential windfall development with no allocated status in the Local Development Plan (LDP). Accordingly, whilst it does not appear an assessment has been previously undertaken of the public sewerage system, we offer the following comments as part of our appraisal of this development.

SEWERAGE

The foul only flows from the proposed development can be accommodated within the public sewerage system. We advise that the flows should be communicated with/to the 150mm public foul sewer at manhole SO03094201 located to the North of the site in the highway of Sweetwater Park, and as indicated on the extract of public sewer record provided. Should a planning application be submitted for this development we will seek to control this point of communication via appropriate planning conditions and therefore recommend that any drainage layout or strategy submitted as part of your application takes this into account. However, should you wish for an alternative connection point to be considered please provide further information to us in the form of a drainage strategy, preferably in advance of a planning application being submitted.

You may need to apply to Dwr Cymru Welsh Water for any connection to the public sewer under Section 106 of the Water Industry Act 1991. However, if the connection to the public sewer network is either via a lateral drain (i.e. a drain which extends beyond the connecting property boundary) or via a new sewer (i.e. serves more than one property), it is now a mandatory requirement to first enter into a Section 104 Adoption Agreement (Water Industry Act 1991). The design of the sewers and lateral drains must also conform to the Welsh Ministers Standards for Foul Sewers and Lateral Drains, and conform with the publication "Sewers for Adoption" – 7th Edition. Further information can be obtained via the Developer Services pages of www.dwrcymru.com.

As of 7th January 2019, this proposed development is subject to Schedule 3 of the Flood and Water Management Act 2010. The development therefore requires approval of Sustainable Drainage Systems (SuDS) features, in accordance with the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems'. As highlighted in these standards, the developer is required to explore and fully exhaust all surface water drainage options in accordance with a hierarchy which states that discharge to a combined sewer shall only be made as a last resort. Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to watercourses in liaison with the Land Drainage Authority and/or Natural Resources Wales.

It is therefore recommended that the developer engage in consultation with Caerphilly County Borough Council, as the determining SuDS Approval Body (SAB), in relation to their proposals for SuDS features. Please note, DCWW is a statutory consultee to the SAB application process and will provide comments to any SuDS proposals by response to SAB consultation.

In addition, please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.

You are also advised that some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011. Please be mindful that under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times.

SEWERAGE TREATMENT

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.



Welsh Water is owned by Glas Cymru – a 'not-for-profit' company.
Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

WATER SUPPLY

The proposed development is in an area where there are water supply problems for which there are no improvements planned within our current Capital Investment Programme AMP6 (years 2015 to 2020). In order to establish what would be required to serve the site with an adequate water supply, it will be necessary for the developer to fund the undertaking of a hydraulic modelling assessment on the water supply network. For the developer to obtain a quotation for the hydraulic modelling assessment, we will require a fee of £250 + VAT.

I trust the above information is helpful and will assist you in forming water and drainage strategies that should accompany any future planning application. I also attach copies of our water and sewer extract plans for the area, and a copy of our Planning Guidance Note which provides further information on our approach to the planning process, making connections to our systems and ensuring any existing public assets or infrastructure located within new development sites are protected.

Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning officers, either on 0800 917 2652 or via email at developer.services@dwrcymru.com

Please quote our reference number in all communications and correspondence.

Yours faithfully,



Owain George
Planning Liaison Manager
Developer Services

Please Note that demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.



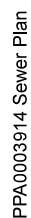
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Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

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Welsh and English

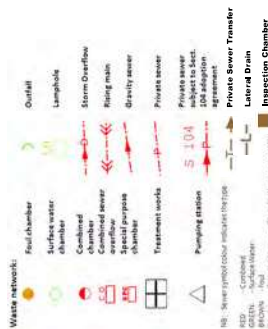
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Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.



LEGEND(Representative of most common features)



Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation.

[illegible]

**JECT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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Map scale: 1:2500
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