

Client:-

**Mr D MacTaggart
Hallrule Farm
Bonchester Bridge
Hawick
TD9 8JF**

Project:-

**BOREHOLE WELL
HALLRULE FARM
BONCHESTER BRIDGE**

**Borehole Well
Hallrule Farm
Bonchester Bridge**

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1:0 INTRODUCTION

Messrs Holequest Limited were commissioned by Mr MacTaggart, to sink a borehole at an agreed location, to locate a possible water supply, and, if successful, to undertake a pumping trial to determine the rate of discharge and nominal depth of draw down.

2:0 SITE WORKS & PUMPING TESTS

The borehole was sunk using a tracked Massenza MI5 top drive rotary drilling rig, at the location instructed by Mr MacTaggart. The borehole was drilled using the Mitsubishi drill system, which drills a 180mm hole with simultaneous permanent steel casing through overburden and upper rock formations. The hole was then advanced using standard DTH 140mm drilling methods to the full depth of the borehole.

The borehole was drilled to a total depth of 43.0m; the depth of overburden was c. 7.5m. Due to the unstable nature of the uppermost rock formations, permanent steel casing was installed to a depth of 9.0m; see borehole record in Appendix II for details.

Groundwater was encountered at 15.0m within the underlying rock formations with an increase in flow rate noted with depth, reaching equilibrium at artesian conditions overnight.

The groundwater flow was such that installation of a well lining was not possible. The artesian flow was controlled by installing and inflating a borehole packer between 24.5m and 25.0m, the packer having a 50mm galvanised steel rising main attached. The annular space between the rising main and the borehole was initially grouted with cement and finished with bentonite

On completion of the drilling, airlifting was undertaken to clean the borehole and gauge the flow rate. Table 1 below records the rate of discharge for the well during the pumping trial undertaken on 18.05.2018

TABLE 1

WELL LOCATION	G.W.L. (m)	Drawdown (m)	Peak Flow (gph)	Min Flow (gph)
BH WELL (18.05.18)	Artesian	None	1100	1100

From the above it can be seen that the investigation has confirmed the existence of a ground water source, generally with a discharge rate in excess of 1100gls/hr, which was the maximum output for the pump in the given groundwater conditions.

3:0 CHEMICAL TEST RESULTS ON WATER SAMPLES

Laboratory analysis on water samples recovered during the pumping trial are summarised in Appendix IV. The limited suites of tests were undertaken by ALS Environmental Ltd on behalf of Holequest Ltd.

From the initial analysis undertaken it can be seen that in general the parameters tested were within acceptable limits.

TVC at 22^c (>1000cfu/ml) were noted to be elevated. The Private Water Supply (Scotland) Regulations 2006 states that the colony count (TVC) should record "no abnormal change", as no background levels for the location are available, it has been assumed that the observed values represent abnormal levels, and as such may require treatment depending on the proposed end use of the water supply.

Additionally, the water is noted to be hard (268mg/ml, CaCO₃).

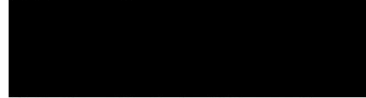
Should the client wish to use the water as a potable supply the installation of a treatment system comprising a Particulate Filter and UV steriliser may be required. It is not unusual for wells to require additional development to enhance quality and consistency of extraction.

Prepared By:-



**F. Murray (Assistant Contracts Manager)
for HOLEQUEST LTD** **Dated:- June 2018**

Approved By:-



**C. Rodger (Technical Manager)
for HOLEQUEST LTD** **Dated:- June 2018**

APPENDIX 1

Terminology Adopted In Description of Soil and Rocks

TERMINOLOGY ADOPTED IN DESCRIPTION OF SOILS

1. The description and classification of soils has been carried out using as a general basis the British Standard Code of Practice for Site Investigations - B.S.5930 - 2015 and BS EN ISO 14688 / 14689
2. Soils containing 35% or more of material passing a 0.06mm sieve will be classified as **CLAY** or **SILT** as appropriate.
3. The relative densities of granular materials given in this report are based upon visual inspection of the borehole / excavation and the results of in-situ standard penetration and cone penetration tests, where carried out

The classification is as follows :-

TABLE 1 Non-cohesive Granular Materials

N - Value	Relative Density
Below 4	Very Loose
4 to 10	Loose
10 to 30	Medium Dense
30 to 50	Dense
50 and Over	Very Dense

TABLE 2A Cohesive Materials (Field Description)

TERM USED FOR FIELD DESCRIPTION	CONSISTENCY DESCRIPTION DEFINITION
Very Soft	Finger easily pushed in up to 25mm. Exudes between fingers
Soft	Finger pushed in up to 10mm. Moulds by light finger pressure
Firm	Thumb makes impression easily. Cannot be moulded by fingers, rolls in the hand to a 3mm thick thread without breaking or crumbling
Stiff	Can be indented slightly by thumb. Crumbles in rolling a 3mm thick thread, but can then be remoulded into a lump
Very Stiff	Can be indented slightly by thumb nail. Cannot be moulded but crumbles under pressure.
Hard	Can be scratched by thumbnail

TABLE 2B Cohesive Materials (Measured Strength Classification)

TERM BASED ON MEASUREMENT	UNDRAINED STRENGTH CLASSIFICATION DEFINITION C_u in kPa
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	300 - 600

4. The consistency of 'fine soils' given in this report is based on both visual inspection of the sample and the results of in-situ and / or laboratory tests, where carried out.

** Note:- When very stiff cohesive materials (generally with a significant proportion of cobbles and boulders) are encountered, the term Hard may be included in the description to enhance the descriptive term of very stiff, especially where cohesive materials were difficult to progress through, or could not be penetrated by normal light cable percussion boring methods.

**BOREHOLE & TRIAL PIT RECORDS
SYMBOLS & ABBREVIATIONS USED:-**

U	80mm or 100mm diam. "Undisturbed" sample	80mm diam sample in windowless sampling / rotary boreholes, 100mm diam sample in light cable percussion boreholes
P	Piston Sample "Undisturbed"	
D	Disturbed sample	
B	Bulk Disturbed sample	
W	Water Sample	
ES	Soil Contamination Sample	
EW	Water Contamination Sample	
SPT	Standard Penetration Test	Split Spoon Sampler - Blow count for 300mm penetration = 'N' value
CPT	Standard Cone penetration Test	Solid Cone replaces split spoon sampler, as above blow count for 'N' value
V	In-situ Borehole Vane Test	
VHP	Variable Head Permeability Test	
CHP	Constant Head Permeability test	
PT	Borehole Packer Test	

ROTARY CORE DRILLING

TCR	Total Core Recovery	Ratio of core recovered (solid and non intact) to length of core run
SCR	Solid Core Recovery	Ratio of solid core recovered to length of core run
RQD	Rock Quality Designation	Ratio of solid core pieces longer than 100mm to length of core run
FI	Fracture Index	Count of the number of spacing of fractures over an arbitrary length of core of similar intensity of fracturing. Commonly reported as Fracture Index (FI, number of fractures per metre) or as Fracture Spacing (f,mm).

GROUND WATER

depth (m)	Ground Water Level	Initial ingress level recorded in water strikes column
comments	Standing Ground Water Level	Time observation or a.m. ground water level recorded in the remarks section of the borehole / trial pit record.

ADDITIONAL INFORMATION

HVT	Hand Vane Tests	Recorded in Samples and In-situ Testing Column on borehole / trial pit records
HPT	Hand Penetrometer Tests	Recorded in Samples and In-situ Testing Column on borehole / trial pit records
CBR	California Bearing Ratio Test	Recorded in Samples and In-situ Testing Column on borehole / trial pit records
PBT	Plate Bearing Test	Recorded in Samples and In-situ Testing Column on borehole / trial pit records

Additional Notes:-

- 1) Ground water levels vary and therefore the observations recorded on the borehole and trial pit records are as observed at the time of the investigation.
- 2) The comments and opinions expressed in this report are based on the ground conditions observed at each location during the site works and on the results of any tests undertaken in-situ or in the laboratory on the samples obtained during the site works.

REFERENCE BIBLIOGRAPHY USED IN REPORTING & TESTING

- | | |
|------------------------------------|---|
| British Standards:- | Code of Practice for Site Investigation BS5930, 2015
BS EN 14688 Part 1: 2002
BS EN 14688 Part 2: 2002
BS EN 14689 Part 1: 2003
Methods of Test for Soils for Civil Engineering Purposes BS 1377
Testing Of Aggregates BS 812
Code of Practice for Foundations BS8004
Code of Practice for Earthworks BS 6031
Code of Practice for Ground Anchorages BS 8081
Cathodic Protection BS 7361 |
| Scottish Development
Department | Specification for Roads & Bridgeworks - Soil Suitability for Earthworks
Use of the Moisture Condition Apparatus |
| Head K.H. | The Manual of Soil Laboratory Testing Vol. 1 to 3. |
-
- | | |
|---|--|
| Terzaghi K. & Peck B.P. | Soil Mechanics in Engineering Practice - Wiley |
| Tomlinson M.J. | Foundation Design & Construction - Pitman |
| Lambe & Whitman | Soil Mechanics - Wiley |
| Blyth F.G.H. &
de Freitas M.H. | A Geology for Engineers - Arnold |
| Burland J.B. & Burbridge M.C.
Scotland | Settlement of Foundations on Sand and Gravel (Glasgow & West of
Association Centenary Celebrations Invited Lectures 1984) |
| Forde M.C. | Earthworks: Selection & Compaction (University of Edinburgh) |
| B.R.E. Publications | |

APPENDIX II

Borehole Record



HOLEQUEST LIMITED

Holequest Ltd
Winston Road
Galashiels
Tel: 01896 752295

Borehole No
BH WELL
Sheet 1 of 2

Project Name Hallrule Farm nr Bonchester Bridge	Project No. 17/083	Co-ords: -	Hole Type RO
Drilling Methods:- Rotary open hole, Numa Supajaws, 180mm diam, GL - 9.0m Rotary open hole, 140mm diam, 9.0 - 43.0m	Level: -	Orientation 90	Logged By MT
Client:- Mr D. MacTaggart	Dates: 09/04/2018-12/04/2018		

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.40		Dark brown TOPSOIL*		1
							Brown silty SAND and GRAVEL*		2
									3
									4
									5
									6
					7.50		Reddish brown SANDSTONE with subordinate beds of white SANDSTONE / SILTSTONE and reddish brown SILTSTONE*		7
							Highly weathered / fractured between 7.5 - 9.0m*		8
									9
									10
									11
									12
									13
									14
									15
									16
									17
									18
									19
									20
									21
									22
									23
									24

Remarks:	* Denotes visual assessment of description based on air flushed borehole returns Groundwater encountered at 5.0m and 13.0m, increasing in flow with depth culminating in a slight artesian head Borehole terminated due to artesian flow at 43.0m Permanent Steel conductor casing installed to 9.0m Borehole packer / assoc grout column and 2" galvanised pipe installed from 25m to control artesian flow	Scale 1:125	Log Status Final
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HOLEQUEST LTD (01896) 752295 Standard Borehole Log of Galashieles 27/11/2018



HOLEQUEST LIMITED

Holequest Ltd
Winston Road
Galashiels
Tel: 01896 752295

Borehole No
BH WELL
Sheet 2 of 2

Project Name Hallrule Farm nr Bonchester Bridge	Project No. 17/083	Co-ords: -	Hole Type RO
Drilling Methods:- Rotary open hole, Numa Supajaws, 180mm diam, GL - 9.0m Rotary open hole, 140mm diam, 9.0 - 43.0m		Level: -	Orientation 90
Client:- Mr D. MacTaggart		Dates: 09/04/2018-12/04/2018	Logged By MT

Well	Water Strikes	Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description	
		Depth (m)	Type	Results					
							Reddish brown SANDSTONE with subordinate beds of white SANDSTONE / SILTSTONE and reddish brown SILTSTONE*	26	
								27	
								28	
								29	
								30	
								31	
								32	
								33	
								34	
								35	
								36	
								37	
							Highly weathered / fractured between 38.0 - 43.0m	38	
								39	
								40	
								41	
								42	
				43.00			End of Borehole at 43.00 m	43	
								44	
								45	
								46	
								47	
								48	
								49	

Remarks:	* Denotes visual assessment of description based on air flushed borehole returns Groundwater encountered at 5.0m and 13.0m, increasing in flow with depth culminating in a slight artesian head Borehole terminated due to artesian flow at 43.0m Permanent Steel conductor casing installed to 9.0m Borehole packer / assoc grout column and 2" galvanised pipe installed from 25m to control artesian flow	Scale 1:125	Log Status Final
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HOLEQUEST LIMITED (Borehole Log of Class ZP) Rev 03

APPENDIX III

Pumping Trial



Certificate No. 642



Certificate No. 007883



HOLEQUEST
• LIMITED •



Test Details

Site Location	Hallrule Farm	
Depth of Borehole	45	meters b.g.l.
Groundwater level	Artesian	meters b.g.l.
Test Pump	SQ5-70	
Depth of Test Pump	10	meters b.g.l.
Pumping Duration	180	mins
Peak Flow	1100.00	Gls / hour
	5.00	m3 / hour
Steady Flow	1100.00	Gls / hour
	5.00	m3 / hour

Water Levels

Elapse time	Depth b.g.l.	Water Temperature
mins	m	deg C
0	0.00	8.79
1	0.00	8.79
2	0.00	8.80
3	0.00	8.81
4	0.00	8.81
5	0.00	8.82
10	0.00	8.82
15	0.00	8.82
20	0.00	8.83
25	0.00	8.82
30	0.00	8.83
60	0.00	8.83
90	0.00	8.83
120	0.00	8.83
180	0.00	8.83

GEOTECHNICAL • SITE INVESTIGATION • WELL DRILLING

Registered Office: Winston Road, Galashiels, TD1 2DA. Tel: (01896) 752295 Fax: (01896) 751515 Email Address admin@holequest.co.uk

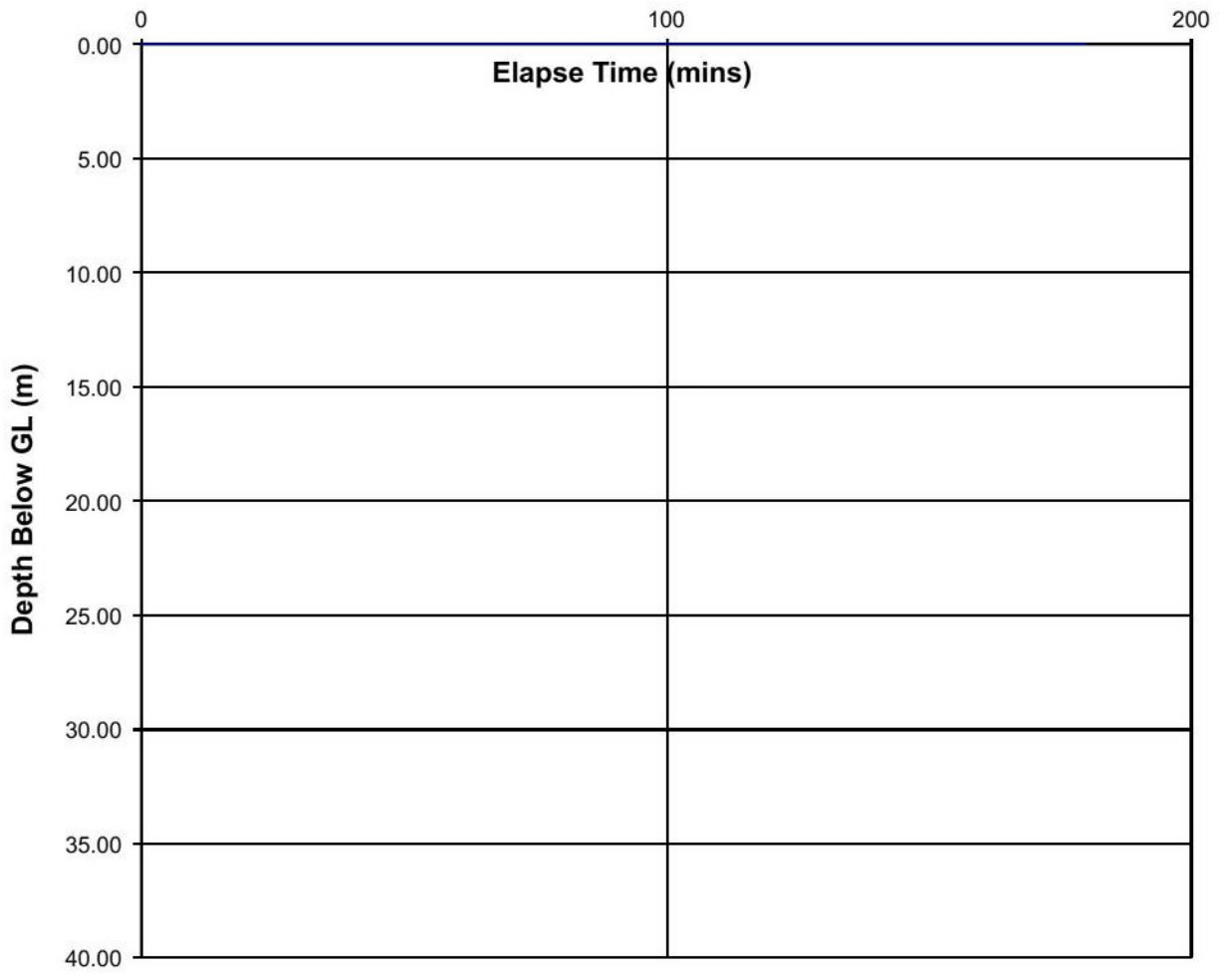
Directors: K.M. Rodger, (Secretary), A.J. Batchelor, (Managing) Registration No. 56002 Scotland, Est.1974, VAT 271 4670 58 www.holequest.co.uk

Site Location	Hallrule Farm	
Depth of Borehole	45	meters b.g.l.
Groundwater level	Artesian	meters b.g.l.
Test Pump	SQ5-70	
Depth of Test Pump	10	meters b.g.l.
Pumping Duration	180	mins
Peak Flow	1100.00	Gls / hour
	5.00	m3 / hour
Minmum Flow	1100.00	Gls / hour
	5.00	m3 / hour

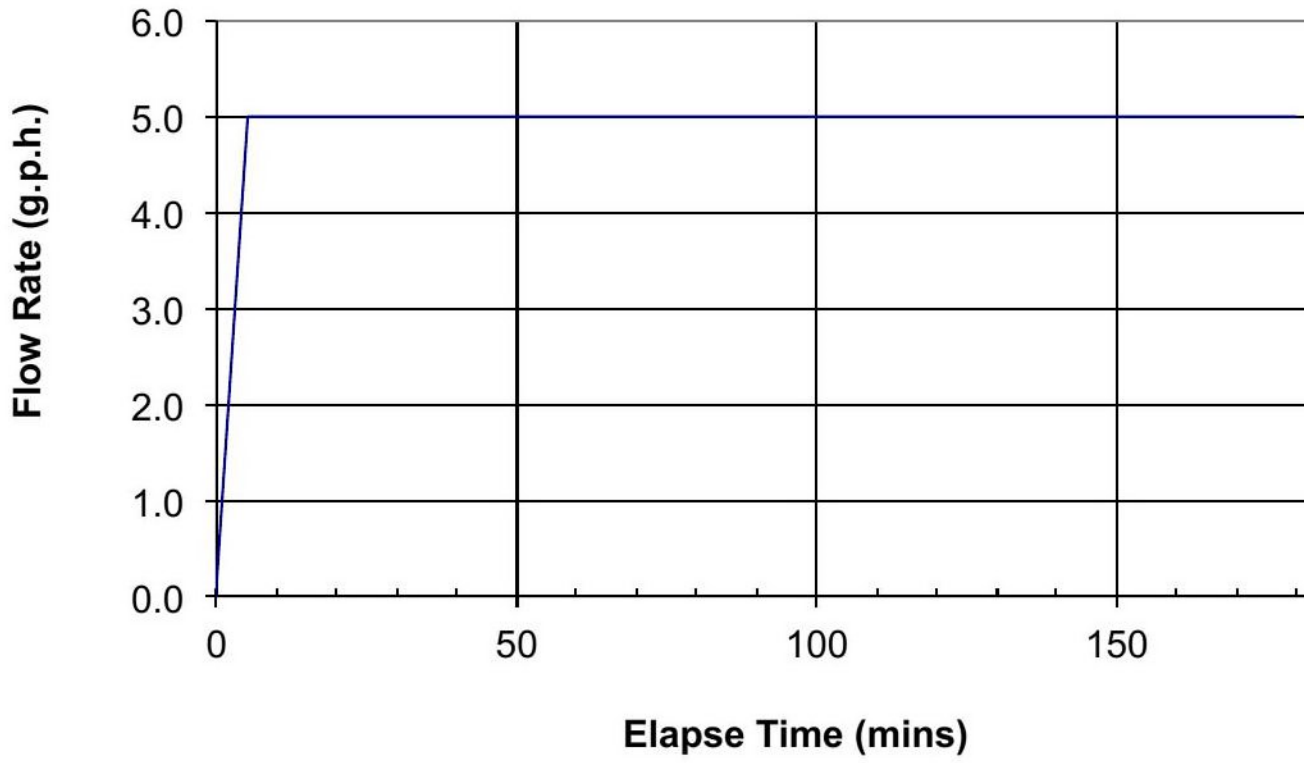
Flow Rates

Elaspe Time mins	Time to Fill Barrel	Flow Rate m3 / hr
0		0.0
5	2.4	5.00
10	2.4	5.00
15	2.4	5.00
20	2.4	5.00
30	2.4	5.00
60	2.4	5.00
90	2.4	5.00
120	2.4	5.00
150	2.4	5.00
180	2.4	5.00

Hallrule Farm



Hallrule Farm - Pump Trial



APPENDIX IV

Laboratory Testing



ALS Environmental Ltd
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Coventry
CV4 9GU

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F: +44 (0)24 7685 6575
www.alsenvironmental.co.uk

Mr Cremer
Holequest
Winston Road
Galasheils TD1 2DA

08 June 2018

Test Report: COV/1557964/2018

Dear Mr Cremer

Analysis of your sample(s) submitted on 31 May 2018 is now complete and we have pleasure in enclosing the appropriate test report(s).

An invoice for the analysis carried out will be sent under separate cover.

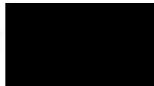
Should you have any queries regarding this report(s) or any part of our service, please contact Customer Services on +44 (0)24 7642 1213 who will be happy to discuss your requirements.

If you would like to arrange any further analysis, please contact Customer Services. To arrange container delivery or sample collection, please call the Couriers Department directly on 024 7685 6562.

Thank you for using ALS Environmental Ltd and we look forward to receiving your next samples.

Yours Sincerely,

Signed:



Name: B. Paige

Title: Microbiology Team Leader



This communication has been sent to you by ALS Environmental Ltd. Registered in England and Wales. Registration No.02148934. Registered Office: ALS Environmental Limited, Torrington Avenue, Coventry, CV4 9GU.

Report Summary

**Mr Graham Cremer
Holequest
Winston Road
Galasheils
TD1 2DA**



Report Number: **COV/1557964/2018**

Issue **1**

Number of Samples
included in this report **1**
Number of Test Results
included in this report **24**

Site Name:
Sample Date:
Job Received:
Analysis Comr

Signed:



Name: **B. Paige**

Title: **Microbiology Team Lead**

ALS Environmental Ltd was not responsible for sampling unless otherwise stated.

Information on the methods of analysis and performance characteristics are available on request.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation. The results relate only to the tests marked 'Not UKAS Accredited' in this Report/Certificate are not included in the UKAS Accreditation Schedule for the relevant standard.

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Torrington Avenue, Coventry, CV4 9GU Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7642 1214

Certificate of Analysis



1314
0897
4409

Site Name: **Hallrule**
Sample Source: **Holequest**
Order No: **17949**

Report Number: **COV**
Samples Received: **31 M**
Analysis Complete: **08 J**

Sample	Sample Date	Sample Description	Test Description
17164115	29 May 2018	Hallrule 17/083	Hardness, Total as CaCO ₃
	29 May 2018		Sulphur, Total as SO ₄
	29 May 2018		Qualitative Taste
	29 May 2018		Qualitative Odour
	29 May 2018		TVC 37C 2 day
	29 May 2018		TVC 22C 3 day
	29 May 2018		Total Coliform presump
	29 May 2018		Total Coliforms confirmed
	29 May 2018		E.coli presumptive
	29 May 2018		Escherichia coli confirmed
	29 May 2018		Calcium, Total as Ca
	29 May 2018		Iron, Total as Fe
	29 May 2018		Magnesium, Total as Mg
	29 May 2018		Arsenic, Total as As
	29 May 2018		Manganese, Total as Mn
	29 May 2018		Sodium, Total as Na
	29 May 2018		Lead, Total as Pb
	29 May 2018		Hydrogen ion (pH)
	29 May 2018		Conductivity
	29 May 2018		Turbidity
	29 May 2018		Nitrite as NO ₂

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

Analysed at: CHE = Chester(CH4 9EP), CTD = Coatbridge(ML5 4FR), COV = Coventry(CV4 9GU), OTT = Otterbourne(SO21 2SW), S = Subcontracted, TR = Torridge(TA25 5JL), WOL = Wolverhampton(WV1 1JF). For Microbiological determinands 0 or ND=Not Detected, For Legionella ND=Not Detected in volume of sample filtered. The LOD for the Legionella analysis is 100 CFU per sample volume analysed. I/S=Insufficient sample. For soil/sludge samples: AR=As received, DW=Dry weight.

ALS Environmental Ltd

Torrington Avenue, Coventry, CV4 9GU Tel:+44 (0)24 7642 1213 Fax:+44 (0)24 7642 1214

Certificate of Analysis



Site Name: **Hallrule**
Sample Source: **Holequest**
Order No: **17949**

Report Number: **COV**
Samples Received: **31 M**
Analysis Complete: **08 J**

Sample	Sample Date	Sample Description	Test Description
17164115	29 May 2018	Hallrule 17/083	Nitrate as NO3
	29 May 2018		Chloride as Cl
	29 May 2018		Total Oxidised Nitrogen as NO3

Sample Matrix for 17164115: Drinking Water

Analyst Comments for 17164115: This sample has been analysed for Hydrogen ion (pH), Qualitative Taste, Qualitative Odour, Total E.coli presumptive, TVC 22C 3 day, TVC 37C 2 day outside recommended stability times. It is th
Estimated.

Signed:



Name: **B. Paige**

Title: **Microbiology Team Lead**

This issue replaces all previous issues

Accreditation Codes: Y = UKAS / ISO17025 Accredited, N = Not UKAS / ISO17025 Accredited, M = MCERTS.

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for sample volume analysed). I/S=Insufficient sample. For soil/sludge samples: AR=As received, DW=Dry weight.

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