Goatstown Development – Ground Investigation

Client:	Orchid Residential Ltd.
Client's Representative:	Barrett Mahony Consulting Engineers
Report No.:	20-0013
Date:	April 2020
Status:	Final for Issue

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Report No.:		20-0013			
Project Title:		Goatstown Development			
Client:		Orchid Residential Ltd.			
Client's Representative:		Barrett Mahony Consulting Engineers			
Revision:	A00	**Status:**	Final for Issue	**Issue Date:**	02 April 2020
Prepared by:		**Reviewed by:**		**Approved by:**	
 Sean Ross BSc MSc MIEI		 Matthew Gilbert MEarthSci FGS		 Darren O'Mahony BSc MSc MIEI EurGeol PGeo	

The works were conducted in accordance with:

British Standards Institute (2015) BS 5930:2015, Code of practice for site investigations.

BS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

Laboratory testing was conducted in accordance with:

British Standards Institute BS 1377:1990 parts 2, 4, 5, 7 and 9

METHODS OF DESCRIBING SOILS AND ROCKS

Soil and rock descriptions are based on the guidance in BS5930:2015, The Code of Practice for Site Investigation.

Abbreviations used on exploratory hole logs	
U	Nominal 100mm diameter undisturbed open tube sample (thick walled sampler).
UT	Nominal 100mm diameter undisturbed open tube sample (thin walled sampler).
P	Nominal 100mm diameter undisturbed piston sample.
B	Bulk disturbed sample.
LB	Large bulk disturbed sample.
D	Small disturbed sample.
C	Core sub-sample (displayed in the Field Records column on the logs).
L	Liner sample from dynamic sampled borehole.
W	Water sample.
ES / EW	Soil sample for environmental testing / Water sample for environmental testing.
SPT (s)	Standard penetration test using a split spoon sampler (small disturbed sample obtained).
SPT (c)	Standard penetration test using 60 degree solid cone.
(x,x/x,x,x,x)	Blows per increment during the standard penetration test. The initial two values relate to the seating drive (150mm) and the remaining four to the 75mm increments of the test length.
(Y for Z/ Y for Z)	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given seating or test length 'Z' (mm).
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm).
HVP / HVR	In situ hand vane test result (HVP) and vane test residual result (HVR). Results presented in kPa.
V VR	Shear vane test (borehole). Shear strength stated in kPa. V: undisturbed vane shear strength VR: remoulded vane shear strength
Soil consistency description	In cohesive soils, where samples are disturbed and there are no suitable laboratory tests, N values may be used to indicate consistency on borehole logs – a median relationship of Nx5=Cu is used (as set out in Stroud & Butler 1975).
dd-mm-yyyy	Date at the end and start of shifts, shown at the relevant borehole depth. Corresponding casing and water depths shown in the adjacent columns.
▽	Water strike: initial depth of strike.
▼	Water strike: depth water rose to.
Abbreviations relating to rock core – reference Clause 36.4.4 of BS 5930: 2015	
TCR (%)	Total Core Recovery: Ratio of rock/soil core recovered (both solid and non-intact) to the total length of core run.
SCR (%)	Solid Core Recovery: Ratio of solid core to the total length of core run. Solid core has a full diameter, uninterrupted by natural discontinuities, but not necessarily a full circumference and is measured along the core axis between natural fractures.
RQD (%)	Rock Quality Designation: Ratio of total length of solid core pieces greater than 100mm to the total length of core run.
FI	Fracture Index: Number of natural discontinuities per metre over an indicated length of core of similar intensity of fracturing.
NI	Non Intact: Used where the rock material was recovered fragmented, for example as fine to coarse gravel size particles.
AZCL	Assessed zone of core loss: The estimated depth range where core was not recovered.
DIF	Drilling induced fracture: A fracture of non-geological origin brought about by the rock coring.
(xxx/xxx/xxx)	Spacing between discontinuities (minimum/average/maximum) measured in millimetres.

Goatstown Development

1 AUTHORITY

On the instructions of Barrett Mahony Consulting Engineers, ("the Client's Representative"), acting on the behalf of Orchid Residential Ltd. ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information for input to the design and construction of a proposed residential development.

This report details the work carried out both on site and in the geotechnical and chemical testing laboratories; it contains a description of the site and the works undertaken, the exploratory hole logs and the laboratory test results. A discussion on the recommendations for construction is also provided.

All information given in this report is based upon the ground conditions encountered during the site investigation works, and on the results of the laboratory and field tests performed. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata, contaminant concentrations, and water conditions between or below exploratory holes. It should be noted that groundwater levels usually vary due to seasonal and/or other effects and may at times differ to those recorded during the investigation. No responsibility can be taken for conditions not encountered through the scope of work commissioned, for example between exploratory hole points, or beneath the termination depths achieved.

This report was prepared by Causeway Geotech Ltd for the use of the Client and the Client's Representative in response to a particular set of instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

2 SCOPE

The extent of the investigation, as instructed by the Client's Representative, included boreholes, soil and sampling, environmental sampling, groundwater and ground gas monitoring, in-situ and laboratory testing, and the preparation of a report on the findings including recommendations for construction.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted on the site of an existing car showroom facility located off the R825/Goatstown Road in Goatstown, Co. Dublin. The site is bounded by Willowfield Park to the south, the R825/Goatstown Road the west and Trimblestown Residential Development to the north and east. The site is relatively flat and comprises hardstanding.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 25th and 28th March 2020, comprised:

- six boreholes by dynamic (windowless) sampling methods; and
- a standpipe installation in three boreholes

The exploratory holes and in-situ tests were located as instructed by the Client's Representative, as shown on the exploratory hole location plan in Appendix A.

4.2 Boreholes

Six boreholes (BH01-BH03 and WS01-WS03) were put down to completion by light percussion boring techniques using a Dando Terrier dynamic sampling rig. The boreholes were put down initially in 150mm diameter, reducing in diameter with depth as required, down to 50mm by use of the smallest sampler.

Hand dug inspection pits were carried out between ground level and 1.20m depth to ensure boreholes were put down clear of services or subsurface obstructions. The boreholes were taken to depths of 2.00m and 3.00m where they were terminated on encountering virtual refusal.

Disturbed (bulk and small bag) samples were taken within the encountered strata. Environmental samples were taken at 0.40m, 1.40m and 2.40m in each of the six boreholes.

Standard penetration tests were carried out in accordance with BS EN 22476-3:2005+A1:2011 at standard depth intervals using the split spoon sampler ($SPT_{(s)}$) or solid cone attachment ($SPT_{(c)}$). The penetrations are stated for those tests for which the full 150mm seating drive or 300mm test drive was not possible. The *N*-values provided on the borehole logs are uncorrected and no allowance has been made for energy ratio corrections. The SPT hammer energy measurement report is provided in Appendix E.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded. Details of the water strikes are presented on the individual borehole logs.

Appendix B presents the borehole logs.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in BH01-BH03. Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Surveying

The as-built exploratory hole positions were surveyed following completion of site operations by a Site Engineer from Causeway Geotech. Surveying was carried out using a Trimble R6 GPS system employing VRS and real time kinetic (RTK) techniques.

The plan coordinates (Irish National Grid) and ground elevation (mOD Malin) at each location are recorded on the individual exploratory hole logs. The exploratory hole plan presented in Appendix A shows these as-built positions.

4.5 Groundwater and ground gas monitoring

Following completion of site works, groundwater and ground gas monitoring was conducted on four rounds. Ground water monitoring was carried out using a water interface probe. Ground gas measurements were carried out using a GA5000 gas meter.

The monitoring records are presented in Appendix C.

5 LABORATORY WORK

Upon their receipt in the laboratory, all disturbed samples were carefully examined and accurately described, and their descriptions incorporated into the borehole logs.

5.1 Environmental laboratory testing of soils

Environmental testing was conducted on selected environmental soil and water samples by Chemtest at its laboratory in Newmarket, Suffolk.

Testing was carried out for a range of determinants, including:

- Metals
- Speciated total petroleum hydrocarbons (TPH)
- Speciated polycyclic aromatic hydrocarbons (PAH)
- Cyanides
- Asbestos screen
- pH.

Results of environmental laboratory testing are presented in Appendix D.

The above results were analysed and a GQRA compiled by WYG. This report is presented in Appendix F along with a PRA.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise Glacial Till. These deposits are underlain by limestones and shales of the Lucan Formation.

6.2 Ground types encountered during investigation of the site

A summary of the ground types encountered in the exploratory holes is listed below, in approximate stratigraphic order:

- **Paved surface:** all location encountered bitmac surfacing ranging in thickness from 100-200mm.
- **Made Ground (fill):** reworked sandy gravelly clay fill encountered to a maximum depth of 1.60m in BH01. Fragments of red brick were encountered in the made ground in BH01, BH02 and WS01.
- **Glacial Till:** sandy gravelly clay, frequently with low cobble content, typically firm or stiff in upper horizons, becoming very stiff with increasing depth.

6.3 Groundwater

Details of the individual groundwater strikes, along with any relative changes in levels as works proceeded, are presented on the exploratory hole logs for each location.

Groundwater was encountered during percussion boring through soil as water strikes at depths of 1.80m in WS01, 1.80m in WS02 and 1.90m in WS03.

Groundwater was not noted during drilling of BH01-BH03. However, it should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any additional groundwater strikes and the possibility of encountering groundwater during excavation works should not be ruled out.

Seasonal variation in groundwater levels should also be factored into design considerations, and continued monitoring of the three installed standpipes will give an indication of the seasonal variation.

Details of groundwater monitoring, as well as results of gas monitoring, are presented in Appendix C.

7 DISCUSSION

7.1 Proposed construction

The development will consist of demolition of the existing building (c.960sqm) and hard surface parking area and construction of a purpose built student accommodation development comprising 239 no. student bed-spaces within a part 4 no. storey, part 6 no. storey building (total gross floor area 6,620sqm), including internal and external amenity space, 188 no. cycle spaces, 6 no car parking spaces, vehicle ingress and egress from Goatstown Road, an ESB substation and switch room, refuse store and all associated site development works including hard and soft landscaping, lighting and ancillary infrastructure all within the 0.39ha site. A drawing of the proposed development is presented in Appendix G.

No further details were available to Causeway Geotech at the time of preparing this report and any designs based on the recommendations or conclusions within this report should be completed in accordance with the current design codes, taking into account the variation and the specific details contained within the exploratory holes. Causeway Geotech were commissioned to provide a geotechnical report, and it is outwith our remit to advise on structure design.

7.2 Recommendations for construction

7.2.1 Summary

Based on the presence of stiff glacial till at relatively shallow depths across the footprint of the proposed building, the implementation of traditional shallow (spread) foundations (trench fill) are considered suitable.

7.2.2 Soil strength parameters

When estimating the shear strength of fine soils (silt/clay), reference is made to the results of Standard Penetration Tests (SPT's) carried out within the boreholes. The undrained shear strength of fine soils can be estimated using the correlation developed by Stroud & Butler:

$$C_u = f_1 \times N$$

where f_1 is typically in the range 4 to 6. A median f_1 value of 5 is adopted for this report.

For granular soils (sand/gravel), a graphical relationship between SPT "N" value and angle of shearing resistance, φ, has been developed by Peck, Hanson and Thorburn. This is published in *Foundation Design and Construction* (Tomlinson, 2001) and is referenced in this report when deriving angles of shearing resistance for the gravel soils.

7.2.3 Foundations and ground floor construction

Foundations should transfer loading to below any Made Ground or subsoil. The recommended foundation construction and allowable bearing pressure (ABP) at the borehole locations are presented in Table 1.

Table 1: Construction recommendations

Borehole	Depth below EGL* to suitable bearing stratum	Estimated ABP (kPa)	Strata description	Foundation type	Ground floor construction	Groundwater
BH01	2.80m	300	Very stiff Glacial Till	Trench fill	Suspended	Not encountered
BH02	2.00m	300	Very stiff Glacial Till	Trench fill	Suspended	Not encountered
BH03	2.00m	300	Very stiff Glacial Till	Trench fill	Suspended	Not encountered
WS01	2.60m	300	Very stiff Glacial Till	Trench fill	Suspended	Strike at 1.80mbgl
WS02	2.00m	300	Very stiff Glacial Till	Trench fill	Suspended	Strike at 1.80mbgl
WS03	2.00m	300	Very stiff Glacial Till	Trench fill	Suspended	Strike at 1.90mbgl

*Existing Ground Level

Based on the findings of the site investigation, spread foundations (strip/pad and trench fill) are considered suitable with estimated allowable bearing pressures greater than 300kPa at depths of 2.00-2.80m on very stiff glacial till.

Should proposed structural loadings from the development be significantly greater than those outlined in Table 1 above, greater ABP's may be achievable at greater depths. Alternatively, if a deep foundation method such as piling is the preferred foundation method, it is recommended that rotary drilling is undertaken to prove bedrock across the footprint of the proposed store.

The base of foundation excavations should be thoroughly inspected and tested at intervals as set out in the Earthwork's Specification; any soft or loose soils removed with the resultant void backfilled with ST1 concrete or engineered backfill. A consistent bearing stratum should be provided for any building unit to limit differential settlements.

Given the generally fine grained/cohesive nature of the soils throughout the proposed formation levels, excavations for foundations are likely to be relatively stable. However, any instability can be minimised by battering the side slopes at 2 vertical to 1 horizontal and by limiting the duration that the excavation is open. Groundwater control, where required, will be possible by pumping from sumps formed in the base of excavations.

7.2.4 Floor slabs

Floor slabs should not bear directly onto Made Ground or soft soils. Consequently, the use of ground bearing floor slabs is considered appropriate following the removal of any surface Made Ground and soft clay layers and their replacement using well-graded well-compacted granular fill. However, a suspended floor slab should be adopted where the difference in levels of the proposed floor and the base of Made Ground/soft soils is greater than 600mm.

Therefore, given the depth to the base of Made Ground, a suspended floor slab will be required across the site. The use of intermediate lines of support stub walls would reduce the spans required for flooring units.

7.2.5 Soil aggressivity

An assessment of the Aggressive Chemical Environment for Concrete (ACEC) was undertaken through reference to the Building Research Establishment (BRE) Special Digest 1 (2017).

As noted by BRE Special Digest 1, sulphates in the soil and groundwater are the chemical agents most likely to attack concrete. The extent to which sulphates affect concrete is linked to their concentrations, the type of ground, the presence of groundwater, the type of concrete and the form of construction in which concrete is used.

BRE Special Digest 1 identifies four different categories of site which require specific procedures for investigation for aggressive ground conditions:

- Sites not subjected to previous industrial development and not perceived as containing pyrite;
- Sites not subjected to previous industrial development and perceived as containing pyrite;
- Brownfield sites not perceived as containing pyrite;
- Brownfield sites perceived as containing pyrite.

For the purposes of this report the site was classified as not having been subject to previous industrial development and not perceived as containing pyrite.

The results of chemical tests (pH and water soluble sulphate contents) on soil samples indicate Design Sulphate Class DS-1 and ACEC Class AC-1 – reference Table C1 of BRE Special Digest 1 (Building Research Establishment, 2005). The Special Digest does not require any measures to protect underground concrete elements greater that 140mm thick.

8 REFERENCES

Geotechnical Society of Ireland (2016), Specification & Related Documents for Ground Investigation in Ireland

IS EN 1997-2: 2007: Eurocode 7 - Geotechnical design - Part 2 Ground investigation and testing.

BS 1377: 1990: Methods of test for soils for civil engineering purposes. British Standards Institution.

BS 5930: 2015: Code of practice for ground investigations. British Standards Institution.

BS EN ISO 14688-1:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 1 Identification and description.

BS EN ISO 14688-2:2018: Geotechnical investigation and testing. Identification and classification of soil. Part 2 Principles for a classification.

BS EN ISO 22476-3:2005+A1:2011: Geotechnical investigation and testing. Field testing. Standard penetration test.

Building Research Establishment (2005) BRE Special Digest 1, Concrete in aggressive ground.

CAUSEWAY GEOTECH

APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLAN

CAUSEWAY GEOTECH

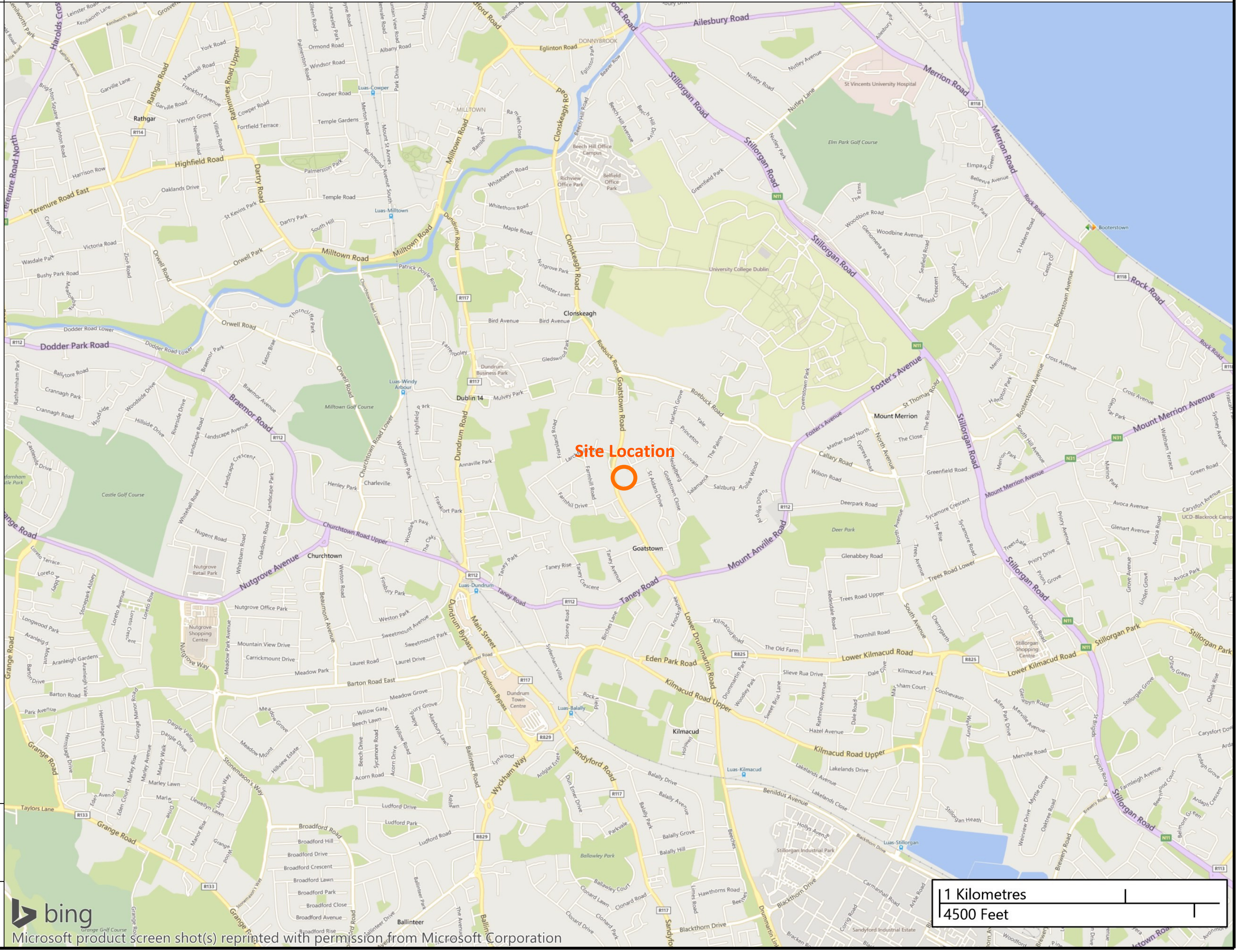
Project No.: 20-0013

Project Name: Goatstown Development, Dublin

Client: Orchid Residential Ltd

Client's Representative: Barrett Mahony Consulting Engineers

Legend Key



Title:
Site Location Plan

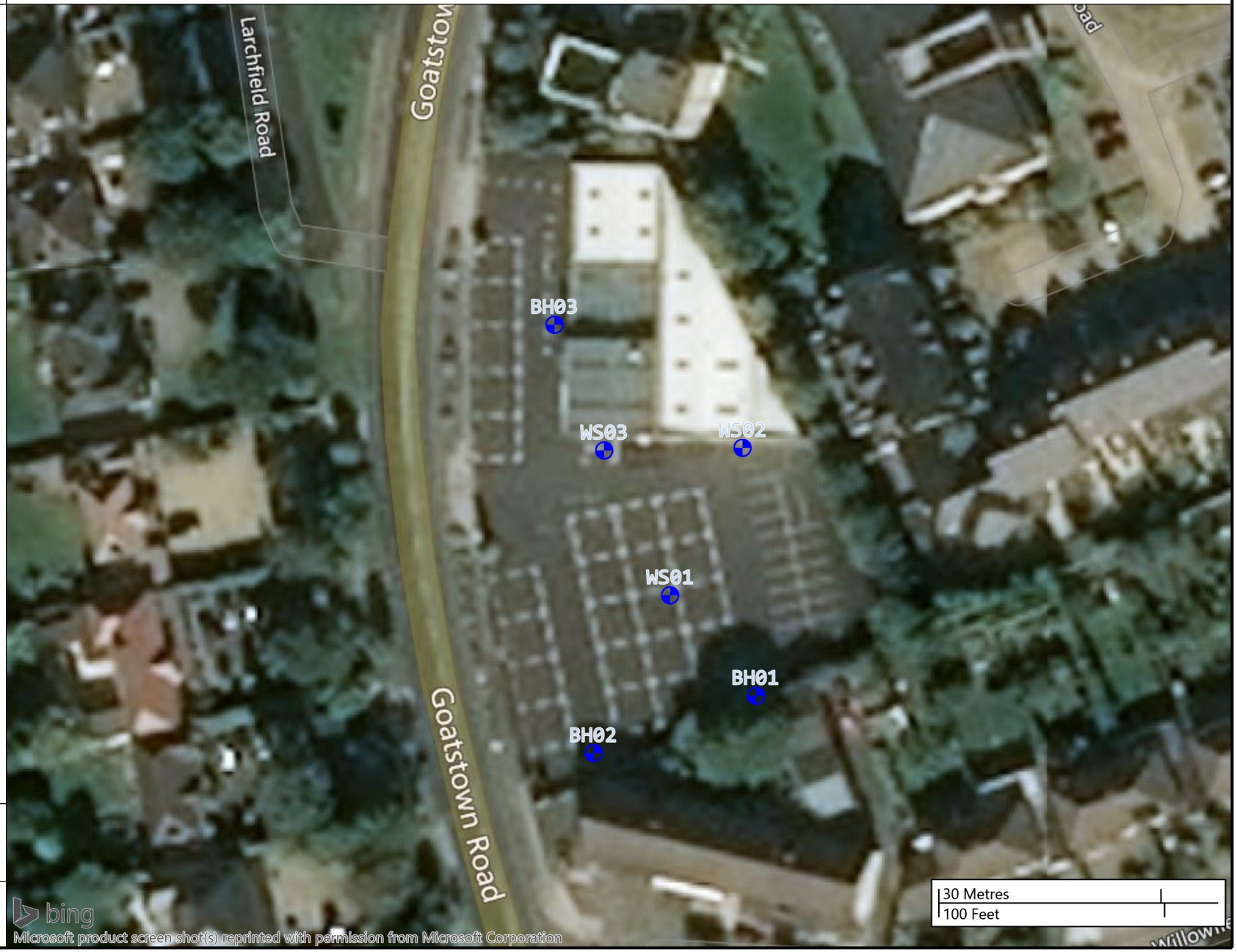
Last Revised:	Scale:
26/03/2020	1:30000

CAUSEWAY GEOTECH

Project No.:	20-0013	**Client:**	Orchid Residential Ltd
Project Name:	Goatstown Development, Dublin	**Client's Representative:**	Barrett Mahony Consulting Engineers

Legend Key

Locations By Type - CP



Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
26/03/2020	1:750

CAUSEWAY GEOTECH

APPENDIX B

BOREHOLE LOGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH01
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.80	317844.02 E 228900.37 N

Final Depth:	2.80 m	Start Date:	26/02/2020	Driller:	JC
Elevation:	46.01 mOD	End Date:	26/02/2020	Logger:	SF

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
0.10 - 1.20	B4				45.91	0.10		BITMAC
0.40 - 0.60	ES7							MADE GROUND: Firm becoming stiff light brown sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel angular fine to coarse of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=30 (3,3/3,7,9,11) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES8							
1.60 - 2.00	B5				44.41	1.60		Very stiff brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.
2.00 - 2.45	D2							
2.00 - 2.45	SPT (S)	N=30 (5,5/6,7,8,9) Hammer SN = 0490	0.00	Dry				
2.30 - 2.80	B6				43.71	2.30		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
2.40 - 2.60	ES9							
2.80 - 3.24	D3				43.21	2.80		End of Borehole at 2.80m
2.80 - 3.24	SPT (S)	N=50 (10,13/50 for 285mm) Hammer SN = 0490	0.00	Dry				

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH02
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317822.17 E 228892.06 N

Final Depth:	2.00 m	Start Date:	26/02/2020	Driller:	JC	Sheet 1 of 1 Scale: 1:40
Elevation:	45.95 mOD	End Date:	26/02/2020	Logger:	SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
								BITMAC
0.20 - 1.00	B3				45.75	0.20		MADE GROUND: Soft light yellow sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
0.40 - 0.60	ES5							
1.10 - 2.00	B4				44.85	1.10		Firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=13 (2,3/3,3,3,4) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES6							
2.00 - 2.45	D2				43.95	2.00		End of Borehole at 2.00m
2.00 - 2.45	SPT (S)	N=50 (5,9/12,12,13,13) Hammer SN = 0490	0.00	Dry				

Water | Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH03
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.00	317815.45 E 228949.97 N

Final Depth:	3.00 m	Start Date:	26/02/2020	Driller:	JC	Sheet 1 of 1 Scale: 1:40
Elevation:	44.62 mOD	End Date:	26/02/2020	Logger:	MFG	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B4				44.42	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES7									
1.00 - 2.00	B5				43.62	1.00		Firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=11 (2,2/2,3,3,3) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES8									
2.00 - 2.45	D2				42.62	2.00		Very stiff brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
2.00 - 3.00	B6									
2.00 - 2.45	SPT (S)	N=39 (4,6/8,10,11,10) Hammer SN = 0490	0.00	Dry						
2.40 - 2.60	ES9									
3.00 - 3.41	D3				41.62	3.00		End of Borehole at 3.00m		
3.00 - 3.41	SPT (S)	N=50 (9,11/50 for 260mm) Hammer SN = 0490	0.00	Dry						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS01
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.60	317832.09 E 228913.70 N

Final Depth:	2.60 m	Start Date:	28/02/2020	Driller:	jc	Sheet 1 of 1 Scale: 1:40
Elevation:	45.57 mOD	End Date:	28/02/2020	Logger:	SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B6				45.37	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel sis subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES4									
1.00 - 1.80	B7				44.57	1.00		Soft becoming firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subangular fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=14 (3,3/3,3,4,4) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES5									
		Water strike at 1.80m.			43.77	1.80		Medium dense brown slightly clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of mixed lithologies.	▼	
1.99		17-01-2020	0.00	1.80						
2.00 - 2.30	B8									
2.00 - 2.45	D2									
2.00 - 2.45	SPT (S)	N=27 (10,8/7,6,7,7) Hammer SN = 0490	0.00	1.90	43.27	2.30		Very stiff black slightly sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
2.30 - 2.60	B9				42.97	2.60		End of Borehole at 2.60m		
2.60 - 2.99	D3									
2.60 - 2.99	SPT (S)	N=50 (12,12/50 for 240mm) Hammer SN = 0490	0.00	1.80						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS02
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317841.43 E 228933.92 N

Final Depth:	2.00 m	Start Date:	28/02/2020	Driller:	JC
Elevation:	45.20 mOD	End Date:	28/02/2020	Logger:	SF

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
								BITMAC
0.20 - 1.00	B3				45.00	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
0.40 - 0.60	ES7							
1.00 - 1.80	B4				44.20	1.00		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=13 (4,3/3,3,3,4) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES6							
1.80 - 2.00	B5				43.40	1.80		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
		Water strike at 1.80m.						
2.00 - 2.45	D2				43.20	2.00		End of Borehole at 2.00m
2.00 - 2.45	SPT (S)	N=50 (8,12/12,12,13,13) Hammer SN = 0490	0.00	1.80				
2.45		17-01-2020	0.00	1.80				

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS03
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317822.67 E 228933.10 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1 Scale: 1:40
2.00 m	28/02/2020	JC	
Elevation: 45.08 mOD	**End Date:** 28/02/2020	**Logger:** SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B3				44.88	0.20		MADE GROUND: Soft to firm light yellowish brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES6									
1.00 - 1.70	B4				44.08	1.00		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=13 (3,3/3,3,3,4) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES7									
1.70 - 2.00	B5				43.38	1.70		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.	▼	
		Water strike at 1.90m.								
2.00 - 2.45	D2				43.08	2.00		End of Borehole at 2.00m		
2.00 - 2.45	SPT (S)	N=50 (10,11/11,12,13,14) Hammer SN = 0490	0.00	1.90						
2.00		17-01-2020	0.00	1.90						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.90			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

APPENDIX C

GROUND WATER AND GAS MONITORING RECORDS

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	06/03/2020
Weather:	Cloudy & windy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	998	0	0	21.9	0	0
After:	998	0	0	21.9	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.0	18.9	0	0
60	0.0	1.2	18.8	0	0
90	0.0	1.3	18.7	0	0
120	0.0	1.4	18.6	0	0
150	0.0	1.4	18.6	0	0
180	0.0	1.4	18.6	0	0
240	0.0	1.4	18.6	0	0
300	0.0	1.4	18.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.2
60	0.2
90	0.2
120	0.2
150	0.2
180	0.2
240	0.2
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	2.38
Depth to bottom of BH	2.75
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.5	15.8	0	0
60	0.0	1.5	15.8	0	0
90	0.0	1.5	15.8	0	0
120	0.0	1.4	15.7	0	0
150	0.0	1.4	15.6	0	0
180	0.0	1.4	15.6	0	0
240	0.0	1.4	15.6	0	0
300	0.0	1.4	15.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	1.82
Depth to bottom of BH	1.65
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.2	20.5	0	0
60	0.0	0.2	20.5	0	0
90	0.0	0.3	20.5	0	0
120	0.0	0.2	20.5	1	0
150	0.0	0.3	20.4	0	0
180	0.0	0.4	20.3	1	0
240	0.0	0.4	20.3	0	0
300	0.0	0.4	20.3	1	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.58
Depth to bottom of BH	2.90
Sample collected (Y/N)	N
Sample depth	-

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	11/03/2020
Weather:	Dry

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	991	0	0.1	21.1	0	0
After:	991	0	0.1	21.1	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.7	18.1	0	0
60	0.0	1.8	17.9	0	0
90	0.0	1.8	17.9	0	0
120	0.0	1.8	17.9	0	0
150	0.0	1.8	17.9	0	0
180	0.0	1.8	17.8	0	0
240	0.0	1.8	17.7	0	0
300	0.0	1.8	17.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.2
150	0.2
180	0.1
240	0.2
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.41
Depth to bottom of BH	2.71
Sample collected (Y/N)	Y
Sample depth	2.41

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.2	15.3	0	0
60	0.0	1.2	16.9	0	0
90	0.0	1.2	16.9	0	0
120	0.0	1.2	16.9	0	0
150	0.0	1.3	16.9	0	0
180	0.0	1.3	16.9	0	0
240	0.0	1.3	16.9	0	0
300	0.0	1.3	16.9	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-15.6
60	-10.1
90	-4.7
120	-3.3
150	-2.3
180	-1.2
240	-0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.80
Depth to bottom of BH	1.57
Sample collected (Y/N)	Y
Sample depth	1.80

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.5	20.9	1	0
60	0.0	0.5	20.9	1	0
90	0.0	0.5	20.9	1	0
120	0.0	0.5	20.9	1	0
150	0.0	0.5	20.9	1	0
180	0.0	0.5	20.9	0	0
240	0.0	0.5	20.9	0	0
300	0.0	0.5	21.0	1	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.2
120	0.1
150	0.2
180	0.1
240	0.1
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	2.55
Depth to bottom of BH	2.90
Sample collected (Y/N)	Y
Sample depth	2.55

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	16/03/2020
Weather:	Cloudy & breezy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	1006	0	0	21.8	0	0
After:	1006	0	0	21.8	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.0	19.5	0	0
60	0.0	1.1	19.4	0	0
90	0.0	1.1	19.4	0	0
120	0.0	1.1	19.4	0	0
150	0.0	1.1	19.4	0	0
180	0.0	1.1	19.4	0	0
240	0.0	1.1	19.4	0	0
300	0.0	1.1	19.4	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	2.38
Depth to bottom of BH	2.70
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.1	16.8	0	0
60	0.0	1.1	16.8	0	0
90	0.0	1.1	16.8	0	0
120	0.0	1.0	16.7	0	0
150	0.0	1.0	16.7	0	0
180	0.0	1.0	16.7	0	0
240	0.0	1.0	16.7	0	0
300	0.0	1.0	16.7	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.77
Depth to bottom of BH	1.55
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.2	21.0	0	0
60	0.0	0.2	21.0	0	0
90	0.0	0.2	21.0	0	0
120	0.0	0.2	21.0	0	0
150	0.0	0.2	21.0	0	0
180	0.0	0.2	21.0	0	0
240	0.0	0.2	21.0	0	0
300	0.0	0.2	21.0	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.55
Depth to bottom of BH	2.85
Sample collected (Y/N)	N
Sample depth	-

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	24/03/2020
Weather:	Cloudy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	1008	0	0	21.5	0	0
After:	1008	0	0	21.5	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.7	19.2	0	0
60	0.0	0.7	19.2	0	0
90	0.0	0.7	19.2	0	0
120	0.0	0.8	19.1	0	0
150	0.0	0.8	19.1	0	0
180	0.0	0.8	19.1	0	0
240	0.0	0.8	19.1	0	0
300	0.0	0.8	19.1	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.40
Depth to bottom of BH	2.70
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.9	16.4	0	0
60	0.0	0.9	16.4	0	0
90	0.0	0.7	16.5	0	0
120	0.0	0.6	16.5	0	0
150	0.0	0.6	16.5	0	0
180	0.0	0.6	16.5	0	0
240	0.0	0.6	16.5	0	0
300	0.0	0.6	16.5	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.2
60	0.2
90	0.2
120	0.2
150	0.2
180	0.2
240	0.2
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	1.77
Depth to bottom of BH	1.55
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.1	20.9	0	0
60	0.0	0.1	20.9	0	0
90	0.0	0.1	20.9	0	0
120	0.0	0.1	20.9	0	0
150	0.0	0.2	20.9	0	0
180	0.0	0.2	20.9	0	0
240	0.0	0.2	20.9	0	0
300	0.0	0.2	20.9	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	2.56
Depth to bottom of BH	2.85
Sample collected (Y/N)	N
Sample depth	-

CAUSEWAY GEOTECH

APPENDIX D

ENVIRONMENTAL LABORATORY TEST RESULTS

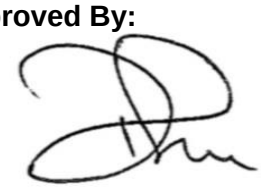
Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-07064-1
Initial Date of Issue:	16-Mar-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Fernando Alfonso Gabriella Horan Joe Gervin John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	20-0013 Goatstown Development, Dublin

Quotation No.:		**Date Received:**	04-Mar-2020
Order No.:		**Date Instructed:**	10-Mar-2020
No. of Samples:	12		
Turnaround (Wkdays):	5	**Results Due:**	16-Mar-2020
Date Approved:	16-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**	980769	980772	980773	980774	980775	980777	980778	980779	980780
		Sample Location:	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02
		Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):	0.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.5
		Date Sampled:	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Ammonium	U	1220	mg/l	0.050	0.44	0.32	< 0.050	< 0.050	< 0.050	0.088	0.062	0.12	0.12
Ammonium	N	1220	mg/kg	0.10	4.7	3.6	0.23	0.21	0.27	1.0	0.69	1.4	1.4

Results - Leachate

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064
Quotation No.:			**Chemtest Sample ID.:**		980781
			Sample Location:		WS03
			Sample Type:		SOIL
			Top Depth (m):		0.5
			Date Sampled:		03-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Ammonium	U	1220	mg/l	0.050	0.18
Ammonium	N	1220	mg/kg	0.10	2.1

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:					**Chemtest Sample ID.:**	980769	980771	980772	980773	980774	980775	980777	980778	980779
					Sample Location:	BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
					Date Sampled:	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
					Asbestos Lab:	COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-		-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A		-		-	-	-	-	-	-	-
Moisture	N	2030	%	0.020		12	8.3	14	12	11	10	10	9.9	15
pH	M	2010		4.0		8.2	8.4	8.2	8.5	8.3	8.7	8.3	8.3	8.4
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010							
Sulphur (Elemental)	M	2180	mg/kg	1.0		2.8		2.6	< 1.0	2.1	1.2	< 1.0	1.0	4.9
Cyanide (Free)	M	2300	mg/kg	0.50			< 0.50							
Cyanide (Total)	M	2300	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	M	2300	mg/kg	5.0			7.5							
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		6.9	10	6.4	6.9	10	7.6	6.5	7.2	8.7
Sulphate (Total)	M	2430	%	0.010		0.050	0.11	0.048	0.055	0.077	0.049	0.050	0.090	0.11
Arsenic	M	2450	mg/kg	1.0		17	19	15	17	15	17	18	17	12
Barium	M	2450	mg/kg	10		76		68	71	57	59	70	70	58
Cadmium	M	2450	mg/kg	0.10		2.4	2.3	2.0	2.2	1.9	1.7	2.5	2.0	1.6
Chromium	M	2450	mg/kg	1.0		18	20	15	15	15	13	17	15	13
Molybdenum	M	2450	mg/kg	2.0		3.6		3.5	4.2	3.8	3.5	3.6	4.4	2.8
Antimony	N	2450	mg/kg	2.0		2.2		< 2.0	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50		32	36	28	29	26	25	28	26	16
Mercury	M	2450	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50		57	59	46	48	40	41	56	51	37
Lead	M	2450	mg/kg	0.50		24	23	21	20	18	16	20	18	15
Selenium	M	2450	mg/kg	0.20		0.39	2.9	0.73	0.57	0.43	1.1	0.34	0.57	0.34
Zinc	U	2450	mg/kg	0.50		91	98	84	81	70	68	90	81	62
Chromium (Trivalent)	N	2490	mg/kg	1.0		18		15	15	15	13	17	15	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40			2.1							
Total Organic Carbon	M	2625	%	0.20		1.2		0.97	0.73	0.54	0.78	0.89	0.74	0.64
Mineral Oil	N	2670	mg/kg	10		< 10		< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**			980769	980771	980772	980773	980774	980775	980777	980778	980779
		Sample Location:			BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
		Date Sampled:			03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
		Asbestos Lab:			COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10		< 0.10							
Acenaphthylene	M	2700	mg/kg	0.10		< 0.10							
Acenaphthene	M	2700	mg/kg	0.10		< 0.10							
Fluorene	M	2700	mg/kg	0.10		< 0.10							
Phenanthrene	M	2700	mg/kg	0.10		< 0.10							
Anthracene	M	2700	mg/kg	0.10		< 0.10							
Fluoranthene	M	2700	mg/kg	0.10		0.40							
Pyrene	M	2700	mg/kg	0.10		0.34							
Benzo[a]anthracene	M	2700	mg/kg	0.10		< 0.10							
Chrysene	M	2700	mg/kg	0.10		< 0.10							
Benzo[b]fluoranthene	M	2700	mg/kg	0.10		< 0.10							
Benzo[k]fluoranthene	M	2700	mg/kg	0.10		< 0.10							
Benzo[a]pyrene	M	2700	mg/kg	0.10		< 0.10							
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10		< 0.10							
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10		< 0.10							
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10		< 0.10							
Total Of 16 PAH's	M	2700	mg/kg	2.0		< 2.0							
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980769	980771	980772	980773	980774	980775	980777	980778	980779
			Sample Location:		BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Anthracene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**			980780	980781	980782
		Sample Location:			WS02	WS03	WS03
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			1.5	0.5	1.5
		Date Sampled:			03-Mar-2020	03-Mar-2020	03-Mar-2020
		Asbestos Lab:			COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	
ACM Detection Stage	U	2192		N/A	-	-	
Moisture	N	2030	%	0.020	11	14	11
pH	M	2010		4.0	8.5	8.5	8.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010
Sulphur (Elemental)	M	2180	mg/kg	1.0	< 1.0	1.6	
Cyanide (Free)	M	2300	mg/kg	0.50			< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	0.50
Thiocyanate	M	2300	mg/kg	5.0			6.9
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	9.4	7.6	6.6
Sulphate (Total)	M	2430	%	0.010	0.054	0.050	0.053
Arsenic	M	2450	mg/kg	1.0	17	13	16
Barium	M	2450	mg/kg	10	57	72	
Cadmium	M	2450	mg/kg	0.10	2.3	1.6	1.9
Chromium	M	2450	mg/kg	1.0	15	15	16
Molybdenum	M	2450	mg/kg	2.0	4.4	2.4	
Antimony	N	2450	mg/kg	2.0	2.0	< 2.0	
Copper	U	2450	mg/kg	0.50	29	16	18
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	48	35	39
Lead	M	2450	mg/kg	0.50	27	15	18
Selenium	M	2450	mg/kg	0.20	1.0	0.32	0.27
Zinc	U	2450	mg/kg	0.50	91	71	76
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	15	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40			1.3
Total Organic Carbon	M	2625	%	0.20	0.85	0.63	
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0

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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980780	980781	980782
			Sample Location:		WS02	WS03	WS03
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.5	0.5	1.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10			< 0.10
Acenaphthylene	M	2700	mg/kg	0.10			< 0.10
Acenaphthene	M	2700	mg/kg	0.10			< 0.10
Fluorene	M	2700	mg/kg	0.10			< 0.10
Phenanthrene	M	2700	mg/kg	0.10			< 0.10
Anthracene	M	2700	mg/kg	0.10			< 0.10
Fluoranthene	M	2700	mg/kg	0.10			< 0.10
Pyrene	M	2700	mg/kg	0.10			< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10			< 0.10
Chrysene	M	2700	mg/kg	0.10			< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10			< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10			< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10			< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10			< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10			< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10			< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0			< 2.0
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980780	980781	980782
			Sample Location:		WS02	WS03	WS03
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.5	0.5	1.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980769						
Sample Ref:							
Sample ID:							
Sample Location:	BH01						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	1.2	3	5	6
Loss On Ignition	2610	M	%	2.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.037	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0018	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0023	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0091	0.091	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0024	< 0.50	4	50	200
Chloride	1220	U	6.6	66	800	15000	25000
Fluoride	1220	U	0.48	4.8	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	65	650	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	54	540	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980772						
Sample Ref:							
Sample ID:							
Sample Location:	BH02						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.97	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.044	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0057	< 0.50	20	100	300
Cadmium	1450	U	0.00020	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0028	< 0.050	2	50	100
Mercury	1450	U	0.00089	0.0089	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0051	< 0.50	4	50	200
Chloride	1220	U	140	1400	800	15000	25000
Fluoride	1220	U	1.2	12	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	42	420	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980773						
Sample Ref:							
Sample ID:							
Sample Location:	BH02						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.73	3	5	6
Loss On Ignition	2610	M	%	1.2	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.017	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0020	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	0.00096	0.0096	0.01	0.2	2
Molybdenum	1450	U	0.0083	0.083	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	25	250	800	15000	25000
Fluoride	1220	U	0.24	2.4	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	20	200	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980774						
Sample Ref:							
Sample ID:							
Sample Location:	BH03						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.54	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.061	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0097	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	0.0016	0.016	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0025	0.025	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0014	< 0.50	4	50	200
Chloride	1220	U	14	140	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	2.3	23	1000	20000	50000
Total Dissolved Solids	1020	N	57	570	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	30	300	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980775						
Sample Ref:							
Sample ID:							
Sample Location:	BH03						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.78	3	5	6
Loss On Ignition	2610	M	%	2.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.065	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0014	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.018	0.18	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	11	110	800	15000	25000
Fluoride	1220	U	0.21	2.1	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	52	520	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	32	320	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980777						
Sample Ref:							
Sample ID:							
Sample Location:	WS01						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.89	3	5	6
Loss On Ignition	2610	M	%	2.1	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.060	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0067	0.067	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.32	3.2	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	25	250	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980778						
Sample Ref:							
Sample ID:							
Sample Location:	WS01						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.74	3	5	6
Loss On Ignition	2610	M	%	1.9	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.083	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.012	0.12	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	1.9	19	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	1.2	12	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	8.6	86	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980779						
Sample Ref:							
Sample ID:							
Sample Location:	WS02						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.64	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.068	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0054	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0013	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0049	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	55	550	800	15000	25000
Fluoride	1220	U	0.22	2.2	10	150	500
Sulphate	1220	U	1.8	18	1000	20000	50000
Total Dissolved Solids	1020	N	61	610	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	35	350	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980780						
Sample Ref:							
Sample ID:							
Sample Location:	WS02						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.85	3	5	6
Loss On Ignition	2610	M	%	2.7	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.090	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0019	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0015	< 0.50	4	50	200
Chloride	1220	U	4.4	44	800	15000	25000
Fluoride	1220	U	0.17	1.7	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	40	400	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980781						
Sample Ref:							
Sample ID:							
Sample Location:	WS03						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.63	3	5	6
Loss On Ignition	2610	M	%	2.1	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.051	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0066	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0012	< 0.050	2	50	100
Mercury	1450	U	0.00054	0.0054	0.01	0.2	2
Molybdenum	1450	U	0.0090	0.090	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0025	< 0.50	4	50	200
Chloride	1220	U	1.7	17	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	61	600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	39	390	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

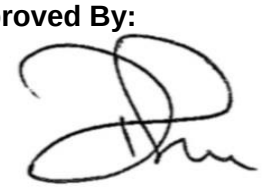
UKAS TESTING
2183

Final Report

Report No.:	20-08376-1
Initial Date of Issue:	26-Mar-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Colm Hurley Carin Cornwall Darren O'Mahony Fernando Alfonso Gabriella Horan Joe Gervin John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	20-0013 Goatstown Development, Dublin

Quotation No.:		**Date Received:**	16-Mar-2020
Order No.:		**Date Instructed:**	20-Mar-2020
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	26-Mar-2020
Date Approved:	26-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Chemtest
The right chemistry to deliver results

Results - Water

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-08376	20-08376	20-08376
Quotation No.:		**Chemtest Sample ID.:**			986808	986809	986810
Order No.:		Client Sample Ref.:			WS	WS	WS
		Sample Location:			BH01	BH02	BH03
		Sample Type:			WATER	WATER	WATER
		Date Sampled:			12-Mar-2020	12-Mar-2020	12-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
pH	U	1010		N/A	8.1	8.2	7.9
Sulphate	U	1220	mg/l	1.0	110	52	150
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Thiocyanate	U	1300	mg/l	0.50	< 0.50	< 0.50	< 0.50
Sulphide	U	1325	mg/l	0.050	[B] < 0.050	[B] < 0.050	[B] < 0.050
Total Hardness as CaCO3	U	1270	mg/l	15	440	290	370
Arsenic (Dissolved)	U	1450	µg/l	1.0	1.6	< 1.0	1.3
Boron (Dissolved)	U	1450	µg/l	20	58	54	48
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	0.15
Chromium (Dissolved)	U	1450	µg/l	1.0	13	7.6	2.7
Copper (Dissolved)	U	1450	µg/l	1.0	4.4	1.8	2.4
Mercury (Dissolved)	U	1450	µg/l	0.50	0.80	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0	5.0	1.6	9.3
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	26	46	57
Zinc (Dissolved)	U	1450	µg/l	1.0	8.6	2.2	10
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20
Total Organic Carbon	U	1610	mg/l	2.0	3.1	3.1	3.1
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	2.1
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	3.2

Chemtest
The right chemistry to deliver results

Results - Water

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-08376	20-08376	20-08376
Quotation No.:			**Chemtest Sample ID.:**		986808	986809	986810
Order No.:			Client Sample Ref.:		WS	WS	WS
			Sample Location:		BH01	BH02	BH03
			Sample Type:		WATER	WATER	WATER
			Date Sampled:		12-Mar-2020	12-Mar-2020	12-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	0.72
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	2.1
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	5.1
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	1.7
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	15
Benzene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Toluene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Ethylbenzene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
m & p-Xylene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
o-Xylene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Total Phenols	U	1920	mg/l	0.030	[B] < 0.030	[B] < 0.030	[B] < 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
986808	WS		BH01	12-Mar-2020	BC	Coloured Winchester 1000ml
986809	WS		BH02	12-Mar-2020	BC	Coloured Winchester 1000ml
986810	WS		BH03	12-Mar-2020	BC	Coloured Winchester 1000ml

Report Information

Key

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>	"greater than"

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Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

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A - Date of sampling not supplied
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All water samples will be retained for 14 days from the date of receipt
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customerservices@chemtest.com

Southern Testing
Environmental & Geotechnical

SPT Hammer Energy Test Report

in accordance with BSEN ISO 22476-3:2005

Southern Testing
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

SPT Hammer Ref: .T5
Test Date: 22/02/2020
Report Date: 03/03/2020
File Name: .T5.spt
Test Operator: NPB

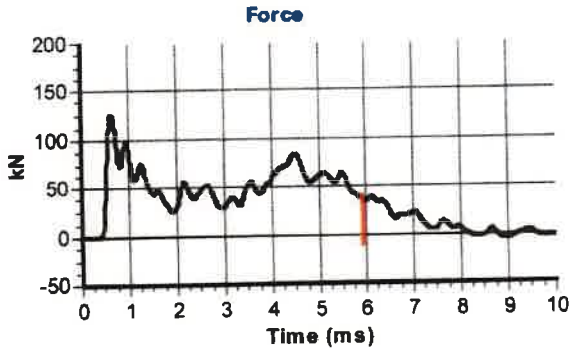
Instrumented Rod Data

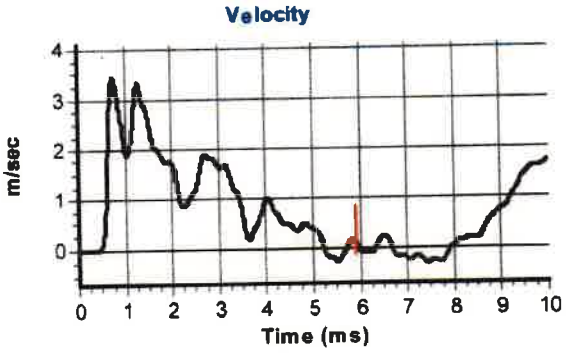
Diameter d_r (mm):	54
Wall Thickness t_r (mm):	6.0
Assumed Modulus E_a (GPa):	200
Accelerometer No.1:	6458
Accelerometer No.2:	9607

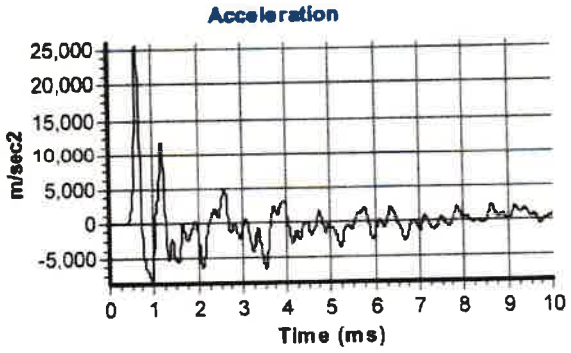
SPT Hammer Information

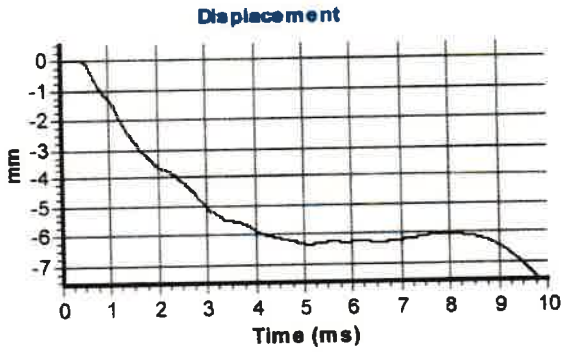
Hammer Mass m (kg):	63.5
Falling Height h (mm):	760
SPT String Length L (m):	10.0

Comments / Location
BALLEYMONEY









Calculations

Area of Rod A (mm2):	905
Theoretical Energy E_{theor} (J):	473
Measured Energy E_{meas} (J):	360

Energy Ratio E_r (%): **76**

Signed: Neil Burrows
Title: Field Operations Manager

The recommended calibration interval is 12 months

CAUSEWAY GEOTECH

APPENDIX E

SPT HAMMER ENERGY MEASUREMENT REPORT

CAUSEWAY GEOTECH

APPENDIX F

PRA/GQRA REPORT

WYG Environment

part of the WYG group

Goatstown Road, Dublin

Land Contamination Assessment

Preliminary & Generic and Quantitative Risk Assessment

A116704

Causeway Geotech Ltd

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Prepared on behalf of WYG Environment and Planning (Northern Ireland) Limited.

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Executive Summary

Instruction	WYG Environmental & Planning (N.I) Ltd (WYG) was instructed by Causeway Geotech Ltd (CGT) to undertake a Preliminary and Generic Quantitative Risk Assessment on the Goatstown Road, Dublin, Co. Dublin. . WYG understand the site is proposed for a future residential end use.
Site Description	The site is a motor vehicle dealer, Vector Motors, mainly bounded by residential properties to the west of the Goatstown Road which forms the western site boundary. There are a number of residential properties are located to the south. The site is made up entirely of hardstanding cover with a large built structure (sales/show room) in the north-east.
Preliminary Risk Assessment Summary	Following completion of the Desktop Study and Preliminary Risk Assessment the following potential pollutant linkages were identified: • Potential for reduced quality soils/groundwater associated with former site development presenting a risk to future site users; and • Potential for reduced quality soils/made ground associated with former development onsite, acting as a source for ground gas generation
Site Investigation	A percussive drilling rig was used to drill a total of 6 no. boreholes (WS01-WS03 and BH01-BH03) (typically to depths 2-3.5 mbgl (meters below ground level).
GQRA	The soil and groundwater results were compared against generic assessment criteria (GACs) based on a residential land use scenario where: • All soil analysis results were reported below the applicable GACs; • A number of marginal exceedances were identified in groundwater; and, • All petroleum (TPH), polycyclic aromatic (PAH) hydrocarbons, BTEX and MTBE results were reported below applicable GACs. Considering the marginal nature of the exceedances and the sites setting, the groundwater exceedances were not considered significant. Based on the monitoring results, the sites ground gas regime was classified as Characteristic Situation 1 (CS1 – very low risk).
Conclusions & Recommendations	No viable PPLs have been identified and the level of risk associated with the site and its proposed development is considered to be low. Recommendations to manage potential construction-phase risks and support compliance with pollution prevention guidance have been provided at the concluding chapter of this risk assessment.
This sheet is intended to provide a summary only of the initial assessment study of the site in relation to contamination. It does not provide a definitive engineering analysis.	

1.0 Introduction

1.1 Instruction

WYG Environmental & Planning (N.I) Ltd (WYG) was instructed by Causeway Geotech Ltd (CGT) to undertake a land contamination assessment for a site at Goatstown Road, Dublin. A site location plan is provided at Figure 1.

1.2 Brief

General information on the topography, geology, hydrology and hydrogeology and a review of current and historic usage was to be completed to enable potential human and environmental receptors, potential pathways and potential sources to be identified. This would enable a preliminary qualitative risk assessment (PRA) to be undertaken. Following this initial assessment, a GQRA (Generic Quantitative Risk Assessment) was undertaken to further investigate the potential pollutant linkages (PPLs) identified following the preliminary assessment.

1.3 Legal Context and Assessment Framework

The work, as presented in this report, has been completed in accordance with best practice guidance documents including "Framework Approach for the Management of Contaminated Land and Groundwater at EPA Licensed Facilities" (EPA, 2012); the "Code of Practice: Environmental Risk Assessment for Unregulated Disposal Sites" (EPA, 2007) and the "Model Procedures for the Management of Land Contamination – Contaminated Land Report 11" (CLR11) (EA, 2004). This latter piece of guidance is specifically relevant to land contamination in the United Kingdom (UK), however it is relevant, as the EPA's framework has been broadly based on it.

The framework approach identifies three stages as outlined below:

Stage 1 – Site Investigation and Assessment including

- Preliminary Site Assessment
- Detailed Site Investigation
- Quantitative Risk Assessment

Stage 2 – Corrective Action Feasibility and Design

- Outline Corrective Action Strategy (Objectives)

- Feasibility study and outline design
- Detailed design
- Final Strategy and implementation plan

Stage 3 – Corrective Action Implementation and Aftercare

- Enabling works
- Corrective Action Implementation and Verification
- Aftercare

The assessment presented in this report presents the results of a site investigation and generic quantitative risk assessment in accordance with Stage 1 above.

The risk assessment process is underpinned by the establishment and continual refinement of a Conceptual Site Model (CSM). A CSM describes the potential sources of contamination at a site, the contaminant migration pathways it may follow and the receptors that could be or are being impacted. When all three are present i.e. source, pathway and receptor, then a potential pollutant linkage is present, requiring characterisation and assessment in order to determine whether remedial works are needed to adequately address any potentially unacceptable risks.

1.4 Terms and Conditions

Attention is drawn to the report conditions, included in Appendix A, and the terms and conditions of the engagement as detailed in our accepted proposal.

1.5 Limitations

The assessment has been completed based on the information as supplied by our Client CGT. WYG cannot be held liable with respect to the, accuracy and completeness of the provided information.

2.0 Preliminary Risk Assessment

The environmental desk study comprises the gathering of all available relevant documentation relating to the site. The review of identified literature ensures that an initial site-specific conceptual model can be developed and allows for the identification of potentially significant pollutant linkages at the site.

In order to develop an outline conceptual model and identify possible pollutant linkages at the site, the following was undertaken:

- A review of current and historical Ordnance Survey maps/Aerial Imagery;
- A review of geological and hydrogeological maps;
- Identification and description of the nearest surface water bodies; and
- A search of designated environmental sites

WYG did not undertake a site walkover of the site as this was undertaken by the contractor, Causeway GeoTech. All relevant information regarding the site was passed on prior to the compilation of this report.. The inspection included land use in the immediate periphery.

2.1 Site Details

2.1.1 Site Description

National Grid Reference: O 17805 28940

The site is located within a predominantly residential setting. The site is currently occupied by Vector Motors, a motor vehicle dealer. The site is made up entirely of hardstanding cover with a built structure in the north-east.. The entirety of the site is generally level; however, the surrounding area rises slightly to the south / south east. The total area of the site is c. 3320m^2.

Surrounding land use is summarised in Table 1 overleaf.

Table 1 - Surrounding Land Use

Boundary	Description
North	The site is bounded to the north by a block of residential properties.
East	The site is bounded to the east by residential housing.

Boundary	Description
South	The site is bounded to the south by residential properties which include 'O'Mahony Property Team', 'Sandra Sheeran Boys & Girls Footwear' and 'Open Training College'. Further to the south lies residential housing.
West	The site is bounded to the immediate west by Goatstown Road, further beyond this to the west lies residential housing.

2.2 Site History

Information on the site's history of use was obtained through an inspection of available historical Ordnance Survey (OS) maps and orthophotography. The historical description below encompasses the period from the 1830s to the present day.

These historical maps were viewed on the online Geohive web viewer and can be viewed online at http://map.geohive.ie/mapviewer.html. Table2 below provides a summary of this information from the historical maps.

Table 2- Site History

OS Map	Description
1837-1842	The 1837-1842 survey indicates that the site itself was undeveloped, denoted as being part of Rosemont Estate. The area surrounding the site appears as being mainly undeveloped land and is also denoted as being mainly for recreational and agricultural use. Large residential dwellings are present to the southeast of the site (c. 20m) and in the surrounding area. The site is bound to the west by a main road in the same location as is visible in present maps.
1888-1913	The 1888-1913 survey indicates that the site and surrounding area remain unchanged in the intervening period. The site has now been identified as part of Trimbleston Lodge estate. A Rath has now been identified c. 140m to the southwest of the site.
1913 - 1995	It is to be noted that no relevant historical maps are readily available between 1913-1995.

OS Map	Description
1995 Aerial Imagery	The site itself has been developed for residential uses. The surrounding areas are now developed along the western and southern boundaries of the site which primarily consists of residential dwellings, similar to those visible today. To the northeast of the site is primarily for agricultural use. Beyond this more residential dwellings reside (c. 250m).
2000 Aerial Imagery	The site has been further developed with extensive hardstanding present to the south of the site. The north of the site still remains undeveloped. The surrounding area are unchanged from the past imagery.
2005-2012 Aerial Imagery	The site is now full developed resembling the same infrastructure present in current mapping. The surrounding area has remained unchanged from the past imagery with the exception of the construction of residential high-rise dwellings to the northeast of the site (c. 10m).
2017 Google Earth aerial imagery	The site and surrounding area are unchanged from past imagery with the exemption of further residential to the northwest of the site (c. 180m).

2.3 Environmental Setting

Details of the site's environmental setting have been obtained from the following sources:

- Geohive website (http://map.geohive.ie)
- Geological Survey Ireland (GSI) Spatial Resources website (http://dcenr.maps.arcgis.com)
- Office of Public Works (OPW) National Catchment-based Flood Risk Assessment & Management (CFRAM) mapping (http://www.cfram.ie/pfra/interactive-mapping/)
- Environmental Protection Agency (EPA) maps (http://gis.epa.ie/Home)
- OPW historical flood mapping (http://www.floodinfo.ie/map/floodmaps/)
- EPA Radon Mapping (http://www.epa.ie/radiation/radonmap).

2.4 Geology

2.4.1 Made Ground

A limited depth of made ground is likely to be present across the site due to the historical development noted on-site.

Depending on its nature and composition, made ground has the potential to be affected by a range of organic and inorganic contaminants, asbestos and be a source of ground borne gases such as carbon dioxide (CO_2) and methane (CH_4).

2.4.2 Superficial Geology

Available geological mapping from the GSI shows that the quaternary drift deposits underlying the site are likely to be till derived from limestones.

2.4.3 Solid Geology

Consultation with the GSI website revealed that the superficial deposits are likely to be underlain by the Lucan Formation, composed of dark limestone & shale.

2.5 Hydrogeology

2.5.1 Aquifer Classification

According to the Geological Survey of Ireland Spatial Resources online, their resources classifies the aquifer underlying the site as 'LI': denoting the aquifer is of local importance and describes a bedrock which is moderately productive only in local zones.

2.5.2 Groundwater Vulnerability

Groundwater vulnerability is defined as the tendency and likelihood of general contaminants to reach the water table after introduction at the ground surface. The pathway between the ground surface and the water table can affect the degree of attenuation of contaminants. The following factors can influence attenuation:

- The permeability of the superficial deposits;
- The thickness of the superficial deposits;
- The mode of groundwater flow in bedrock aquifers (fracture or intergranular flow);
- The permeability and clay content of intergranular bedrock aquifers;
- The depth to the water table in both superficial deposits and intergranular bedrock aquifers.

Based on these influential factors the vulnerability of the bedrock aquifer at the site has been designated as 'L', Low.

2.5.3 Groundwater Flow

Groundwater flow within the site area can only be calculated on a site-specific basis, however based upon the surrounding topography, which decreases slightly in elevation towards the north west, groundwater flow (where present) is considered likely to be in a north-westerly direction toward the Irish Sea c.3.5km to the northeast.

2.5.4 Groundwater Wells and Springs

There are no groundwater wells or springs within a 500m radius of the site vicinity.

2.6 Hydrology

2.6.1 Watercourses

The closest surface water body is the River Dodder which lies c. 1.7km north of the site vicinity. The river subsequently discharges into Dublin Bay.

2.6.2 Surface Water Drainage

Surface water runoff is managed via the local stormwater drainage network.

2.7 Utility Consultation Responses

2.7.1 ESB Ireland

ESB Ireland was contacted in an effort to determine infrastructure on site and in the immediate site vicinity. Their response indicates that MV/LV (10KV/20KV/400V/230V) underground cables enter the site to the west towards the main building onsite. ESB Ireland indicated that MV/LV (10KV/20KV/400V/230V) underground cables are also present c. 4m along the southwestern boundary of the site.

2.7.2 Gas Networks Ireland

Gas Network Ireland were contacted in an effort to determine existing infrastructure on site and in the immediate vicinity. The response received identified infrastructure along Goatstown Road to the west (distribution pipe, medium pressure). The pipeline enters the site and connects to the main building on-site.

A copy of the utility provider responses is included at Appendix B.

2.8 Statutory Consultations

2.8.1 Dun Laoghaire-Rathdown County Council

Dun Laoghaire-Rathdown County Council were contacted with regard to site-specific details on pollution incidents, contaminated land, Industry Pollution (IPC) consents, pollution related complaints and noise and air quality. The council response was unwilling or unable to provide the information as requested.

3.0 Preliminary Conceptual Model

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

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

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

A detailed conceptual model of the site is developed in this section to identify sources, pathways and receptors and thus identify plausible pollutant linkages.

3.1 Potential Contamination Sources

3.1.1 Current Land Use

The current land use is considered low to medium risk with respect to contaminative potential. Potential contaminant sources include hydrocarbons, solvents, paints, lubricants and contaminants associated with automotive repair, servicing and sales.

3.1.2 Historic Land Use

A review of historical mapping has not identified a specific contaminative or potentially contaminative land use(s) on the site. The site has been subject to development as have lands in the immediate periphery. It is assumed that as part of the previous site development works that made ground has been imported which has the potential to contain a variety of organic and inorganic contaminants presents a potential source for ground gas dependant on the nature and extent.

3.2 Risk Pathways

Pathways are the means by which a contaminant can reach a receptor. Active pathways are primarily dependent on the physical characteristics of the site and the surrounding area between source and receptor.

The key environmental pathways and exposure routes by which potentially contaminative substances can reach receptors are considered to be:

Direct

- Dermal contact
- Ingestion
- Inhalation of fugitive dusts

Indirect

- Leaching of potential contaminants from soil to groundwater;
- Vapour and/or gas migration and inhalation of volatile organic compounds (VOCs)/ground gases;
- Lateral and vertical migration of contaminated groundwater onsite (from offsite sources) and offsite; and
- Inhalation of ground gases within buildings

The nature of the site surface affects the potential for surface waters to infiltrate and penetrate the subsurface. The potential for infiltration will in turn affect the potential for leachate generation from potentially impacted vadose (unsaturated) zone soils.

WYG have not been provided with final development proposals at present although it is anticipated site use will residential be for a future residential land use. Therefore, the considered primary exposure pathways in terms of risk to human health are likely to be direct contact pathways, via ingestion, inhalation and dermal contact with potentially contaminated near surface soils in areas of potential future exposure (areas of peripheral landscaping). The potential presence of infilled materials poses a potential risk to future site users via the generation of ground gas and ingress into future development.

With regard to water receptors, geological mapping has identified that the site is likely to be underlain by superficial deposits of till derived from limestones with solid geology described as dark limestone and shale of the Luca Formation. Groundwater is considered to be of low vulnerability. Risk to surface water is considered low given the distance of the River Dodder to the site (c. 1.7km north).

3.3 Receptors

Receptors are defined by their potential for being adversely affected by a contaminant and can be grouped into those that impact human health, and those that effect environmental targets, including controlled waters and sensitive ecological sites.

Human health receptors identified, for this site, include:

- Future site users; and

- Construction workers.

Environmental receptors identified include:

- Shallow groundwater; and
- Surface water; and
- Bedrock aquifer.

3.4 Conceptual Site Model

On the basis of the above, a few possible pollutant linkages have been identified at the site, which are summarised in table 3 below.

Table 3 - Conceptual Site Model

On-site Contaminant	Pathway	Receptor
Potential made ground and reduced quality soils/groundwater (potentially containing a range of organic/inorganic contaminants including asbestos containing materials and/or fibres) associated with former site development	Inhalation of fugitive dusts Ingestion Direct contact	Construction workers and future site users
	Leaching to shallow/deeper groundwater and offsite migration	Onsite and offsite shallow/deeper groundwater.
Potential Ground gas generation from underlying infilling material	Ingress of gases/vapours into buildings Inhalation of gases/vapours	Future site users
Potential impacts to shallow groundwater/groundwater on-site from VOCs	Migration on site Migration onsite, volatilisation to indoor air	Shallow groundwater/groundwater Future site residents

3.5 Preliminary Risk Assessment Conclusions and Recommendations

The Preliminary Risk Assessment has identified potential pollutant linkages (PPL) associated with the historic and current use of the site. The sources identified pose a low / low to moderate potential risk through direct and indirect exposure pathways to human health and controlled waters.

In order to further assess the identified potential pollutant linkage detailed within the developed Conceptual Site Model (CSM), it was recommended that a site investigation be undertaken to investigate the potential pollutant linkage (PPLs) identified.

It was recommended that the site investigation should include the collection of samples (soil and groundwater) for chemical laboratory analysis and to allow an updated Generic Quantitative Risk Assessment (GQRA) to be completed in accordance with CLR 11 Model Procedures. It was also recommended that ground gas monitoring and assessment should also be completed in accordance with best practice guidance.

4.0 Generic Quantitative Risk Assessment

The purpose of a Generic Quantitative Risk Assessment (GQRA) is to refine the conceptual model developed following the preliminary risk assessment. If the GQRA identifies potentially unacceptable risks then it may be necessary to carry out remedial works or further assessment in the form of a DQRA, which in turn may result in remedial works being recommended.

4.1 Site Investigation

CGT progressed a number of boreholes and window samples across the site. A percussive drilling rig was used to drill a total of 6 no. boreholes (WS01-WS03 and BH01-BH03) (typically to depths 2-4 mbgl (meters below ground level)). The borehole locations are presented in Figure 2.

4.1.1 Monitoring Well Installation

Three of the boreholes (BH01, BH02 and BH03) were installed as permanent gas and groundwater monitoring wells. The construction details for the installed wells are presented in the borehole logs in Appendix C.

4.1.2 Soil Sampling

A total of 12 no. representative soil samples were selected for submission to an independent UKAS accredited laboratory for analysis. Samples were selected at intervals during borehole progressions. The soil samples were analysed for a broad range of determinants as outlined in the provided bill of quantities (BOQs) Engineers Ireland Suite I to include the following parameters;

- Speciated Total Petroleum Hydrocarbons (TPH-CWG);
- BTEX/MTBE (benzene, toluene, ethylbenzene, xylene and methyl Tert-Butyl Ether (MTBE)
- Heavy metals;
- Speciated polycyclic aromatic hydrocarbons (PAHs);
- Phenols;
- Asbestos screen;
- PCBs (Polychlorinated biphenyls) and,
- Several Inorganic Parameters including pH, TOC and moisture.

4.1.3 Water Sampling

The results from the groundwater samples have been assessed in accordance with criteria provided in Schedule 5 and 6 of the European Communities Environmental Objectives (Surface Water) Regulations 2009 (S.I. No. 272 of 2009) for other surface waters. Where criteria are not available, samples were assessed against the Water Framework Directive for freshwaters, Environmental Quality Standards (EQS), Schedule 5 of the European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010), European Communities Environmental European Union (Drinking Water) Regulations 2014 (S.I No. 122 of 2014), , WHO (World Health Organisation standards for Drinking Water) or other appropriate guidance values.

In respect of Petroleum Hydrocarbons, the WHO Values (World Health Organisation) - Petroleum Products in Drinking Water, Background document for development of WHO Guidelines for Drinking Water Quality, WHO) have been considered or where applicable an appropriate indicator compound.

Risk to health from contaminants on groundwater via the vapour exposure pathway (inhalation of indoor air) has been assessed for those contaminants considered to be of sufficient volatility via comparison of derived SOBRA assessment criteria[1].

4.1.4 Ground Gas Monitoring

Installed borehole locations were monitored for ground gas on four No. occasions by CGT. Measurements of flow rate, methane (CH_4), carbon dioxide (CO_2), oxygen (O_2) carbon monoxide (CO) and hydrogen sulphide (H_2S) concentrations were undertaken using a GA5000 Gas Analyser.

4.2 Ground Conditions Encountered

A copy of the derived exploratory logs is presented at Appendix C. Ground conditions were generally described as made ground comprising of reworked gravelly clay with low cobble content. Fragments of red brick were also reported at BH01, BH02 and WS01. Made ground was reported to typical depths of 0.1 to 1 mbgl.

Superficial deposits typically comprised brown stiff sandy gravelly clay with sub-rounded gravel on occasion to typical depths of around 2.3 mbgl with colours changing to black and becoming stiffer as the BH's progress at depths typically around 2.3 3.4 mbgl.

[1] *SOBRA Development of Generic Assessment Criteria for Assessing Vapour Risks to Human Health from Volatile Contaminants in Groundwater, Version 1.0, February 2017.*

4.2.1 Groundwater Occurrence

During the borehole progressions groundwater was encountered at varying depths during the trial pit investigation at depths of 1.8 mbgl (WS01), 1.8 mbgl (WS02) and 1.9 mbgl (WS03).

4.2.2 Visual/Olfactory evidence of contamination

There was no evidence of visual or olfactory contamination during the progression of any of the 6no. boreholes.

4.3 Contamination Assessment Methodology

To assess the human health and environmental risks posed by potential contaminants within the underlying soils and groundwater, WYG undertook a comparison of the laboratory analysis for soil and groundwater samples using generic assessment criteria. Generic assessment criteria are contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

4.3.1 Soil

Following the UK CLEA methodology, generic assessment criteria in the form of CIEH S4UL`s and WYG Threshold Screening Values (TSVs) have been used to assess a risk to human health.

A soil organic matter value of 1% has been used to calculate TSVs using the CLEA v1.07 model for all contaminant which is considered conservative based on reported site-specific soil organic matter concentrations. For each contaminant, threshold screening values (TSVs) have been derived for various land use types. These include:

- Residential with plant uptake (RwP);
- Residential without plant uptake (RWoP);
- Residential;
- Public open space (residential)
- Public open space (park); and,
- Allotments.

WYG have not been provided with specific development plans however it is residential understood that a residential land use is proposed. In an effort to provide a conservative assessment of risk to health from contaminants in soils reported concentrations have been assessed against the residential relevant residential generic assessment criteria (GAC).

A summary of the assessment criteria used, and the method of their derivation is included within the S4UL document however, this cannot be reproduced for inclusion in the report. Where S4UL`s are not available WYG criteria are used, a copy of the source reference material is presented in Appendix D.

4.3.2 Ground Gas

The CIRIA C665 document provides guidance on the collection of relevant and valid data that allows an accurate description of soil gases to be made; a rigorous consistent and transparent assessment of the risks posed by soil gas to be undertaken and an appropriate strategy for remedial works developed. The tables currently utilised for classifying gassing sites is shown as Appendix E.

The criteria shown use both gas concentrations and boreholes flow rates to define a characteristic situation for a site based on limiting borehole gas volume flow for methane and carbon dioxide, called the Gas Screening Value. The Gas Screening Value (litre of gas per hour) = borehole flow rate (l/h) x gas concentration (%). This calculation is carried out for both carbon dioxide and methane, and the worst-case value adopted. The characteristic situation is then determined.

Considering the sites likely future use the onsite gas regime will be assessed assuming a Situation B type development applying the Wilson and Card Assessment system as per CIRIA C665 guidance and as described at Appendix E.

4.4 Soil Assessment

A total of 12 no. soil samples were selected and analysed for a range of the following determinants including metals, speciated polycyclic aromatic hydrocarbons (PAHs), speciated TPH, BTEX, phenol and several inorganic parameters. The results of the laboratory soil analyses are summarised in Appendix F in which they are compared to the relevant generic assessment criteria (GAC) assuming a residential end use.

Laboratory certificates for analysis are provided in Appendix G.

4.4.1 Heavy Metals

Twelve no. samples were analysed for heavy metals with no determinants reported to be in excess of their respective GAC.

4.4.2 Organics

Polycyclic aromatic hydrocarbons (PAHs)

No PAH compounds in any of the 12no. boreholes were reported in excess of the respective GAC and are therefore not considered to present a risk assuming a residential land use.

Speciated Total Petroleum Hydrocarbons (TPH)

The reported concentrations for all aliphatic/aromatic fractions were not reported above applicable residential GAC in all of the 12no. boreholes sampled from.

BTEX & MTBE

The reported concentrations for all MTBE and BTEX compounds were reported at less than the laboratory limit of detection and were reported less than residential GAC.

Inorganics

No inorganic contaminants of concern were identified. The pH of samples tested were all within the naturally occurring range (pH 5 to pH 9).

4.4.3 Asbestos

ACMs (asbestos containing materials) or asbestos fibres were not detected in any of the 12no. boreholes sampled from.

4.4.4 Summary of Soil Assessment

The assessment of soil contaminant concentrations has identified no outstanding contaminants present within the soils which are considered to present a potential risk to health when assuming a residential land use.

4.5 Groundwater Assessment - Controlled Waters

A total of 3 no. groundwater samples were collected from BH01, BH02 and BH03 following appropriate well development. These samples were submitted to a UKAS accredited laboratory for analysis for suites of metals, organic hydrocarbons and a number of inorganic compounds. The screening summary sheet presented in Appendix F details the selected water quality standards used to assess each given contaminant and summarises the associated laboratory data, highlighting any results that exceed the relevant screening value. Laboratory Certificates are provided in Appendix G.

4.5.1 Metals

All groundwater samples were analysed for a suite of heavy metals. The results showed that the majority of results were reported below target values. However:

- Cadmium concentrations of 0.15ug/l at BH03 exceeded the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Inland Surface Waters (AA) of 0.08ug/l.
- Chromium concentrations of 13ug/l at BH01 exceeded the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Inland Surface Waters (AA) of 4.7ug/l.
- Mercury concentrations of 0.8ug/l at BH01 exceeded the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Inland Surface Waters (AA) of 0.05ug/l, the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Other Surface Waters (AA) of 0.05ug/l and also the European Communities Environmental Objectives (Groundwater) Regulations 2010 – Groundwater intended for human consumption of 0.75ug/l.
- Selenium concentrations of 26.0ug/l (BH01), 46.0ug/l (BH02) and 57ug/l (BH03) exceeded the European Union (Drinking Water) Regulations 2014 of 10ug/l.
- Zinc concentrations of 8.6ug/l at BH01 and 10ug/l at BH03 exceeded the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Inland Surface Waters (AA) of 8.0ug/l.

Potable groundwater abstractions are not known or suspected onsite or in the immediate site environs therefore exceedances of potable standards are not considered of significance. Similarly, the closest surface water to the site has been identified as the river Dodder located c. 1.7km away. Risk to surface waters is therefore considered low to negligible base on the site context.

4.5.2 Organic Hydrocarbons

Aliphatic and Aromatic Hydrocarbons

All 3 no. samples were analysed for the presence of petroleum hydrocarbons, and results were compared against World Health Organisation (WHO) guideline values for petroleum hydrocarbons in groundwater and UK Drinking Water Standards (UK DWS). The results were found to be below the laboratory limit of detection (LoD) in all instances.

Polycyclic aromatic hydrocarbons (PAHs)

All 3 no. samples were analysed for the presence of PAH compounds. Results were reported at concentrations below the target assessment criteria for most parameters where available. However, the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Inland Surface Waters (AA) and the European Communities Environmental Objectives (Surface Water) Regulations 2009 – Other Surface Waters (AA) were exceeded in the following instances:

- Elevated anthracene concentrations (1.7ug/l) were found in BH03 exceeding the thresholds of 0.1ug/l.
- Marginally elevated Benzo(a)pyrene concentrations (0.10ug/l) were elevated at BH01, BH02 and BH03, exceeding the thresholds of 0.05ug/l.

Due to these concentrations being relatively marginal and the absence of a viable surface water receptor(s) in the site vicinity, it is unlikely that they will pose a risk to controlled waters.

Phenols

Concentrations for phenols were reported below the laboratory limit of detection for all 3no. analysed samples.

4.5.3 Inorganics

All 3 no. samples were analysed for a range of inorganic parameters, the results for all 3no. samples were below the screening criteria.

The groundwater and surface water pH were reported within the natural range of >6, <9.

4.6 Groundwater Assessment–Human Health

Measured groundwater concentrations did not exceed the SoBRA groundwater screening criteria for assessing the risk to residential development.

4.7 Groundwater Analysis Summary Assessment

The groundwater assessment has identified low level heavy metal and PAH contamination in groundwater samples analysed. The concentrations reported as not considered to present a significant risk to surface water due to the relatively low concentrations reported and the not insignificant distance to the closest surface water receptor (river Dodder, 1.7km). Reported concentrations in groundwater are also not considered to present a risk to health assuming a proposed residential land use following comparison of reported concentrations with relevant GAC.

4.8 Ground Gas Assessment

Detailed gas monitoring data is presented in Appendix I. Using an GA5000, 3 no. boreholes were monitored on 4no. occasions from the 6th March to the 24th March by CGT, following the completion of the site investigation.

4.8.1 Meteorological Conditions

Barometric pressure was recorded during each of the monitoring events, measuring 991mB and 1008mB. Weather conditions ranged from 'dry' to 'cloudy and breezy' during the monitoring period.

4.8.2 Site Gas Concentrations

Concentrations of methane and carbon dioxide were reported as low across the monitoring rounds and did not exceed the recommended threshold values of 1% v/v and 5%v/v respectively.

The maximum recorded CO_2 concentration was 1.8%v/v (round 2, BH01) and the CH_4 was 0.0v/v across all rounds. The maximum flow rate (measure of ground gas generation potential) recorded over the period was -15.6 l/h (litres per hour), however this reduced to -3.3 l/h after ninety seconds. The flow in all boreholes throughout the four rounds of monitoring was typically seen at 0.1 l/h or 0.2 l/h. The highest positive flow over the four monitoring rounds was recorded at 0.2 l/h.

Ground gas risk has been assessed in line with CIRIA C665 which assigns a characteristic situation (CS) on the basis of hazard level.

A calculated Gas Screening Value (GSV) (concentration x flow) for CO_2 is 1.8%vol x 0.2 l/h = 0.004 and the GSV for CH_4 is 0.0%vol x 0.2 l/h = 0.000. It is therefore recommended the site's ground gas regime be classified as CS1, low risk.

5.0 Revised Conceptual Site Model

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

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

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

Following a review of the site information and associated laboratory test data provided to WYG by CGT no significant pollutant linkages have been identified on the basis of the proposed land use.

6.0 Conclusion & Recommendations

On the basis of the information provided to WYG by CGT following the recent site exploratory works, the site is not considered to be subject to significant contamination and is not considered to present a potential risk to health or to the environment.

Based on this assessment, the level of risk associated with the site's redevelopment for a residential land use is considered **low** and as a result specific remedial measures to support development are not recommended.

General recommendations are provided in the following sections to mitigate potential construction-phase land contamination risks and support the compliant management of development waste arisings should they occur.

6.1 Contractor Works

The risks posed to construction workers through short term exposure to potentially reduced quality soils and groundwater can be minimised through adherence to the following relevant health and safety regulations / guidance.

The health and safety implications of working with potentially contaminated soils and groundwater should be fully considered prior to the commencement of any earthworks through the development of an appropriate health and safety plan. It is considered that the measures adopted to minimise the exposure of construction workers to contaminants should include following as a minimum:

- 1) Provision should be made for washing and toilet facilities; clean and dirty collection, laundering and storage facilities for protective clothing; and wash facility for footwear.
- 2) Provision of Personal protective equipment (PPE) as a minimum PPE should include the following:
  - headwear
  - footwear
  - disposable overalls/impermeable outer garments
  - gloves
  - eye protection

Should any unexpected materials be encountered during the earthworks, site operations should stop until the materials have been identified.

6.2 Unexpected Contamination

Should any unexpected materials be encountered during the development earthworks, site operations should stop until the materials have been identified. Examples of such materials include buried barrels or containers, soil or water with an unusual colour or odour, and other evidence of contamination, for example iridescent sheens (like oil or diesel) on soil or water. Should such contamination be identified the following measure should be undertaken by construction workers to minimise the potential risks.

6.3 Waste Management

Where significant waste arisings are generated during site enabling works these materials should be legally classified to ensure compliance with applicable waste legislation. Regulations are informed by EU Directives including the Waste Framework Directive, as implemented at national level in Ireland via the Waste Management Acts 1996-2008 and other regulations. Waste should be classified in line with the Environmental Protection Agency (EPA) Guidance, Waste Classification, List of Waste & Determining if Waste is Hazardous or Non-Hazardous (2018).

Figures

Figure 1 – Site Location Plan

Key

Site Boundary

N

Project: A116704	Date: 31/03/2020	Drawn by: EMN	Checked by: PH	Verified by: PH	Absolute Scale @A3 1:7,579

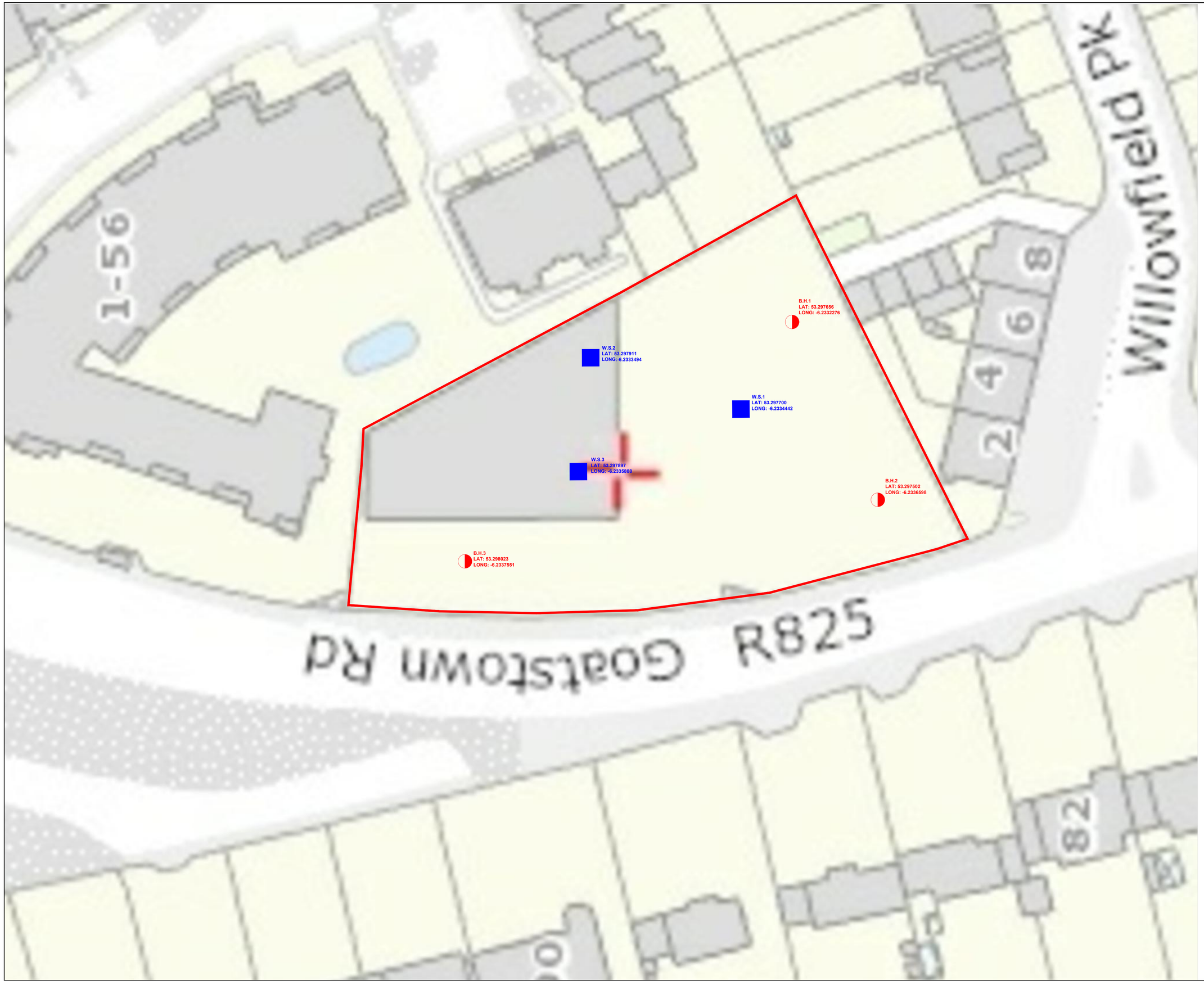
Figure 1: Site Location Plan

Drawn using ESRI ArcMap 10

WYG
Locksley Business Park
Montgomery Road
BELFAST
BT6 9UP

Telephone: +44 (0)28 90706000
Email: belfast@wyg.com
Web: www.wyg.com

Figure 2 – Borehole Location Plan



NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS & ARCHITECT'S DRAWINGS.FIGURED DIMENSIONS ONLY (NOT SCALING) TO BE USED. WHERE A CONFLICT OF INFORMATION EXISTS OR IF IN ANY DOUBT - 'ASK'.
2. CONSULTANTS TO BE INFORMED IMMEDIATELY OF ANY DISCREPANCIES BEFORE WORK PROCEEDS.

BOREHOLE LOCATION

WINDOW SAMPLE LOCATION

ISSUE	DATE	DESCRIPTION	DRN. / CHKD	P.E. / P.D.
T1	06.01.19	ISSUED FOR TENDER	TMH / TMH	POD / BM

DRAWING STAGE

TENDER

BM
BARRETT MAHONY
Dublin Office:
Sandwith House, 52-54 Lower Sandwith Street, Dublin 2, Ireland.
Tel: (01) 677 3200 Fax: (01) 677 3164
London Office:
12 Mill Street, London SE1 2AY, United Kingdom
Tel: (0044) 20 3750 3530
Consulting Engineers, Civil . Structural . Project Management.E-mail: bmce@bmce.ie Web: www.bmce.ie

The Institution of Structural Engineers · ACEI · FIDIC International Federation of Consulting Engineers

CLIENT

ORCHID RESIDENTIAL LTD.

PROJECT TITLE	BM PROJECT No.
SITE INVESTIGATION LAYOUT	19.289

MODEL REFERENCE	MODEL REV.	SUITABILITY

DRAWING TITLE

SITE INVESTIGATION LAYOUT

DRAWING No.	ISSUE
GOAT-MD-ZZ-ZZ-DR-C-1050	T1

Appendix A- WYG Terms & Conditions

WYG ENVIRONMENTAL LTD

REPORT CONDITIONS

Contaminated Land Risk Assessment & Waste Classification Report
Goatstown, Dublin

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

This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to WYGE. In time improved practices, fresh information or amended legislation may necessitate a re-assessment. Opinions and information provided in this report are on the basis of WYGE using due skill and care in the preparation of the report.

This report refers, within the limitations stated, to the environment of the site in the context of the surrounding area at the time of the inspections. Environmental conditions can vary, and no warranty is given as to the possibility of changes in the environment of the site and surrounding area at differing times.

This report is limited to those aspects reported on, within the scope and limits agreed with the client under our appointment. It is necessarily restricted, and no liability is accepted for any other aspect. It is based on the information sources indicated in the report. Some of the opinions are based on unconfirmed data and information and are presented as the best obtained within the scope for this report.

Reliance has been placed on the documents and information supplied to WYGE by others but no independent verification of these has been made and no warranty is given on them. No liability is accepted, or warranty given in relation to the performance, reliability, standing etc of any products, services, organisations or companies referred to in this report.

Whilst skill and care have been used, no investigative method can eliminate the possibility of obtaining partially imprecise, incomplete or not fully representative information. Any monitoring or survey work undertaken as part of the commission will have been subject to limitations, including for example timescale, seasonal and weather-related conditions.

Although care is taken to select monitoring and survey periods that are typical of the environmental conditions being measured, within the overall reporting programme constraints, measured conditions may not be fully representative of the actual conditions. Any predictive or modelling work, undertaken as part of the commission will be subject to limitations including the representativeness of data used by the model and the assumptions inherent within the approach used. Actual environmental conditions are typically more complex and variable than the investigative, predictive and modelling approaches indicate in practice, and the output of such approaches cannot be relied upon as a comprehensive or accurate indicator of future conditions.

The potential influence of our assessment and report on other aspects of any development or future planning requires evaluation by other involved parties.

The performance of environmental protection measures and of buildings and other structures in relation to acoustics, vibration, noise mitigation and other environmental issues is influenced to a large extent by the degree to which the relevant environmental considerations are incorporated into the final design and specifications and the quality of workmanship and compliance with the specifications on site during construction. WYGE accept no liability for issues with performance arising from such factors.

Appendix B – Utility Provider Responses

From:	DialBeforeYouDig (ESB Networks) <dig@esb.ie>
Sent:	17 February 2020 11:37
To:	victoria.welsh
Cc:	patrick.higgins
Subject:	DUBLIN HV OH & UG: Electrical Network Information Request Reference No: 20200217-019_a3
Attachments:	ESB Construction Safety 28th 11.40.pdf; 20200217-019_A3.pdf; ATT00001.txt; ATT00002.htm

ESB Networks Reference: 20200217-019_A3

To Whom it May Concern,

Thank you for your recent enquiry regarding the location of ESB electrical network. Please find notice below of documentation which must be reviewed carefully in advance of site works at the requested location.

- Attached PDF map(s) of requested location.
- ESB Networks 'Avoiding Danger From Overhead Electricity Lines'.
  - https://esbnetworks.ie/docs/default-source/publications/avoid-electrical-hazards-when-working-near-overhead-electric-lines.pdf?sfvrsn=4
  - https://www.esbnetworks.ie/docs/default-source/publications/code-of-practice-for-avoiding-danger-from-overhead-electricity-lines.pdf?sfvrsn=425d33f0_8
- ESB Networks 'Safe System of Work for Digging'.
  - http://esbnetworks.ie/docs/default-source/publications/avoid-electrical-hazards-when-digging.pdf
- ESB Networks Code of Practice 'Safe Construction with Electricity'.
  - -See Attached Document.

Please fully read the contents of this e-mail and all attached or referenced Documentation carefully before you proceed.

The attached PDF map(s) indicate the approximate location of ESB underground (UG) cables and overhead (OH) lines. ESB makes no representation that the maps accurately show the location of ESB cables.

ESB Networks has issued this map as a PDF document. If printing a paper version of this map and to maintain a clear and correct representation of the electrical network information, it must be ensured that

(1) **It has been printed in colour to fit the page size that has been indicated within each PDF document (The PDF document indicates if the map should be printed on either of A4, A3, A2, A1, A0).**
(2) **Each of the colours indicated on the colour code legend (incorporated in the PDF document) are clear and distinct from each other.**

Please note that there are High Voltage Overhead Lines and Underground Cables in the area concerned. If you intend working or undertaking development within an 80 meter corridor of the overhead lines or in the direct vicinity of the underground cables you must immediately contact: Overhead: Alan Brown, Ph: 087-9273970 or Underground: Gareth Paisley, Ph: 087-9374867, ESB Transmission, Jamestown Road, Inchicore, Dublin 8 to agree safe working procedures and necessary clearances between the lines and the development in advance of any excavation.

If works don't commence before or continue beyond 6 weeks following the date of issue, then you must obtain an updated map. Each new job requires a new map. It is imperative that before any works commence you first locate and trace the routes of all electric cables by using appropriate locator equipment (in both power and radio modes). Before using a mechanical excavator, ONLY MANUAL means should be employed to prove the location of ESB cables. Even where manual excavation is used, extreme caution must always be exercised, as failure to do so could result in serious injury or electrocution. Under no circumstances should iron bars be used during manual excavation. Careful Hand Digging of Trial Holes using 'HSA Code of Practice for Avoiding Danger from Buried Services' should be used for accurate cable location and prior to using a mechanical excavator in the vicinity of electrical cables. See H.S.A. Code of Practice publication "Avoiding Danger From Underground Services" for further guidelines

Please note that, if during excavation, damage or interference occurs to our cables, causing damage to any property, injury or death to any person or loss of supply to any customers, ESB may at its discretion serve a STOP WORK Notice, and notify the relevant Health and Safety Authority immediately. The user will also be liable to reimburse the ESB on a full indemnity basis, The full costs, expenses and damages arising (directly or indirectly) as a result. It is essential before excavating in the vicinity of ESB cables that the ESB Network Controller in the area you are working in is contacted.

ESB will extend every assistance in indicating the route of the cables and arrangements can be made by contacting the relevant ESB office. ESB cannot, however, accept responsibility for the absence or incorrect position of any particular cable on ESB's records and drawings supplied. Please note that a charge may be made where a movement of networks is required, and/or where ESB provide staff outside of normal working hours.

Please ensure that all contractors and their personnel involved in excavations have been furnished with this map.

In the event that you have any issues of concern please do not hesitate to contact Central Networks Mapping, ESB Network by the means

E-Mail: dig@esb.ie

Telephone: 1850 928 960

Address:
Central Networks Mapping,
ESB Networks,
St. Margaret's Road,
Finglas,
Dublin 11.

Yours faithfully,
Central Networks Mapping,
ESB Networks

ESB Networks

TITLE: 20200217-019_A3

COLOUR CODE:

- BLACK - 38KV & HIGHER VOLTAGE OVERHEAD LINES
- GREEN - MV(10KV/20KV) OVERHEAD LINES
- BLUE - LV (400V/230V) OVERHEAD LINES
- CYAN - 38KV & HIGHER VOLTAGE UNDERGROUND CABLE ROUTES
- RED - MV/LV (10KV/20KV/400V/230V) UNDERGROUND CABLE ROUTES

DATE: 17-Feb-2020

** SCALE: 1:1000

** SCALE WHEN PRINTED ON AN A3 PAGE
XY COORDINATES DISPLAYED IN IRISH GRID COORDINATE SYSTEM

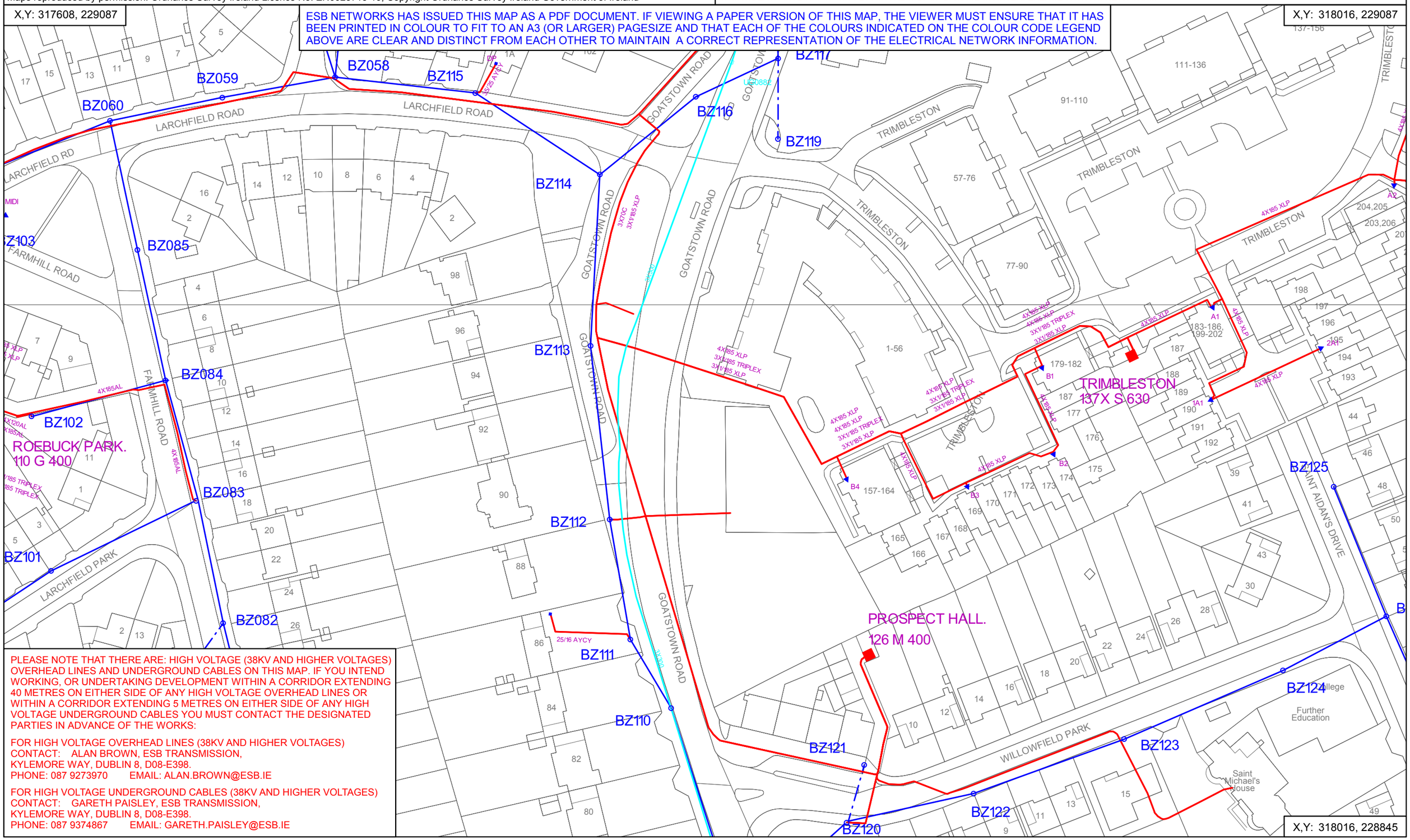
WARNING

THIS MAP INDICATES THE APPROXIMATE LOCATION OF ESB TRANSMISSION (400KV, 220KV, 110KV, 38KV) AND DISTRIBUTION (20KV, 10KV, 230V/400V) UNDERGROUND CABLES AND OVERHEAD LINES IN THE GENERAL AREA OF THE PROPOSED WORKS. ESB NETWORKS TAKES NO RESPONSIBILITY FOR THE ACCURACY OR COMPLETENESS OF THE MAP. IT IS THE USER'S RESPONSIBILITY TO INDEPENDENTLY VERIFY THE INFORMATION AND THE LOCATION OF UNDERGROUND CABLES AND OVERHEAD LINES. LOW VOLTAGE (230V/400V) SERVICE CABLES (E.G. HOUSE SERVICES, FACTORY/SHOP SERVICES, PUBLIC LIGHTING LAMP SERVICES, ETC) ARE NOT INCLUDED BUT THEIR PRESENCE SHOULD BE ANTICIPATED. THE DEPTHS OF UNDERGROUND CABLES MUST NEVER BE ASSUMED. ADDITIONAL MORE DETAILED INFORMATION IS AVAILABLE FOR HIGH VOLTAGE TRANSMISSION UNDERGROUND CABLES (38KV, 110KV, 220KV, 400KV) FROM THE LOCAL ESB NETWORKS TRANSMISSION REPRESENTATIVE - SEE ATTACHED LIST FOR CONTACT DETAILS OR CALL 1850 372 757. NO WORK SHOULD BE CARRIED OUT IN THE VICINITY OF 38KV OR HIGHER VOLTAGE UNDERGROUND CABLES WITHOUT PRIOR CONSULTATION WITH ESB NETWORKS. BEFORE ANY MECHANICAL EXCAVATION IS UNDERTAKEN, THE ACTUAL LOCATION OF ALL UNDERGROUND ELECTRICITY CABLES MUST BE ESTABLISHED AND VERIFIED ON THE SITE USING: (A) UP-TO-DATE MAP RECORDS; (B) CABLE LOCATER EQUIPMENT OPERATED IN BOTH POWER AND RADIO MODES; (C) CAREFUL HAND DIGGING OF TRIAL HOLES USING 'SAFE DIGGING PRACTICE'. REFER ALSO TO 'HSA CODE OF PRACTICE FOR AVOIDING DANGER FROM UNDERGROUND SERVICES'. ESB TAKES NO RESPONSIBILITY FOR AND SHALL BEAR NO LIABILITY, HOWSOEVER ARISING, IN RELATION TO ANY DAMAGE, INJURY/DEATH OR LOSS OF SUPPLY AS A RESULT OF DAMAGE OR INTERFERENCE WITH ITS NETWORKS.

X,Y: 317608, 229087

ESB NETWORKS HAS ISSUED THIS MAP AS A PDF DOCUMENT. IF VIEWING A PAPER VERSION OF THIS MAP, THE VIEWER MUST ENSURE THAT IT HAS BEEN PRINTED IN COLOUR TO FIT TO AN A3 (OR LARGER) PAGESIZE AND THAT EACH OF THE COLOURS INDICATED ON THE COLOUR CODE LEGEND ABOVE ARE CLEAR AND DISTINCT FROM EACH OTHER TO MAINTAIN A CORRECT REPRESENTATION OF THE ELECTRICAL NETWORK INFORMATION.

X,Y: 318016, 229087



PLEASE NOTE THAT THERE ARE: HIGH VOLTAGE (38KV AND HIGHER VOLTAGES) OVERHEAD LINES AND UNDERGROUND CABLES ON THIS MAP. IF YOU INTEND WORKING, OR UNDERTAKING DEVELOPMENT WITHIN A CORRIDOR EXTENDING 40 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE OVERHEAD LINES OR WITHIN A CORRIDOR EXTENDING 5 METRES ON EITHER SIDE OF ANY HIGH VOLTAGE UNDERGROUND CABLES YOU MUST CONTACT THE DESIGNATED PARTIES IN ADVANCE OF THE WORKS:

FOR HIGH VOLTAGE OVERHEAD LINES (38KV AND HIGHER VOLTAGES)
CONTACT: ALAN BROWN, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9273970 EMAIL: ALAN.BROWN@ESB.IE

FOR HIGH VOLTAGE UNDERGROUND CABLES (38KV AND HIGHER VOLTAGES)
CONTACT: GARETH PAISLEY, ESB TRANSMISSION,
KYLEMORE WAY, DUBLIN 8, D08-E398.
PHONE: 087 9374867 EMAIL: GARETH.PAISLEY@ESB.IE

X,Y: 318016, 228845

From: DIG <Dig@gasnetworks.ie>
Sent: 07 February 2020 12:22
To: victoria.welsh
Subject: RE: Request for Information
Attachments: 92-96 Goatstown Road Friarland.pdf; GNI A5 Safety Advice Booklet April 2019.pdf

Thank you for your enquiry to the Gas Networks Ireland ***Dial Before You Dig*** service, please find the attached network map for your area of interest.

Gas Networks Ireland has ***Distribution Gas Network*** within your area of interest.

Before you start work, you must have a current gas network map (or maps) for the work location. A current gas network map (or maps) must always be kept on site while work is under way.

Reading your Map

- High pressure transmission gas pipe is shown **Red.**
- Medium pressure distribution gas pipe is shown **Blue.**
- Low Pressure distribution gas pipe is shown **Green.**

The gas network map is indicative only. You must conform to the safety and legal notices printed on the map. For further information on reading this map refer to the ***Safety Information.***

Breaking Ground

- Supervision by Gas Networks Ireland is **not** required when working in the vicinity of Distribution gas pipes (unless noted otherwise). Safe digging practices **must** be followed. All work in the vicinity of a gas transmission pipeline **must** be carried out in compliance with:
    - Health and Safety Authority, ***Code of Practice for Avoiding Danger from Underground Services.***
    -

Critical Activity

Quarrying or blasting must not be carried out within 400 m of the gas network until Gas Networks Ireland has been consulted on **1850 42 77 47**

Aurora Telecom

- Part of the Aurora Telecom Network may be present on your network map. For further information, Aurora can be contacted on **01 892 6166** (Office Hours) or auroralink@gasnetworks.ie.

Service Pipes

- Service pipes feeding individual properties are not generally shown but their presence should always be anticipated. For further information on domestic gas services refer to the ***Safety Information.***

Safety Information

- Before starting work any work in the vicinity of the gas network, please refer to the Gas Networks Ireland safety booklet, ***Safety advice for working in the vicinity of natural gas pipelines***, available at https://www.gasnetworks.ie/home/safety/dial-before-you-dig/

  This booklet contains important safety information, including advice on how to read the gas network maps you have requested.

  If you did not request this map. please contact Customer Service on 1850 42 77 47.

Thank you for your enquiry to Gas Networks Ireland.

T 1850 20 50 50 (Emergency)
T 1850 42 77 47 (Dial Before You Dig enquiries)

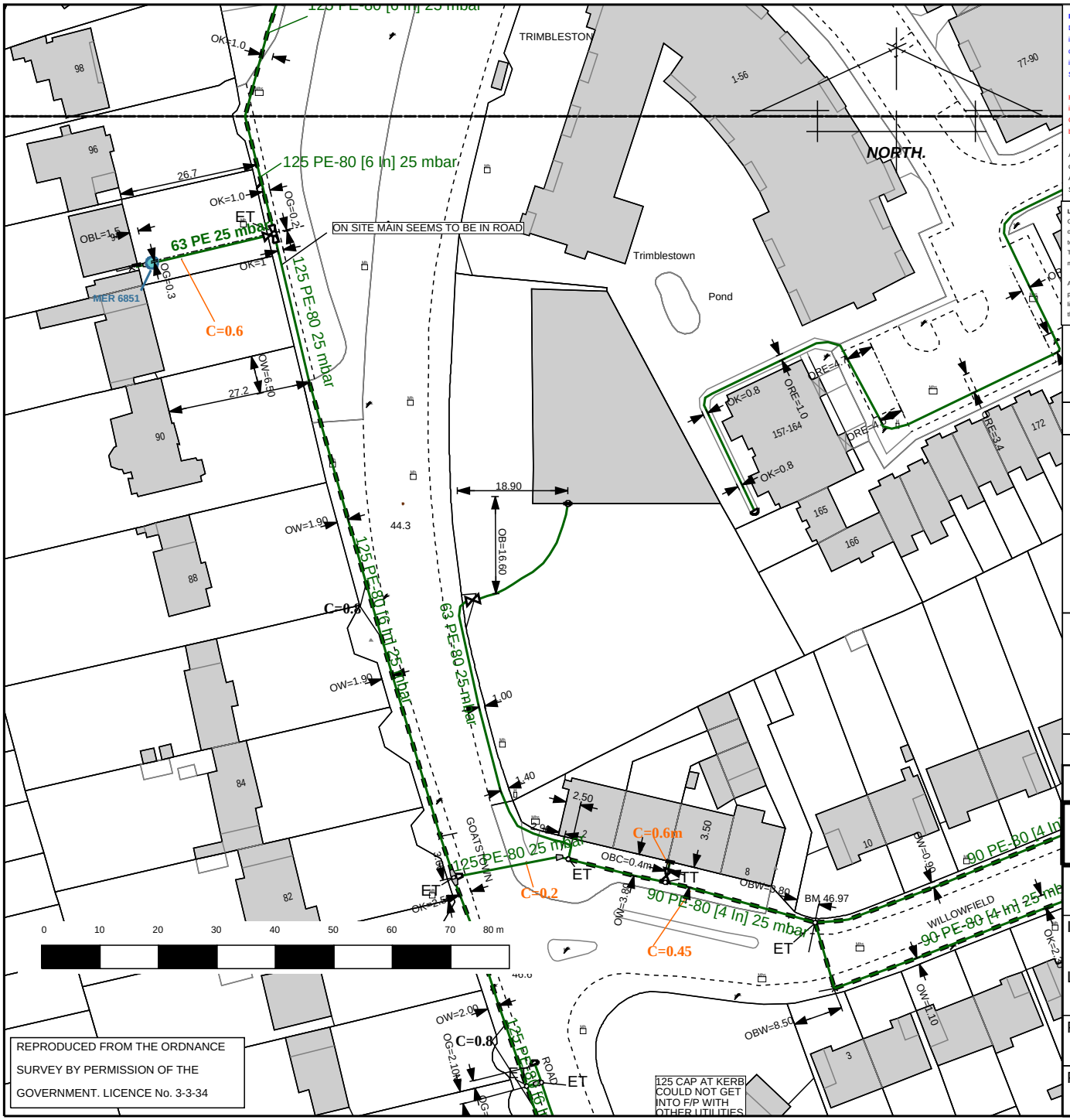
E dig@gasnetworks.ie

Gas Networks Ireland Networks Services Centre, St. Margaret's Road, Finglas, D11 Y895 gasnetworks.ie | Find us on Twitter

Useful Publications

- Health and Safety Authority, ***Code of Practice for Avoiding Danger from Underground Services***
- Health and Safety Authority, ***Guide to Safety in Excavations***

Both are available free of charge from: Health and Safety Authority on **1890 289 389** www.hsa.ie



Important Safety Notice:

Damage to gas pipelines can result in serious injury or death. Gas network information is provided as a general guide. The exact location and depth of medium or low pressure distribution gas pipes must be verified on site by carrying out necessary investigations, including, for example, hand digging trial holes along the route of the pipe. Service pipes are not generally shown but their presence should always be anticipated.

High pressure transmission pipelines are shown in red. If a transmission pipeline is identified within 10m of any intended excavations then work must not proceed before GNI has been consulted. The true location and depth of a transmission pipeline must be verified on site by a representative of GNI. Contact can be made through 1850 427 747.

All work in the vicinity of the gas network must be completed in accordance with the current edition of the Health & Safety Authority publication, Â Code of Practice For Avoiding Danger From Underground ServicesÂ which is available from the Health and Safety Authority (1890 289 389) or can be downloaded at www.hsa.ie.

- Aurora Telecom Fibre Optic Cable
- Aurora Telecom Duct
- Aurora Telecom Sub-duct
- Aurora Telecom Inserted Gas Pipe

Contact Aurora Telecom on 1850-427-399 or (01)203-0120.

- Transmission Pipe (High Pressure)
- Transmission Pipe (Construction Issue)
- Distribution Pipe (Medium Pressure)
- Distribution Pipe (Low Pressure)
- Service Pipe (Medium Pressure)
- Service Pipe (Low Pressure)
- Strategic Pipe (Medium Pressure)
- Strategic Pipe (Low Pressure)
- Inserted Pipe (Medium Pressure)
- Inserted Pipe (Low Pressure)
- Distribution Pipe (Abandoned)

- .C=? Cover (depth in meters)
- CP Test Point
- End Cap
- Hot Tap
- Installation
- Valve
- Mains Verification **
- Pressure Monitor
- Protection (Sleeve)
- Protection (Slabbing)
- Reducer
- Service Terminator
- Tee
- Transition

** Please contact GNI on 1850-427747 for specific information.

Design Department - CORK

Gas Networks Ireland

GAS NETWORK INFORMATION

Issue: WYG	
Location: 92-96 Goatstown Road Friarland	
Plot Date: 07/02/2020	Contact: V Welsh
Plotted by: KOC	Scale: 1:1000

Appendix C – Borehole Logs

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH01
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.80	317844.02 E 228900.37 N

Final Depth:	2.80 m	Start Date:	26/02/2020	Driller:	JC
Elevation:	46.01 mOD	End Date:	26/02/2020	Logger:	SF

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
0.10 - 1.20	B4				45.91	0.10		BITMAC
0.40 - 0.60	ES7							MADE GROUND: Firm becoming stiff light brown sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel angular fine to coarse of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=30 (3,3/3,7,9,11) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES8							
1.60 - 2.00	B5				44.41	1.60		Very stiff brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.
2.00 - 2.45	D2							
2.00 - 2.45	SPT (S)	N=30 (5,5/6,7,8,9) Hammer SN = 0490	0.00	Dry				
2.30 - 2.80	B6				43.71	2.30		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
2.40 - 2.60	ES9							
2.80 - 3.24	D3				43.21	2.80		End of Borehole at 2.80m
2.80 - 3.24	SPT (S)	N=50 (10,13/50 for 285mm) Hammer SN = 0490	0.00	Dry				

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH02
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317822.17 E 228892.06 N

Final Depth:	2.00 m	Start Date:	26/02/2020	Driller:	JC	Sheet 1 of 1 Scale: 1:40
Elevation:	45.95 mOD	End Date:	26/02/2020	Logger:	SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
								BITMAC
0.20 - 1.00	B3				45.75	0.20		MADE GROUND: Soft light yellow sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
0.40 - 0.60	ES5							
1.10 - 2.00	B4				44.85	1.10		Firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=13 (2,3/3,3,3,4) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES6							
2.00 - 2.45	D2				43.95	2.00		End of Borehole at 2.00m
2.00 - 2.45	SPT (S)	N=50 (5,9/12,12,13,13) Hammer SN = 0490	0.00	Dry				

Water | Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	BH03
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	3.00	317815.45 E 228949.97 N

Final Depth:	3.00 m	Start Date:	26/02/2020	Driller:	JC	Sheet 1 of 1 Scale: 1:40
Elevation:	44.62 mOD	End Date:	26/02/2020	Logger:	MFG	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B4				44.42	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES7									
1.00 - 2.00	B5				43.62	1.00		Firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=11 (2,2/2,3,3,3) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES8									
2.00 - 2.45	D2				42.62	2.00		Very stiff brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
2.00 - 3.00	B6									
2.00 - 2.45	SPT (S)	N=39 (4,6/8,10,11,10) Hammer SN = 0490	0.00	Dry						
2.40 - 2.60	ES9									
3.00 - 3.41	D3				41.62	3.00		End of Borehole at 3.00m		
3.00 - 3.41	SPT (S)	N=50 (9,11/50 for 260mm) Hammer SN = 0490	0.00	Dry						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.
No groundwater encountered.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS01
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.60	317832.09 E 228913.70 N

Final Depth:	2.60 m	Start Date:	28/02/2020	Driller:	jc	Sheet 1 of 1 Scale: 1:40
Elevation:	45.57 mOD	End Date:	28/02/2020	Logger:	SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B6				45.37	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content and fragments of red brick. Sand is fine to coarse. Gravel sis subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES4									
1.00 - 1.80	B7				44.57	1.00		Soft becoming firm brown sandy gravelly CLAY. Sand is fine coarse. Gravel is subangular fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=14 (3,3/3,3,4,4) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES5									
		Water strike at 1.80m.			43.77	1.80		Medium dense brown slightly clayey fine to coarse SAND and subangular to subrounded fine to coarse GRAVEL of mixed lithologies.	▼	
1.99		17-01-2020	0.00	1.80						
2.00 - 2.30	B8									
2.00 - 2.45	D2									
2.00 - 2.45	SPT (S)	N=27 (10,8/7,6,7,7) Hammer SN = 0490	0.00	1.90	43.27	2.30		Very stiff black slightly sandy gravelly CLAY. Sand is fine coarse. Gravel is subrounded fine to medium of mixed lithologies.		
2.30 - 2.60	B9				42.97	2.60		End of Borehole at 2.60m		
2.60 - 2.99	D3									
2.60 - 2.99	SPT (S)	N=50 (12,12/50 for 240mm) Hammer SN = 0490	0.00	1.80						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS02
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317841.43 E 228933.92 N

Final Depth:	2.00 m	Start Date:	28/02/2020	Driller:	JC
Elevation:	45.20 mOD	End Date:	28/02/2020	Logger:	SF

Sheet 1 of 1
Scale: 1:40
FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description
								BITMAC
0.20 - 1.00	B3				45.00	0.20		MADE GROUND: Soft to firm light brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.
0.40 - 0.60	ES7							
1.00 - 1.80	B4				44.20	1.00		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
1.20 - 1.65	D1							
1.20 - 1.65	SPT (S)	N=13 (4,3/3,3,3,4) Hammer SN = 0490	0.00	Dry				
1.40 - 1.60	ES6							
1.80 - 2.00	B5				43.40	1.80		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.
		Water strike at 1.80m.						
2.00 - 2.45	D2				43.20	2.00		End of Borehole at 2.00m
2.00 - 2.45	SPT (S)	N=50 (8,12/12,12,13,13) Hammer SN = 0490	0.00	1.80				
2.45		17-01-2020	0.00	1.80				

Water

Backfill

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.80			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

CAUSEWAY GEOTECH

Project No.	Project Name:	Borehole ID
20-0013	Goatstown Development, Dublin	WS03
	Client: Orchid Residential Ltd	
	Client's Rep: Barrett Mahony Consulting Engineers	

Method	Plant Used	Top (m)	Base (m)	Coordinates
Light Percussion	Dando Terrier	0.00	2.00	317822.67 E 228933.10 N

Final Depth:	Start Date:	Driller:	Sheet 1 of 1 Scale: 1:40
2.00 m	28/02/2020	JC	
Elevation: 45.08 mOD	**End Date:** 28/02/2020	**Logger:** SF	FINAL

Depth (m)	Sample / Tests	Field Records	Casing Depth (m)	Water Depth (m)	Level mOD	Depth (m)	Legend	Description	Water	Backfill
								BITMAC		
0.20 - 1.00	B3				44.88	0.20		MADE GROUND: Soft to firm light yellowish brown sandy gravelly CLAY with low cobble content. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of mixed lithologies.		
0.40 - 0.60	ES6									
1.00 - 1.70	B4				44.08	1.00		Firm brown sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.		
1.20 - 1.65	D1									
1.20 - 1.65	SPT (S)	N=13 (3,3/3,3,3,4) Hammer SN = 0490	0.00	Dry						
1.40 - 1.60	ES7									
1.70 - 2.00	B5				43.38	1.70		Very stiff black slightly sandy gravelly CLAY. Sand is fine to coarse. Gravel is subrounded fine to medium of mixed lithologies.	▼	
		Water strike at 1.90m.								
2.00 - 2.45	D2				43.08	2.00		End of Borehole at 2.00m		
2.00 - 2.45	SPT (S)	N=50 (10,11/11,12,13,14) Hammer SN = 0490	0.00	1.90						
2.00		17-01-2020	0.00	1.90						

Water Strikes

Struck at (m)	Casing to (m)	Time (min)	Rose to (m)
1.90			

Casing Details

To (m)	Diameter

Water Added

From (m)	To (m)

Chiselling Details

From (m)	To (m)	Time (hh:mm)

Remarks

Hand dug inspection pit excavated to 1.20m.

Termination Reason

Terminated at refusal in very stiff clay.

Last Updated

31/03/2020

AGS

Appendix D – WYG Generic Assessment Criteria

SOIL - TIER ONE HUMAN HEALTH SCREENING VALUES (Northern Ireland)

Status	End Use	Issue No	Issue Date
WYG FINAL	**Residential With Plant Uptake**	**16**	**23/05/17**

Determinand	Units	SOIL ORGANIC MATTER 1%	SOIL ORGANIC MATTER 2.5%	SOIL ORGANIC MATTER 6%	SOURCE
pH		<5, >9			
Asbestos	%	Presence			
HEAVY METALS/METALLOIDS					
Arsenic	mg/kg	37			CIEH/LQM S4ULs
Cadmium	mg/kg	11			CIEH/LQM S4ULs
Chromium (III)	mg/kg	910			CIEH/LQM S4ULs
Chromium (VI)	mg/kg	6			CIEH/LQM S4ULs
Lead [Note 12]	mg/kg	200			C4SL
Mercury (Elemental) [Note 9]	mg/kg	1.2			CIEH/LQM S4ULs
Mercury (Inorganic) [Note 9]	mg/kg	40			CIEH/LQM S4ULs
Mercury (Methyl) [Note 9]	mg/kg	11			CIEH/LQM S4ULs
Nickel	mg/kg	130			CIEH/LQM S4ULs
Selenium	mg/kg	250			CIEH/LQM S4ULs
Berylium	mg/kg	1.7			CIEH/LQM S4ULs
Boron	mg/kg	290			CIEH/LQM S4ULs
Vanadium	mg/kg	410			CIEH/LQM S4ULs
Copper	mg/kg	2,400			CIEH/LQM S4ULs
Zinc	mg/kg	3,700			CIEH/LQM S4ULs
GENERAL INORGANICS					
Easily Liberatable Cyanide (free) [Note 13]	mg/kg	24			WYG Acute Effects to Infant 1 dose 5g of soil
US EPA PRIORITY PAHs					
Acenaphthene	mg/kg	210	510	1100	CIEH/LQM S4ULs
Acenaphthylene	mg/kg	170	420	920	CIEH/LQM S4ULs
Anthracene	mg/kg	2,400	5,400	11000	CIEH/LQM S4ULs
Benzo(a)anthracene	mg/kg	7.2	11	13	CIEH/LQM S4ULs
Benzo(b)fluoranthene	mg/kg	2.6	3.3	3.7	CIEH/LQM S4ULs
Benzo(k)fluoranthene	mg/kg	77	93	100	CIEH/LQM S4ULs
Benzo(g,h,i)perylene	mg/kg	320	340	350	CIEH/LQM S4ULs
Benzo(a)pyrene [Note 9]	mg/kg	2.2	2.7	3	CIEH/LQM S4ULs
Chrysene	mg/kg	15	22	27	CIEH/LQM S4ULs
Di-benzo(a,h)anthracene	mg/kg	0.24	0.28	0.30	CIEH/LQM S4ULs
Fluoranthene	mg/kg	280	560	890	CIEH/LQM S4ULs
Fluorene	mg/kg	170	400	860	CIEH/LQM S4ULs
Indeno(1,2,3-cd)pyrene	mg/kg	27	36	41	CIEH/LQM S4ULs
Naphthalene	mg/kg	2.3	5.6	13	CIEH/LQM S4ULs
Phenanthrene	mg/kg	95	220	440	CIEH/LQM S4ULs
Pyrene	mg/kg	620	1200	2000	CIEH/LQM S4ULs
Chloroalkanes and alkenes					
1,2-Dichloroethane (1,2 DCA)	mg/kg	0.0071	0.011	0.019	CIEH/LQM S4ULs
1,1,1-Trichloroethane (1,1,1 TCA)	mg/kg	8.8	18	39	CIEH/LQM S4ULs
1,1,1,2-Tetrachloroethane (1,1,1,2 PCA)	mg/kg	1.2	2.8	6.40	CIEH/LQM S4ULs
1,1,2,2-Tetrachloroethane (1,1,2,2 PCA)	mg/kg	1.6	3.4	7.5	CIEH/LQM S4ULs
Tetrachloroethene (PCE)	mg/kg	0.18	0.39	0.90	CIEH/LQM S4ULs
Tetrachloromethane (Carbon Tetrachloride)	mg/kg	0.026	0.056	0.13	CIEH/LQM S4ULs
Trichloroethene (TCE)	mg/kg	0.016	0.034	0.075	CIEH/LQM S4ULs
Trichloromethane (Chloroform)	mg/kg	0.91	1.7	3.4	CIEH/LQM S4ULs
Vinyl Chloride (VC)	mg/kg	0.00064	0.00087	0.0014	CIEH/LQM S4ULs
Phenolics					
Phenol	mg/kg	120	200	380	CIEH/LQM S4ULs
Chlorophenols	mg/kg	0.87	2	4.5	CIEH/LQM S4ULs
Pentachlorophenols	mg/kg	0.22	0.52	1.2	CIEH/LQM S4ULs
TPH [Note 10]					
TPH Aliphatic >C5-6	mg/kg	42	78	160	CIEH/LQM S4ULs
TPH Aliphatic >C6-8	mg/kg	100	230	530	CIEH/LQM S4ULs
TPH Aliphatic >C8-10	mg/kg	27	65	150	CIEH/LQM S4ULs
TPH Aliphatic >C10-12	mg/kg	130 (48)[vap]	330 (118)[vap]	770 (283)[vap]	CIEH/LQM S4ULs
TPH Aliphatic >C12-16	mg/kg	1,100 (24)[sol]	2,400 (59)[sol]	4,400 (142)[sol]	CIEH/LQM S4ULs
TPH Aliphatic >C16-35	mg/kg	65,000 (8.48)[sol]	92,000 (21)[sol]	110,000	CIEH/LQM S4ULs
TPH Aliphatic >C35-44	mg/kg	65,000 (8.48)[sol]	92,000 (21)[sol]	110,000	CIEH/LQM S4ULs
TPH Aromatic >EC5-7 (benzene)	mg/kg	70 [Note 14]	140 [Note 14]	300 [Note 14]	CIEH/LQM S4ULs
TPH Aromatic >EC7-8	mg/kg	130	290	660	CIEH/LQM S4ULs
TPH Aromatic >EC8-10	mg/kg	34	83	190	CIEH/LQM S4ULs
TPH Aromatic >EC10-12	mg/kg	74	180	380	CIEH/LQM S4ULs
TPH Aromatic >EC12-16	mg/kg	140	330	660	CIEH/LQM S4ULs
TPH Aromatic >EC16-21	mg/kg	260	540	930	CIEH/LQM S4ULs
TPH Aromatic >EC21-35	mg/kg	1,100	1,500	1,700	CIEH/LQM S4ULs
TPH Aromatic >EC35-44	mg/kg	1,100	1,500	1,700	CIEH/LQM S4ULs
TPH Aliphatic & Aromatic >EC44-70	mg/kg	1,600	1,800	1,900	CIEH/LQM S4ULs
Total TPH	mg/kg	**No Sum**	**No Sum**	**No Sum**	
BTEX					
Benzene	mg/kg	0.087	0.17	0.37	CIEH/LQM S4ULs
Toluene	mg/kg	130	290	660	CIEH/LQM S4ULs
Ethylbenzene	mg/kg	47	110	260	CIEH/LQM S4ULs
m-Xylene	mg/kg	59	140	320	CIEH/LQM S4ULs
o-Xylene	mg/kg	60	140	330	CIEH/LQM S4ULs
p-Xylene	mg/kg	56	130	310	CIEH/LQM S4ULs
Xylenes (mixed isomers)	mg/kg	56	130	310	CIEH/LQM S4ULs

SOIL - TIER ONE HUMAN HEALTH SCREENING VALUES (Northern Ireland)

Status	End Use	Issue No	Issue Date
WYG FINAL	**Residential With Plant Uptake**	**16**	**23/05/17**

Determinand	Units	SOIL ORGANIC MATTER 1%	SOIL ORGANIC MATTER 2.5%	SOIL ORGANIC MATTER 6%	SOURCE
Explosives					
2,4,6 - Trinitrotoluene	mg/kg	1.6	3.7	8.1	CIEH/LQM S4ULs
RDX and HMX	mg/kg	120	250	540	CIEH/LQM S4ULs
Pesticides					
Aldrin	mg/kg	5.7	6.6	7.1	CIEH/LQM S4ULs
Dieldrin	mg/kg	0.97	2	3.5	CIEH/LQM S4ULs
Atrazine	mg/kg	3.3	7.6	17.4	CIEH/LQM S4ULs
Dichlorvos	mg/kg	0.032	0.066	0.14	CIEH/LQM S4ULs
Alpha-Endosulfan	mg/kg	7.4	18	41	CIEH/LQM S4ULs
Beta-Endosulfan	mg/kg	7	17	39	CIEH/LQM S4ULs
Alpha-Hexachlorocyclohexane	mg/kg	0.23	0.55	1.2	CIEH/LQM S4ULs
Beta-Hexachlorocyclohexane	mg/kg	0.085	0.2	0.46	CIEH/LQM S4ULs
Gamma-Hexachlorocyclohexane	mg/kg	0.06	0.14	0.33	CIEH/LQM S4ULs
Chlorobenzenes					
Chlorobenzene	mg/kg	0.46	1	2.4	CIEH/LQM S4ULs
1,2-Dichlorobenzene	mg/kg	23	55	130	CIEH/LQM S4ULs
1,3-Dichlorobenzene	mg/kg	0.4	1	2.3	CIEH/LQM S4ULs
1,4-Dichlorobenzene	mg/kg	61	150	350	CIEH/LQM S4ULs
1,2,3-Trichlorobenzenes	mg/kg	1.5	3.6	8.6	CIEH/LQM S4ULs
1,2,4-Trichlorobenzenes	mg/kg	2.6	6.4	15	CIEH/LQM S4ULs
1,3,5-Trichlorobenzenes	mg/kg	0.33	0.81	1.9	CIEH/LQM S4ULs
1,2,3,4-Tetrachlorobenzene	mg/kg	15	36	78	CIEH/LQM S4ULs
1,2,3,5-Tetrachlorobenzene	mg/kg	0.66	1.6	3.7	CIEH/LQM S4ULs
1,2,4,5-Tetrachlorobenzene	mg/kg	0.33	0.77	1.6	CIEH/LQM S4ULs
Pentachlorobenzene	mg/kg	5.8	12	22	CIEH/LQM S4ULs
Hexachlorobenzene	mg/kg	1.8 (0.20)[vap]	3.3 (0.50)[vap]	4.9	CIEH/LQM S4ULs
Other					
Carbon Disulphide	mg/kg	0.14	0.29	0.62	CIEH/LQM S4ULs
Hexachlorobutadiene	mg/kg	0.29	0.7	1.6	CIEH/LQM S4ULs
Sum of PCDDs, PCDFs and dioxin like PCBS [Note 11]	mg/kg	0.008			EA SR SC050021, 2009 SGV

NOTES

1) Compare individual samples values against Soil Screening Values (SSV). If exceedences are identified this will signify a potential human health risk and will warrant further consideration. If in doubt regarding next steps discuss with Project Manager and / or member of the WYG QRA Group.

2) These values are for initial screening of potential risk to human health only. They are not remediation thresholds. Assessment of risk to other receptors to be completed separately as appropriate for the site, e.g. for water, ecology, building materials.

3) Where the SSV exceeds saturation limits, (derived in CLEA by using partitioning equations) the saturation limit is given in brackets.
Further background information on the derivation and implication of saturation limits is provided in Section 4.12 of the CLEA Software Handbook (SR4).
a) sol - S4UL exceeds soil saturation limit which is given in brackets (Note that if soil data exceeds the solubility limit, free product may be present)
b) vap - S4UL exceeds vapour saturation limit which is given in brackets
For screening consider applicability of both solubility limit and SSV.

4) Screening criteria denoted with hash (#) were capped at 1000000mg/kg, the maximum theoretical value.

5) SSVs are provided for a select range of more commonly encountered chemical constituents listed above. **For VOC and SVOC not listed above refer to CL:AIRE "Soil Generic Assessment Criteria for Human Health Risk Assessment" January 2010.** If screening criteria are required for other chemical constituents, contact a member of the WYG QRA group.

6) SSVs derived for certain constituents may be low in relation to standard laboratory Limits of Detection (LoD). It is advised that the Project Team check that laboratory limits of detection are sufficient to permit comparison of soil data with screening criteria. Ideally the LoD should be no more than 10% of the screening criteria noting though that this is not practicable for all constituents.

7) SSVs were calculated using a Soil Organic Matter (SOM) values of 1.0%, 2.5% and 6%. This is equivalent to a Fraction Organic Carbon (FOC) values of approx. 0.006, 0.0145 and 0.035 respectively (For reference FOC = 0.58*SOM/100). Note that some soils may have SOM lower than 1.0%; in these situations it may be appropriate to consider derivation of alternative screening criteria using the CLEA software. If in doubt discuss with Project Manager and / or member of the WYG QRA Group.

8) In general, SSVs have been rounded down to 2 significant figures.

9) Use Mercury (Inorganic) SSV for Mercury unless evidence suggesting elemental or methyl mercury may be present.

10) For sites with a known TPH issue it may be of benefit to determine the TPH Hazard Index (EA Science Report P5-080/TR3 2005). For a given soil sample first divide each TPH fraction concentration by the SSV of that TPH fraction. This gives the Hazard Quotient for the TPH fraction. Then sum all the Hazard Quotients together for the soil sample to give the Hazard Index. A Hazard Index > 1 respresents a potentially significant risk to human health. Alternatively this can be done using the CLEA Model by entering the TPH source concentrations for indiviual fractions and running the model in ratio mode. If required seek advice from a member of the WYG QRA Group.

11) For sites with known risk from multiple PCDDs, PCDFs and PCBS calculate the hazard index as presented in EA technical note SCHO0909BQYQ-E-P 2009 Appendix 1

12) The TSV for lead is the C4SL derived using a Low Level of Toxicological Concern (LLTC) of 3.5ug/dL blood lead.

13) See WYG Technical Memorandum: Derivation of a SSV for Cyanide for explanation of deriviation

14) Variation of S4ULs for benzene and TPH Aromatic >EC5-7 (Benzene) is due to the health criteria value (HCV) applied in each case. The HCV for benzene is based on its non threshold (carcinogenic) effects, whereas that for Aromatic >EC5-7 is for threshold (see section 17.3.5 S4UL Document). The latter is intended to allow the additive effect from this fraction to be considered together with the threshold effects of all other fractions, however individual assessments for the indicator compounds (e.g. benzene), are also required.

Appendix E – Gas Risk Assessment Tables

Wilson & Card Method for Classifying Gassing Sites

Characteristic Situation (CIRIA R149)	Comparable Partners in Technology Gas Regime	Gas Screening Value (CH4 or CO2) (l/hr)1	Additional limiting factors	Typical source of generation
1	A	<0.07	Typically methane ≤ 1% and or carbon dioxide =/ >5% otherwise consider increasing to situation 2.	Natural soils with low organic content
2	B	<0.7	Borehole air flow rate not to exceed 70l/hr otherwise increase to characteristic situation3	Natural soil, high peat/organic content
3	C	<3.5		Old landfill, inert waste, mine working flooded
4	D	<15	Quantitative risk assessment required to evaluate scope of protection measures	Mine working – susceptible to flooding, completed landfill, inert waste (WMP 26B criteria)
5	E	<70		Mine working unflooded inactive
6	F	>70		Recent landfill site

Notes:
Gas screening value: litres of gas/hour is calculated by multiplying the gas concentration (%) by the measured borehole flow rate (l/h)
Site characteristics should be based on gas monitoring of gas concentrations and borehole flow rates for specified minimum periods in table 5.5 of the CIRIA guidance
Source of gas and generation potential/performance must be identified
Soil gas investigation to be in accordance with guidance provided in chapters 4-6 of CIRIA guidance.
If there is not a detectable flow use the limit of detection of the instrument.
The boundaries between the Partners in Technology classification do not fit exactly with the boundaries for the CIRIA classification.

Appendix F – Soils and Groundwater Assessment Summary

Soil Screening Summary Table

Contaminant GAC	Residential - with plant uptake - 1% SOM	BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03	WS03
	Depth(m)	0.5	2.5	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50
Heavy Metals	mg/kg												
Arsenic	37	17	19	15	17	15	17	18	17	12	17	13	16
Cadmium	11	2.4	2.3	2	2.2	1.9	1.7	2.5	2	1.6	2.3	1.6	1.9
Chromium III (total)	910	18		15	15	15	13	17	15	13	15	15	
Chromium VI	6	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Copper	2400	32	36	28	29	26	25	28	26	16	29	16	18
Inorganic Mercury	40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	130	57	59	46	48	40	41	56	51	37	48	35	39
Selenium	250	0.39	2.9	0.73	0.57	0.43	1.1	0.34	0.57	0.34	1	0.32	0.27
Zinc	3700	91	98	84	81	70	68	90	81	62	91	71	76
Lead	200	24	23	21	20	18	16	20	18	15	27	15	18
Phenolics													
Phenols, Total Detected monohydric		< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Total Petroleum Hydrocarbons													
Aliphatics													
EC>C5-C6	42	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C6-C8	100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C8-C10	27	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C10-C12	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C12-C16	1100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C16-C21	65000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C21-C35	65000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C35-C44	65000	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total aliphatics	NA	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatics													
EC 5-7 (benzene)	70	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C7-C8 (toluene)	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C8-C10	34	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C10-C12	74	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C12-C16	140	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C16-C21	260	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C21-C35	1100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
EC>C35-C44	1100	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total aromatics	NA	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Aliphatics and Aromatics	NA	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Gasoline Range Organics													
GRO >C5-C10		< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Total Aliphatics >C5-C10		< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
Total Aromatics >EC5-EC10		< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0	< 3.0
BTEX/MTBE													
MTBE	-	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	
Benzene	0.087	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	130	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	47	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-xylene	60	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m&p-xylene	59	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Polycyclic Aromatic Hydrocarbons													
Acenaphthene	210	< 1.0	< 0.10	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 0.10
Acenaphthylene	170	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	2400	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benz(a)anthracene	7.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(a)pyrene	2.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(b)fluoranthene	2.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(ghi)perylene	320	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo(k)fluoranthene	77	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	15	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Compiled: PH
Date: March 2020

Soil Screening Summary Table

Contaminant GAC	Residential - with plant uptake - 1% SOM	BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02	WS03	WS03
	Depth(m)	0.5	2.5	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50	0.50	1.50
Dibenz(a,h)anthracene	0.24	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	280	< 0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	170	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(123cd)pyrene	27	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene	2.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	95	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	620	< 0.10	0.34	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
PAH 16 Total	NA	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB's - (Solids)	mg/kg												
PCB congener 101		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 118		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 138		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 153		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 180		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 28		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
PCB congener 52		< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	
Sum of detected PCB 7 Congeners		< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	
Inorganics													
Free Cyanide	24		< 0.50										< 0.50
Total Cyanide	NA	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	NA		7.5										6.9
Sulphate (2:1 water soluble)			< 0.010										< 0.010
pH (pH Units)	<5, >9	8.2	8.4	8.2	8.5	8.3	8.7	8.3	8.3	8.4	8.5	8.5	8.7
Asbestos Screening													
Inspection	Present / Absent	NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Amosite (Brown) Asbestos		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Chrysotile (White) Asbestos		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Crocidolite (Blue) Asbestos		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Fibrous Actinolite		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Fibrous Anthophyllite		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Fibrous Tremolite		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
Non-Asbestos Fibre		NAD		NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	NAD	
ORGANICS													
Soil Organic Matter (SOM)	NA		2.1										1.3
Fraction Organic Carbon	NA	1.200		0.97	0.73	0.54	0.78	0.89	0.74	0.64	0.85	0.630	

GACs are the LQM S4ULs with 1% SOM with the exception of those listed below:-

1. The GAC for lead is the C4SL derived using a Low Level of Toxicological Concern (LLTC) of 3.5ug/dL blood lead.
2. Free Cyanide - WYG derived using CLEA. See WYG Technical Memorandum: Derivation of a SSV.

Compiled: PH
Date: March 2020

Groundwater Screen

Sample Point / Determinands	TSV	WHO Guidance Values	SOBRA Residential GACgwvap	BH01	BH02	BH03
HEAVY METALS	**µg/l**		**µg/l**			
Arsenic	**25 (1), 20 (2), 7.5 (3), 10 (5)**			1.60	< 1.0	1.30
Boron	**750 (3), 750 (4), 1000 (5)**			58	54	48
Cadmium	**0.08(1), 0.2(2), 3.75 (3), 5.0 (5)**			< 0.080	< 0.080	**0.15**
Chromium (total)	**4.7(1), 37.5 (4), 50 (5)**			**13**	7.6	2.7
Copper	**5(1), 5(2), 1500 (4), 2000 (5)**			4.4	1.8	2.4
Lead	**7.2 (1), 7.2 (2), 18.75 (4), 10(5)**			< 1.0	< 1.0	< 1.0
Mercury	**0.05 (1), 0.05(2), 0.75(4), 1.0 (5)**			**0.8**	< 0.50	< 0.50
Nickel	**20(1), 20(2), 15(4), 20(5)**			5	1.6	9.3
Selenium	**10(5)**			**26.0**	**46.0**	**57.0**
Zinc	**8(1), 40(2)**			**8.6**	2.2	**10**
Phenols	**ug/l**					
Phenol	**8(1), 8(2)**			< 0.030	< 0.030	< 0.030
Speciated TPH	**µg/l**					
Aliphatics						
EC C5-C6	-		1,900	< 0.10	< 0.10	< 0.10
EC>C6-C8	-		1,500	< 0.10	< 0.10	< 0.10
EC>C8-C10	-		57	< 0.10	< 0.10	< 0.10
EC>C10-C12	-		37	< 0.10	< 0.10	< 0.10
EC>C12-C16	-		-	< 0.10	< 0.10	< 0.10
EC>C16-C21	-		-	< 0.10	< 0.10	< 0.10
EC>C21-C35	-		-	< 0.10	< 0.10	< 0.10
EC>C35-C44	**10**		-	< 0.10	< 0.10	< 0.10
Total Aliphatics >C5-C35	-		-	< 5.0	< 5.0	< 5.0
Aromatics						
EC C5-C7	-		210000	< 0.10	< 0.10	< 0.10
EC>C7-C8	-		220,000	< 0.10	< 0.10	< 0.10
EC>C8-C10	-		1900	< 0.10	< 0.10	< 0.10
EC>C10-C12	-		6,800	< 0.10	< 0.10	< 0.10
EC>C12-C16	-		39000	< 0.10	< 0.10	< 0.10
EC>C16-C21	-		-	< 0.10	< 0.10	< 0.10
EC>C21-C35	-		-	< 0.10	< 0.10	< 0.10
EC>C35-C44	**10**		-	< 0.10	< 0.10	< 0.10
Total Aromatics >EC5-EC35	-		-	< 5.0	< 5.0	< 5.0
Total Aliphatics & Aromatics >C5-35	**10(6)**		-	< 10	< 10	< 10
Polyaromatic Hydrocabons	**µg/l**					
Acenaphthene (aq)			170,000	< 0.10	< 0.10	0.72
Acenaphthylene (aq)			220,000	< 0.10	< 0.10	3.2
Anthracene (aq)	**0.1 (1), 0.1(2)**			< 0.10	< 0.10	**1.7**
Benzo(a)anthracene (aq)				< 0.10	< 0.10	< 0.10
Benzo(a)pyrene (aq)	**0.05(1), 0.05(2)**			**< 0.10**	**< 0.10**	**< 0.10**
Benzo(b)fluoranthene (aq)				< 0.10	< 0.10	< 0.10
Benzo(g,h,i)perylene (aq)				< 0.10	< 0.10	< 0.10
Benzo(k)fluoranthene (aq)				< 0.10	< 0.10	< 0.10
Chrysene (aq)				< 0.10	< 0.10	< 0.10
Dibenzo(a,h)anthracene (aq)				< 0.10	< 0.10	< 0.10
Fluoranthene (aq)	**0.1(1), 0.1(1)**			< 0.10	< 0.10	< 0.10
Fluorene (aq)			210,000	< 0.10	< 0.10	2.1
Indeno(1,2,3-cd)pyrene (aq)				< 0.10	< 0.10	< 0.10
Naphthalene (aq)	**2.4(1), 1.2(2)**		220	< 0.10	< 0.10	**2.1**
Phenanthrene (aq)				< 0.10	< 0.10	5.1
Pyrene (aq)				< 0.10	< 0.10	< 0.10
PAH, Total USEPA 16 (aq)				< 2.0	< 2.0	15
INORGANICS	**mg/l**					
Sulphate	**187.5(3), 187.5(4), 250 (5)**			110	52	150
Cyanide, Total	**10(1), 10(2), 37.5(4), 50(5)**			< 0.050	< 0.050	< 0.050
pH (pH Units)	**5-9**			8.1	8.2	7.9

(1) European Communities Enviromental Objectives (Surface Water) Regulations 2009 - Inland Surface Waters (AA)
(2) European Communities Enviromental Objectives (Surface Water) Regulations 2009 - Other Surface Waters (AA)
(3) European Communities Environmental Objectives (Groundwater) 2010 - General Groundwater body quality
(4) European Communities Environmental Objectives (Groundwater) 2010 - Groundwater intended for human consumption
(5) European Union (Drinking Water) Regulations 2014
(6) UK Drinking water standard

#. AQC failure, accreditation has been removed from this result.
Result outside calibration range, results should be considered as indicative only and are not accredited.

Appendix G– Soils and Groundwater Laboratory Test Certificates

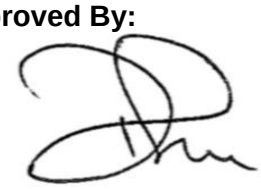
Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Final Report

Report No.:	20-07064-1
Initial Date of Issue:	16-Mar-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Carin Cornwall Colm Hurley Darren O'Mahony Fernando Alfonso Gabriella Horan Joe Gervin John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	20-0013 Goatstown Development, Dublin

Quotation No.:		**Date Received:**	04-Mar-2020
Order No.:		**Date Instructed:**	10-Mar-2020
No. of Samples:	12		
Turnaround (Wkdays):	5	**Results Due:**	16-Mar-2020
Date Approved:	16-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

Chemtest
The right chemistry to deliver results

Results - Leachate

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**	980769	980772	980773	980774	980775	980777	980778	980779	980780
		Sample Location:	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02	WS02
		Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):	0.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5	1.5
		Date Sampled:	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**								
Ammonium	U	1220	mg/l	0.050	0.44	0.32	< 0.050	< 0.050	< 0.050	0.088	0.062	0.12	0.12
Ammonium	N	1220	mg/kg	0.10	4.7	3.6	0.23	0.21	0.27	1.0	0.69	1.4	1.4

Results - Leachate

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064
Quotation No.:			**Chemtest Sample ID.:**		980781
			Sample Location:		WS03
			Sample Type:		SOIL
			Top Depth (m):		0.5
			Date Sampled:		03-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**	
Ammonium	U	1220	mg/l	0.050	0.18
Ammonium	N	1220	mg/kg	0.10	2.1

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd					**Chemtest Job No.:**	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:					**Chemtest Sample ID.:**	980769	980771	980772	980773	980774	980775	980777	980778	980779
					Sample Location:	BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
					Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
					Top Depth (m):	0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
					Date Sampled:	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
					Asbestos Lab:	COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**										
ACM Type	U	2192		N/A		-		-	-	-	-	-	-	-
Asbestos Identification	U	2192	%	0.001		No Asbestos Detected		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected
ACM Detection Stage	U	2192		N/A		-		-	-	-	-	-	-	-
Moisture	N	2030	%	0.020		12	8.3	14	12	11	10	10	9.9	15
pH	M	2010		4.0		8.2	8.4	8.2	8.5	8.3	8.7	8.3	8.3	8.4
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40		< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010							
Sulphur (Elemental)	M	2180	mg/kg	1.0		2.8		2.6	< 1.0	2.1	1.2	< 1.0	1.0	4.9
Cyanide (Free)	M	2300	mg/kg	0.50			< 0.50							
Cyanide (Total)	M	2300	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Thiocyanate	M	2300	mg/kg	5.0			7.5							
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50		6.9	10	6.4	6.9	10	7.6	6.5	7.2	8.7
Sulphate (Total)	M	2430	%	0.010		0.050	0.11	0.048	0.055	0.077	0.049	0.050	0.090	0.11
Arsenic	M	2450	mg/kg	1.0		17	19	15	17	15	17	18	17	12
Barium	M	2450	mg/kg	10		76		68	71	57	59	70	70	58
Cadmium	M	2450	mg/kg	0.10		2.4	2.3	2.0	2.2	1.9	1.7	2.5	2.0	1.6
Chromium	M	2450	mg/kg	1.0		18	20	15	15	15	13	17	15	13
Molybdenum	M	2450	mg/kg	2.0		3.6		3.5	4.2	3.8	3.5	3.6	4.4	2.8
Antimony	N	2450	mg/kg	2.0		2.2		< 2.0	2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Copper	U	2450	mg/kg	0.50		32	36	28	29	26	25	28	26	16
Mercury	M	2450	mg/kg	0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50		57	59	46	48	40	41	56	51	37
Lead	M	2450	mg/kg	0.50		24	23	21	20	18	16	20	18	15
Selenium	M	2450	mg/kg	0.20		0.39	2.9	0.73	0.57	0.43	1.1	0.34	0.57	0.34
Zinc	U	2450	mg/kg	0.50		91	98	84	81	70	68	90	81	62
Chromium (Trivalent)	N	2490	mg/kg	1.0		18		15	15	15	13	17	15	13
Chromium (Hexavalent)	N	2490	mg/kg	0.50		< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40			2.1							
Total Organic Carbon	M	2625	%	0.20		1.2		0.97	0.73	0.54	0.78	0.89	0.74	0.64
Mineral Oil	N	2670	mg/kg	10		< 10		< 10	< 10	< 10	< 10	< 10	< 10	< 10
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**			980769	980771	980772	980773	980774	980775	980777	980778	980779
		Sample Location:			BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
		Sample Type:			SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
		Top Depth (m):			0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
		Date Sampled:			03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
		Asbestos Lab:			COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10		< 0.10							
Acenaphthylene	M	2700	mg/kg	0.10		< 0.10							
Acenaphthene	M	2700	mg/kg	0.10		< 0.10							
Fluorene	M	2700	mg/kg	0.10		< 0.10							
Phenanthrene	M	2700	mg/kg	0.10		< 0.10							
Anthracene	M	2700	mg/kg	0.10		< 0.10							
Fluoranthene	M	2700	mg/kg	0.10		0.40							
Pyrene	M	2700	mg/kg	0.10		0.34							
Benzo[a]anthracene	M	2700	mg/kg	0.10		< 0.10							
Chrysene	M	2700	mg/kg	0.10		< 0.10							
Benzo[b]fluoranthene	M	2700	mg/kg	0.10		< 0.10							
Benzo[k]fluoranthene	M	2700	mg/kg	0.10		< 0.10							
Benzo[a]pyrene	M	2700	mg/kg	0.10		< 0.10							
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10		< 0.10							
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10		< 0.10							
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10		< 0.10							
Total Of 16 PAH's	M	2700	mg/kg	2.0		< 2.0							
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0		< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Naphthalene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980769	980771	980772	980773	980774	980775	980777	980778	980779
			Sample Location:		BH01	BH01	BH02	BH02	BH03	BH03	WS01	WS01	WS02
			Sample Type:		SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
			Top Depth (m):		0.5	2.5	0.5	1.5	0.5	1.5	0.5	1.5	0.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY		COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Anthracene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Coronene	N	2800	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0		< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
PCB 28	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 52	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 90+101	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 118	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 153	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 138	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
PCB 180	U	2815	mg/kg	0.010	< 0.010		< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Chemtest
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Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-07064	20-07064	20-07064
Quotation No.:		**Chemtest Sample ID.:**			980780	980781	980782
		Sample Location:			WS02	WS03	WS03
		Sample Type:			SOIL	SOIL	SOIL
		Top Depth (m):			1.5	0.5	1.5
		Date Sampled:			03-Mar-2020	03-Mar-2020	03-Mar-2020
		Asbestos Lab:			COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
ACM Type	U	2192		N/A	-	-	
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	
ACM Detection Stage	U	2192		N/A	-	-	
Moisture	N	2030	%	0.020	11	14	11
pH	M	2010		4.0	8.5	8.5	8.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010
Sulphur (Elemental)	M	2180	mg/kg	1.0	< 1.0	1.6	
Cyanide (Free)	M	2300	mg/kg	0.50			< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	0.50
Thiocyanate	M	2300	mg/kg	5.0			6.9
Sulphide (Easily Liberatable)	N	2325	mg/kg	0.50	9.4	7.6	6.6
Sulphate (Total)	M	2430	%	0.010	0.054	0.050	0.053
Arsenic	M	2450	mg/kg	1.0	17	13	16
Barium	M	2450	mg/kg	10	57	72	
Cadmium	M	2450	mg/kg	0.10	2.3	1.6	1.9
Chromium	M	2450	mg/kg	1.0	15	15	16
Molybdenum	M	2450	mg/kg	2.0	4.4	2.4	
Antimony	N	2450	mg/kg	2.0	2.0	< 2.0	
Copper	U	2450	mg/kg	0.50	29	16	18
Mercury	M	2450	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Nickel	M	2450	mg/kg	0.50	48	35	39
Lead	M	2450	mg/kg	0.50	27	15	18
Selenium	M	2450	mg/kg	0.20	1.0	0.32	0.27
Zinc	U	2450	mg/kg	0.50	91	71	76
Chromium (Trivalent)	N	2490	mg/kg	1.0	15	15	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Organic Matter	M	2625	%	0.40			1.3
Total Organic Carbon	M	2625	%	0.20	0.85	0.63	
Mineral Oil	N	2670	mg/kg	10	< 10	< 10	
Aliphatic TPH >C5-C6	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C6-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C16-C21	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aliphatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980780	980781	980782
			Sample Location:		WS02	WS03	WS03
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.5	0.5	1.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Total Aliphatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C7-C8	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C8-C10	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C10-C12	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C12-C16	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C16-C21	U	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C21-C35	M	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Aromatic TPH >C35-C44	N	2680	mg/kg	1.0	< 1.0	< 1.0	< 1.0
Total Aromatic Hydrocarbons	N	2680	mg/kg	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	2680	mg/kg	10.0	< 10	< 10	< 10
Naphthalene	M	2700	mg/kg	0.10			< 0.10
Acenaphthylene	M	2700	mg/kg	0.10			< 0.10
Acenaphthene	M	2700	mg/kg	0.10			< 0.10
Fluorene	M	2700	mg/kg	0.10			< 0.10
Phenanthrene	M	2700	mg/kg	0.10			< 0.10
Anthracene	M	2700	mg/kg	0.10			< 0.10
Fluoranthene	M	2700	mg/kg	0.10			< 0.10
Pyrene	M	2700	mg/kg	0.10			< 0.10
Benzo[a]anthracene	M	2700	mg/kg	0.10			< 0.10
Chrysene	M	2700	mg/kg	0.10			< 0.10
Benzo[b]fluoranthene	M	2700	mg/kg	0.10			< 0.10
Benzo[k]fluoranthene	M	2700	mg/kg	0.10			< 0.10
Benzo[a]pyrene	M	2700	mg/kg	0.10			< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2700	mg/kg	0.10			< 0.10
Dibenz(a,h)Anthracene	M	2700	mg/kg	0.10			< 0.10
Benzo[g,h,i]perylene	M	2700	mg/kg	0.10			< 0.10
Total Of 16 PAH's	M	2700	mg/kg	2.0			< 2.0
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	

Chemtest
The right chemistry to deliver results

Results - Soil

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-07064	20-07064	20-07064
Quotation No.:			**Chemtest Sample ID.:**		980780	980781	980782
			Sample Location:		WS02	WS03	WS03
			Sample Type:		SOIL	SOIL	SOIL
			Top Depth (m):		1.5	0.5	1.5
			Date Sampled:		03-Mar-2020	03-Mar-2020	03-Mar-2020
			Asbestos Lab:		COVENTRY	COVENTRY	
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	
Coronene	N	2800	mg/kg	0.10	< 0.10	< 0.10	
Total Of 17 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	
PCB 28	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 52	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 90+101	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 118	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 153	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 138	U	2815	mg/kg	0.010	< 0.010	< 0.010	
PCB 180	U	2815	mg/kg	0.010	< 0.010	< 0.010	
Total PCBs (7 Congeners)	U	2815	mg/kg	0.10	< 0.10	< 0.10	
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980769						
Sample Ref:							
Sample ID:							
Sample Location:	BH01						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	1.2	3	5	6
Loss On Ignition	2610	M	%	2.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.037	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0018	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0023	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0091	0.091	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0024	< 0.50	4	50	200
Chloride	1220	U	6.6	66	800	15000	25000
Fluoride	1220	U	0.48	4.8	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	65	650	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	54	540	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980772						
Sample Ref:							
Sample ID:							
Sample Location:	BH02						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.97	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.2	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.044	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0057	< 0.50	20	100	300
Cadmium	1450	U	0.00020	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0028	< 0.050	2	50	100
Mercury	1450	U	0.00089	0.0089	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0051	< 0.50	4	50	200
Chloride	1220	U	140	1400	800	15000	25000
Fluoride	1220	U	1.2	12	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	42	420	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980773						
Sample Ref:							
Sample ID:							
Sample Location:	BH02						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.73	3	5	6
Loss On Ignition	2610	M	%	1.2	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.017	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0020	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	0.00096	0.0096	0.01	0.2	2
Molybdenum	1450	U	0.0083	0.083	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	25	250	800	15000	25000
Fluoride	1220	U	0.24	2.4	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	55	550	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	20	200	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	12

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980774						
Sample Ref:							
Sample ID:							
Sample Location:	BH03						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.54	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.061	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0097	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	0.0016	0.016	0.01	0.2	2
Molybdenum	1450	U	0.014	0.14	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	0.0025	0.025	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0014	< 0.50	4	50	200
Chloride	1220	U	14	140	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	2.3	23	1000	20000	50000
Total Dissolved Solids	1020	N	57	570	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	30	300	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980775						
Sample Ref:							
Sample ID:							
Sample Location:	BH03						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.78	3	5	6
Loss On Ignition	2610	M	%	2.0	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.7	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.065	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0014	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.018	0.18	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	11	110	800	15000	25000
Fluoride	1220	U	0.21	2.1	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	52	520	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	32	320	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980777						
Sample Ref:							
Sample ID:							
Sample Location:	WS01						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.89	3	5	6
Loss On Ignition	2610	M	%	2.1	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.060	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	< 0.0010	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0067	0.067	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	< 1.0	< 10	800	15000	25000
Fluoride	1220	U	0.32	3.2	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	62	620	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	25	250	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	10

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980778						
Sample Ref:							
Sample ID:							
Sample Location:	WS01						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.74	3	5	6
Loss On Ignition	2610	M	%	1.9	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.3	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.083	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0021	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.012	0.12	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	1.9	19	800	15000	25000
Fluoride	1220	U	0.18	1.8	10	150	500
Sulphate	1220	U	1.2	12	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	8.6	86	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	9.9

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980779						
Sample Ref:							
Sample ID:							
Sample Location:	WS02						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.64	3	5	6
Loss On Ignition	2610	M	%	1.8	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.4	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.068	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0054	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0013	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.0049	< 0.050	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	< 0.0010	< 0.50	4	50	200
Chloride	1220	U	55	550	800	15000	25000
Fluoride	1220	U	0.22	2.2	10	150	500
Sulphate	1220	U	1.8	18	1000	20000	50000
Total Dissolved Solids	1020	N	61	610	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	35	350	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	15

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980780						
Sample Ref:							
Sample ID:							
Sample Location:	WS02						
Top Depth(m):	1.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.85	3	5	6
Loss On Ignition	2610	M	%	2.7	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.090	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0019	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	< 0.0010	< 0.050	2	50	100
Mercury	1450	U	< 0.00050	< 0.0050	0.01	0.2	2
Molybdenum	1450	U	0.010	0.10	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0015	< 0.50	4	50	200
Chloride	1220	U	4.4	44	800	15000	25000
Fluoride	1220	U	0.17	1.7	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	51	510	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	40	400	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	11

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Results - Single Stage WAC

Project: 20-0013 Goatstown Development, Dublin

					Landfill Waste Acceptance Criteria Limits		
Chemtest Job No:	20-07064						
Chemtest Sample ID:	980781						
Sample Ref:							
Sample ID:							
Sample Location:	WS03						
Top Depth(m):	0.5						
Bottom Depth(m):							
Sampling Date:	03-Mar-2020						
Determinand	**SOP**	**Accred.**	**Units**		**Inert Waste Landfill**	**Stable, Non-reactive hazardous waste in non-hazardous Landfill**	**Hazardous Waste Landfill**
Total Organic Carbon	2625	M	%	0.63	3	5	6
Loss On Ignition	2610	M	%	2.1	--	--	10
Total BTEX	2760	M	mg/kg	< 0.010	6	--	--
Total PCBs (7 Congeners)	2815	M	mg/kg	< 0.10	1	--	--
TPH Total WAC (Mineral Oil)	2670	M	mg/kg	< 10	500	--	--
Total (Of 17) PAH's	2800	N	mg/kg	< 2.0	100	--	--
pH	2010	M		8.5	--	>6	--
Acid Neutralisation Capacity	2015	N	mol/kg	0.051	--	To evaluate	To evaluate
Eluate Analysis			**10:1 Eluate mg/l**	**10:1 Eluate mg/kg**	**Limit values for compliance leaching test using BS EN 12457 at L/S 10 l/kg**		
Arsenic	1450	U	< 0.0010	< 0.050	0.5	2	25
Barium	1450	U	0.0066	< 0.50	20	100	300
Cadmium	1450	U	< 0.00010	< 0.010	0.04	1	5
Chromium	1450	U	< 0.0010	< 0.050	0.5	10	70
Copper	1450	U	0.0012	< 0.050	2	50	100
Mercury	1450	U	0.00054	0.0054	0.01	0.2	2
Molybdenum	1450	U	0.0090	0.090	0.5	10	30
Nickel	1450	U	< 0.0010	< 0.050	0.4	10	40
Lead	1450	U	< 0.0010	< 0.010	0.5	10	50
Antimony	1450	U	< 0.0010	< 0.010	0.06	0.7	5
Selenium	1450	U	< 0.0010	< 0.010	0.1	0.5	7
Zinc	1450	U	0.0025	< 0.50	4	50	200
Chloride	1220	U	1.7	17	800	15000	25000
Fluoride	1220	U	0.19	1.9	10	150	500
Sulphate	1220	U	< 1.0	< 10	1000	20000	50000
Total Dissolved Solids	1020	N	61	600	4000	60000	100000
Phenol Index	1920	U	< 0.030	< 0.30	1	-	-
Dissolved Organic Carbon	1610	U	39	390	500	800	1000

Solid Information	
Dry mass of test portion/kg	0.090
Moisture (%)	14

Waste Acceptance Criteria

Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes. This analysis is only applicable for hazardous waste landfill acceptance and does not give any indication as to whether a waste may be hazardous or non-hazardous.

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

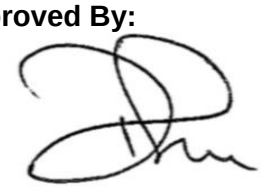
UKAS TESTING
2183

Final Report

Report No.:	20-08376-1
Initial Date of Issue:	26-Mar-2020
Client	Causeway Geotech Ltd
Client Address:	8 Drumahiskey Road Balnamore Ballymoney County Antrim BT53 7QL
Contact(s):	Colm Hurley Carin Cornwall Darren O'Mahony Fernando Alfonso Gabriella Horan Joe Gervin John Cameron Lucy Newland Matthew Gilbert Neil Haggan Paul Dunlop Paul McNamara Sean Ross Stephen Franey Stephen McCracken Stephen Watson Stuart Abraham
Project	20-0013 Goatstown Development, Dublin

Quotation No.:		**Date Received:**	16-Mar-2020
Order No.:		**Date Instructed:**	20-Mar-2020
No. of Samples:	3		
Turnaround (Wkdays):	5	**Results Due:**	26-Mar-2020
Date Approved:	26-Mar-2020		

Approved By:



Details: Darrell Hall, Director

Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.com

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Results - Water

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd		**Chemtest Job No.:**			20-08376	20-08376	20-08376
Quotation No.:		**Chemtest Sample ID.:**			986808	986809	986810
Order No.:		Client Sample Ref.:			WS	WS	WS
		Sample Location:			BH01	BH02	BH03
		Sample Type:			WATER	WATER	WATER
		Date Sampled:			12-Mar-2020	12-Mar-2020	12-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
pH	U	1010		N/A	8.1	8.2	7.9
Sulphate	U	1220	mg/l	1.0	110	52	150
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050
Thiocyanate	U	1300	mg/l	0.50	< 0.50	< 0.50	< 0.50
Sulphide	U	1325	mg/l	0.050	[B] < 0.050	[B] < 0.050	[B] < 0.050
Total Hardness as CaCO3	U	1270	mg/l	15	440	290	370
Arsenic (Dissolved)	U	1450	µg/l	1.0	1.6	< 1.0	1.3
Boron (Dissolved)	U	1450	µg/l	20	58	54	48
Cadmium (Dissolved)	U	1450	µg/l	0.080	< 0.080	< 0.080	0.15
Chromium (Dissolved)	U	1450	µg/l	1.0	13	7.6	2.7
Copper (Dissolved)	U	1450	µg/l	1.0	4.4	1.8	2.4
Mercury (Dissolved)	U	1450	µg/l	0.50	0.80	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0	5.0	1.6	9.3
Lead (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	U	1450	µg/l	1.0	26	46	57
Zinc (Dissolved)	U	1450	µg/l	1.0	8.6	2.2	10
Chromium (Hexavalent)	U	1490	µg/l	20	< 20	< 20	< 20
Total Organic Carbon	U	1610	mg/l	2.0	3.1	3.1	3.1
Aliphatic TPH >C5-C6	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C6-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aliphatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Aromatic TPH >C5-C7	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C7-C8	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C8-C10	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C35-C44	N	1675	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Aromatic Hydrocarbons	N	1675	µg/l	5.0	< 5.0	< 5.0	< 5.0
Total Petroleum Hydrocarbons	N	1675	µg/l	10	< 10	< 10	< 10
Naphthalene	U	1700	µg/l	0.10	< 0.10	< 0.10	2.1
Acenaphthylene	U	1700	µg/l	0.10	< 0.10	< 0.10	3.2

Chemtest
The right chemistry to deliver results

Results - Water

Project: 20-0013 Goatstown Development, Dublin

Client: Causeway Geotech Ltd			**Chemtest Job No.:**		20-08376	20-08376	20-08376
Quotation No.:			**Chemtest Sample ID.:**		986808	986809	986810
Order No.:			Client Sample Ref.:		WS	WS	WS
			Sample Location:		BH01	BH02	BH03
			Sample Type:		WATER	WATER	WATER
			Date Sampled:		12-Mar-2020	12-Mar-2020	12-Mar-2020
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Acenaphthene	U	1700	µg/l	0.10	< 0.10	< 0.10	0.72
Fluorene	U	1700	µg/l	0.10	< 0.10	< 0.10	2.1
Phenanthrene	U	1700	µg/l	0.10	< 0.10	< 0.10	5.1
Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	1.7
Fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Chrysene	N	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1700	µg/l	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	1700	µg/l	2.0	< 2.0	< 2.0	15
Benzene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Toluene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Ethylbenzene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
m & p-Xylene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
o-Xylene	U	1760	µg/l	1.0	[C] < 1.0	[C] < 1.0	[C] < 1.0
Total Phenols	U	1920	mg/l	0.030	[B] < 0.030	[B] < 0.030	[B] < 0.030

Deviations

In accordance with UKAS Policy on Deviating Samples TPS 63. Chemtest have a procedure to ensure 'upon receipt of each sample a competent laboratory shall assess whether the sample is suitable with regard to the requested test(s)'. This policy and the respective holding times applied, can be supplied upon request.The reason a sample is declared as deviating is detailed below. Where applicable the analysis remains UKAS/MCERTs accredited but the results may be compromised.

Sample:	Sample Ref:	Sample ID:	Sample Location:	Sampled Date:	Deviation Code(s):	Containers Received:
986808	WS		BH01	12-Mar-2020	BC	Coloured Winchester 1000ml
986809	WS		BH02	12-Mar-2020	BC	Coloured Winchester 1000ml
986810	WS		BH03	12-Mar-2020	BC	Coloured Winchester 1000ml

Report Information

Key

U	UKAS accredited
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N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at the indicated laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container
E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

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

Appendix H – Ground Gas Analysis Results Summary

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	06/03/2020
Weather:	Cloudy & windy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	998	0	0	21.9	0	0
After:	998	0	0	21.9	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.0	18.9	0	0
60	0.0	1.2	18.8	0	0
90	0.0	1.3	18.7	0	0
120	0.0	1.4	18.6	0	0
150	0.0	1.4	18.6	0	0
180	0.0	1.4	18.6	0	0
240	0.0	1.4	18.6	0	0
300	0.0	1.4	18.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.2
60	0.2
90	0.2
120	0.2
150	0.2
180	0.2
240	0.2
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	2.38
Depth to bottom of BH	2.75
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.5	15.8	0	0
60	0.0	1.5	15.8	0	0
90	0.0	1.5	15.8	0	0
120	0.0	1.4	15.7	0	0
150	0.0	1.4	15.6	0	0
180	0.0	1.4	15.6	0	0
240	0.0	1.4	15.6	0	0
300	0.0	1.4	15.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	1.82
Depth to bottom of BH	1.65
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.2	20.5	0	0
60	0.0	0.2	20.5	0	0
90	0.0	0.3	20.5	0	0
120	0.0	0.2	20.5	1	0
150	0.0	0.3	20.4	0	0
180	0.0	0.4	20.3	1	0
240	0.0	0.4	20.3	0	0
300	0.0	0.4	20.3	1	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.58
Depth to bottom of BH	2.90
Sample collected (Y/N)	N
Sample depth	-

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	11/03/2020
Weather:	Dry

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	991	0	0.1	21.1	0	0
After:	991	0	0.1	21.1	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.7	18.1	0	0
60	0.0	1.8	17.9	0	0
90	0.0	1.8	17.9	0	0
120	0.0	1.8	17.9	0	0
150	0.0	1.8	17.9	0	0
180	0.0	1.8	17.8	0	0
240	0.0	1.8	17.7	0	0
300	0.0	1.8	17.6	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.2
150	0.2
180	0.1
240	0.2
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.41
Depth to bottom of BH	2.71
Sample collected (Y/N)	Y
Sample depth	2.41

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.2	15.3	0	0
60	0.0	1.2	16.9	0	0
90	0.0	1.2	16.9	0	0
120	0.0	1.2	16.9	0	0
150	0.0	1.3	16.9	0	0
180	0.0	1.3	16.9	0	0
240	0.0	1.3	16.9	0	0
300	0.0	1.3	16.9	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-15.6
60	-10.1
90	-4.7
120	-3.3
150	-2.3
180	-1.2
240	-0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.80
Depth to bottom of BH	1.57
Sample collected (Y/N)	Y
Sample depth	1.80

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.5	20.9	1	0
60	0.0	0.5	20.9	1	0
90	0.0	0.5	20.9	1	0
120	0.0	0.5	20.9	1	0
150	0.0	0.5	20.9	1	0
180	0.0	0.5	20.9	0	0
240	0.0	0.5	20.9	0	0
300	0.0	0.5	21.0	1	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.2
120	0.1
150	0.2
180	0.1
240	0.1
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	2.55
Depth to bottom of BH	2.90
Sample collected (Y/N)	Y
Sample depth	2.55

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	16/03/2020
Weather:	Cloudy & breezy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	1006	0	0	21.8	0	0
After:	1006	0	0	21.8	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.0	19.5	0	0
60	0.0	1.1	19.4	0	0
90	0.0	1.1	19.4	0	0
120	0.0	1.1	19.4	0	0
150	0.0	1.1	19.4	0	0
180	0.0	1.1	19.4	0	0
240	0.0	1.1	19.4	0	0
300	0.0	1.1	19.4	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	2.38
Depth to bottom of BH	2.70
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	1.1	16.8	0	0
60	0.0	1.1	16.8	0	0
90	0.0	1.1	16.8	0	0
120	0.0	1.0	16.7	0	0
150	0.0	1.0	16.7	0	0
180	0.0	1.0	16.7	0	0
240	0.0	1.0	16.7	0	0
300	0.0	1.0	16.7	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.77
Depth to bottom of BH	1.55
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.2	21.0	0	0
60	0.0	0.2	21.0	0	0
90	0.0	0.2	21.0	0	0
120	0.0	0.2	21.0	0	0
150	0.0	0.2	21.0	0	0
180	0.0	0.2	21.0	0	0
240	0.0	0.2	21.0	0	0
300	0.0	0.2	21.0	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	1.55
Depth to bottom of BH	2.85
Sample collected (Y/N)	N
Sample depth	-

Groundwater Ground Gas Monitoring

Site:	Goatstown
Project No.:	20-0013
Date:	24/03/2020
Weather:	Cloudy

Equipment:		Geotechnical Instruments GA5000				
Ambient Conditions	Barometric Pressure	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
Before:	1008	0	0	21.5	0	0
After:	1008	0	0	21.5	0	0

BH01	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.7	19.2	0	0
60	0.0	0.7	19.2	0	0
90	0.0	0.7	19.2	0	0
120	0.0	0.8	19.1	0	0
150	0.0	0.8	19.1	0	0
180	0.0	0.8	19.1	0	0
240	0.0	0.8	19.1	0	0
300	0.0	0.8	19.1	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.1
60	0.1
90	0.1
120	0.1
150	0.1
180	0.1
240	0.1
300	0.1

Groundwater monitoring	mbgl
Depth to top of water	2.40
Depth to bottom of BH	2.70
Sample collected (Y/N)	N
Sample depth	-

BH02	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.9	16.4	0	0
60	0.0	0.9	16.4	0	0
90	0.0	0.7	16.5	0	0
120	0.0	0.6	16.5	0	0
150	0.0	0.6	16.5	0	0
180	0.0	0.6	16.5	0	0
240	0.0	0.6	16.5	0	0
300	0.0	0.6	16.5	0	0

Flow rates	
Time (sec)	Flow (l/h)
30	0.2
60	0.2
90	0.2
120	0.2
150	0.2
180	0.2
240	0.2
300	0.2

Groundwater monitoring	mbgl
Depth to top of water	1.77
Depth to bottom of BH	1.55
Sample collected (Y/N)	N
Sample depth	-

BH03	Gas readings				
Time (sec)	CH_4 (%)	CO_2 (%)	O_2 (%)	CO (ppm)	H_2S (ppm)
30	0.0	0.1	20.9	0	0
60	0.0	0.1	20.9	0	0
90	0.0	0.1	20.9	0	0
120	0.0	0.1	20.9	0	0
150	0.0	0.2	20.9	0	0
180	0.0	0.2	20.9	0	0
240	0.0	0.2	20.9	0	0
300	0.0	0.2	20.9	0	0

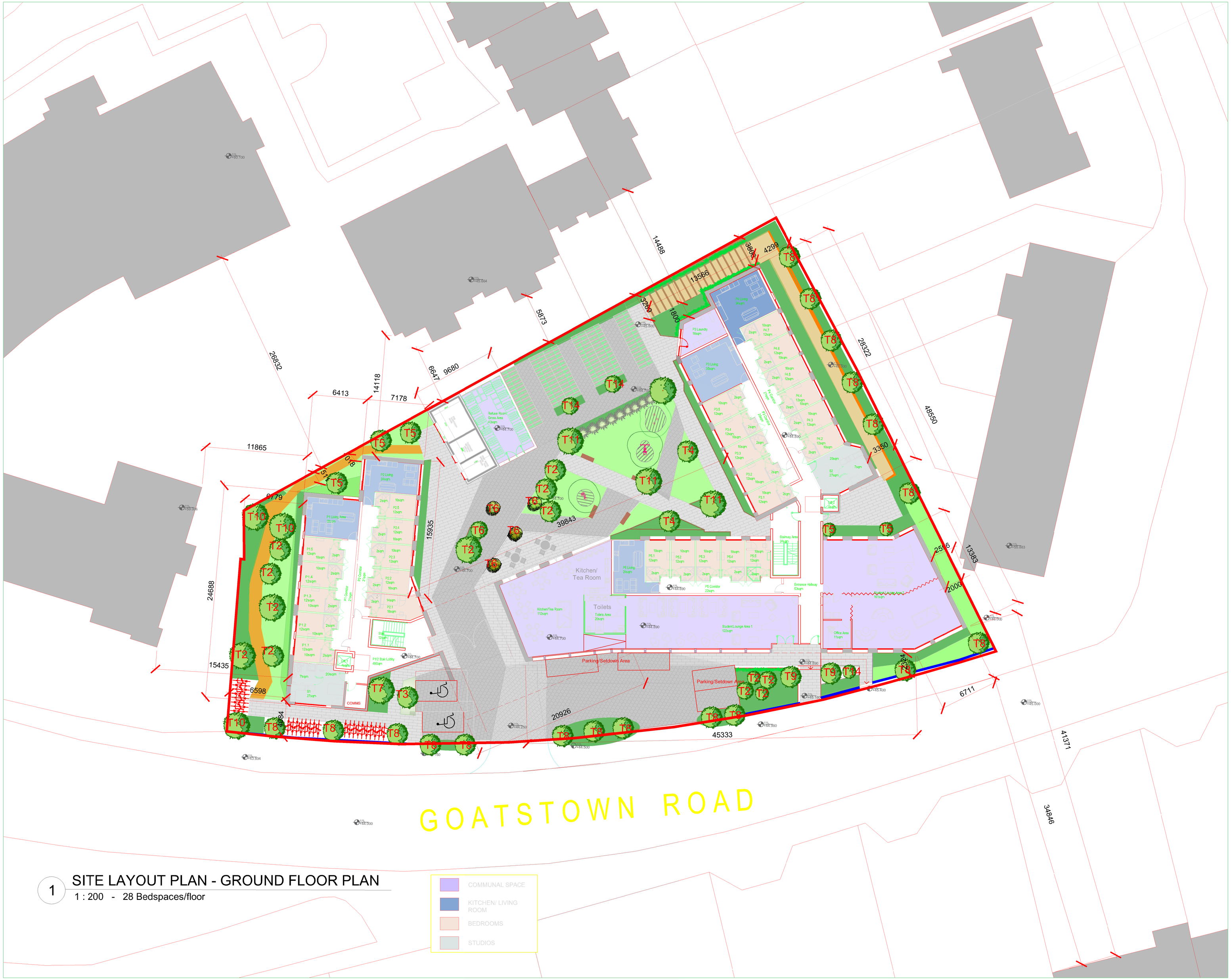
Flow rates	
Time (sec)	Flow (l/h)
30	-0.1
60	-0.1
90	-0.1
120	-0.1
150	-0.1
180	-0.1
240	-0.1
300	-0.1

Groundwater monitoring	mbgl
Depth to top of water	2.56
Depth to bottom of BH	2.85
Sample collected (Y/N)	N
Sample depth	-

CAUSEWAY GEOTECH

APPENDIX G

PROPOSED DEVELOPMENT



1 SITE LAYOUT PLAN - GROUND FLOOR PLAN

1 : 200 - 28 Bedspaces/floor

	COMMUNAL SPACE
	KITCHEN/ LIVING ROOM
	BEDROOMS
	STUDIOS

Notes:

DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS IN ALL CASES. VERIFY DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE ARCHITECTS IMMEDIATELY. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ARCHITECTS SPECIFICATION. © THIS DRAWING IS COPYRIGHT AND MAY ONLY BE REPRODUCED WITH THE ARCHITECTS PERMISSION.

OSi License Number - AR 0052220
Projection / Spatial Reference:
Projection= IRENET95_Irish_Transverse_Mercator
Centre Point Coordinates:
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Reference Index:
Map Series | Map Sheets
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Vertical Datum:
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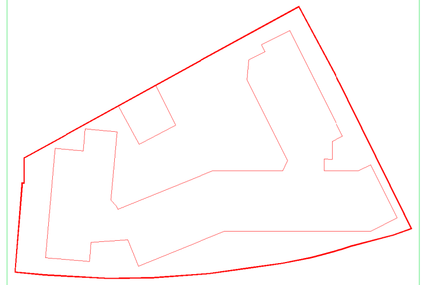

Key Plan

PLANNING LEGEND

SYMBOL	DESCRIPTION
	SITE BOUNDARY LINE

Rev	Date	DRN	Description
P3	xx/02/22	LW	Planning
P2	28/08/20	LW	Planning
P1	25/02/20	LW	Pre-Planning ABP issue

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Project Details:
PROPOSED STUDENT RESIDENCE
GOATSTOWN ROAD, DUBLIN 14

Drawing Title:
Site Layout Plan - Ground Floor Plan

Job No	Date	Scale@A1
19-181D	28.08.20	1:200
Status: Planning		Drawn By: JB
Purpose: Planning Permission		Checked By: LW

Drawing Number: 19-181D-RAU-ZZ-GF-DR-A-GAP-104
Revision: P03