Appendix III

Photos from Recent Site Walkovers

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No.	Date:
1	12/06/18

Description:

Site entrance to industrial units

Photo No.	Date:
2	12/06/18

Description:

Grassed areas near industrial units carpark

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 3	Date: 12/06/18

Description:

Old gas well near industrial unit carpark

Photo No. 4	Date: 12/06/18

Description:

Site entrance to derelict mushroom buildings

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 5	Date: 12/06/18

Description:

Area in front of derelict mushroom buildings

Photo No. 6	Date: 12/06/18

Description:

Site entrance to vegetated field

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 7 | **Date:** 12/06/18

Description:

Southern section of vegetated field

Photo No. 8 | **Date:** 12/06/18

Description:

Area west of industrial units, north of derelict mushroom buildings

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 9	Date: 12/06/18

Description:

Northern section of site, looking westwards

Photo No. 10	Date: 12/06/18

Description:

Waste material protruding from northern boundary adjacent to surface water ditch

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 11	Date: 12/06/18

Description:

Exposed waste material at western boundary of Corrinshigo lake

Photo No. 12	Date: 12/06/18

Description:

Exposed waste material at western boundary of Corrinshigo lake

PHOTOGRAPHIC LOG

Consultants in Engineering and Environmental Sciences

www.fehilytimoney.ie

FEHILY TIMONEY & COMPANY

Client Name: Monaghan Co. Council	Site Location: Killycard	Project Number: P1655

Photo No. 13	Date: 12/06/18

Description:

Waste material protruding from soil surface

Photo No. 14	Date: 12/06/18

Description:

Waste material protruding from soil surface

Appendix II

Causeway Geotechnical Reports

Monaghan Landfills Killycard – Ground Investigation

Client:	Monaghan County Council
Client's Representative:	Fehily Timoney
Report No.:	18-0838A
Date:	October 2018
Status:	Final for Issue

Causeway Geotech Ltd
8 Drumahiskey Road, Ballymoney
Co. Antrim, N. Ireland, BT53 7QL

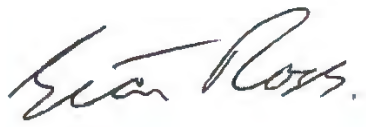
+44 (0)28 2766 6640
info@causewaygeotech.com
www.causewaygeotech.com

Registered in Northern Ireland. Company Number: NI610766
Approved: ISO 9001 • ISO 14001 • OHSAS 18001

CONTENTS

APPENDICES

Document Control Sheet

Report No.:		18-0838A			
Project Title:		Monaghan Landfills - Killycard			
Client:		Monaghan County Council			
Client's Representative:		Fehily Timoney			
Revision:	A00	**Status:**	Final for Issue	**Issue Date:**	16 October 2018
Prepared by:		**Reviewed by:**		**Approved by:**	
 Sean Ross BSc MSc		 Matthew Gilbert MEarthSci FGS		 Darren O'Mahony BSc MSc MIEI	

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. The length achieved is stated (mm) for any test increment less than 75mm
N=X	SPT blow count 'N' given by the summation of the blows 'X' required to drive the full test length (300mm)
N=X/Z	Incomplete standard penetration test where the full test length was not achieved. The blows 'X' represent the total blows for the given test length 'Z' (mm)
V VR	Shear vane test (borehole) Hand vane test (trial pit) Shear strength stated in kPa V: undisturbed vane shear strength VR: remoulded vane shear strength
dd/mm/yy: 1.0 dd/mm/yy: dry	Date & water level at the borehole depth at the end of shift and the start of the following shift
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.

Monaghan Landfills - Killycard

1 AUTHORITY

On the instructions of Fehily Timoney Consulting Engineers, ("the Client's Representative"), acting on the behalf of Monaghan County Council ("the Client"), a ground investigation was undertaken at the above location to provide geotechnical and environmental information to aid in the remediation of an old landfill site.

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.

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, trial pits, soil sampling, in-situ and laboratory testing, and the preparation of a factual report on the findings.

3 DESCRIPTION OF SITE

As shown on the site location plan in Appendix A, the works were conducted on the site of an old landfill north west of Castleblaney, just off the R183. The site is bordered to the east by industrial units, to the west by Malone's Lake and to the north by agricultural lands.

The site slopes gently downwards in the direction of Malone's Lake within the area of the old landfill.

4 SITE OPERATIONS

4.1 Summary of site works

Site operations, which were conducted between 20th September and 1st October 2018, comprised:

- three boreholes by rotary drilling methods;
- standpipe installation in all three boreholes;
- thirteen machine dug trial pits; and
- variable head permeability tests in all 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

Three boreholes (GW01 – GW03) were put to their completion by rotary drilling techniques only. The boreholes were completed using a Hanjin-8D tracked rotary rig.

Symmetrix-cased full hole rotary percussive drilling techniques were employed to advance the boreholes through overburden and bedrock to scheduled depths of 10m.

Any water strikes encountered during boring were recorded along with any changes in their levels as the borehole proceeded.

Where water was added to assist with boring, a note has been added to the log to account for same.

Appendix B presents the borehole logs.

4.3 Standpipe installations

A groundwater monitoring standpipe was installed in boreholes GW01 – GW03.

Details of the installations, including the depth range of the response zone, are provided in Appendix B on the individual borehole logs.

4.4 Trial Pits

Thirteen trial pits (TP01–TP13) were excavated using a 13t tracked excavator fitted with a 600mm wide bucket, to depths of 4.2 – 4.5m.

Environmental samples were taken at depths of 0.5m in TP04 and TP08.

Disturbed (bulk bag) samples were taken within the capping material of the landfill.

Any water strikes encountered during excavation were recorded along with any changes in their levels as the excavation proceeded. The stability of the trial pit walls was noted on completion.

Appendix C presents the trial pit logs with photographs of the pits and arising provided in Appendix D.

4.5 Variable head permeability testing

In-situ permeability tests were carried out in all boreholes by variable head permeability methods, following development of the wells. Testing was carried out in accordance with the guidance as set out in BS EN ISO 22282-2: 2012

The permeabilities were calculated using Hvorslev's formula k=A/FT as defined in BS 5930:1999 (pg 52).

The results are presented in Appendix E.

4.6 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.

4.7 Ground water and ground gas monitoring

Following completion of site works, ground water was conducted on one round. Ground water monitoring was carried out using a water interface probe.

The monitoring records are presented in Table 1 below.

Table 1 Results of groundwater monitoring undertaken on site

Date - 09/10/2018	Water Level (mbgl)
GW01	1.52
GW02	2.22
GW03	1.71

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 Geotechnical laboratory testing of soils

Laboratory testing of soils comprised:

- **soil classification:** moisture content measurement, Atterberg Limit tests and particle size distribution analysis.

Laboratory testing of soils samples was carried out in accordance with British Standards Institute: *BS 1377, Methods of test for soils for civil engineering purposes; Part 1 (2016), and Parts 2-9 (1990).*

The test results are presented in Appendix F.

5.2 Environmental laboratory testing of soils

Environmental testing, in the form of WAC testing was conducted on two environmental soil samples by Chemtest at its laboratory in Newmarket, Suffolk.

Results of environmental laboratory testing are presented in Appendix G.

6 GROUND CONDITIONS

6.1 General geology of the area

Published geological mapping indicate the superficial deposits underlying the site comprise peat and glacial till. These deposits are underlain by sandstone and microconglomerate of the Oghill 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:

- **Topsoil:** encountered in all trial pits with thicknesses ranging between 50 – 100mm. Driller's logs record 500mm of topsoil, however as this was drilled via rotary percussion methods, depths are by visual observations of drilling returns.
- **Made Ground (sub-base):** 500mm of stone fill encountered in GWO1 within the hardstanding area of the site, however as this was drilled via rotary percussion methods, depths are by visual observations of drilling returns.
- **Made Ground (fill):** reworked clay/silt fill with localised pockets of glass, plastic, wood, red brick and steel encountered down to a depth of 4.4m in TP08.
- **Made Ground (general waste):** black general waste encountered to a depth of 3.4m in TP11.
- **Recent deposits (peat):** spongy brown fibrous peat encountered in all trial pits except TP11, to a maximum depth of 4.5m in TP08.
- **Glacial Till:** silty clay, soft to firm encountered underlying the peat stratum in all trial pits to the maximum extent of the trial pit.
- **Bedrock (Limestone):** Rockhead was encountered at depths ranging from 5.5m in GW03 to about 6m in boreholes GW01 and GW02.

6.3 Groundwater

Groundwater was encountered during percussion boring through soil and trial pit excavations as water strikes as shown in Table 2 below.

Table 2 Groundwater strikes encountered during the ground investigation

GI Ref	Water Level (mbgl)	Comments
GW01	6.0	Very Strong
GW02	6.5	Very Strong
GW03	5.5	Very Strong
TP01	2.1	Fast flow
TP02	1.8	Flow
TP02	2.7	Fast flow
TP03	2.1	

TP04	4.1	Seepage
TP06	1.2	Heavy flow
TP07	1.0	Seepage
TP10	1.6	Seepage
TP11	3.0	Fast flow
TP12	2.8	Seepage
TP13	2.1	Fast flow

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.

It should be noted that the casing used in supporting the borehole walls during drilling may have sealed out any additional groundwater strikes encountered.

It should be noted that any additional groundwater strikes within bedrock may have been masked by the fluid used as the drilling flush medium

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

7 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. British Standards Institution.

BS EN ISO 14688-2:2004+A1:2013: 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.

BS EN ISO 22282-2: 2012: Geotechnical investigation and testing. Geohydraulic testing – Part 2: Water permeability tests in a borehole using open systems.

CAUSEWAY GEOTECH

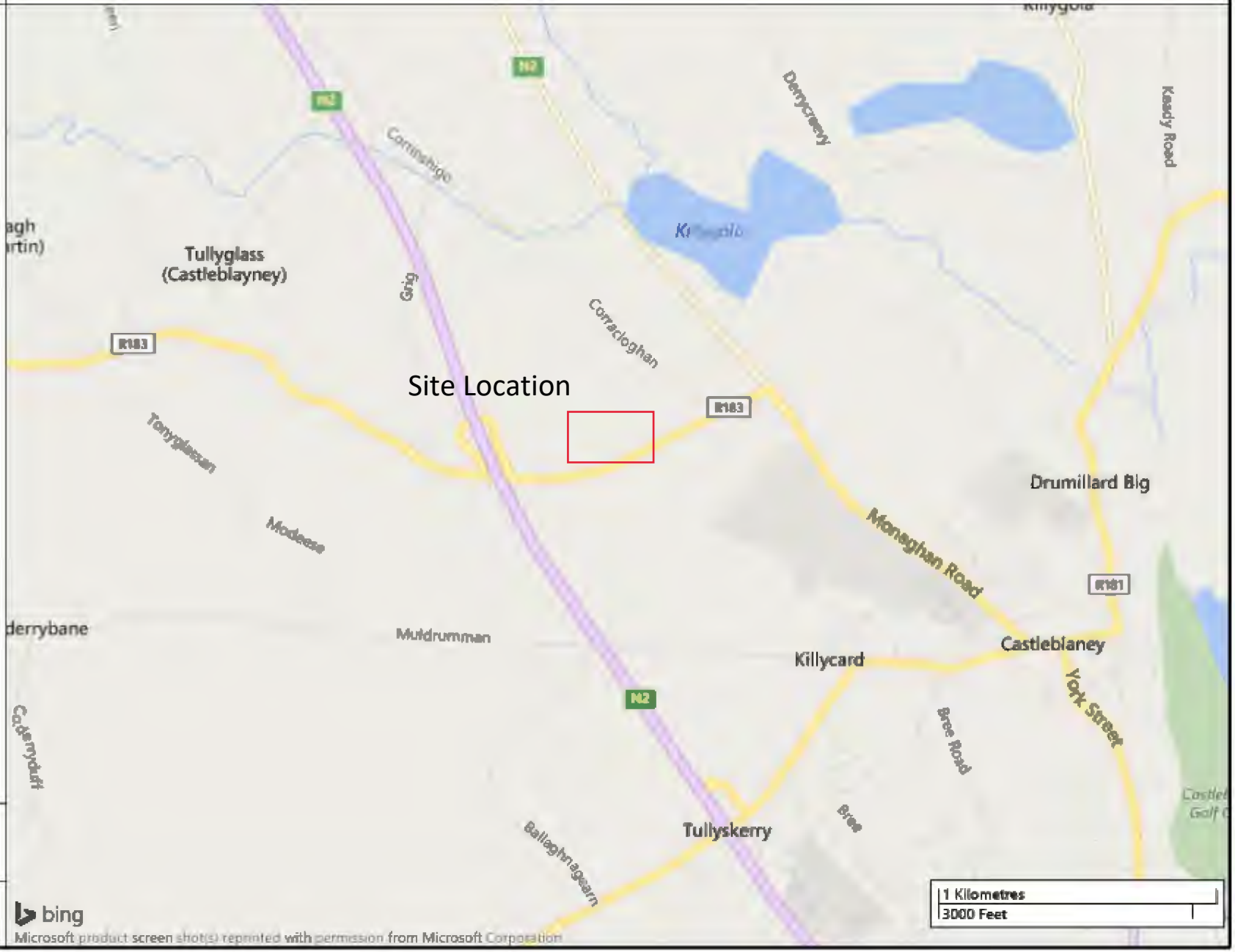
APPENDIX A

SITE AND EXPLORATORY HOLE LOCATION PLANS

CAUSEWAY GEOTECH

Project No.:	18-0838A	**Client:**	Monaghan County Council
Project Name:	Monaghan Landfills - Killycard	**Client's Representative:**	Fehily Timoney

Legend Key



Title:
Site Location Plan

Last Revised:	**Scale:**
12/10/2018	1:20000

CAUSEWAY GEOTECH

Project No.:	18-0838A	**Client:**	Monaghan County Council
Project Name:	Monaghan Landfills - Killycard	**Client's Representative:**	Fehily Timoney

Legend Key

- Locations By Type - RO
- Locations By Type - TP

Title:
Exploratory Hole Location Plan

Last Revised:	**Scale:**
15/10/2018	1:1000