APPENDIX B: DRAWINGS

Drawing Number	Description	Scale
N/A	Intrusive works Location Map	1:1700
P18159-GP-D01	Geophysical Profiles Location Map	As stated at A1
P18159-GP-D02	Cross Section and Interpretation	As stated at A1.
P18159-GP-D03	Cross Section and Interpretation	As stated at A1
P18159-GP-D04	Cross Section and Interpretation	As stated at A1
P18159-GP-D05	Cross Section and Interpretation	As stated at A1
P18159-GP-D06	Cross Section and Interpretation	As stated at A1

Project Id:	P18159	Title:	Site Plan
Project Title:	Longford Landfills - Cartron Big	Scale:	1:1700
Location:	Co. Longford	Engineer:	Fehily Timoney
Client:		Contractor:	PGL

priority geotechnical

Legend Key

- ● CB - RC - CB - RC
- ◆ CB - SA - CB - SA
- ■ CB - TP - CB - TP

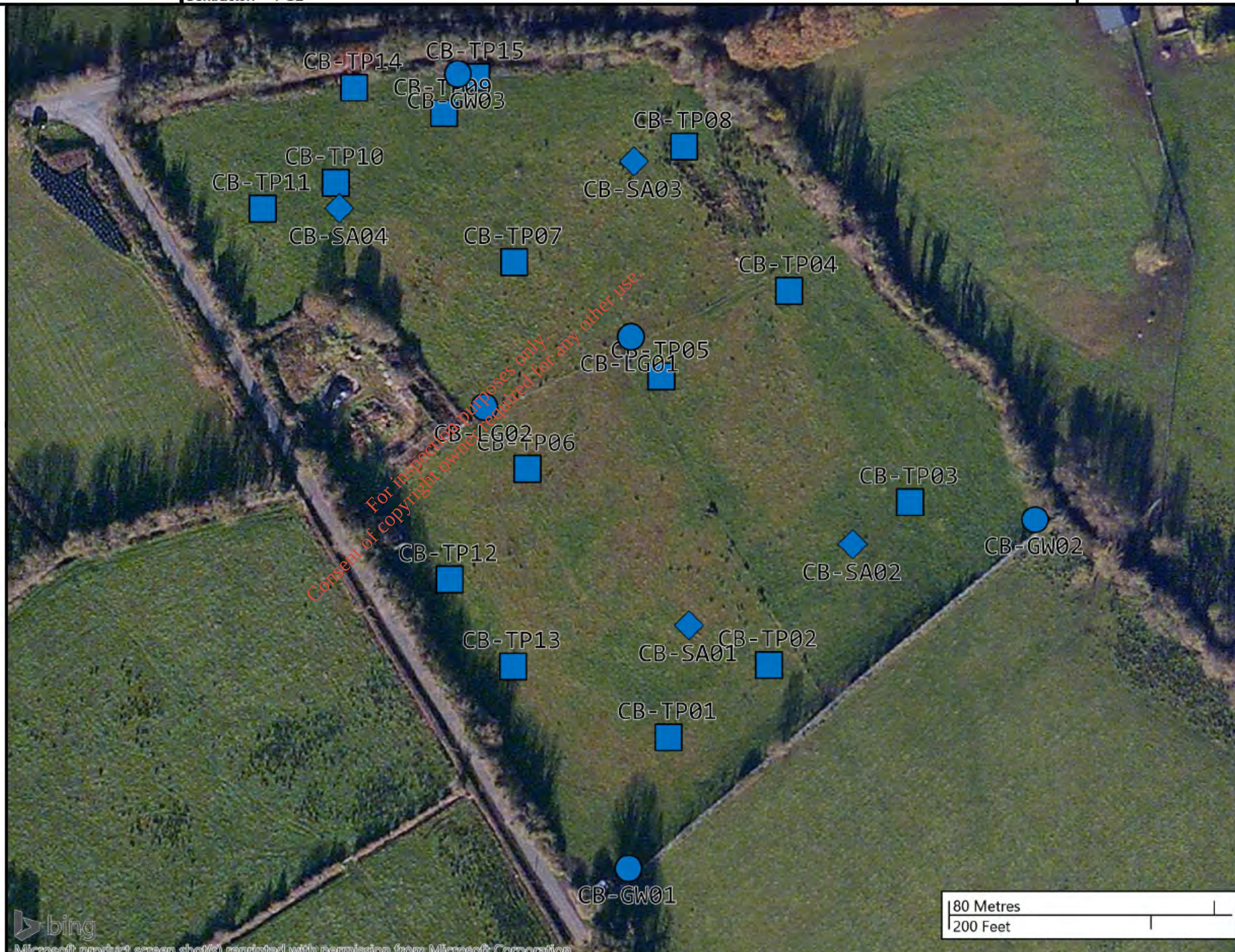


FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

PROJECT:	CONSULTING ENGINEERS:	JOB NUMBER:	DRAWN BY:	APPROVED:	Legend:
GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	FEHILY TIMONEY	P18159	HP	GH	1. Approximate landfill material lateral extent indicated by orange hatch.
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin	
Sheet Title: LOCATION MAP	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D01	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018	
			REVISION: D01 – DRAFT FOR COMMENT		

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

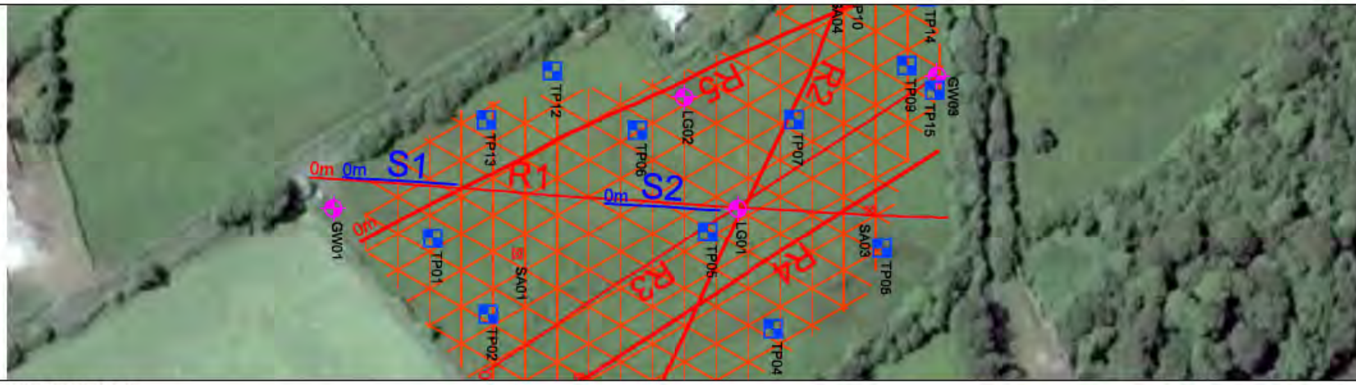
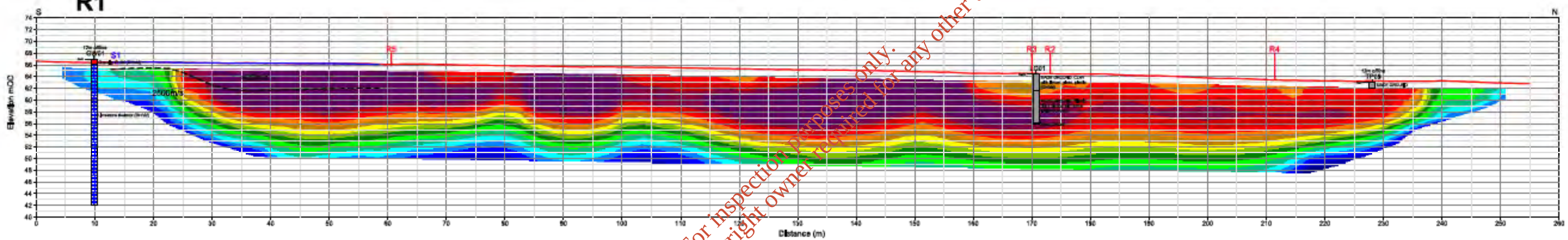
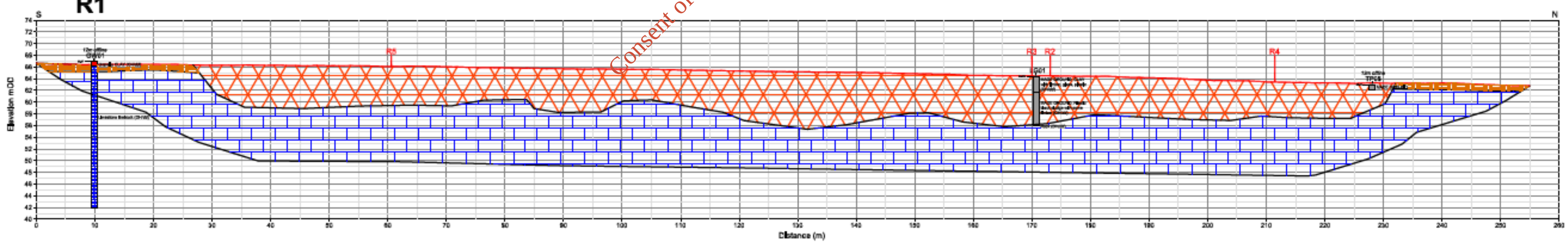


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:400

R1



R1



PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R1	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D02	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile

Seismic Refraction Profile

Resistivity in ohm.m

Seismic refraction boundaries with P-wave velocities (m/s):

400m/s

1000m/s

3000m/s

Geophysical Interpretation

Overburden

Topsoil

Landfill Material

Bedrock

LIMESTONE possibly argillaceous in nature

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

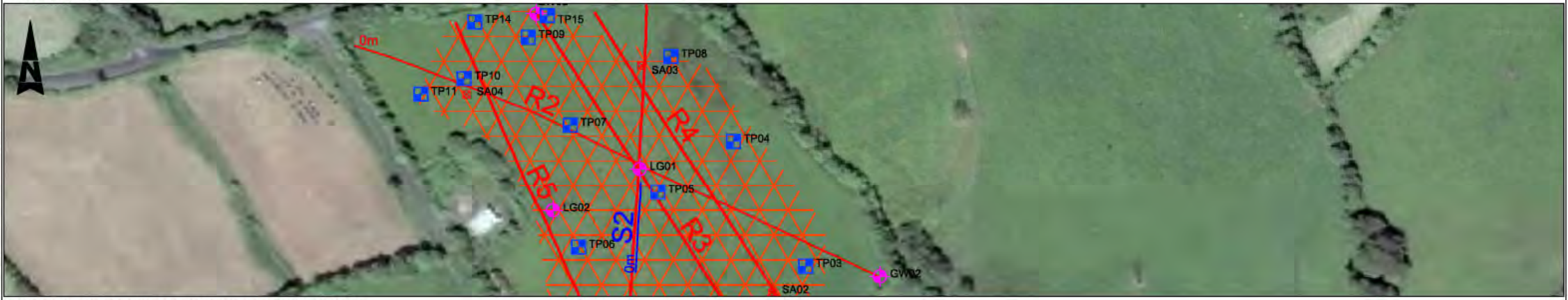
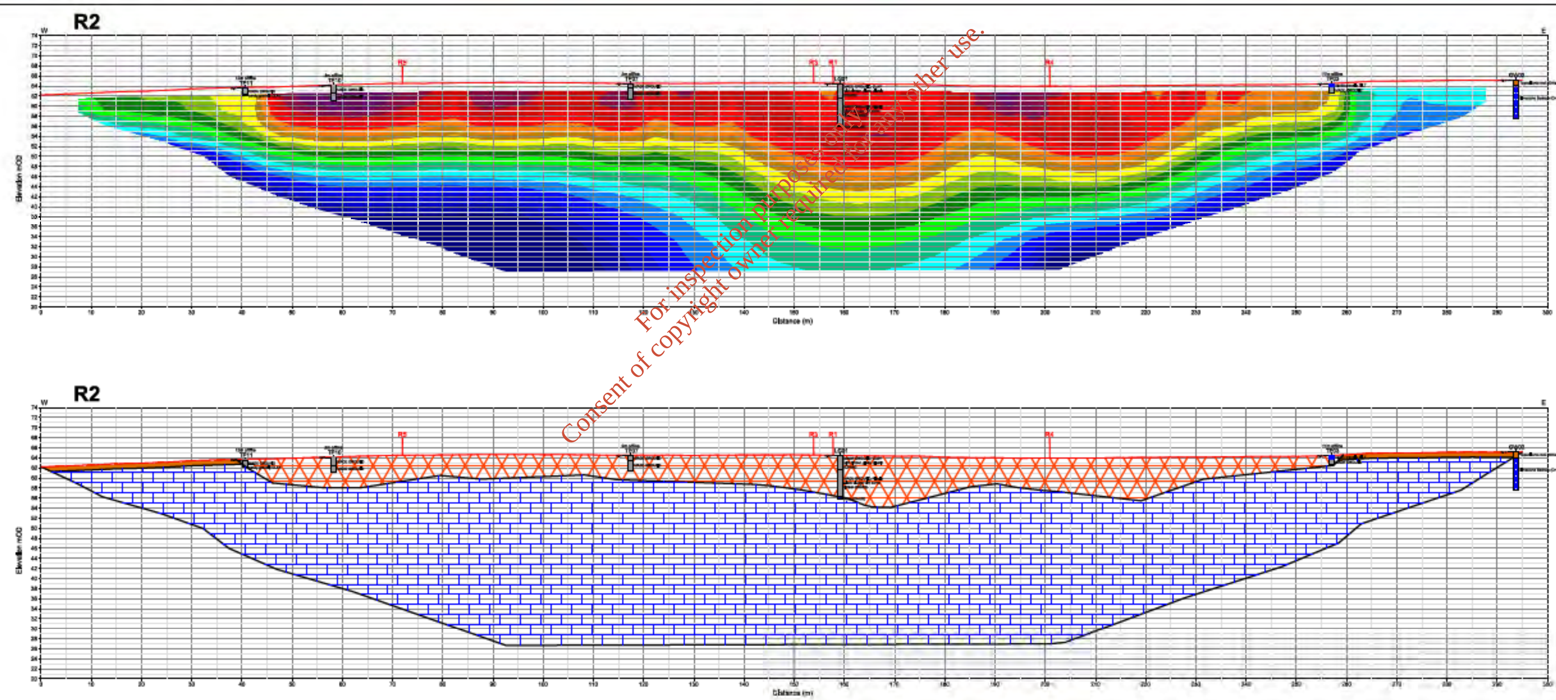


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
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Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R2	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D03	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile
Seismic Refraction Profile

7.22 15.6 33.7 72.6 157 338 730 1575
Resistivity in ohm.m

Seismic refraction boundaries with P-wave velocities (m/s):
400m/s
1000m/s
3000m/s

Geophysical Interpretation
Overburden
Topsoil
Landfill Material

Bedrock
LIMESTONE possibly argillaceous in nature

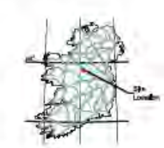


FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

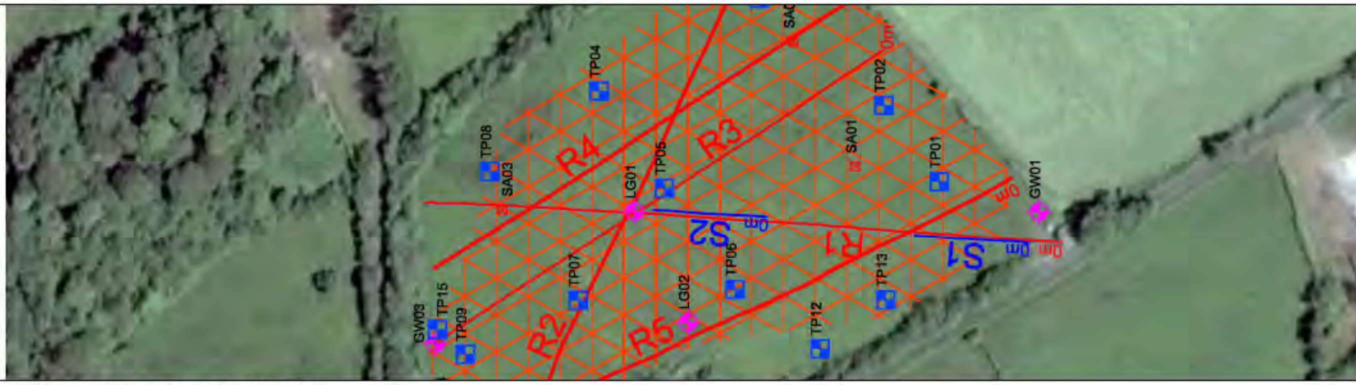
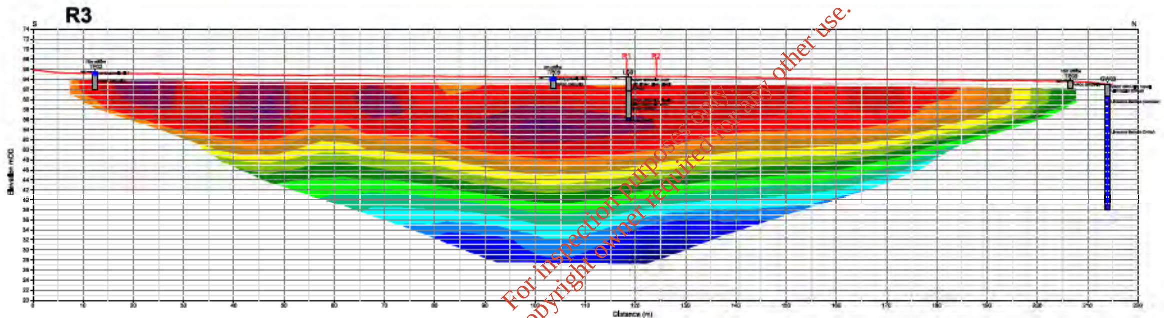
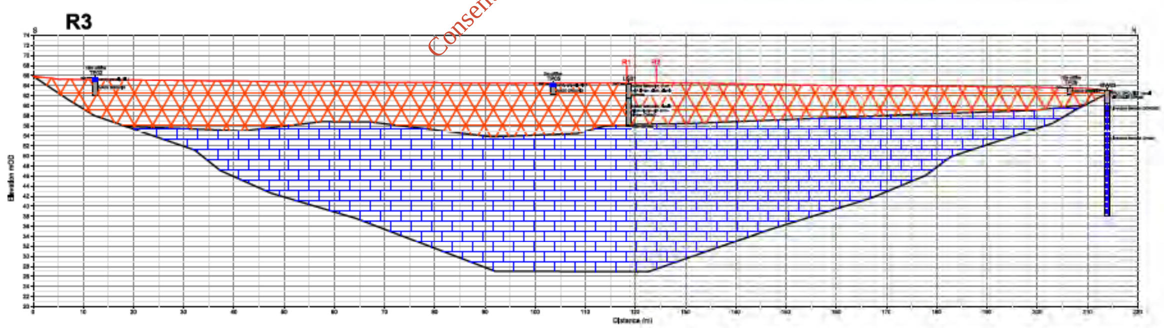


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500





PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R3	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D04	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile
Seismic Refraction Profile

Resistivity in ohm.m

Seismic refraction boundaries with P-wave velocities (m/s):
400m/s
1800m/s
3000m/s

Geophysical Interpretation
Overburden
Topsoil
Landfill Material

Bedrock
LIMESTONE possibly argillaceous in nature

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

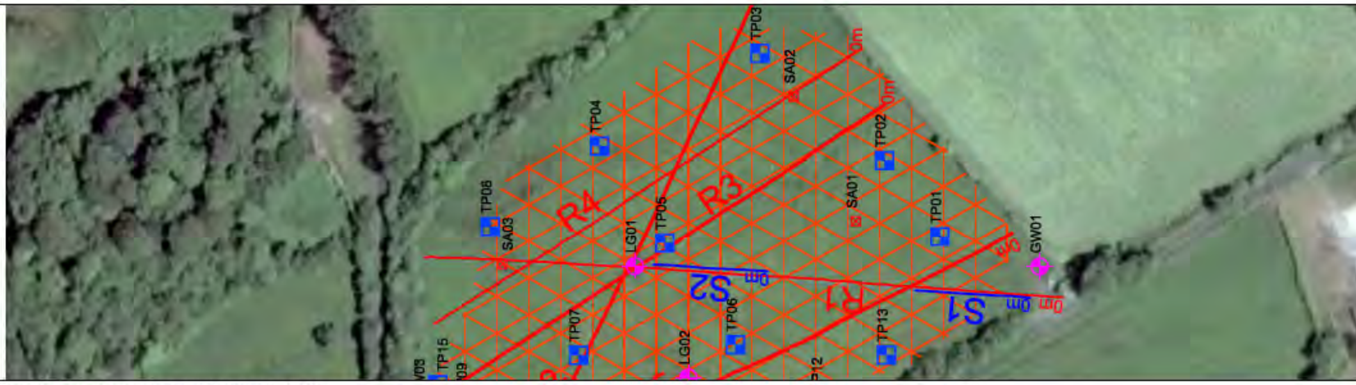
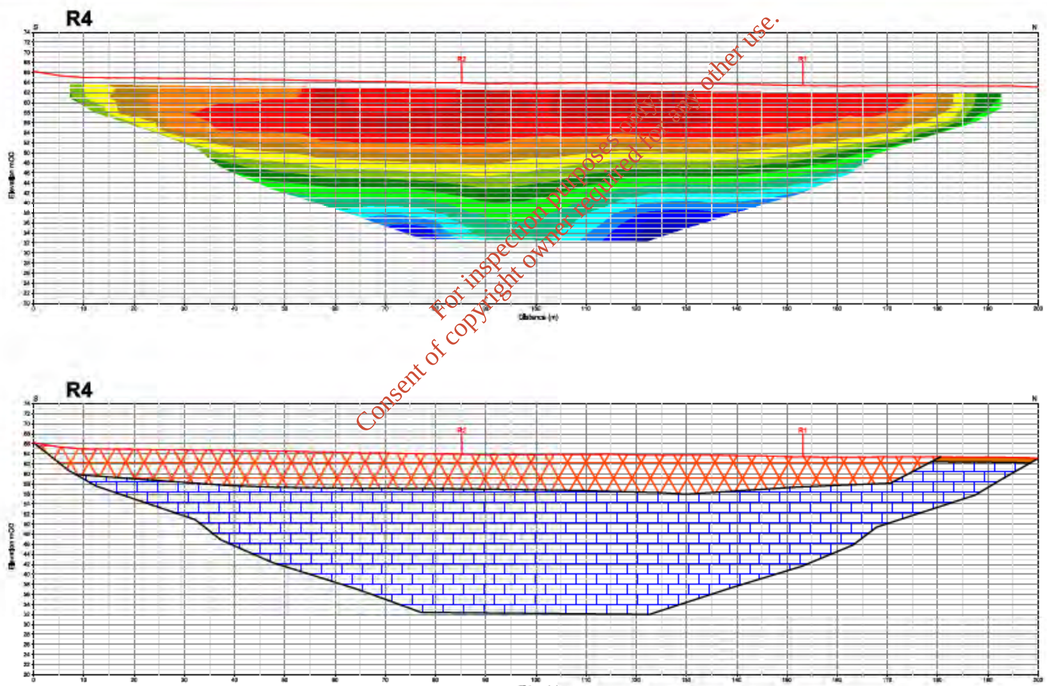


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R4	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D05	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile
Seismic Refraction Profile

7.22 15.6 33.7 72.8 157 339 731 1575
Resistivity in ohm.m

Seismic refraction boundaries with P-wave velocities (m/s):
400m/s
1800m/s
3000m/s

Geophysical Interpretation
Overburden
Topsoil
Landfill Material

Bedrock
LIMESTONE possibly argillaceous in nature

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

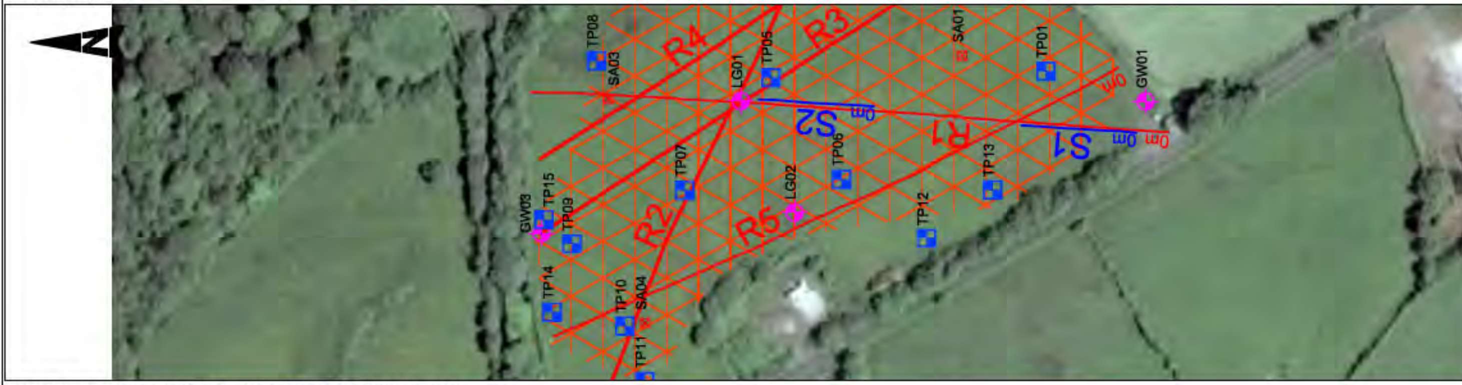
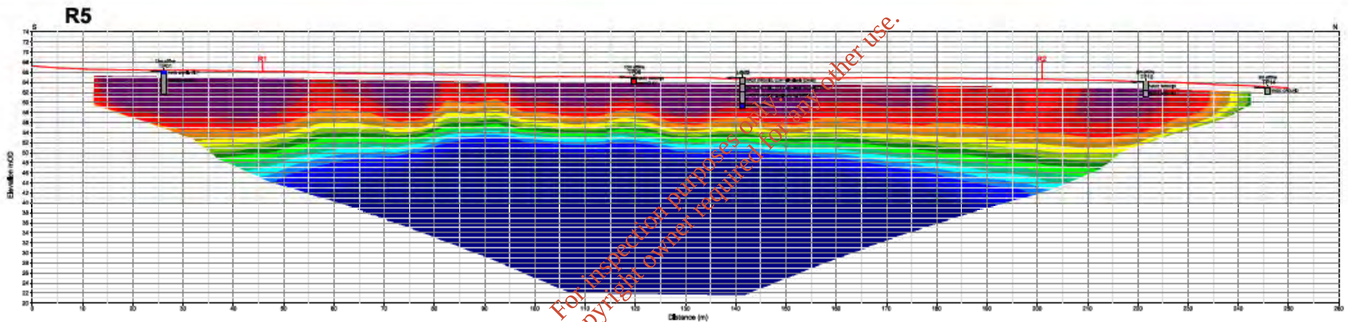
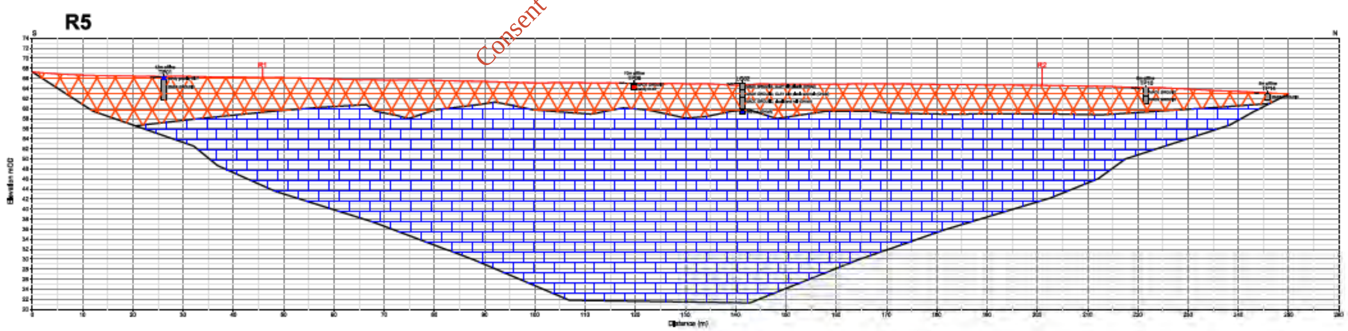


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500





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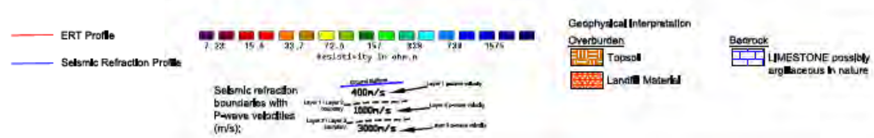
GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	FEHILY TIMONEY	P18159	HP	GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R5	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D06	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:



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Soske, J. (1959). THE BLIND ZONE PROBLEM IN ENGINEERING GEOPHYSICS. *GEOPHYSICS*, 24(2), pp.359-365.

Telford W.S., Geldart L.P, Sheriff R.E. (1990) Applied Geophysics Second Edition (Cambridge University Press) 769pp

Williamson E.D and Adams L.H. (1923). Density distribution in the Earth. J. Wash. Acad. Sci., 13, p413-28.

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GSEG (2002) Geophysics in Engineering Investigations. Geological Society Engineering Geology Special Publication 19, London, 2002.

Loke, M. (2000). Electrical imaging surveys for environmental and engineering studies.

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Geophys Report

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CARTRON BIG LANDFILL

GROUND INVESTIGATION

GEOPHYSCIAL SURVEY

REPORT No. P18159_Gp_Rp_D01

Priority Geotechnical Ltd.

REPORT CONTROL SHEET

Client						
Engineer Representative	Fehily Timoney					
Project Name	CARTRON BIG LANDFILL GROUND INVESTIGATION					
Document Name	Geophysical Survey Draft Report					
Project Number	P18159_Gp					
This Report Comprises of	TOC	Text	No. of Volume	No. of Appendices	Drawings	Electronic data
	1	11	1	1	6	*.dwg, *.pdf

Revision	Status	Author(s)	Approved By	Issue Date
D01	Draft	HP	GH	24/09/2018

TABLE OF CONTENTS

A) Introduction

A.1) Scope of Works

Priority Geotechnical Ltd. was instructed by Fehily Timoney to undertake a geophysical investigation in conjunction with a site investigation survey at Cartron Big Landfill, Longford, Co. Longford.

The survey consisted of seismic refraction and electrical resistivity surveying in accordance with BS5930 and BS7022 and the Geological Society Engineering Group Working Party Report on Engineering Geophysics. The survey location is shown in Figure A.1 below.

The survey was carried out on 15th and 16th August 2018.

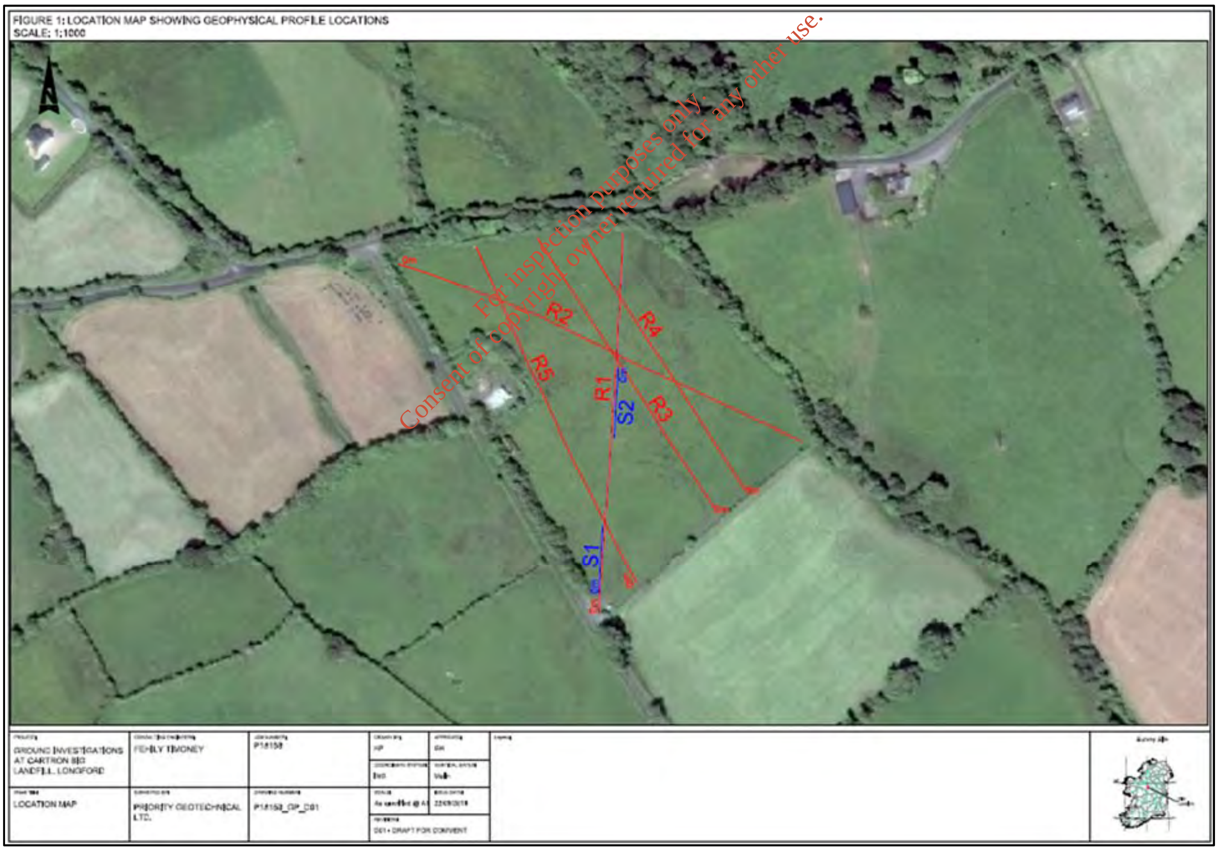


Figure A.1 Background map showing survey location.

A.2) Survey Objectives

The survey objectives were to provide information on the following:

- Lateral and vertical variations in overburden and bedrock type and thickness along the surveyed profiles.
- Extent and thickness of landfill material across along the surveyed profiles.

A.3) Site Topography

Site topography consists of a mostly flat grassy field with areas of rough ground. The perimeter of the site is comprised of densely vegetated ditches on the west, north and east sides of the site, while a metal fence with some vegetation makes up the southern perimeter. Man-made features in the site include several small dilapidated buildings and several metal poles protruding from the ground surface. The site is flanked by roads to the west and north.

A.4) Coordinate System and Datum

All coordinates are given in Irish Transverse Mercator (ITM). All elevations are given in metres Ordnance Datum Malin (OD Malin).

A.5) Intrusive Works

This report considers all relevant site investigation results. Relevant site investigation results have been overlaid on the interpretive drawings.

A.6) Acronyms

bgl – below ground level
ERT – Electrical Resistivity Tomography
ITM – Irish Transverse Mercator
OD Malin – metres above Ordnance Datum Malin
PGL – Priority Geotechnical Ltd.
SRP – Seismic Refraction Profiling

A.7) Site Geology

According to the GSI 100k Geology Map (see Fig. A.2) the survey area is underlain by a formation of Argillaceous Limestones, shown in lavender colour. To the southwest of the survey area lies the Ballysteen Formation, described as fossiliferous and argillaceous limestones with shale and shown in cyan colour. These two formations are divided by a northwest-southeast fault. Northeast of the site lies a formation of Mudbank Limestones, shown in a lilac colour.

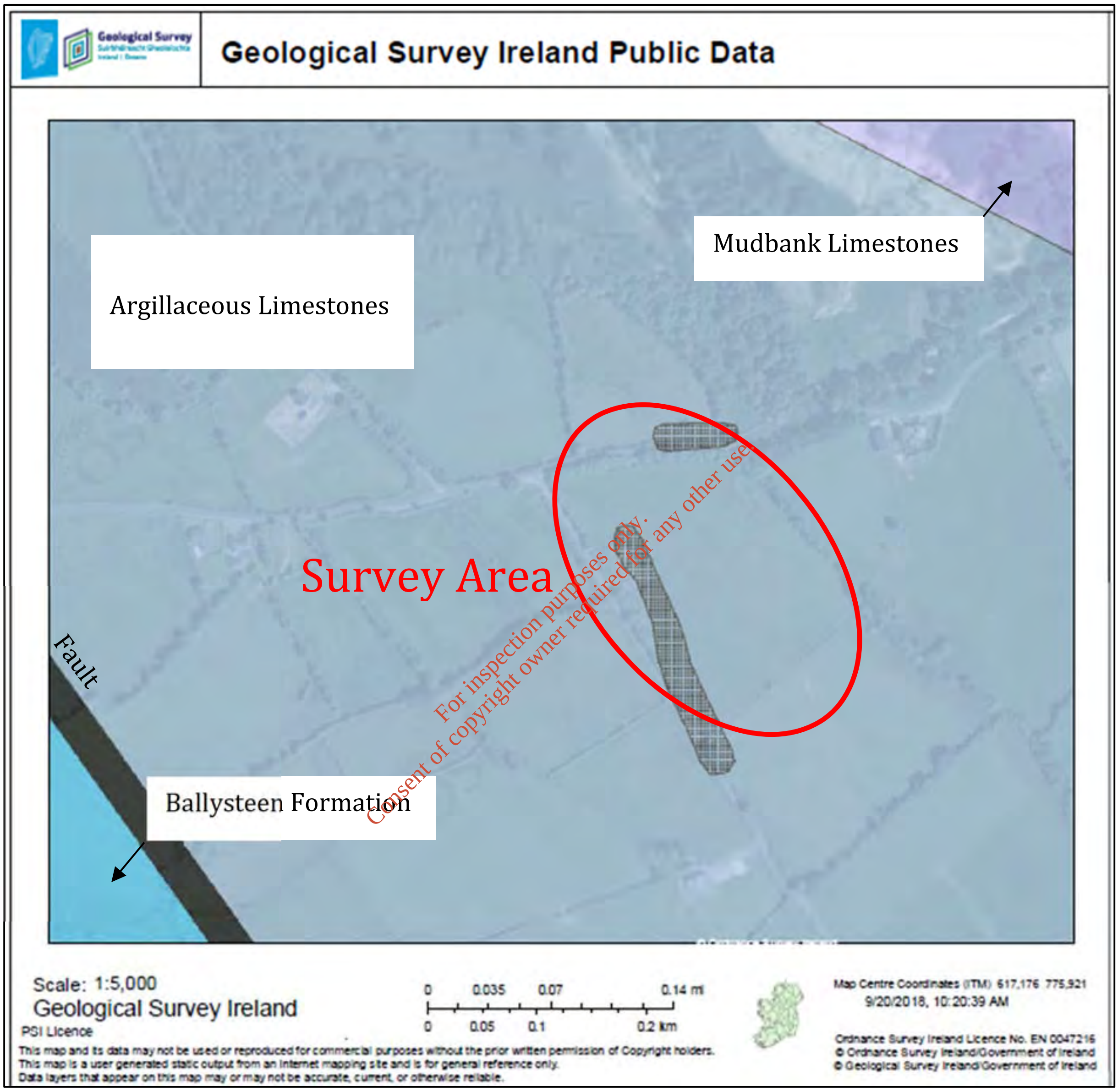


Figure A.2: GSI 100k Bedrock Geology Map of the site.

According to the Quaternary Soils Map (see Fig. A.3) most of the study area is underlain by "Till derived from cherts", shown in yellow. The other major sediment in the area is described as "Till derived from Lower Palaeozoic Sandstones and Shales", shown in a pink colour. To the northwest of the area is "Alluvium", shown in orange colour.

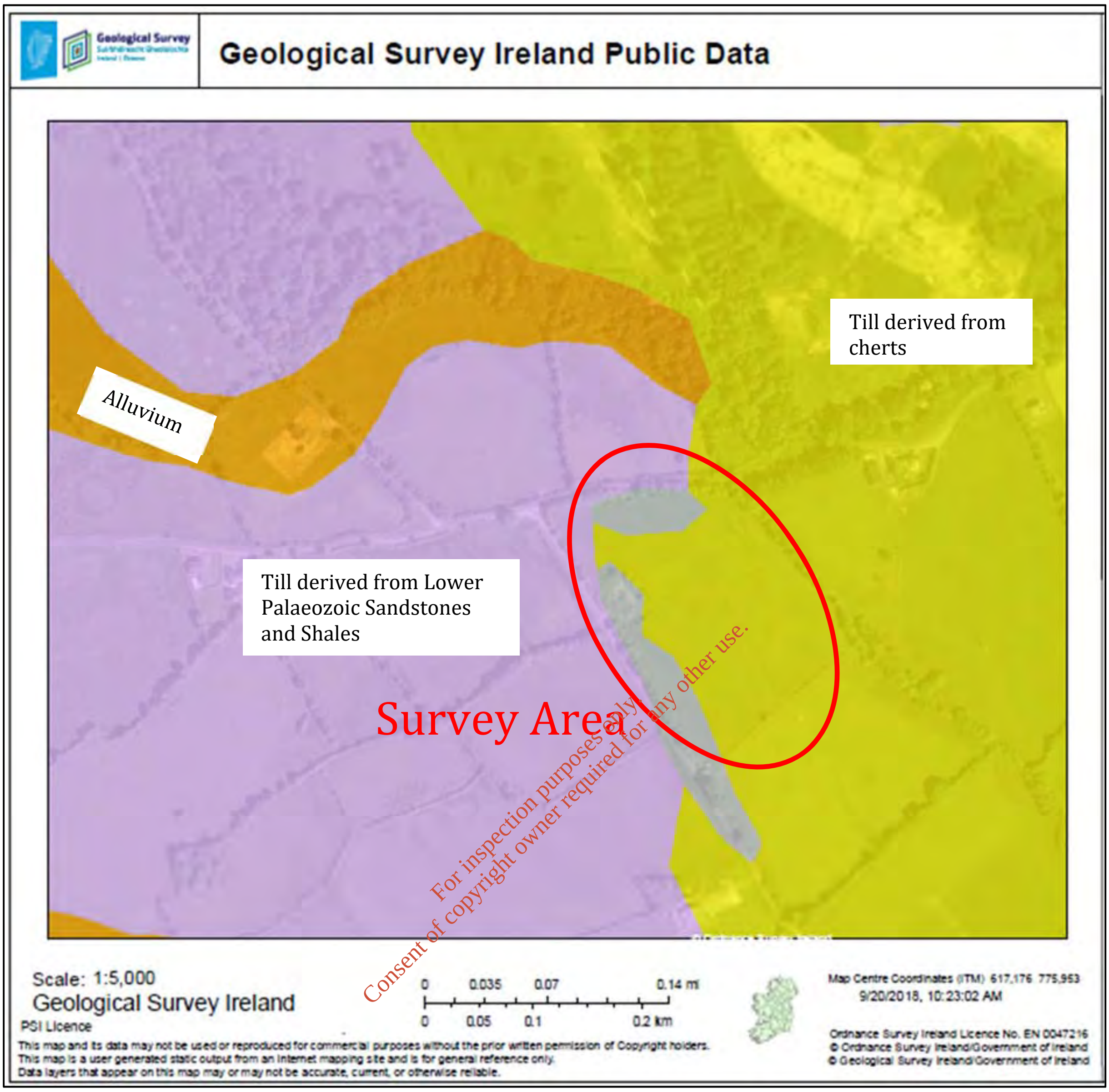


Figure A.3: Quaternary Sediments Map of the site.

All above mapping is available for free viewing on the Geological Survey of Ireland website at *https://www.gsi.ie/en-ie/Pages/default.aspx.*

B) Methodology and Results

B.1) 2D Electrical Resistivity Tomography (ERT)

The geophysical survey comprised of 2D electrical resistivity tomography (ERT) to measure the ground resistivity distribution across the survey area.

The resistivity survey was comprised of three profiles along pre-determined lines as well as two additional profiles, all of which were named R1 through R5. These profiles were collected with an electrode spacing of 3m spacing, and varied in length with R1, R2, R3, R4, and R5 measuring 255m, 295m, 215m, 200m, and 250m respectively.

B.1.i) Data Acquisition

Survey data was collected using a 64 channel Tigre Resistivity Meter. The Tigre has a maximum power of 36 watts and maximum current output of 200mA. The receiver incorporates automatic gain steps providing a range of measurements from 0.001ohm to 360kohm.

Multicore resistivity cables with 32 take-outs were used with stainless steel electrodes. Contact resistivities were checked prior to running the survey, to ensure an adequate electrical contact between the ground and the electrodes were made. Electrodes with poor contacts were treated with saline solution and rechecked till an optimum contact resistance were obtained.

The Tigre was connected to a laptop running Imager Pro™ 2006 acquisition software (Campus International Products Ltd., 2006) and subsequently viewed and inverted using Res2DInv software. All data was checked on site and any spurious readings were repeated until satisfactory results were achieved.

B.1.ii) Array Type

The Wenner Alpha Array protocol was utilized during this survey. The Wenner Array uses four equally spaced electrodes. Current is injected through the two outer electrodes and the resulting voltage difference at two inner electrodes. From the current (I) and the voltage (V) an apparent resistivity (p_a) value is calculated.

$$p_a = k\,V/I$$

Where k is the geometric factor which depends on the arrangement of the 4 electrodes. This calculated resistivity value is not the true resistivity of the subsurface but an "apparent" resistivity value, i.e. the resistivity of a homogenous ground which would give the same resistance value for the same electrode arrangement. To determine "true" ground resistivity an inversion of the measured apparent resistivity is undertaken, in this case using Res2DInv software.

The Wenner array is relatively sensitive to vertical changes (i.e. horizontal structures), but relatively poor in detecting horizontal changes (i.e. narrow vertical structures). Among the common array types for ERT profiling the Wenner alpha array has the strongest signal strength (Loke, 2000).

B.1.iii) Data Processing

Survey data was processed using Res2DInv, where the raw files were edited and inverted. The software does this by first dividing the subsurface 2D model into rectangular blocks and then calculates the resistivity of these blocks such that the calculated apparent resistivity measurements of the blocks agree with the measured values from the field survey.

Up to 5 iterations of the inversion of the measured data were carried out for each profile to obtain a 2D pseudosection of the apparent resistivities. The least squares inversion was used to produce an apparent resistivity depth model.

A degree of fit between the measured apparent resistances and the inverted resistances is calculated by the program, allowing an assessment of the degree of confidence of the inverted data. A damping factor can be applied to smooth erroneous data points; however, resolution lessens with an increased damping factor. A moderate damping factor was used during all inversions. All but one (R4) of the ERT dataset inversions resulted in an RMS error of > 10% (R1 = 18.1%, R2 = 13.7%, R3 = 12.9%, R4 = 9.4%, R5 = 35.8%).

Resistivity values in the inverted profiles varied from 7 to c.1575 Ohm-m.

B.2) Seismic Refraction Profiling (SRP)

PGL recorded 2 no. SRP profiles in total across the survey area along the pre-determined lines. SRP profiles are named S1 and S2 and measured 46m in length. The geophone spacing used for this survey was 2m providing p-wave seismic velocities (Vp) for overburden and bedrock materials.

SRP profile S2 was seen to be of poor quality, insufficient for picking of first break Vp arrival times. This has been observed by PGL in areas of landfill material previously. As such the SRP was abandoned in favour of acquisition of additional ERT across the survey area.

Seismic refraction measurements are made by measuring the travel time of direct and refracted acoustic waves as they travel from the surface through one layer to another and back to the surface where their arrival times are recorded. The travel time is a function of the seismic or acoustic velocity and geometry of the subsurface layers of soil and rock.

Modelled seismic velocities (Vp) ranged from 400 to 2500 m/s over two separate layers for the soil and bedrock materials on SRP profile S1. The resulting layer boundaries and seismic velocities are shown as thick dashed lines on cross sections in the attached drawings. The model was developed with average velocities and boundaries moved to minimise the model deviation.

B.2.i) Data Acquisition

A 24-channel Geometrics Geode seismic system was utilized with a 24-channel seismic multicore cable and 4.5Hz geophones. A sledge hammer and a HDPE plate were used as a seismic source. A geophone spacing of 2m was utilised during data acquisition resulting in a profile length of 46m.

Data was recorded using SGOS Seismodule Controller software. A total of 7 shots were undertaken on each seismic line; 2 end-shots, 2 off-shots and 3 mid-shots. To improve signal to noise ratio, individual hammer shots were stacked at each shot location where necessary.

B.2.ii) Data Processing

Data processing was undertaken utilizing Seisimager Seismic 2D software programs. Surveyed topography was input for each seismic spread. First breaks were picked after which a time term inversion was computed using travel-time computation via ray-tracing. Velocity modeling and travel time plots were constructed for each spread. Seismic velocity phases were picked and the thickness of each velocity unit calculated using the intercept-time method.

B.2.iii) Data Interpretation

It should be noted that when layer thicknesses are modelled from the seismic data the areas of greatest coverage (i.e. the centre of the spread) will have the greatest accuracy. At the edges of the spread less ray coverage reduces the accuracy of layer interpretation and thickness calculation.

Approximate errors for velocities are estimated to be +/-10%. Errors for the calculated layer thickness are of the order of +/-15%. Possible errors due to the "hidden layer" and "velocity" effects may also occur (Soske, 1959). Seismic refraction generally determines the depth to horizontal or near horizontal layers where the compaction/strength/rock quality changes. Where low velocity layers are present or where layers dip with more than 20 degrees angle the accuracy becomes less.

B.3) Spatial Relocation

Horizontal control and elevation were provided by a Trimble VRS (Real Time Kinematic/Virtual Reference Station) enabled GPS. Survey Controller software was used to provide high-accuracy, GNSS positioning. All positions are plotted in ITM. Elevations are to OD Malin using geoid model OSGM15.

C) Results and Interpretation

The modelled profiles and geophysical interpretations are shown in APPENDIX A: Drawing No.'s P18159-GP-D02 to P18159-GP-D06. A location map of the surveyed profiles is supplied as Drawing No. P18159-GP-D01.

The ERT was used to interpret the overburden and bedrock composition on all profiles. The ERT has generally interpreted on the following basis;

Resistivity (Ohm-m)	Interpretation
< 10	Landfill Material
> 10 boundaries extending to depth to > 1000	Limestone bedrock

Table C.1: Interpretation based on electrical resistivity

Landfill material was seen to extend to a maximum depth of 10m bgl and was imaged on all ERT profiles as an area of very low resistivity (high conductivity) (<10 Ohm-m) at the surface. The SRP methodology was not capable of penetrating the landfill material likely due to the unconsolidated nature of the material. The ERT profiles mapped the lateral extent of the landfill material with an increase in resistivity close to the surface outside areas of landfill material. ERT profile R3, R4 (to the south) and R5 did not image the lateral extent of the landfill material as it extended across the entire length of the profiles. An area on Drawing No. P18159-GP-D01 was been hatched to give the rough outline of the imaged landfill material.

The bedrock / landfill interface was seen as a gradual increase in depth on all profiles apart from R5 where there was a rapid increase in resistivity below the landfill material. This gradual increase in resistivity may represent landfill leachate penetrating the upper weathered bedrock and thus reducing its resistivity. Bedrock is indicated as argillaceous LIMESTONE in the GSI mapping, resistivity ranges for the bedrock are within the range of bedrock expected for this lithology.

SRP profile S1 gave bedrock Vp velocity of 2500m/s representing a weathered bedrock.

APPENDIX A: DRAWINGS

Drawing Number	Description	Scale
P18159-GP-D01	Location Map	As stated at A1
P18159-GP-D02	Cross Section and Interpretation	As stated at A1.
P18159-GP-D03	Cross Section and Interpretation	As stated at A1
P18159-GP-D04	Cross Section and Interpretation	As stated at A1
P18159-GP-D05	Cross Section and Interpretation	As stated at A1
P18159-GP-D06	Cross Section and Interpretation	As stated at A1

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

PROJECT:	CONSULTING ENGINEERS:	JOB NUMBER:	DRAWN BY:	APPROVED:	Legend:
GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	FEHILY TIMONEY	P18159	HP	GH	1. Approximate landfill material lateral extent indicated by orange hatch.
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin	
Sheet Title: LOCATION MAP	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D01	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018	
			REVISION: D01 – DRAFT FOR COMMENT		

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

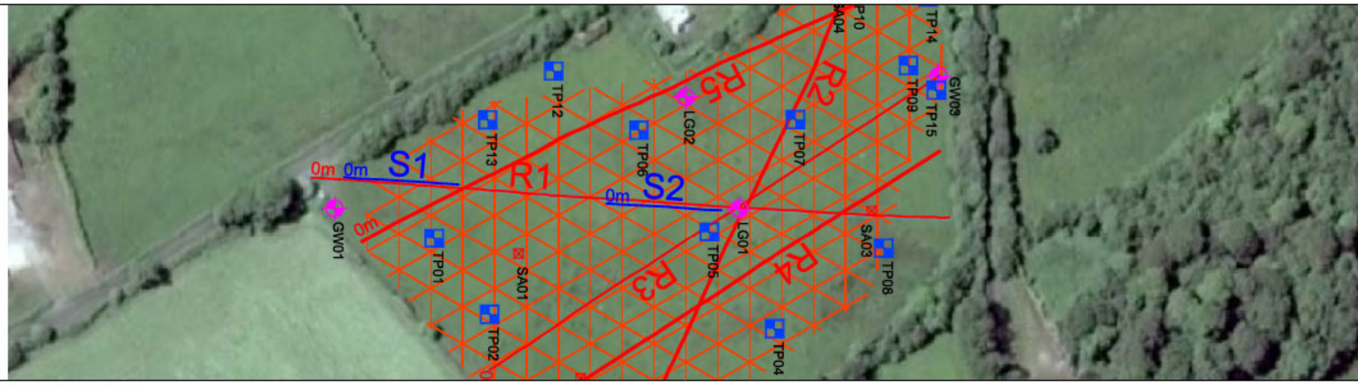
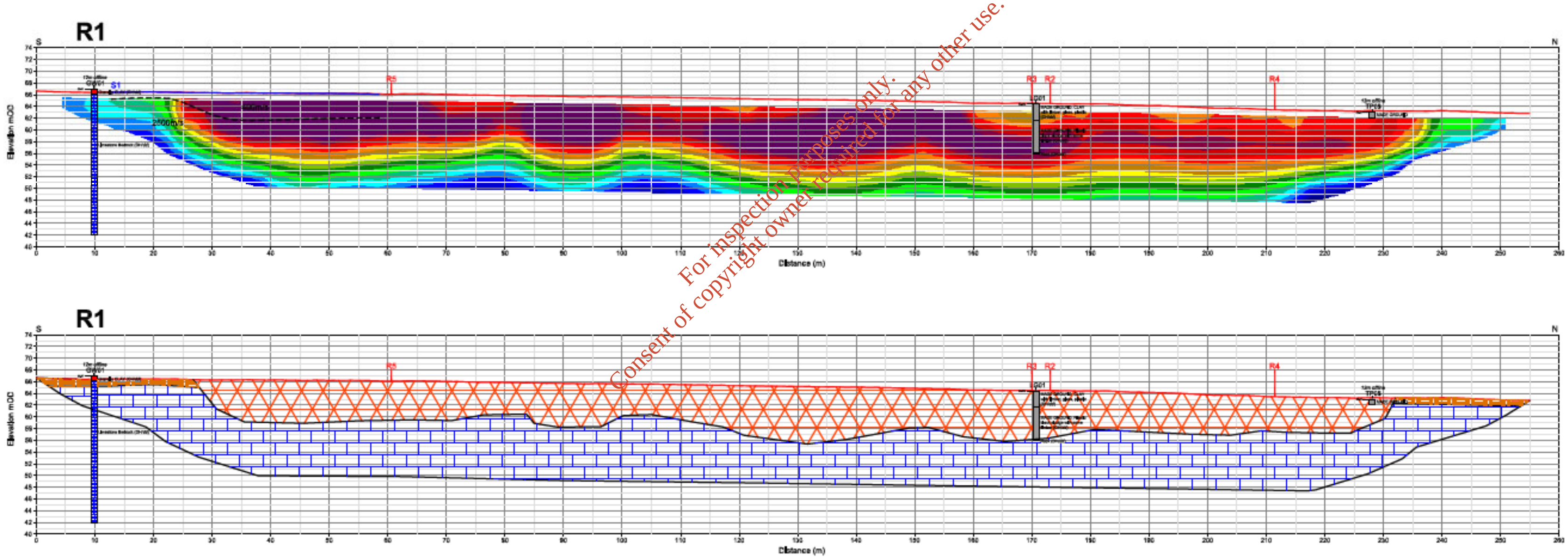


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:400



PROJECT:	CONSULTING ENGINEERS:	JOB NUMBER:	DRAWN BY:	APPROVED:
GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	FEHILY TIMONEY	P18159	HP	GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R1	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D02	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile

Seismic Refraction Profile

Resistivity in ohm.m: 7.23 15.6 33.7 72.6 157 338 730 1575

Seismic refraction boundaries with P-wave velocities (m/s): 400m/s 1000m/s 3000m/s

Geophysical Interpretation

Overburden

Topsoil

Landfill Material

Bedrock

LIMESTONE possibly argillaceous in nature

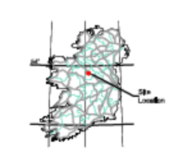


FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

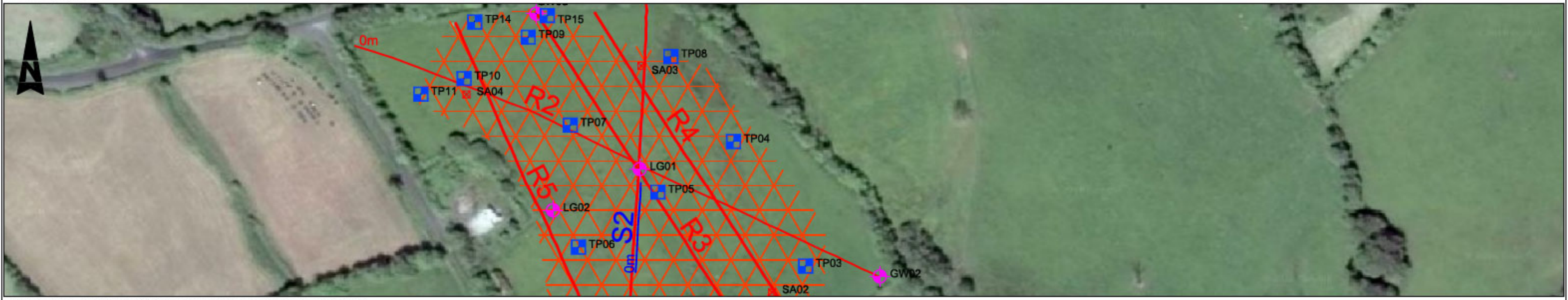
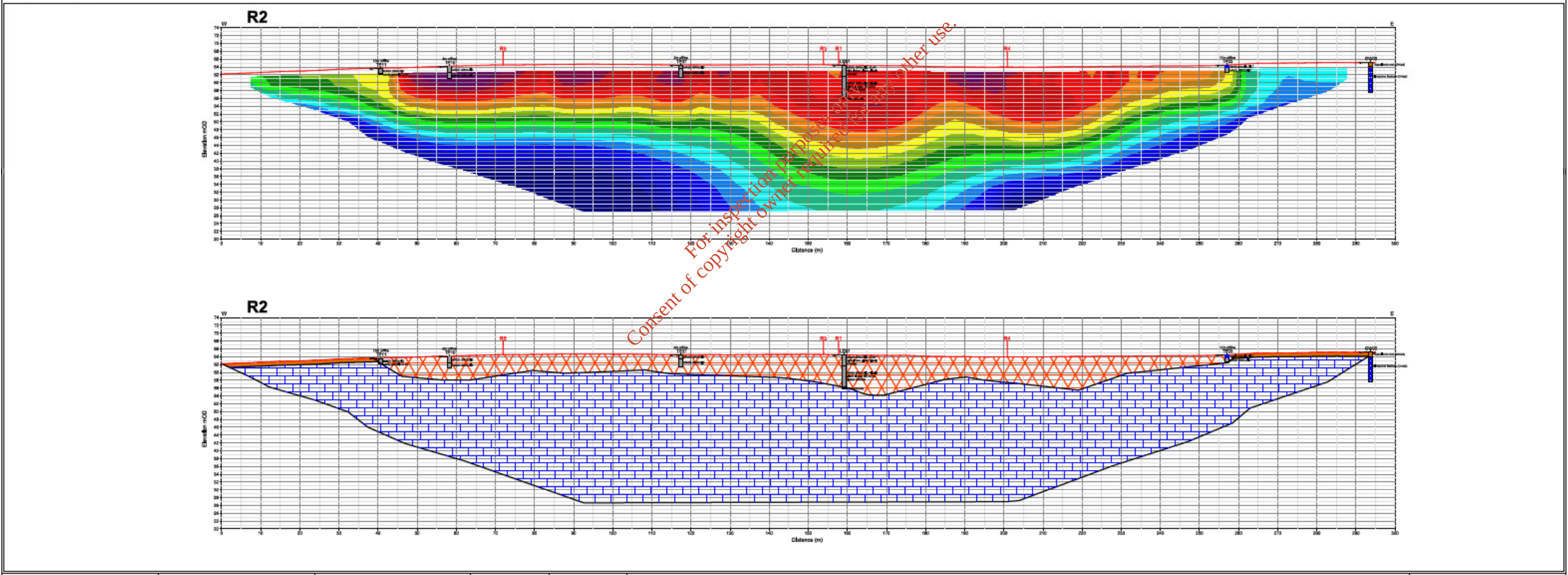


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R2	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D03	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:
ERT Profile
Seismic Refraction Profile
7.23 15.6 33.7 72.6 157 338 730 1575
Resistivity in ohm.m
Seismic refraction boundaries with P-wave velocities (m/s):
400m/s
1000m/s
3000m/s
Geophysical Interpretation
Overburden
Topsoil
Landfill Material
Bedrock
LIMESTONE possibly argillaceous in nature

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

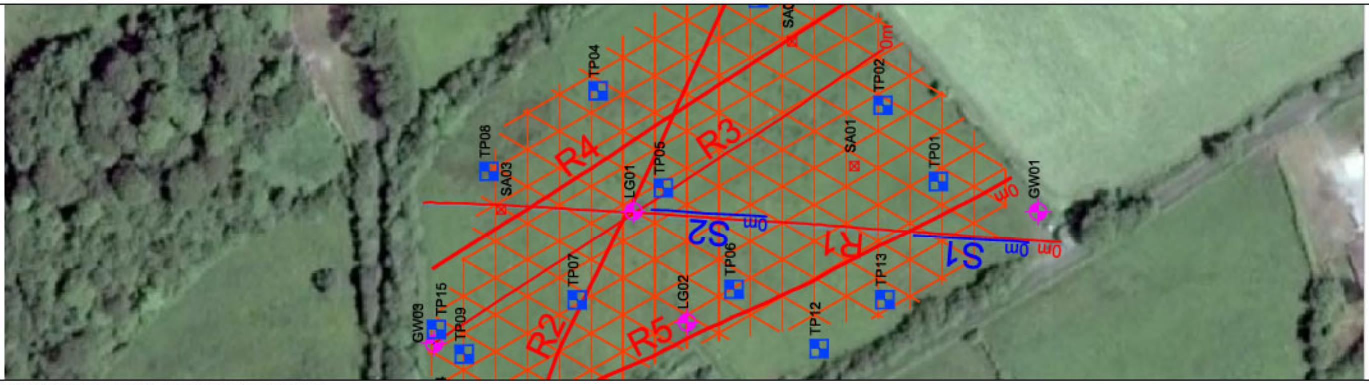
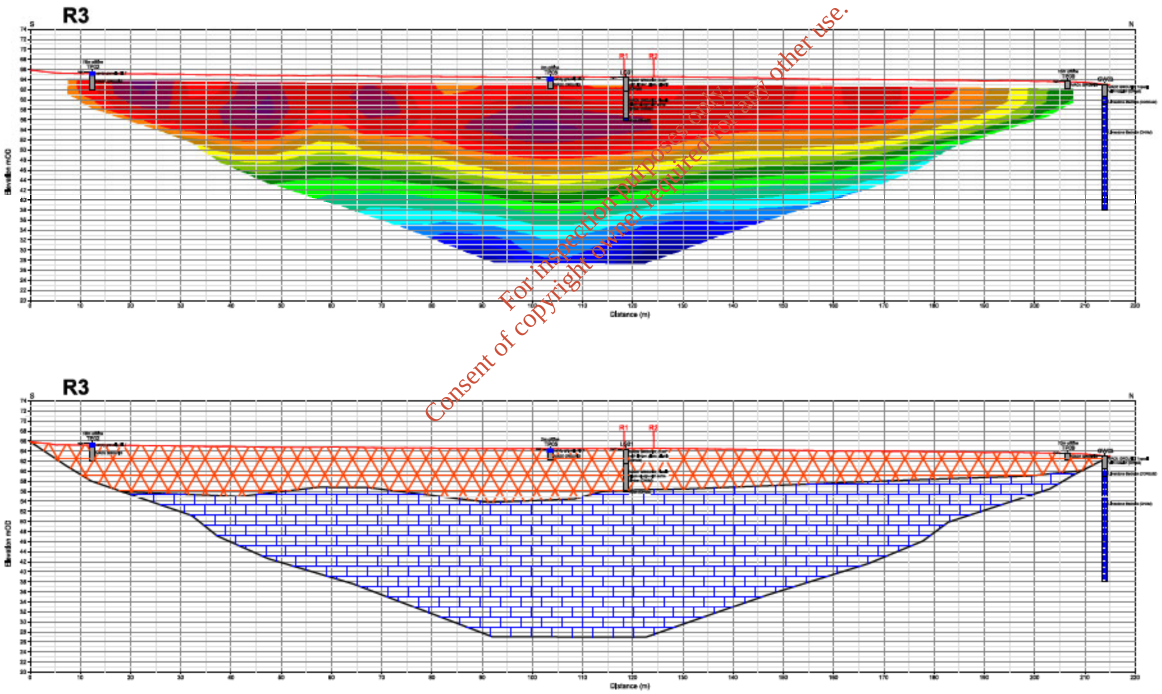


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500



PROJECT:	CONSULTING ENGINEERS:	JOB NUMBER:	DRAWN BY:	APPROVED:
GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	FEHILY TIMONEY	P18159	HP	GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R3	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D04	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

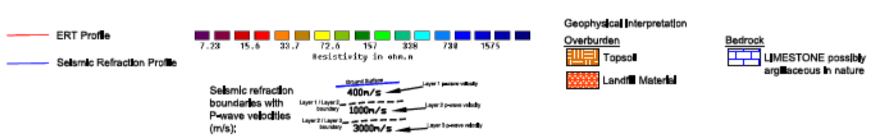


FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

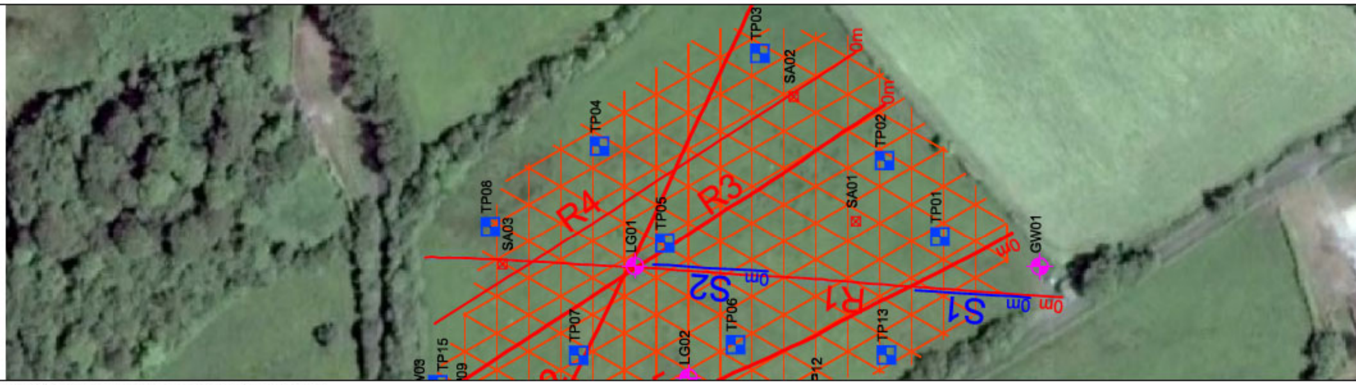
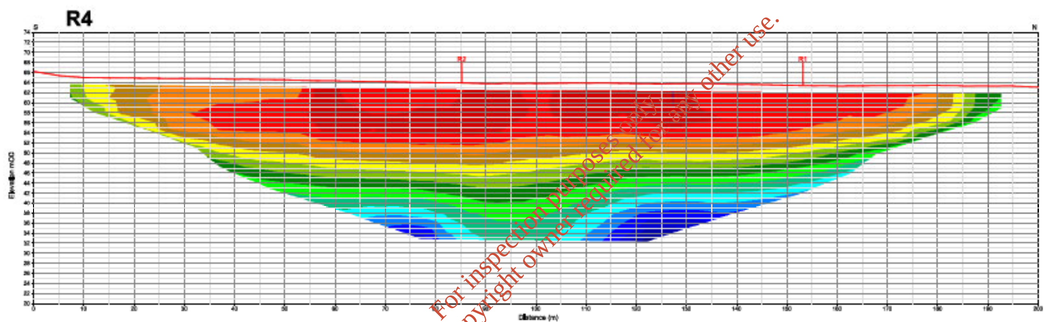
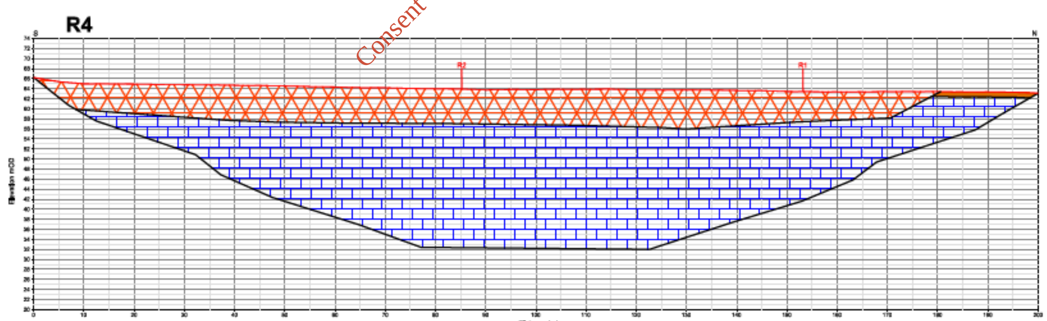


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500





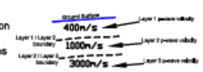
PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R4	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D05	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

ERT Profile
Seismic Refraction Profile

Resistivity in ohm.m: 7.23, 15.6, 33.7, 72.6, 157, 338, 730, 1575

Seismic refraction boundaries with P-wave velocities (m/s):



Geophysical Interpretation
Overburden
Topsoil
Landfill Material

Bedrock
LIMESTONE possibly argillaceous in nature

FIGURE 1: LOCATION MAP SHOWING GEOPHYSICAL PROFILE LOCATIONS
SCALE: 1:1000

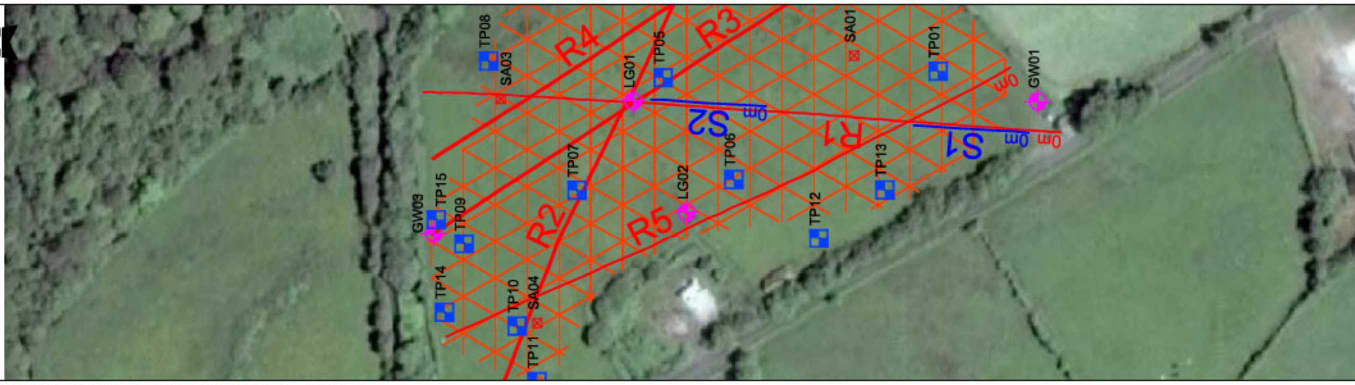
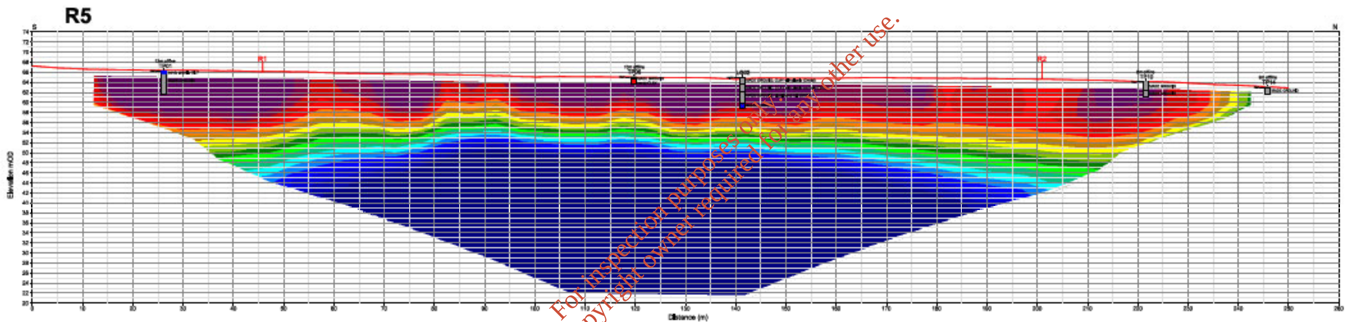
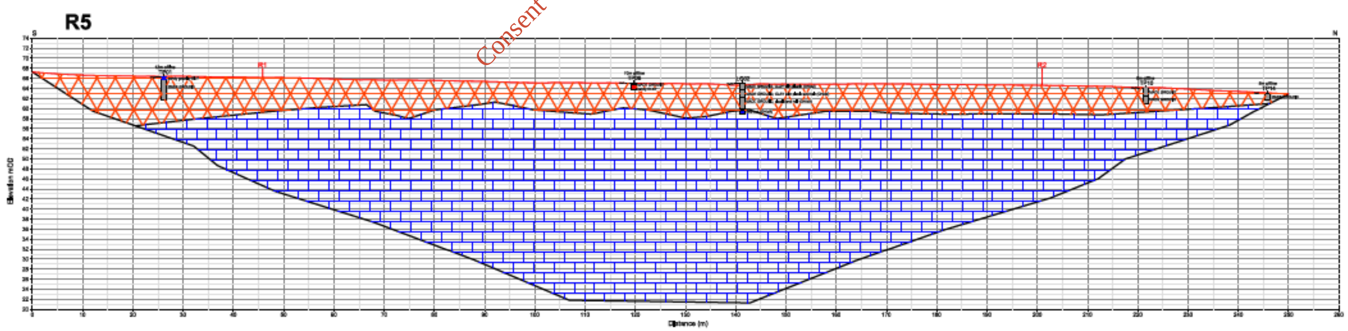


FIGURE 2: GEOPHYSICAL PROFILE CROSS SECTIONS
SCALE: 1:500





PROJECT: GROUND INVESTIGATIONS AT CARTRON BIG LANDFILL, LONGFORD	CONSULTING ENGINEERS: FEHILY TIMONEY	JOB NUMBER: P18159	DRAWN BY: HP	APPROVED: GH
			COORDINATE SYSTEM: ING	VERTICAL DATUM: Malin
Sheet Title: GEOPHYSICAL PROFILE LOCATION MAP AND INTERPRETED CROSS SECTIONS - R5	SURVEYED BY: PRIORITY GEOTECHNICAL LTD.	DRAWING NUMBER: P18159_GP_D06	SCALE: As specified @ A1	ISSUE DATE: 24/09/2018
			REVISION: D01 - DRAFT FOR COMMENT	

Legend:

- ERT Profile
- Seismic Refraction Profile

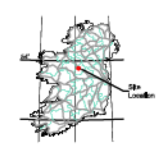
Resistivity in ohm.m: 7.23, 15.6, 33.7, 72.6, 157, 338, 730, 1575

Seismic refraction boundaries with P-wave velocities (m/s): 400m/s, 1000m/s, 3000m/s

Geophysical Interpretation

Overburden
- Topsoil
- Landfill Material

Bedrock
- LIMESTONE possibly argillaceous in nature



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