Castlepollard Quarry, Deerpark, Castlepollard, Co. Westmeath

Castlepollard Quarry

Environmental Impact Assessment Report

Appendix 6.1

Report on the Geophysical Investigation

((Phase II)

At Castlepollard, Westmeath

February 2022

LAGAN
Part of the Breedon Group

Prepared by:

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AGP18040_02

Report on the Geophysical Investigation (Phase II) at Castlepollard, Co. Westmeath. For Lagan Asphalt Ltd.

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4th December 2018

PRIVATE AND CONFIDENTIAL

THE FINDINGS OF THIS REPORT ARE THE RESULT OF A GEOPHYSICAL SURVEY USING NON-INVASIVE SURVEY TECHNIQUES CARRIED OUT AT THE GROUND SURFACE. INTERPRETATIONS CONTAINED IN THIS REPORT ARE DERIVED FROM A KNOWLEDGE OF THE GROUND CONDITIONS, THE GEOPHYSICAL RESPONSES OF GROUND MATERIALS AND THE EXPERIENCE OF THE AUTHOR. APEX GEOSERVICES LTD. HAS PREPARED THIS REPORT IN LINE WITH BEST CURRENT PRACTICE AND WITH ALL REASONABLE SKILL, CARE AND DILIGENCE IN CONSIDERATION OF THE LIMITS IMPOSED BY THE SURVEY TECHNIQUES USED AND THE RESOURCES DEVOTED TO IT BY AGREEMENT WITH THE CLIENT. THE INTERPRETATIVE BASIS OF THE CONCLUSIONS CONTAINED IN THIS REPORT SHOULD BE TAKEN INTO ACCOUNT IN ANY FUTURE USE OF THIS REPORT.

PROJECT NUMBER	AGP18040		
AUTHOR	**CHECKED**	**REPORT STATUS**	**DATE**
EURGEOL PETER O'CONNOR P.GEO., M.SC (GEOPHYSICS), DIP. EIA MGT.	TONY LOMBARD M.SC (GEOPHYSICS)	V.02	4TH DECEMBER 2018

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1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Lagan Asphalt Group Limited to carry out a geophysical investigation to determine the potential for additional resources below and around the Castlepollard Quarry, Co Westmeath. A previous survey in the lands immediately adjacent to the quarry was carried out in February 2018. Both surveys have been combined in this updated report. The lease area for the quarry extends to approx. 11.4 Ha (Fig.2.1).

The Geological Survey of Ireland (GSI) 1:100,000 Bedrock Geology map indicates that the quarry and the survey area is underlain by cherty limestone and minor shale of the Derravaragh Cherts Formation. The limestone is prone to karstification. The GSI database indicates the bedrock is a "Locally Important Aquifer - Karstified"

The GSI subsoil map indicates that the site is located mainly within an area of bedrock at surface surrounded by glacial till, with lake clays to the north and fen peat to the north-east of the site.

The Phase II investigation consisted of 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction Profiling. Phase I included EM31 Conductivity as well as ERT and Seismic Refraction.

The interpreted soil cover from the geophysical data is thin (0.5-1.5m) on the elevated ground to the south of the quarry. The soil type indicated is sandy gravelly clay with cobbles and boulders. The soil thickness over the loading area to the north of the quarry floor (northern part of R4 and R5, and R6) increases to between 16 and 20m. The resistivity of this material is in line with the deposit of lake clays shown on the soils map.

Material with a resistivity of between 1015 - 4500 Ohm-m has been interpreted as slightly weathered to fresh cherty limestone with tight joints. The seismic P-wave velocities indicate around 5m of moderately to highly weathered rock over slightly weathered – fresh, generally strong bedrock. The ERT along the quarry floor indicate that this limestone extends to at least 30m below ground level (bgl).

Material with a resistivity of 300 - 1015 Ohm-m has been interpreted as moderately to highly weathered limestone with clay infill in open joints. Resistivities within the rock mass below 300 Ohm-m have been interpreted as highly to completely weathered cherty limestone with clay infill.

The geophysical results have been used to divide the resource area into two zones as follow:

Zone A – thin overburden over slightly weathered to fresh cherty limestone, with some clay infill and an upper 2-5m weathered zone.

Zone B – thin overburden over moderately to highly weathered cherty limestone, with clay infill in open joints throughout, and occasional highly to completely weathered zones with clay infill. The rock is this zone may require further processing due to the higher clay content, and clay zones may be encountered in the face.

Rotary coring with sampling and testing is recommended to confirm the geophysical interpretation. The geophysical report should be reviewed after the completion of any direct investigation.

2. INTRODUCTION

APEX Geoservices Limited was requested by Lagan Asphalt Group Limited to carry out a geophysical investigation to determine the potential for additional resources below and around the Castlepollard Quarry, Co Westmeath. A previous survey in the lands immediately adjacent to the quarry was carried out in February 2018. Both surveys have been combined in this updated report.

2.1 Survey Objectives

The objectives of the survey were to:

1. Provide information on the type, thickness and variation of the overburden.
2. Provide information on the depth to and type of bedrock.

2.2 Site Background

Castlepollard Quarry is located 2.4 km south-east of Castlepollard, County Westmeath. The lease area for the quarry extends to approx. 11.4 Ha (Fig.2.1). Topography is dome shaped ranging from 85 mOD to 128 mOD.

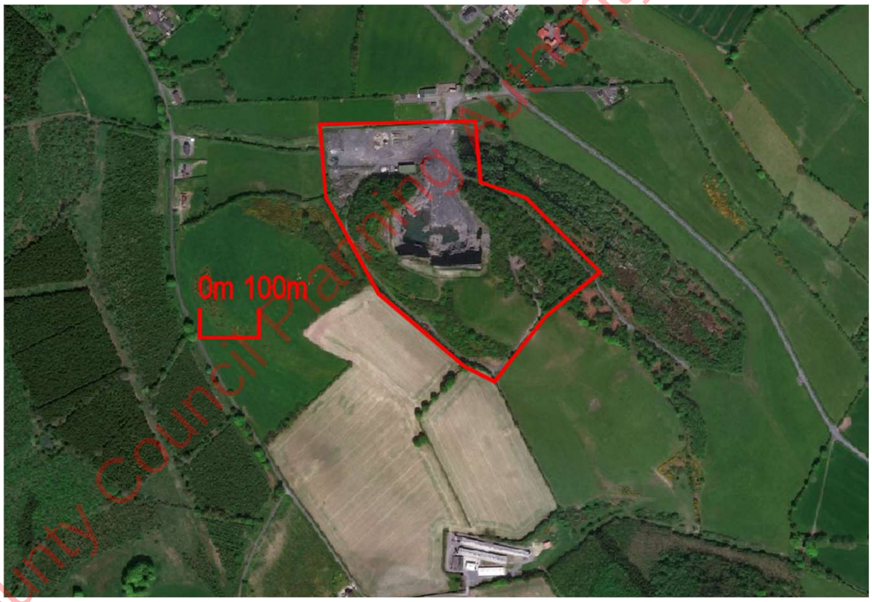

Fig.2.1. Site location (red=quarry lease).

2.3 Bedrock and soils

The Geological Survey of Ireland (GSI) 1:100,000 Bedrock Geology map (Fig.2.2) indicates that the quarry and the survey area is underlain by cherty limestone and minor shale of the Derravaragh Cherts Formation. It consists of unfossiliferous, dark grey, gently dipping, thinly-bedded calcsilicates and wackestones with thin shales. The limestone is prone to karstification. The GSI karst database indicates the nearest karst features c. 1.9 km to the north-west and 3.9 km to the east. The GSI bedrock map also indicates a number of rock outcrops within and to the south-west of the site (see Fig. 2.2).

Fig.2.2. Bedrock geology of the survey area (blue=Derravaragh Cherts, grey=rock outcrop).

The GSI subsoil map indicates that the site is located mainly within an area of bedrock at surface surrounded by glacial till, with lake clays to the north and fen peat to the north-east of the site (see Fig. 2.3).

Fig.2.3. Subsoils of the survey area (GSI, L=Lake Clays, FenPt=Fen Peat, Rck=Rock, red background glacial till).

2.4 Groundwater aquifer and vulnerability

The GSI database indicates bedrock within the site as “Locally Important Aquifer - Karstified” (Fig. 2.4) and the GSI vulnerability dataset indicates “Rock at or near Surface or Karst”.

Fig.2.4. Aquifer classification of the survey area.

2.5 Historical Sheet

The 6" Geological Sheet (Fig.2.5) indicates a number of limestone rock outcrops within the site and in its close vicinity.

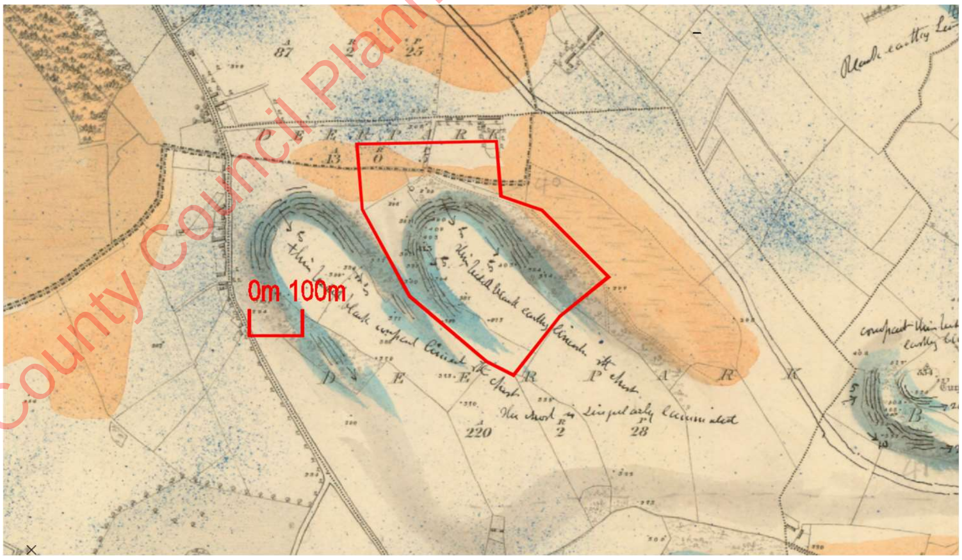

Fig.2.5. GSI 6" Sheet of the survey area (limestone outcrop marked in blue).

2.6 Survey Rationale

The Phase II investigation consisted of 2D Electrical Resistivity Tomography (ERT) and Seismic Refraction Profiling.

Electrical Resistivity Tomography (ERT) soundings will image the resistivity of the materials in the subsurface along a profile to produce a pseudo-section showing the variation in resistivity to a depth which is dependent on the length of the profile. Each pseudo-section will be interpreted to determine the material type along the profile at increasing depth, based on the typical resistivities returned for Irish ground materials. Zones of increased bedrock weathering can be expected to have a lower bedrock resistivity.

Seismic Refraction Profiling measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities. Readings are taken using geophones connected via multi-core cable to a seismograph. This method will allow us to profile the depth to the top of the bedrock, along profiles across the site.

As with all geophysical methods the results are based on indirect readings of the subsurface properties. The effectiveness of the proposed approach will be affected by variations in the ground properties. By combining a number of techniques it is possible to provide a higher quality interpretation and reduce any ambiguities which may otherwise exist. Further information on the detailed methodology of each geophysical method employed in this investigation is given in **APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY**

3. RESULTS

The Phase I survey was carried out in February 2018 and consisted of EM31, ERT profiles (R1-R3) and seismic refraction profiles (S1-S3). Phase II was recorded on the 22nd November 2018 and involved the collection of 5 no. ERT profiles (R4-R8) and 1 seismic refraction profile (S4). The geophysical survey locations are indicated on Drawing AGP18040_01 (Appendix C).

The results of both Phase I and Phase II surveys will be discussed together in this report.

3.1 EM Ground Conductivity Mapping (Phase I only)

The conductivity results (Drawing AGP18040_02) are indicative of the bulk conductivity of the ground materials from 0-6.0m bgl. The values range from 1.0 - 4.0 mS/m and have been generally interpreted in conjunction with the ERT and Seismic data as follows:

Conductivity (mS/m)	Interpretation
1 - 2	thin overburden over slightly weathered to fresh cherty limestone
2 - 4	thin overburden over mod.to highly weath. cherty limestone, with clay infill in open joints

3.2 ERT (Phase I & II)

Eight ERT Profiles (R1 - R8) have been acquired across the site. The resistivity values have been interpreted on the following basis:

Resistivity (Ohm-m)	Interpretation
20 - 300	Lake CLAYS and glacial TILL
300 - 1015	Moderately to highly weathered cherty LIMESTONE, with clay infill in open joints. Rock fill at surface (loading area).
1015 - 4500	Slightly weathered to fresh cherty LIMESTONE

The interpreted profiles are shown in Drawings AGP18040_R1-R8.

3.3 Seismic Refraction Profiling (Phase I & II)

Four seismic refraction spreads were recorded (Drawing AGP18040_01).. The seismic refraction data has been interpreted on the following basis:

Layer	Seismic Velocity (m/s)	Average Seismic Velocity (m/s)	Interpretation	Stiffness/ Rock Quality
1	347 - 360	354	Topsoil	Soft/Loose
2	742 - 1050	897	Completely to highly weathered bedrock (soft-firm semi-saturated lake clays on S4)	Poor
3	1768 - 1956	1887	Moderately weathered bedrock	Fair
4	3206 - 3895	3567	Slightly weathered - fresh bedrock	Good

Note. Data quality on S4 was very poor and only 2 layers were interpreted.

3.4 DISCUSSION

The conductivity results are plotted on Drawing AGP18040_02, with the integrated interpretations on Drawing AGP18040_03. The interpreted ERT profiles R1-R8 and seismic refraction profiles S1-S4 are shown in Drawings AGP18040_R1-R8. (The location of profiles on the quarry floor was restricted by the stockpiles.)

3.4.1 Soil

The interpreted soil cover is thin (0.5-1.5m) on those profiles located on the elevated ground to the south of the existing quarry (R1, R2, R3, R7 and R8). The soil type indicated is sandy gravelly clay with much cobbles and boulders.

The soil thickness increases significantly on those profiles recorded over the loading area to the north of the quarry floor (northern part of R4 and R5, and R6) to between 16 and 20m. The resistivity of this material is low (20 – 300 Ohm-m) and is typical of clay/silt rich sediments. This is in line with the deposit of lake clays shown on the GSI soils map for this location (Fig. 2.3).

3.4.2 Bedrock

Material with a resistivity of 300 - 1015 Ohm-m has been interpreted as moderately to highly weathered limestone with clay infill in open joints. (Note: this interpretation has been updated from the February Phase I report which classified this material as cherty limestone with shale as per the GSI map description. Examination of the exposed rock at the quarry face during the current survey has shown minimal shale present, but clay infilling of open joints and possible clay wayboards were visible in the faces. Weathering and infill decrease with depth down the face.)

Fig.3.1. Eastern face showing jointing and clay infill.

Where the resistivity within the rock mass falls below 300 Ohm-m (parts of R1, R3, R7 and R8) this has been interpreted as highly to completely weathered cherty limestone with clay infill.

Material with a resistivity of between 1015 - 4500 Ohm-m has been interpreted as slightly weathered to fresh cherty limestone with tight joints. The southern parts of profiles R4 and R5 located along the quarry floor indicate that this unweathered limestone extends to at least 30m below ground level (bgl).

Seismic refraction results have delineated the variation in rock quality. The P-wave velocities of 742 – 1050 m/s have been interpreted as completely - highly weathered bedrock. The velocities of 1768 – 1956 m/s are indicative of moderately weathered bedrock and velocities of 3206 – 3895 m/s indicate slightly weathered – fresh, generally strong bedrock. (The 742 – 1050 m/s range on S4 over the lake clays is typical for semi-saturated clay/silt material).

A resource area leaving a boundary rim at 120 mOD around the working area has been outlined using the geophysical and topographic data. The geophysical results have been used to divide the resource area in to two zones as follow:

Zone A – thin overburden over slightly weathered to fresh cherty limestone, with minimal clay infill and an upper 2-5m weathered zone. The rock in this zone should be of similar quality to what is currently being extracted.

Zone B – thin overburden over moderately to highly weathered cherty limestone, with clay infill in open joints throughout, and occasional highly to completely weathered zones with clay infill. The rock is this zone may require further processing due to the expected higher clay content.

4. RECOMENDATIONS

Rotary coring is recommended at the following locations to confirm the findings of the geophysical investigation:

No.	Easting	Northing	Depth (m bgl)	Target
PBH1	647759.2	768240.0	62	Confirm thickness of cherty limestone
PBH2	647826.0	768215.0	62	Investigate possible clay zone
PBH3	647799.0	768196.0	62	Investigate possible clay zone
PBH4	647880.7	768144.1	62	Confirm thickness of cherty limestone
PBH5	647708.0	768326.0	25	Confirm thickness of chert limestone(quarry floor)

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APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY

A combination of geophysical techniques was used to provide a high quality interpretation and reduce any ambiguities, which may otherwise exist.

EM Ground Conductivity Mapping

Principles

This is an electromagnetic technique used to investigate lateral variations in overburden material and to assist with the indication of the depth to bedrock. This method operates on the principle of inducing currents in conductive substrata and measuring the resultant secondary electro-magnetic field. The strength of this secondary EM field is calibrated tore give apparent ground conductivity in milliSiemens/metre (mS/m). Readings over material such as organic waste and peat give high conductivity values while readings over dry materials with low clay mineral content such as gravels, limestone or quartzite give low readings. The EM31 survey technique determines the apparent conductivity of the ground material from 0-6m bgl depending on the dipole mode used. Depending on the dipole mode used, the measured conductivity is a function of the different overburden layers and/or rock from 0 to 6m below ground level.

Data collection

The EM31 equipment used was a GF CMD-4 conductivity meter equipped with data logger. This instrument features a real time graphic display of the previous 20 measurement points to monitor data quality and results. Conductivity and in-phase values were recorded across the site. Local conditions and variations were recorded.

Data processing

The conductivity and in-phase field readings were downloaded, contoured and plotted using the SURFER 9 program (Golden Software, 2009). Data which was affected by metallic objects was removed. Assignation of material types and possible anomaly sources was carried out, with cross-reference to other data.

Electrical Resistivity Tomography (ERT)

Electrical Resistivity Tomography was carried out to provide information on lateral variations in the overburden material as well as on the underlying overburden and bedrock.

Principles

This surveying technique makes use of the Wenner resistivity array. The 2D-resistivity profiling method records a large number of resistivity readings in order to map lateral and vertical changes in material types. This method involves the use of electrodes connected to a resistivity meter, using computer software to control the process of data collection and storage.

Data Collection

Profiles were recorded using a Tigre resistivity meter, imaging software, two 32 takeout multicore cables and up to 64 stainless steel electrodes. Saline solution was used at the electrode/ground interface in order to gain a good electrical contact required for the technique to work effectively. The recorded data were processed and viewed immediately after surveying.

Data Processing

The field readings were stored in computer files and inverted using the RES2DINV package (Geotomo Software, 2006) with up to 5 iterations of the measured data carried out for each profile to obtain a 2D-depth model of the resistivities.

The inverted 2D resistivity models and corresponding interpreted geology are displayed on the accompanying drawings alongside the processed seismic sections. Profiles have been contoured using the same contour intervals and colour codes. Distance is indicated along the horizontal axis of the profiles.

Seismic refraction profiling

Principles

This method measures the velocity of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher seismic velocities while soft, loose or fractured materials have lower velocities.

Seismic profiling measures the p-wave velocity (Vp) of refracted seismic waves through the overburden and rock material and allows an assessment of the thickness and quality of the materials present to be made. Stiffer and stronger materials usually have higher Vp velocities while soft, loose or fractured materials have lower Vp velocities. Readings are taken using geophones connected via multi-core cable to a seismograph.

Data Collection

A Geode high resolution 24 channel digital seismograph, 24 10HZ vertical geophones and a 10 kg hammer were used to provide first break information, with a 24 take-out cable (3m spacing). Equipment was carried was operated by a two-person crew.

Readings are taken using geophones connected via multi-core cable to a seismograph. The depth of resolution of soil/bedrock boundaries is determined by the length of the seismic spread, typically the depth of resolution is about one third the length of the profile.(eg. 69m profile ~23m depth, 33m profile ~ 11m depth)

Shots from seven different positions were taken (2 x off-end, 2 x end, 3 x middle) to ensure optimum coverage of all refractors. All profiles were surveyed to Irish National Grid using a ProXR dGPS system.

Data Processing

First break picking in digital format was carried out using the FIRSTPIX software program to construct p-wave (Vp) traveltime plots for each spread. Velocity phases were selected from these plots using the GREMIX software program and were used to calculate the thickness of individual velocity units. Topographic data were input. Material types were assigned and estimation made of material properties.

First break picking in digital format was carried out using the FIRSTPIX software program to construct traveltime plots for each spread. The recorded data was processed and interpreted using the GREMIX software program. GREMIX interprets seismic refraction data as a laterally varying layered earth structure. It incorporates the slope-intercept method, parts of the Plus-Minus Method of Hagedoorn (1959), Time-Delay Method, and features the Generalized Reciprocal Method (GRM) of Palmer (1980). Up to four layers can be mapped; one deduced from direct arrivals and three deduced from refractions. Phantoming of all possible travel time pairs can be carried out by adjusting reciprocal times of off shots. Material types were assigned and estimation made of material properties, cross-referenced to borehole data.

Approximate errors for Vp velocities are estimated to be +/- 10%. Errors for the calculated layer thicknesses are of the order of +/-20%. Possible errors due to the "hidden layer" and "velocity inversion" effects may also occur (Soske, 1959).

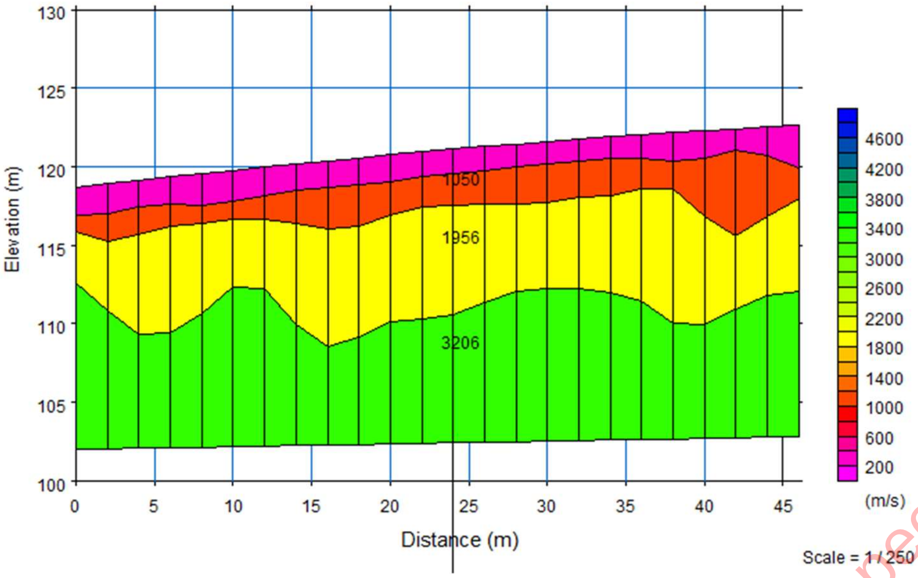
Note: Spreads S1-S3 were processed using SEISIMAGER software in Phase 1.

Spatial Relocation

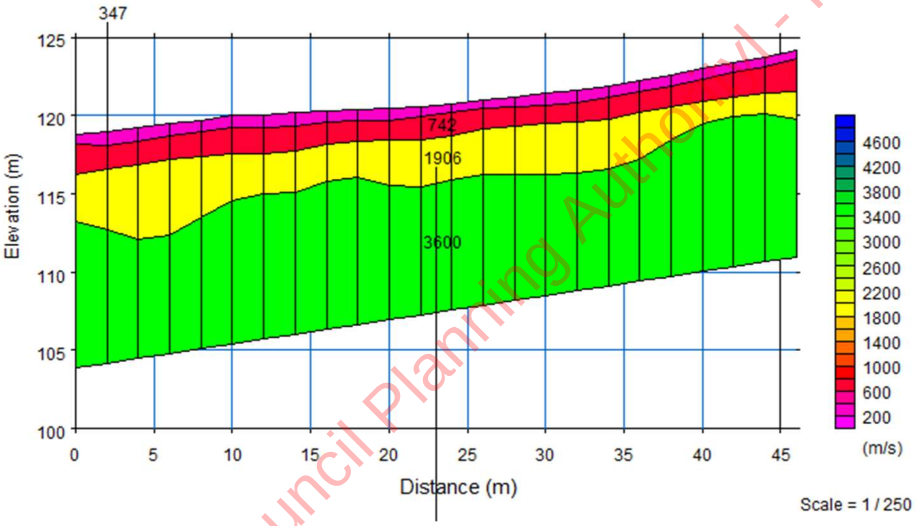
All the geophysical investigation locations were acquired using Trimble Geo 7X high-accuracy GNSS handheld GPS system using the settings listed below. This system allows collecting GPS data with c.20mm accuracy.

Projection:	Irish Transverse Mercator
Datum:	Ordnance
Coordinate units:	Meters
Altitude units:	Meters
Survey altitude reference:	MSL
Geoid model:	Republic of Ireland

APPENDIX B: SEISMIC DATA



Profile S1



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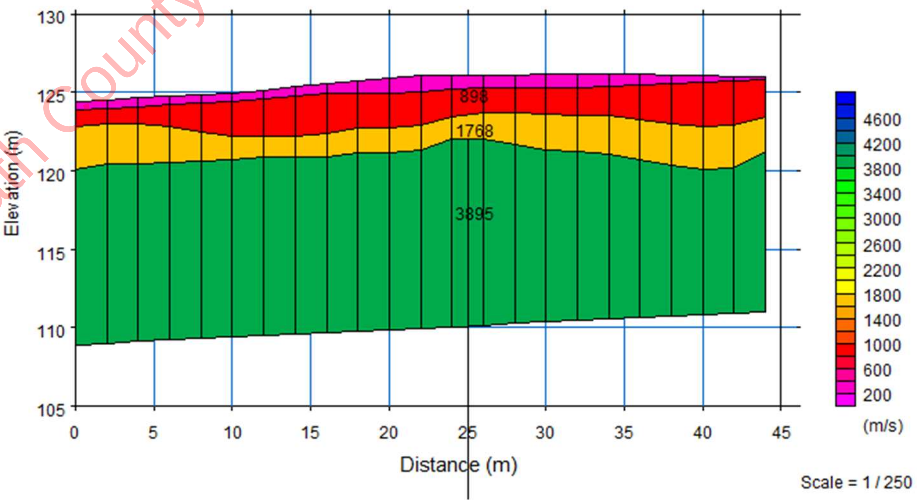

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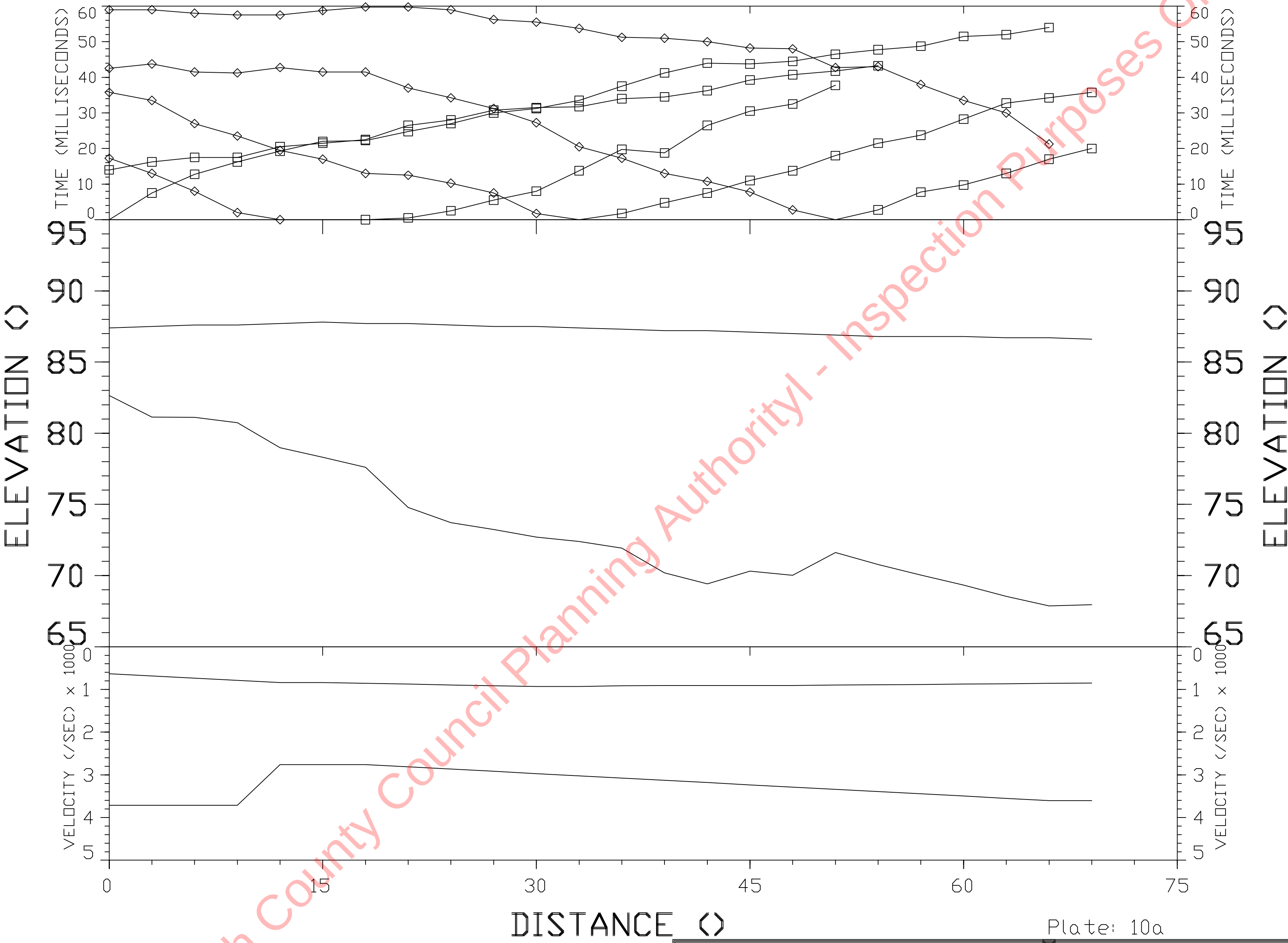


Plate: 10a

LAGAN ASPHALT		AGP18140
by: APEX Geoservices Ltd.		Castlepollard Westmeath
Data SetS4	Date: 5-10-18	
Equipment: Geode	Spread: S4	Azimuth:

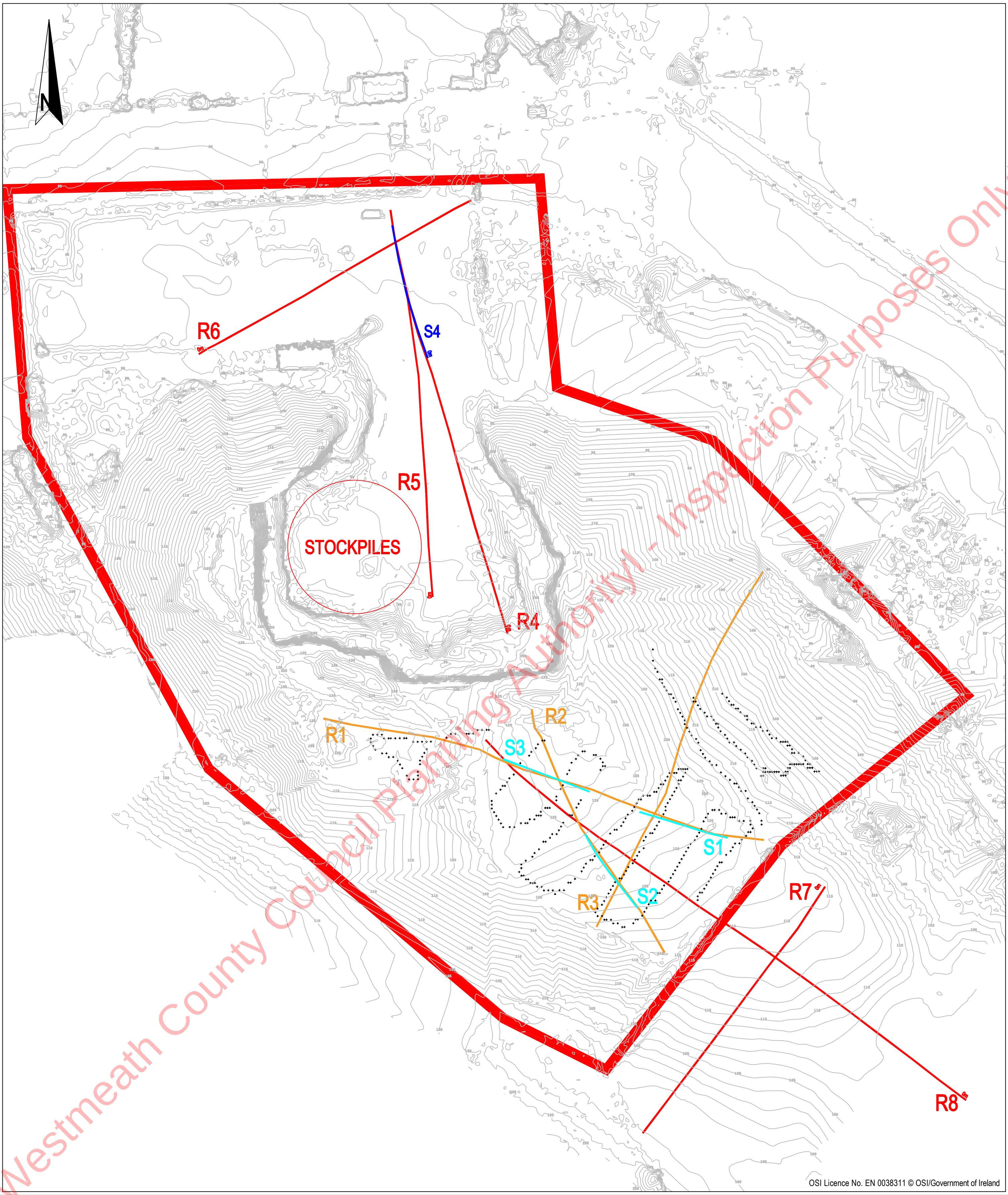
APPENDIX C: DRAWINGS

The information derived from the geophysical investigation as well as correlation with the available direct investigation is presented in the following drawings:

AGP18040_01	Geophysical Locations	1:2500	@ A4
AGP18040_02	EM Conductivity Contours (mS/m)	1:2500	@ A4
AGP18040_03	Summary Interpretation Map	1:2500	@ A4
AGP18040_R1	ERT R1, S1, S3 Results & Interpretation	1:1250	@ A4
AGP18040_R2	ERT R2, S2 Results & Interpretation	1:1000	@ A4
AGP18040_R3	ERT R3 Results & Interpretation	1:1000	@ A4
AGP18040_R4	ERT R4, S4 Results & Interpretation	1:1000	@ A4
AGP18040_R5	ERT R5, Results & Interpretation	1:1000	@ A4
AGP18040_R6	ERT R6, Results & Interpretation	1:1000	@ A4
AGP18040_R7	ERT R7, Results & Interpretation	1:1000	@ A4
AGP18040_R8	ERT R8, Results & Interpretation	1:2000	@ A4

AERIAL PHOTO - GEOPHYSICAL LOCATIONS

SCALE 1:2500



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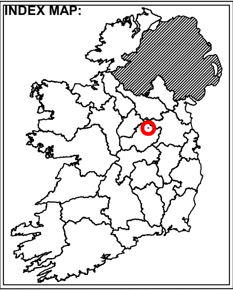
INDEX MAP:



LEGEND:

- Lease Area
- EM31 Conductivity reading
- R1 2D resistivity profile (Phase I)
- R4 2D resistivity profile (Phase II)
- S1 Seismic refraction profile (Phase I)
- S4 Seismic refraction profile (Phase II)

The information displayed here is to be used in conjunction with Report AGP18040_01 Report on the Geophysical Investigation (Phase II) at Castlepollard, Co. Westmeath, APEX Geophysics Ltd. 24th January 2022.

PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_01
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	TL
02	24-01-2022	POC	TL

AERIAL PHOTO - EM CONDUCTIVITY

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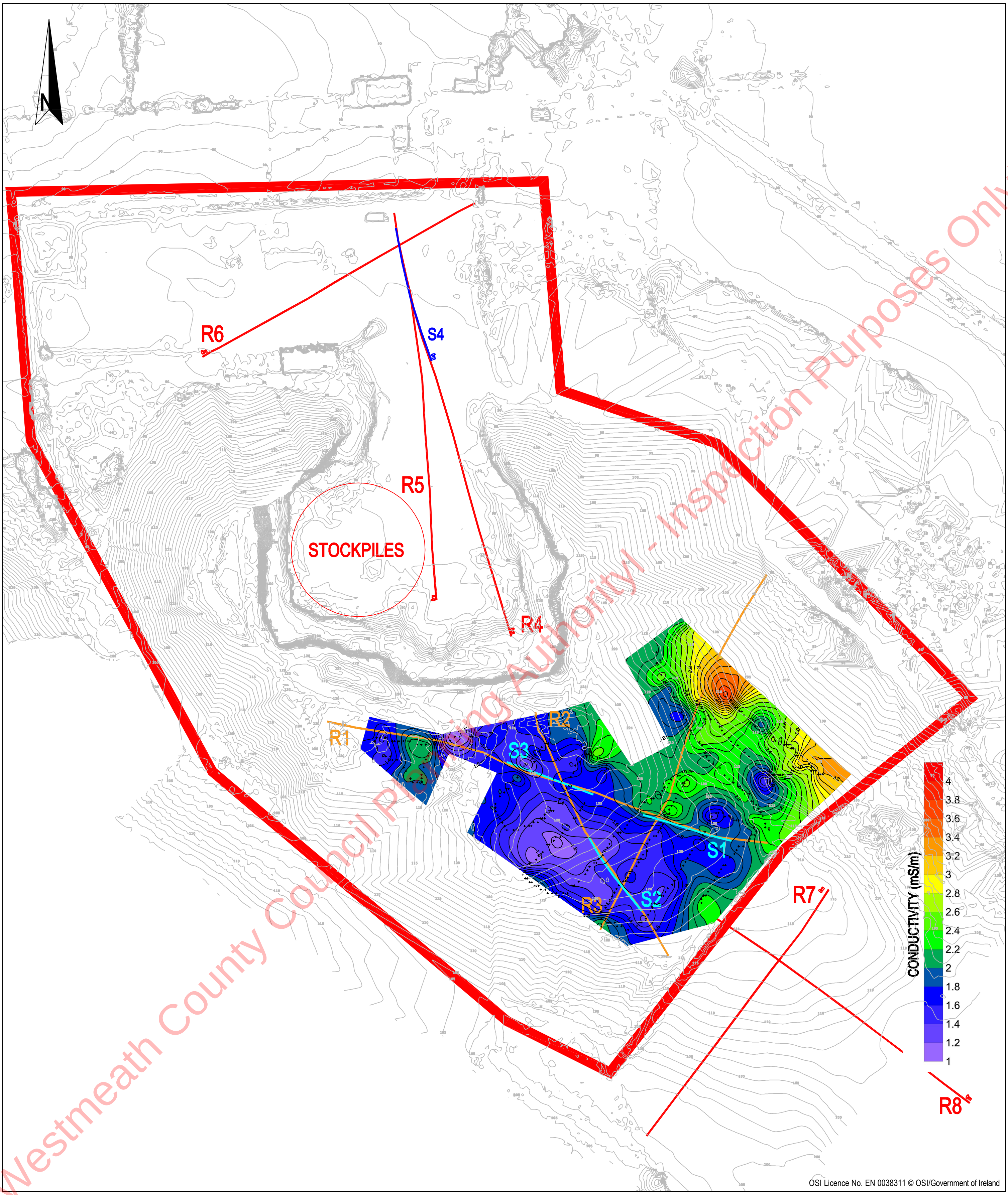

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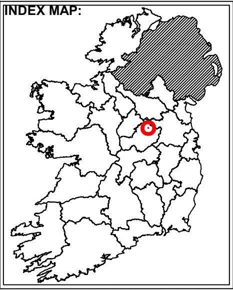
INDEX MAP:



LEGEND:

- Lease Area
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CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_02
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
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02	24-01-2022	POC	TL

AERIAL PHOTO - SUMMARY INTERPRETATION

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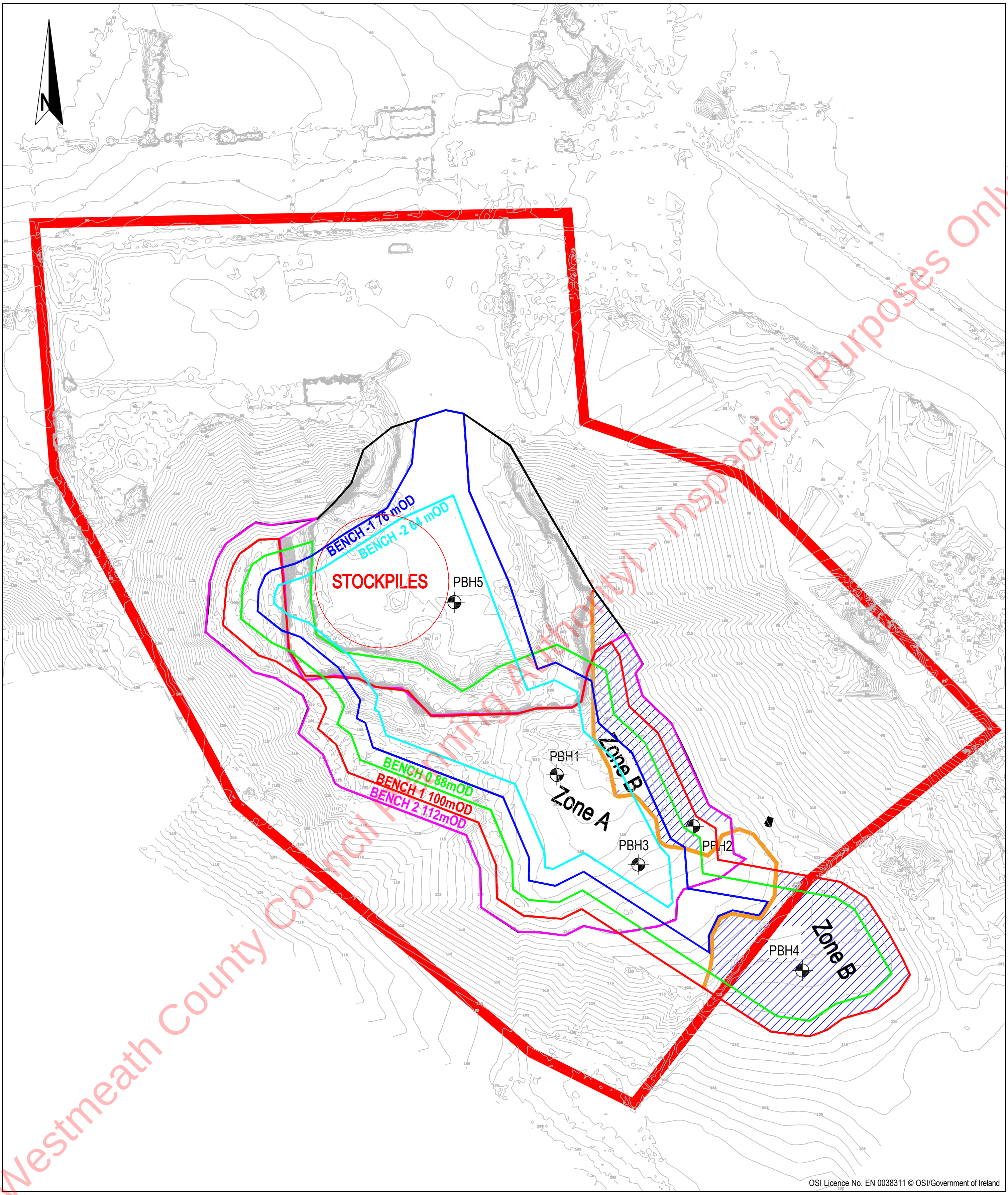

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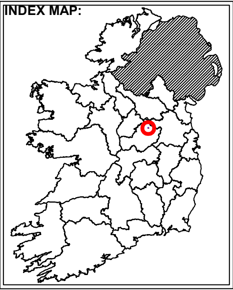
INDEX MAP:



LEGEND:

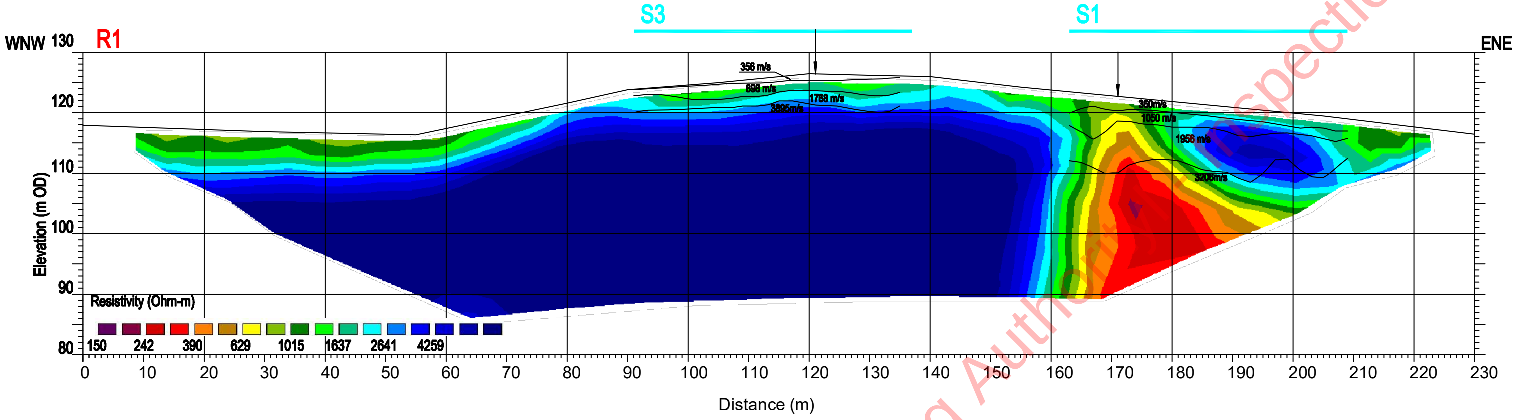
- Site
- Proposed Benches
- PBH1 Proposed borehole
- ZONE A Cherty LIMESTONE
- Moderately-highly weathered cherty LIMESTONE with clay infill

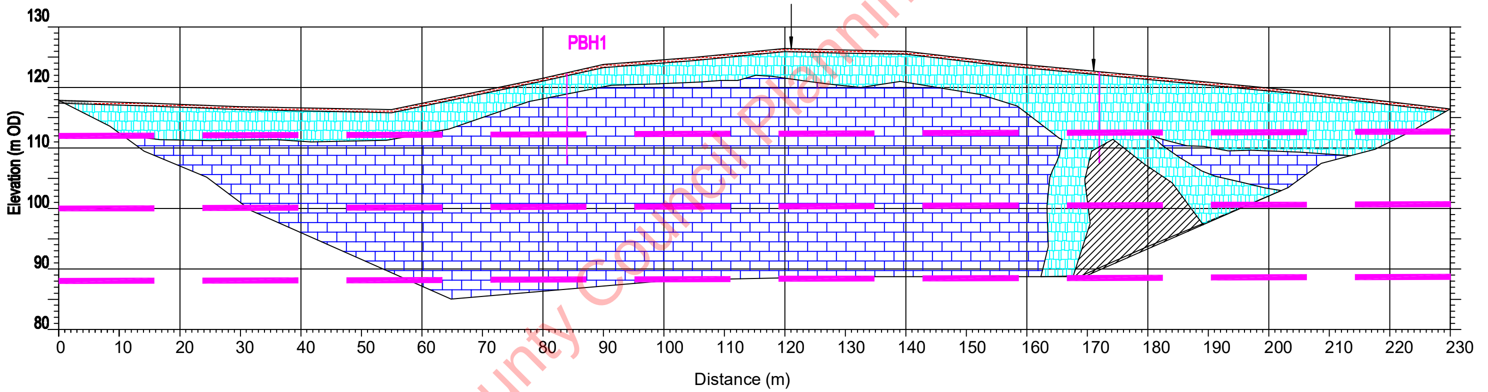
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_03
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	TL
02	24-01-2022	POC	TL

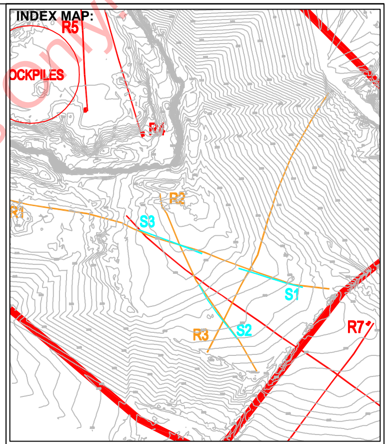
FIGURE 1: ERT PROFILE R1

SCALE 1:1250





INDEX MAP:



LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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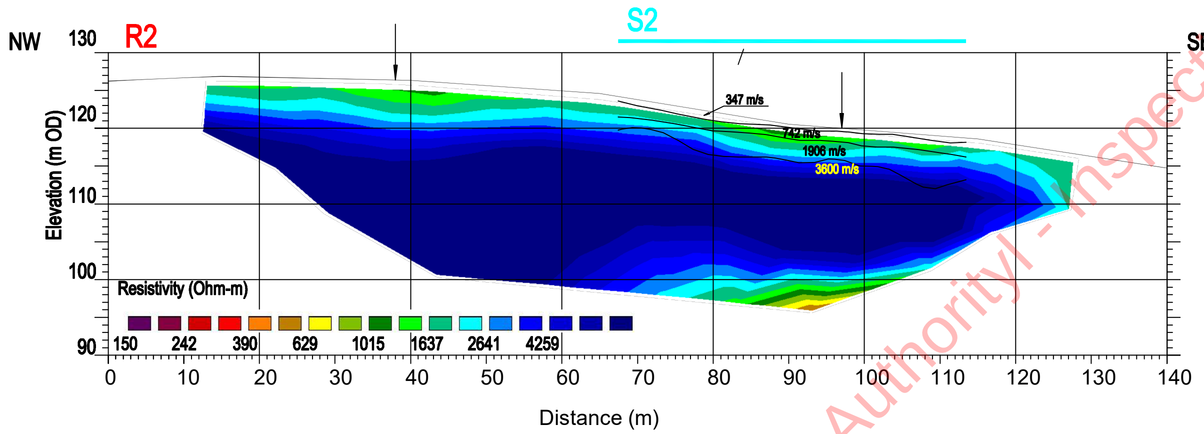
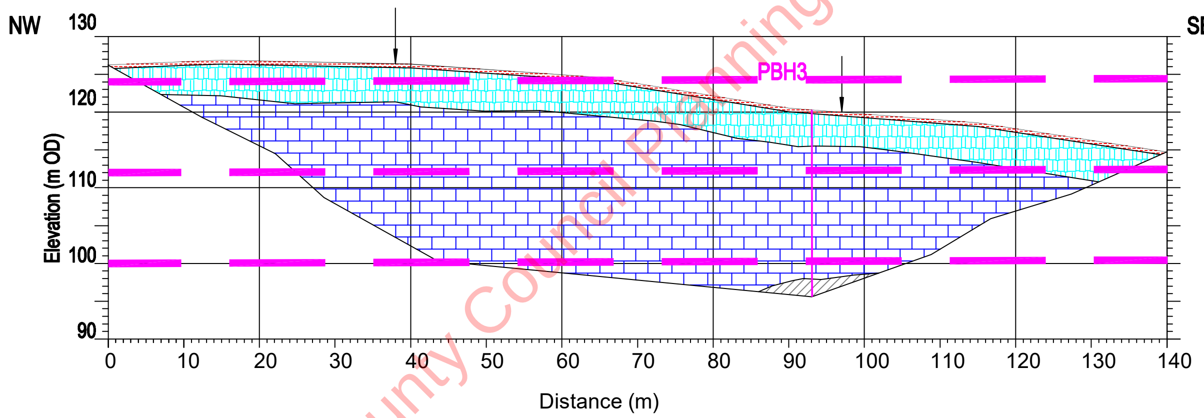
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R1
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

FIGURE 1: ERT PROFILE R2

SCALE 1:1000





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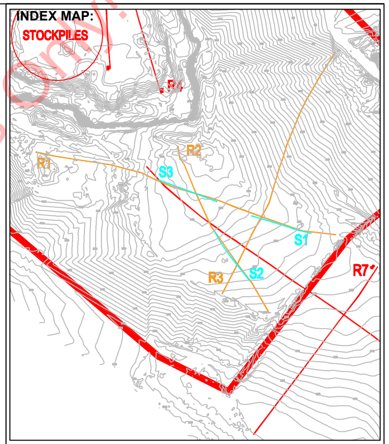

LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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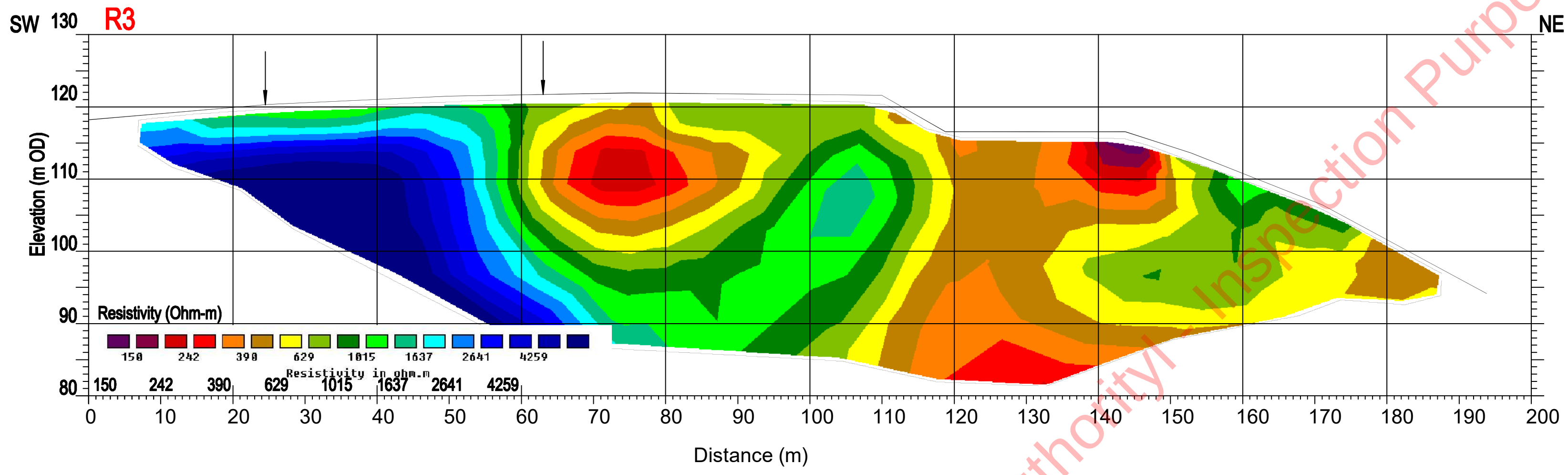
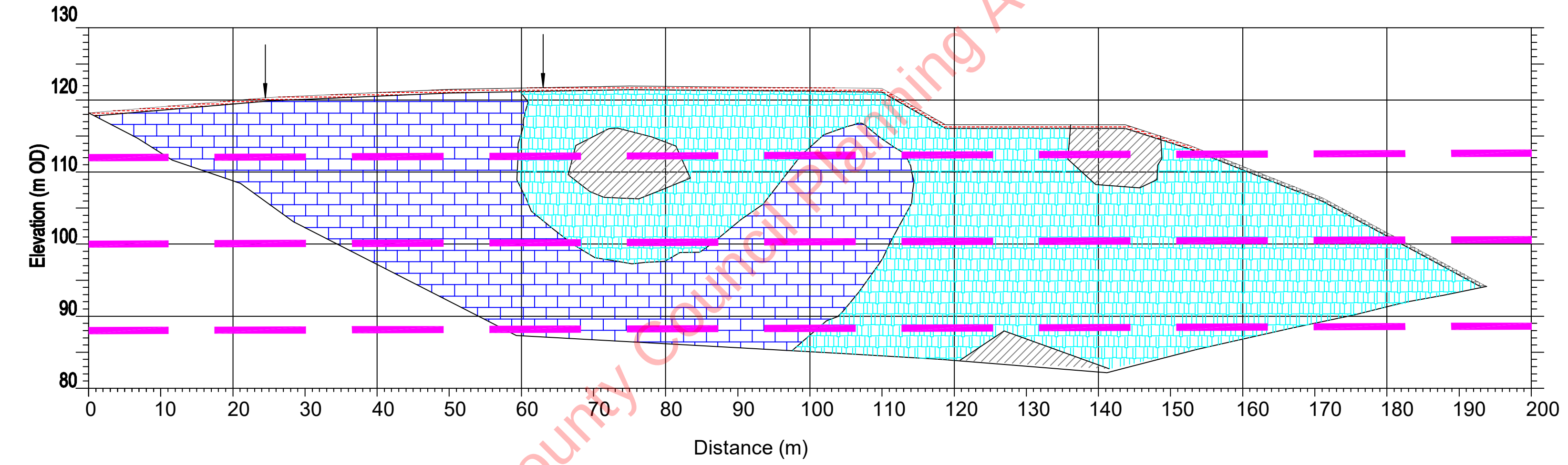
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R2
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

FIGURE 1: ERT PROFILE R3

SCALE 1:1000





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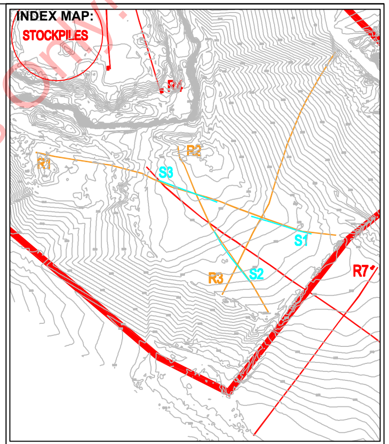

LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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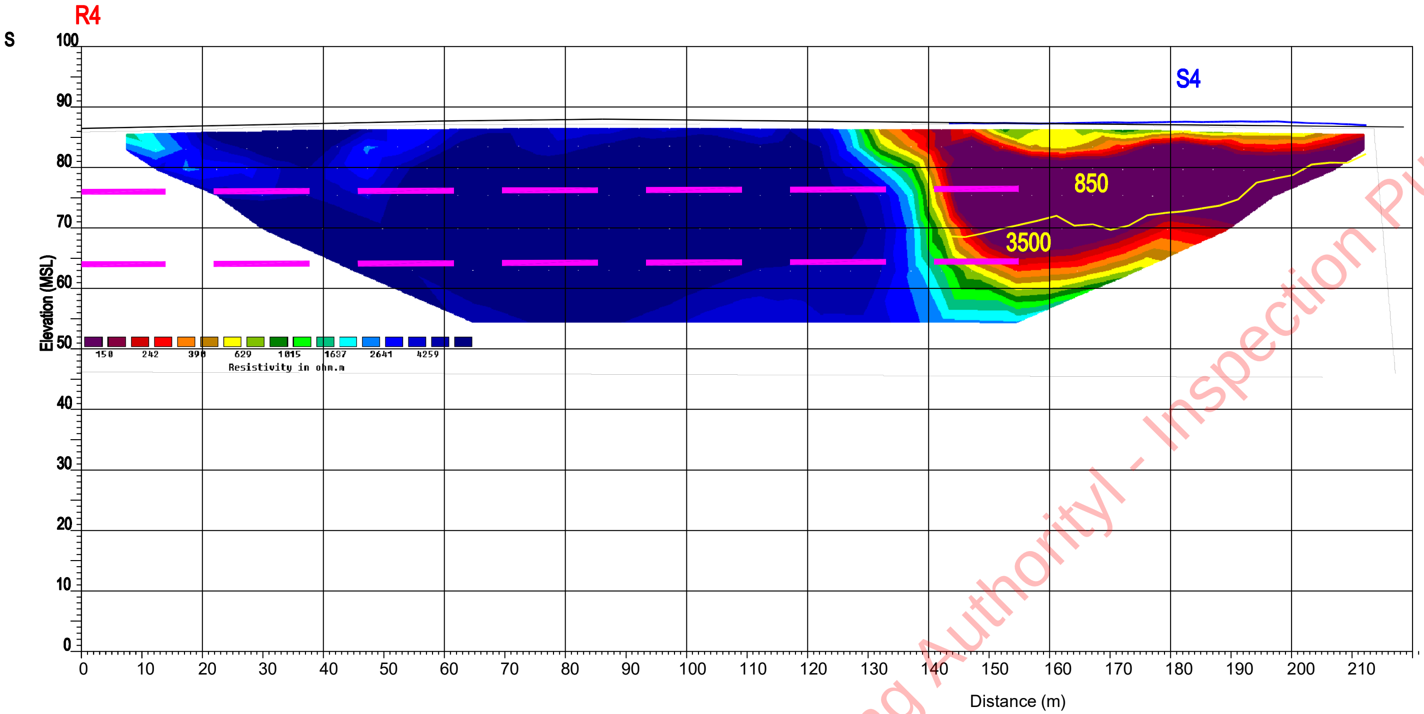
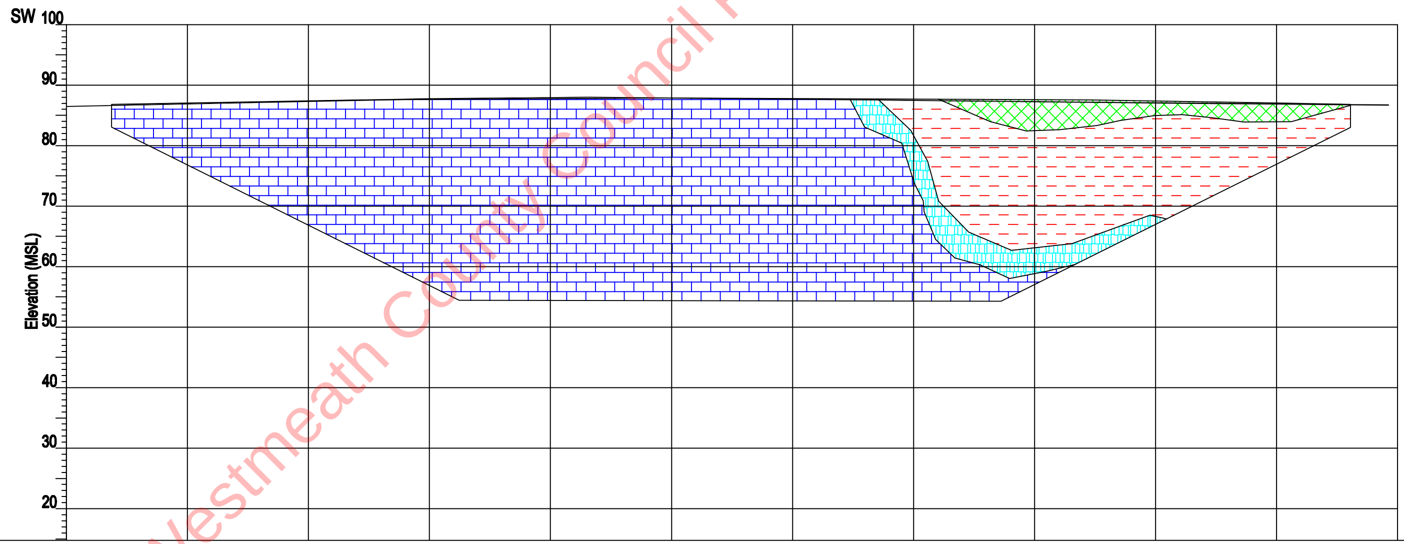
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R3
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

FIGURE 1: ERT PROFILE R4

SCALE 1:1000





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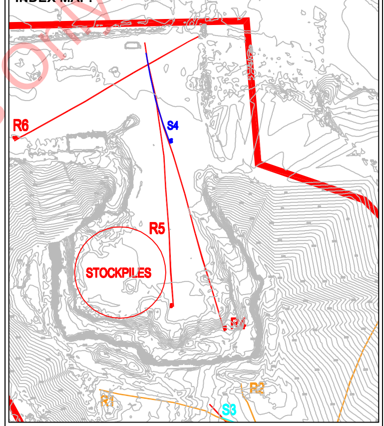

LEGEND:

Clay/Silt

Fill

Completely to highly weathered cherty LIMESTONE with clay infill

Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill

Slightly weathered to fresh cherty LIMESTONE

901-1105 m/s Seismic velocity layers

Bench Levels

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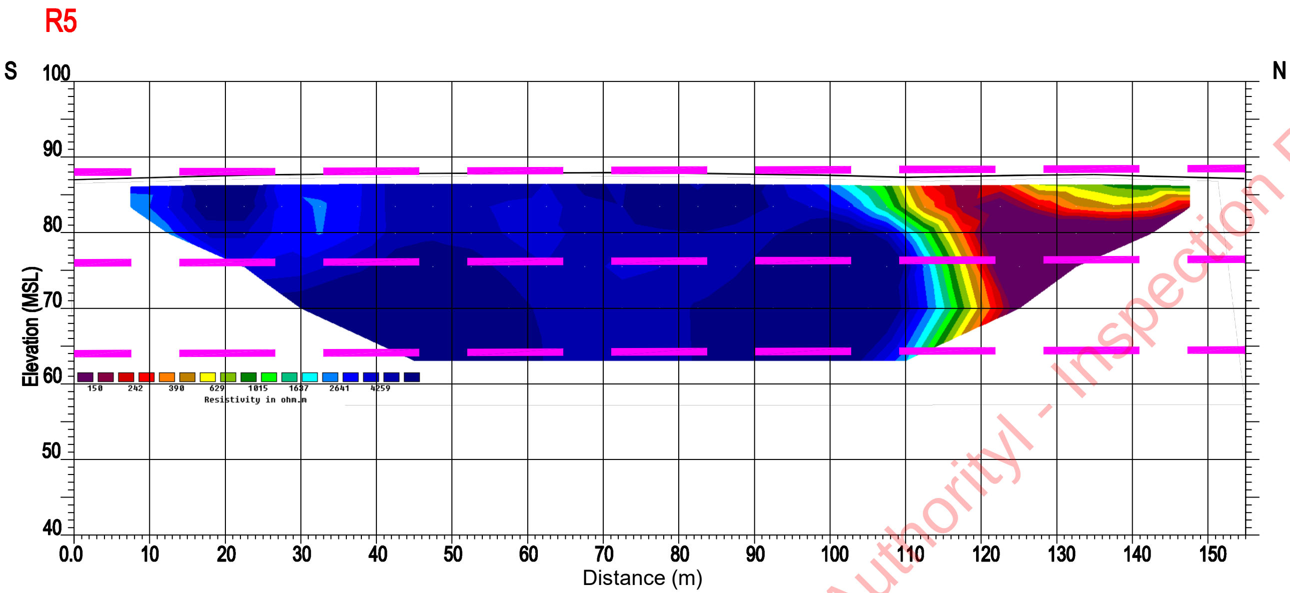
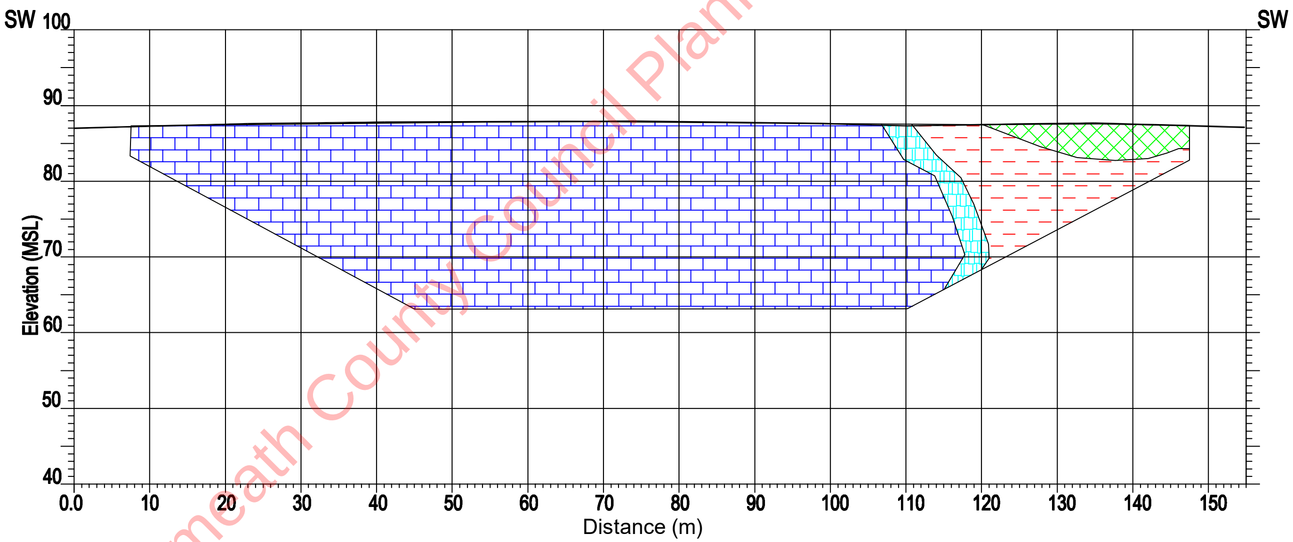
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R4
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

FIGURE 1: ERT PROFILE R5

SCALE 1:1000





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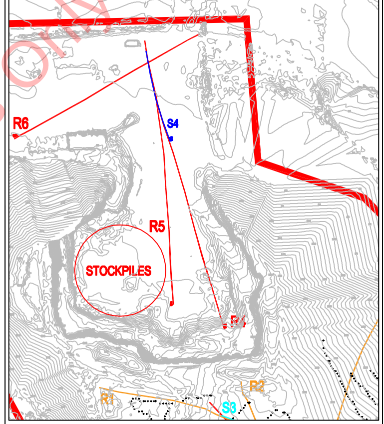

LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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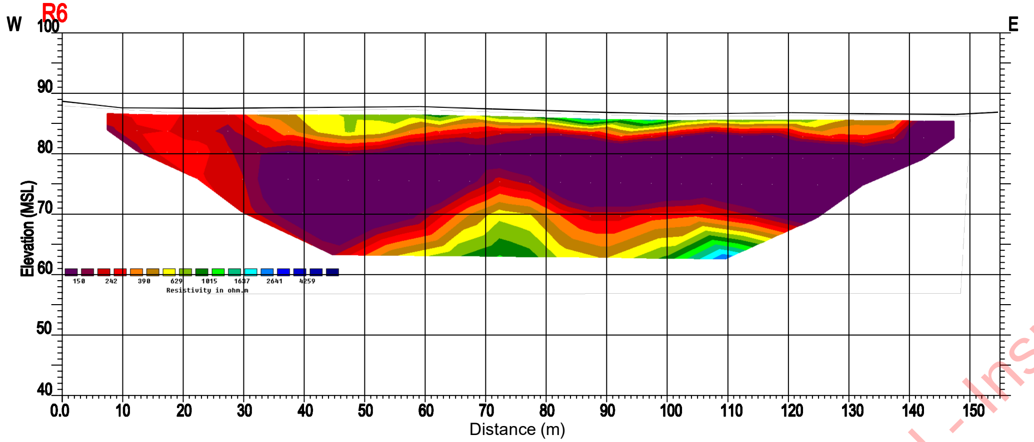
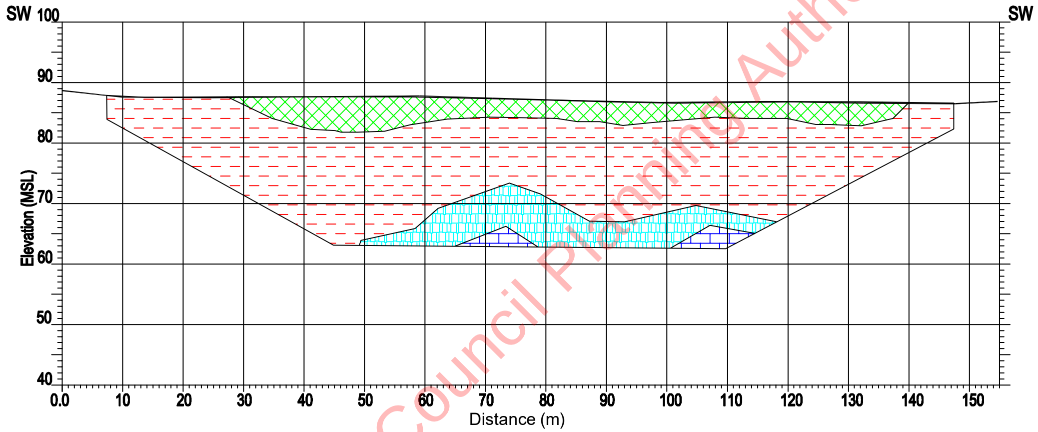
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R5
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

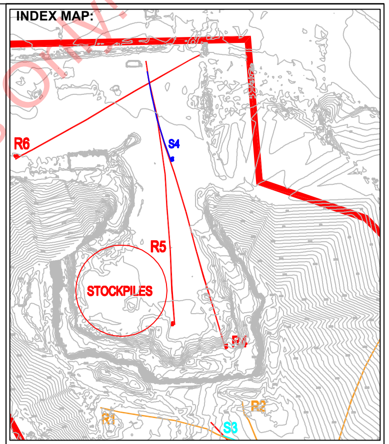
Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

FIGURE 1: ERT PROFILE R6

SCALE 1:1000







LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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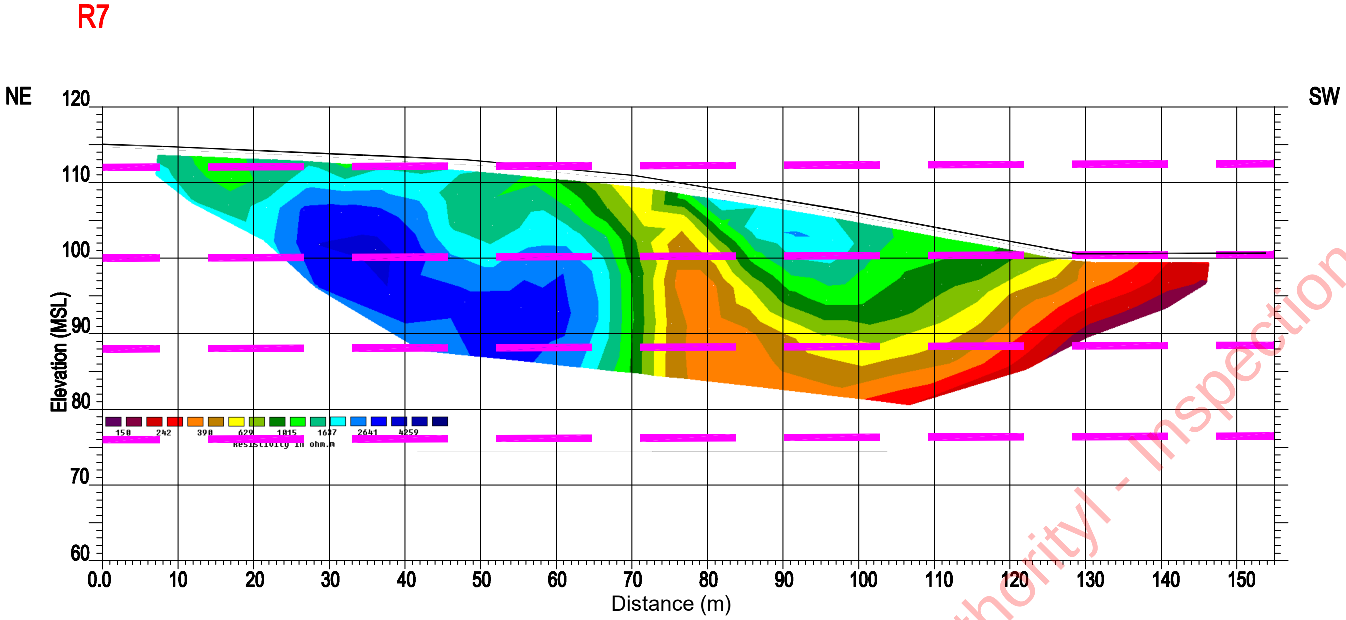
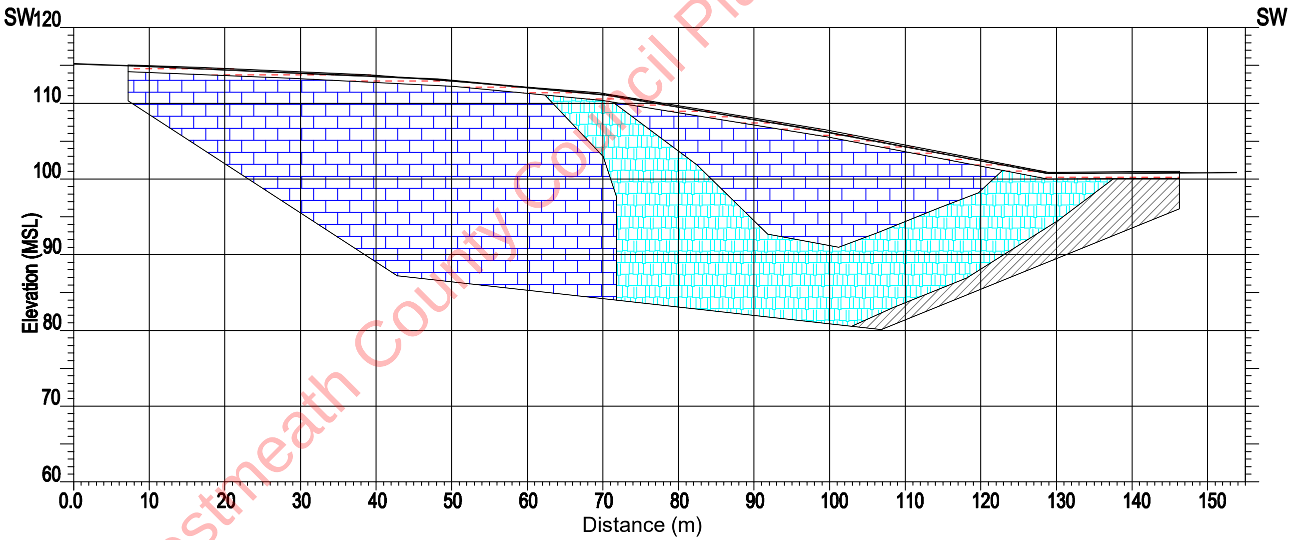
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R6
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

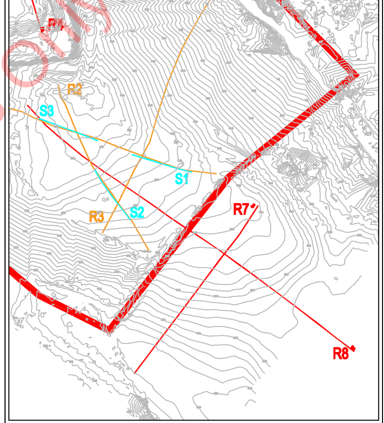
FIGURE 1: ERT PROFILE R7

SCALE 1:1000





INDEX MAP:



LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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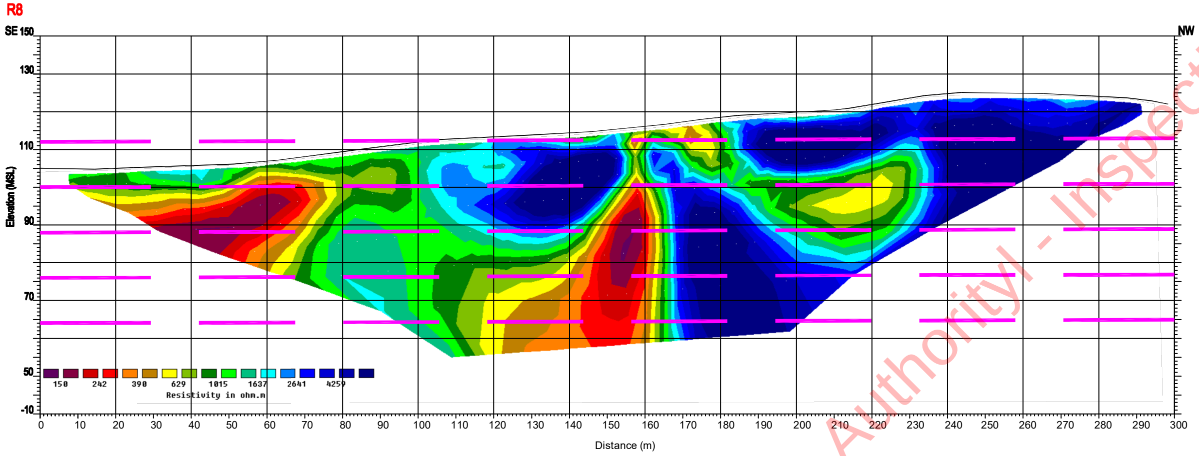
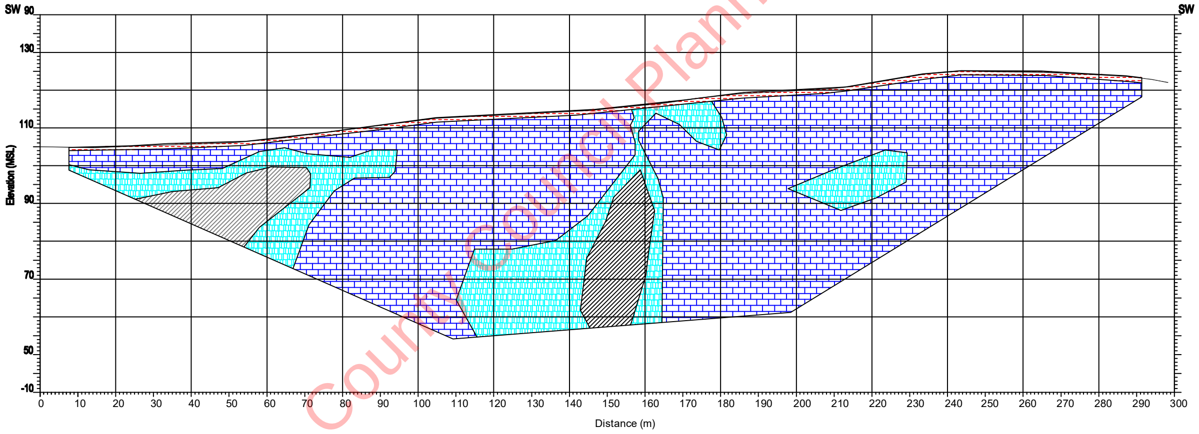
PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R7
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL

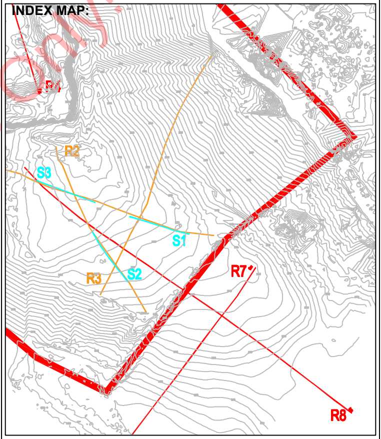
FIGURE 1: ERT PROFILE R8

SCALE 1:2000





INDEX MAP:



LEGEND:

- Clay/Silt
- Fill
- Completely to highly weathered cherty LIMESTONE with clay infill
- Moderately-highly weathered (occ. completely weath.) cherty LIMESTONE with clay infill
- Slightly weathered to fresh cherty LIMESTONE
- 901-1105 m/s Seismic velocity layers
- Bench Levels

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PROJECT:	CASTLEPOLLARD GEOPHYSICAL SURVEY PHASE II
CLIENT.:	LAGAN ASPHALT GROUP
DRAWING NO:	AGP18040_R8
SCALE:	AS INDICATED @ A4
DATE:	28-11-2018

Version:	Date:	Drawn By:	Checked:
01	28-11-2018	POC	YOC
02	24-01-2022	POC	TL