



Appendix 8.1

Geophysical Investigation Report

Coolglass Wind Farm EIAR Volume 3

Coolglass Wind Farm Limited

SLR Project No.: 501.V00727.00006

26 June 2023

AGP22027_02

**REPORT
ON THE
GEOPHYSICAL INVESTIGATION
FOR THE
THE SWAN WIND TURBINE,
CO. LAOIS
FOR
SLR CONSULTING LIMITED**



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9TH MARCH 2023

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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 GEOPHYSICS 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.

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1. EXECUTIVE SUMMARY

Apex Geophysics Limited has been commissioned by SLR Consulting Limited to carry out a geophysical investigation to try and identify the presence of a potential adit at The Swan Wind Turbine, The Swan, County Laois.

The site is located c. 2.2km northeast of The Swan village Co. Laois and is forested with topography varying from 240.2 m OD in the west to 245.4mOD in the east.

The objective of the investigation was to provide information on the presence of a possible adit.

The Geological Survey of Ireland (GSI) Quaternary Sediments map for the area indicates that the site is in an area of till derived from Namurian sandstones and shales. The GSI bedrock map for the area indicates the site is underlain by feldspathic quartzitic sandstone of Clay Gall Sandstone Formation.

The investigation was carried out on the 24th and 25th May 2022 and involved the collection of Electrical Resistivity Tomography (ERT) profiles.

The results of the investigation are presented in maps and sections in **Appendix B** and are summarised as follows:

- Soil layers consisting primarily of sandy gravelly clay across the site with small ‘pockets’ of silt/clay and clayey silty sand/gravel at or close to the surface are 0.9 m to 8.8 m thick and overly possible rock, interpreted as mudstone/siltstone and sandstone.

Below the interpreted top of possible rock three anomalous zones are present as follows:

- A vertical/subvertical zone of reduced model resistivity values indicating the presence of a possible shaft close to the proposed turbine base (**Zone A**).
- A horizontal/subhorizontal zone of reduced model resistivity values indicating the presence of a possible adit 5 to 20 m west of the proposed turbine base (**Zone B**).
- A vertical/subvertical zone of slightly reduced model resistivity values indicating the presence of a possible shaft approximately 15 m south of the turbine base (**Zone C**).

Boreholes are recommended at three locations to confirm the findings of the geophysical investigation.

The geophysical report should be reviewed after any further direct investigation.

2. INTRODUCTION

Apex Geophysics Limited has been commissioned by SLR Consulting Limited to carry out a geophysical investigation to try and identify the presence of a possible adit at the site of proposed turbine base T8 at The Swan, County Laois.

2.1 Survey Objectives

The objective of the investigation is to provide information on the following:

- the presence of a possible adit.

2.2 Site Background

The site is located c. 2.2km northeast of The Swan village Co. Laois (Fig. 2.1). The site is forested and topography varies from 240.2 m OD in the west to 245.4mOD in the east.



Figure 2.1. Aerial photo of site (ERT profiles in red).

2.2.1 Soils

The Geological Survey of Ireland (GSI) Quaternary Sediments map (GSI, 2019) for the area indicates that the site is in an area of till derived from Namurian sandstones and shales (Fig. 2.2). Subcropping/ outcropping rock is mapped approx. 450 m west of the site. Alluvial deposits are also indicated c. 450m to the west of the site.



Figure 2.2: Quaternary sediments map (ERT profiles marked in red).

2.2.2 Geology

The GSI 1:100k Bedrock Geology map for the area (GSI, 2018) indicates the site is underlain by feldspathic quartzitic sandstone of Clay Gall Sandstone Formation (Fig. 2.3).



Figure 2.3. Geological map for the survey area (ERT profiles marked in red).

2.2.3 Groundwater

The groundwater vulnerability rating for the site (GSIb, 2019) is classified as 'Extreme' across the site (Fig. 2.4) and the bedrock is classified as a 'Locally Important Aquifer - Bedrock which is Generally Moderately Productive' (GSIa, 2019).

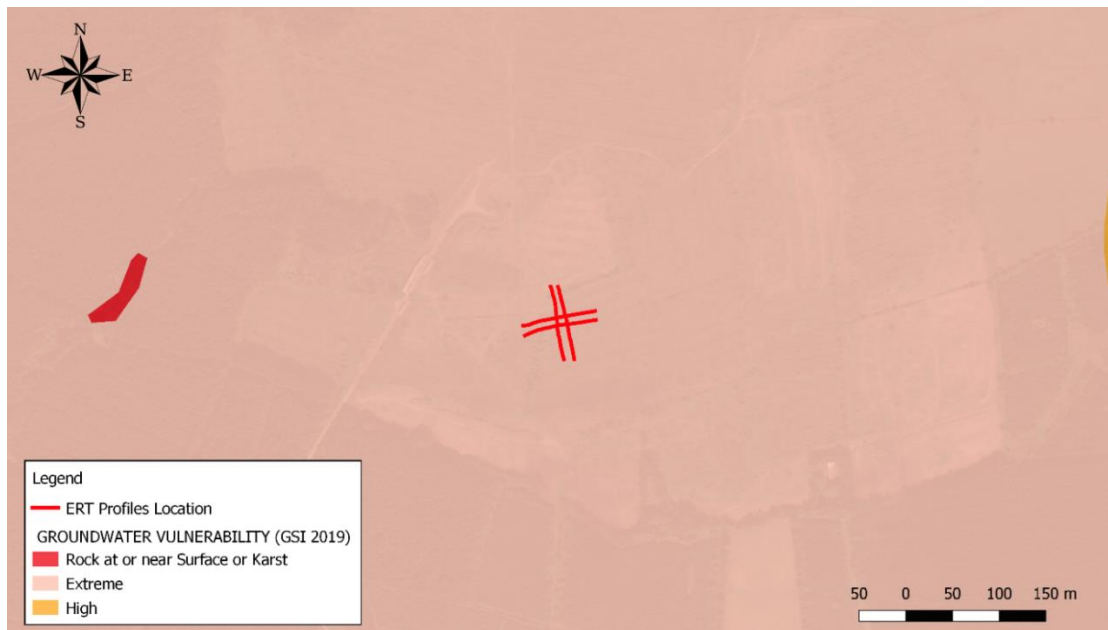


Fig 2.4. Groundwater vulnerability classification for the survey area (ERT profiles marked in red).

2.2.4 Historical Data

The historical 6 inch sheet for the area indicates grey grits, earthy shales outcropping 650 m southwest and hard bluish grey grits outcropping 700m to the northwest of the site (Fig. 2.5). The map also indicates a number of pits to the east of the site.

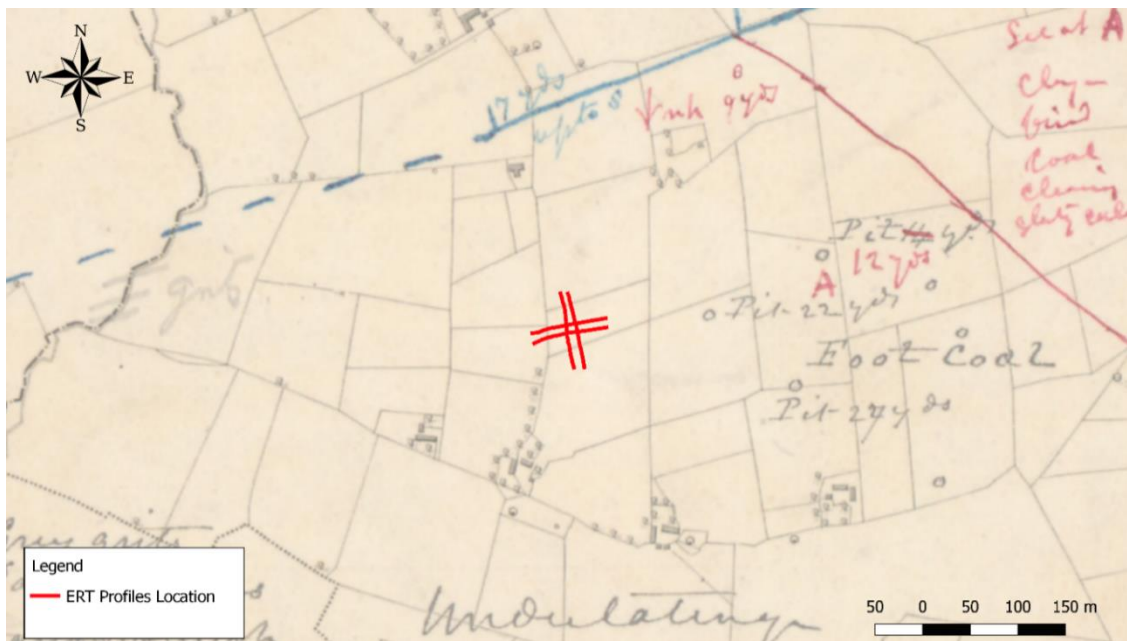


Fig 2.5: The historical 6-inch map (ERT profiles marked in red).

2.2.5 Direct Investigation

There was no direct investigation information available at the time of writing the report.

2.3 Survey Rationale

The investigation consisted of 2D Electrical Resistivity Tomography (ERT) profiling.

ERT images the electrical resistivity of the materials in the subsurface along a profile to produce a cross-section showing the variation in resistivity with depth. Each cross-section will be interpreted to determine the material type along the profile based on typical resistivities returned for Irish ground materials.

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. Further information on the detailed methodology is given in **APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY**.

3. RESULTS AND INTERPRETATION

The survey was carried out on the 24th and 25th May 2022 and involved the collection of 4 ERT profiles. The geophysical survey locations are indicated on Drawing AGP22027_01 (Appendix B).

3.1 ERT

Four ERT Profiles (R1- R4) were recorded at the proposed location of turbine base T8. The modelled resistivity values have been interpreted on the following basis.

Resistivity (Ohm-m)	Interpretation
25-50	SILT/CLAY
50 - 250	Sandy gravelly CLAY
250-1000	Clayey Silty SAND/GRAVEL
	Possible ROCK

3.2 Interpretation

The geophysical results are presented on Drawings AGP22027_02 to AGP22027_04, Appendix B and indicate:

- Soil consisting primarily of sandy gravelly clay across the site with small ‘pockets’ of silt/clay and clayey silty sand/gravel at or close to the surface.
- The soil layers range in thickness from 0.9 m bgl approximately 18 m south of the proposed turbine base (see Drawing AGP22027_03) to 6.8 to 8.8 m bgl approximately 27 m north and approximately 21 m east of the turbine, (see Drawing AGP22027_02), (average 4.7 m bgl). This material overlies:
- Possible rock, interpreted from the ERT data with a model resistivity of 250-1,000 Ohm-m as mudstone/siltstone and sandstone.

Below the interpreted top of possible rock three anomalous zones are present as follows:.

- A vertical/subvertical zone of reduced model resistivity values (<300 Ohm-m) indicating the presence of a possible shaft (Zone A) close to the proposed turbine base (See Drawings AGP22027_02 to AGP22027_04).
- A horizontal/subhorizontal zone of reduced model resistivity values (<350 Ohm-m) indicating the presence of a possible adit (Zone B) 5 to 20 m west of the proposed turbine base (See Drawing AGP22027_02).
- A vertical/subvertical zone of slightly reduced model resistivity values (<400 Ohm-m) indicating the presence of a possible shaft (Zone C) approximately 15 m south of the turbine base (see ERT profile R3 on Drawing AGP22027_03).

The geophysical data does not indicate air filled shafts/adits across the site which generally are expected to have higher model resistivity values than those recorded here. The model resistivity values of < 350 Ohm-m indicate the possible shafts/adit contain sandy/gravelly clay and clayey sand/gravel.

4. RECOMMENDATIONS

Boreholes are recommended at the following locations to 15 m bgl to confirm the findings of the geophysical investigation:

No.	Easting	Northing	Target
PBH1	657532	684462	Possible shaft location
PBH2	657521	684466	Possible adit location
PBH3	657534	684449	Possible shaft location

The geophysical report should be reviewed after any further direct investigation.

REFERENCES

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APPENDIX A: DETAILED GEOPHYSICAL METHODOLOGY

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

The ERT profiles were recorded using an ABEM Terrameter LS resistivity meter, imaging software, multicore takeout cables and up to 80 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.

Spatial Relocation

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

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

The EM conductivity locations were acquired using a system integrated GPS receiver to an x,y accuracy of +/- 5m or better and converted to ITM.

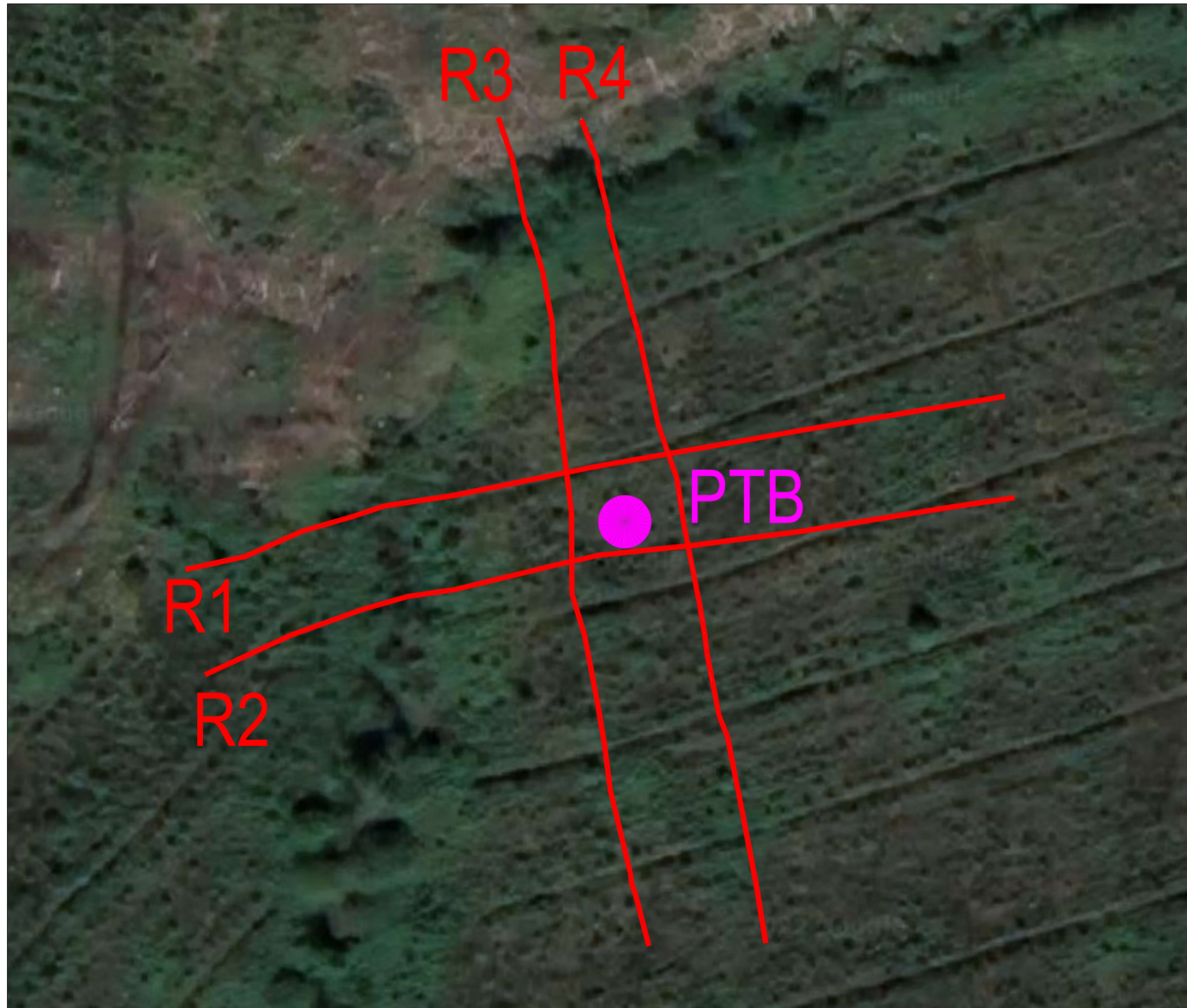
APPENDIX B: DRAWINGS

The information derived from the geophysical investigation is presented in the following drawings:

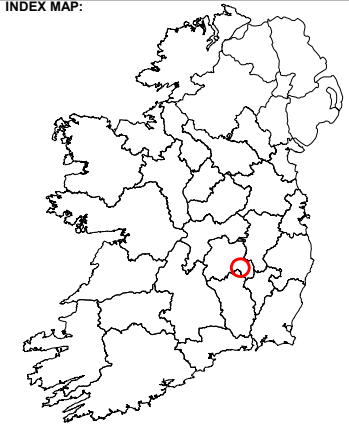
AGP22027_01	Geophysical Investigations Locations	1:500	@ A4
AGP22027_02	Fig. 1: Results & Interpretation - R1	1:500	@ A4
	Fig. 2: Results & Interpretation - R2	1:500	@ A4
AGP22027_03	Fig. 1: Results & Interpretation – R3	1:500	@ A4
	Fig. 2: Results & Interpretation – R4	1:500	@ A4
AGP22027_04	Summary Map	1:500	@ A4

GEOPHYSICAL INVESTIGATION LOCATIONS

SCALE 1:500



INDEX MAP:



LEGEND:

- R1 2D resistivity profile
- PTB Proposed Turbine Base

The information displayed here is to be used in conjunction with AGP22027_01 Report on the Geophysical Investigation for The Swan, Wind Turbine for SLR Consulting Limited, APEX Geophysics Ltd. 09th March 2023.



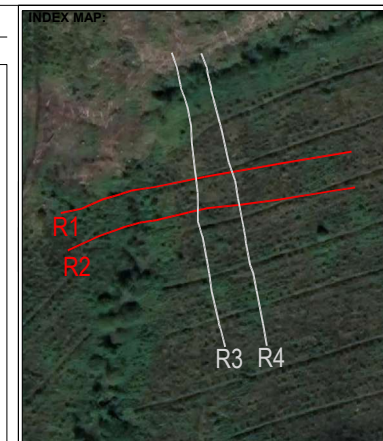
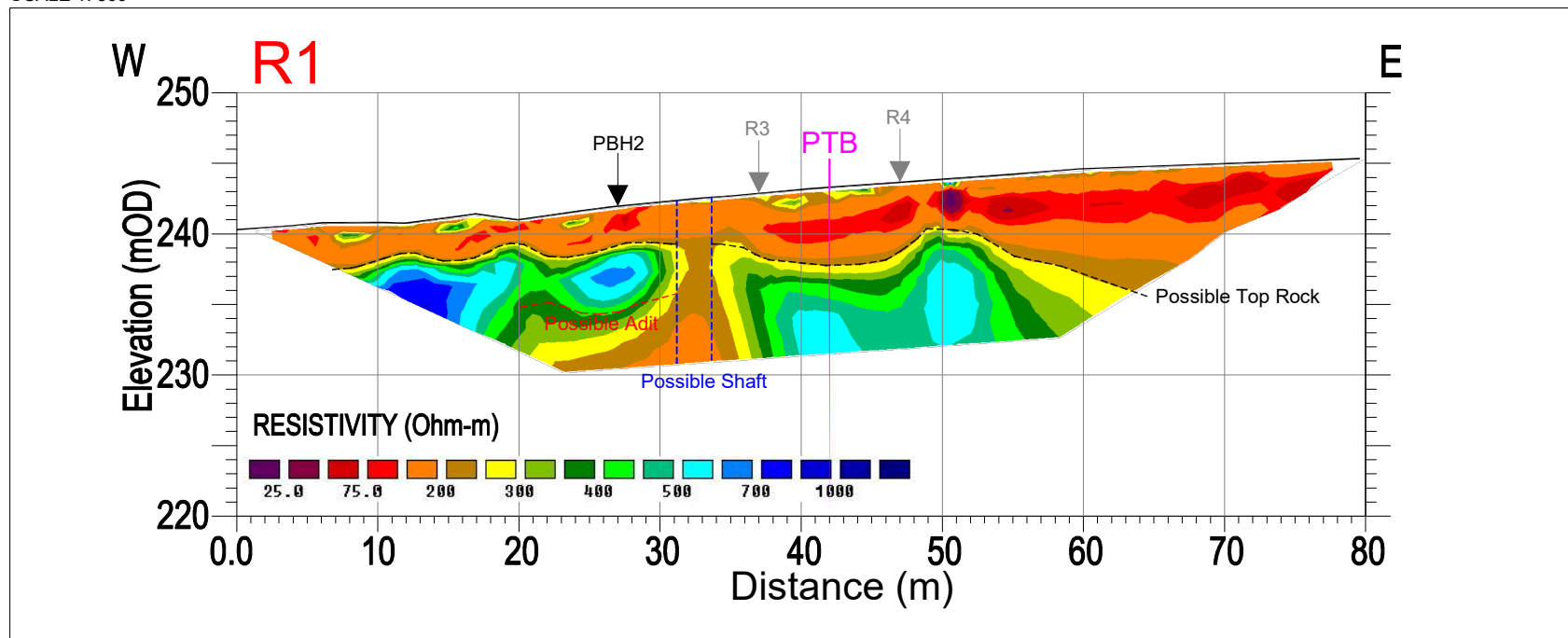
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PROJECT:	THE SWAND WIND TURBINE GEOPHYSICAL SURVEY		
CLIENT:	SLR CONSULTING		
DRAWING NO:	AGP22027_01		
SCALE:	AS INDICATED @ A4		
DATE:	09-03-2023		
Version:	Date:	Drawn By:	Checked:
01	15-08-2022	TL	IS
02	09-03-2023	TL	IS

RESULTS AND INTERPRETATION - R1

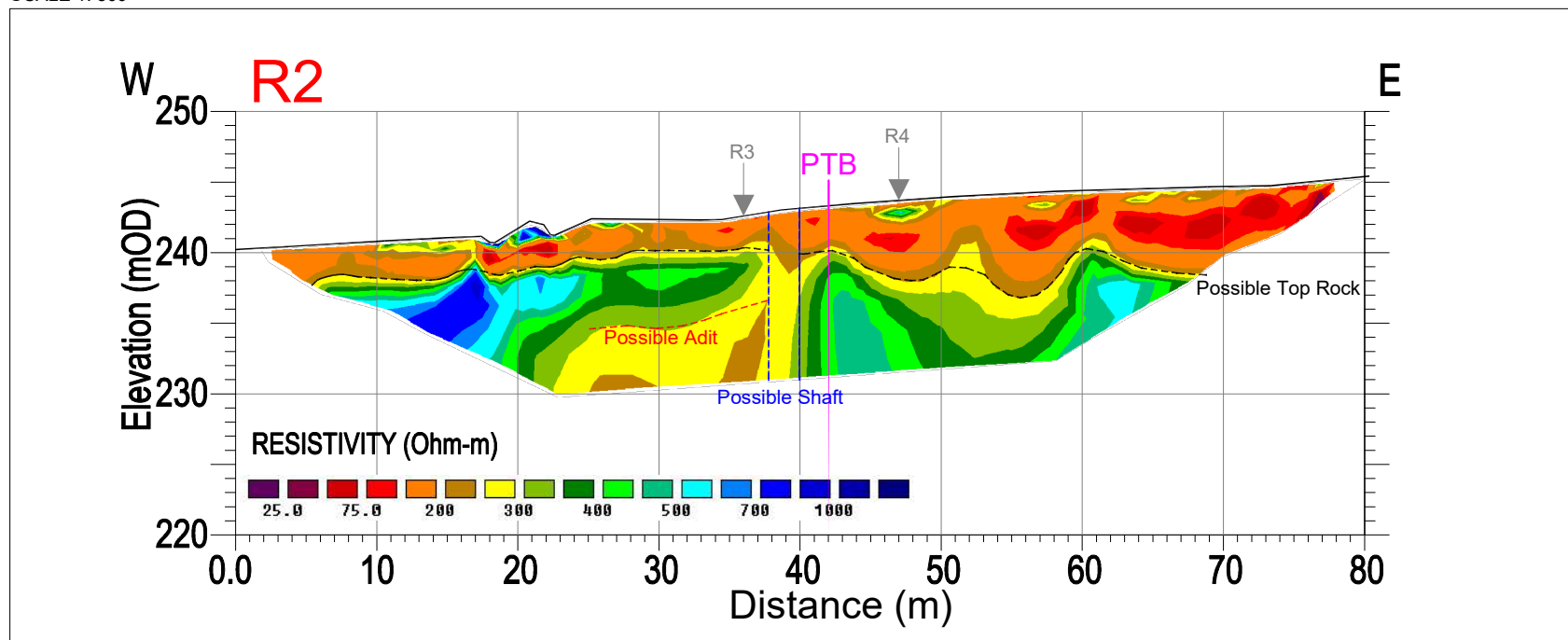
SCALE 1: 500



- LEGEND:**
- PTB Proposed Turbine Base
 - Possible shaft location
 - Possible adit location
 - Possible Top of ROCK
 - PBH Proposed Borehole Location

RESULTS AND INTERPRETATION - R2

SCALE 1: 500



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PROJECT: THE SWAND WIND TURBINE
GEOPHYSICAL SURVEY

CLIENT: SLR CONSULTING

DRAWING NO: AGP22027_R1

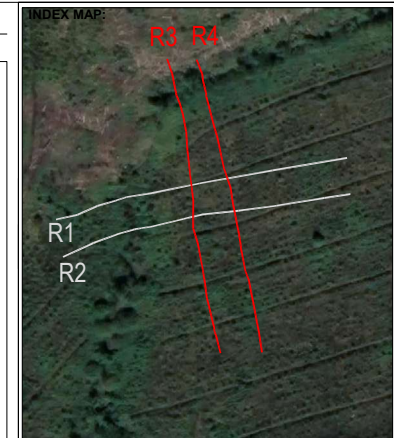
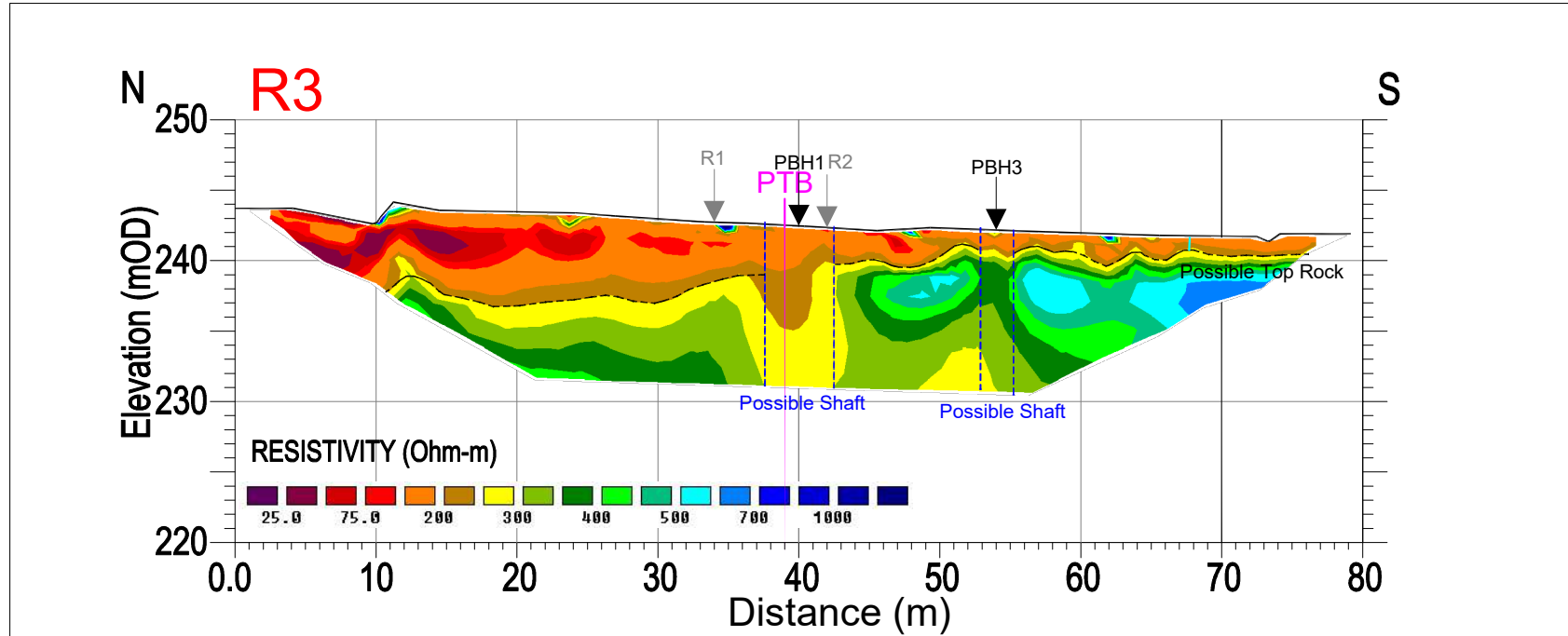
SCALE: AS INDICATED @ A4

DATE: 09-03-2023

Version:	Date:	Drawn By:	Checked:
01	15-08-2022	TL	IS
02	09-03-2023	TL	IS

RESULTS AND INTERPRETATION - R3

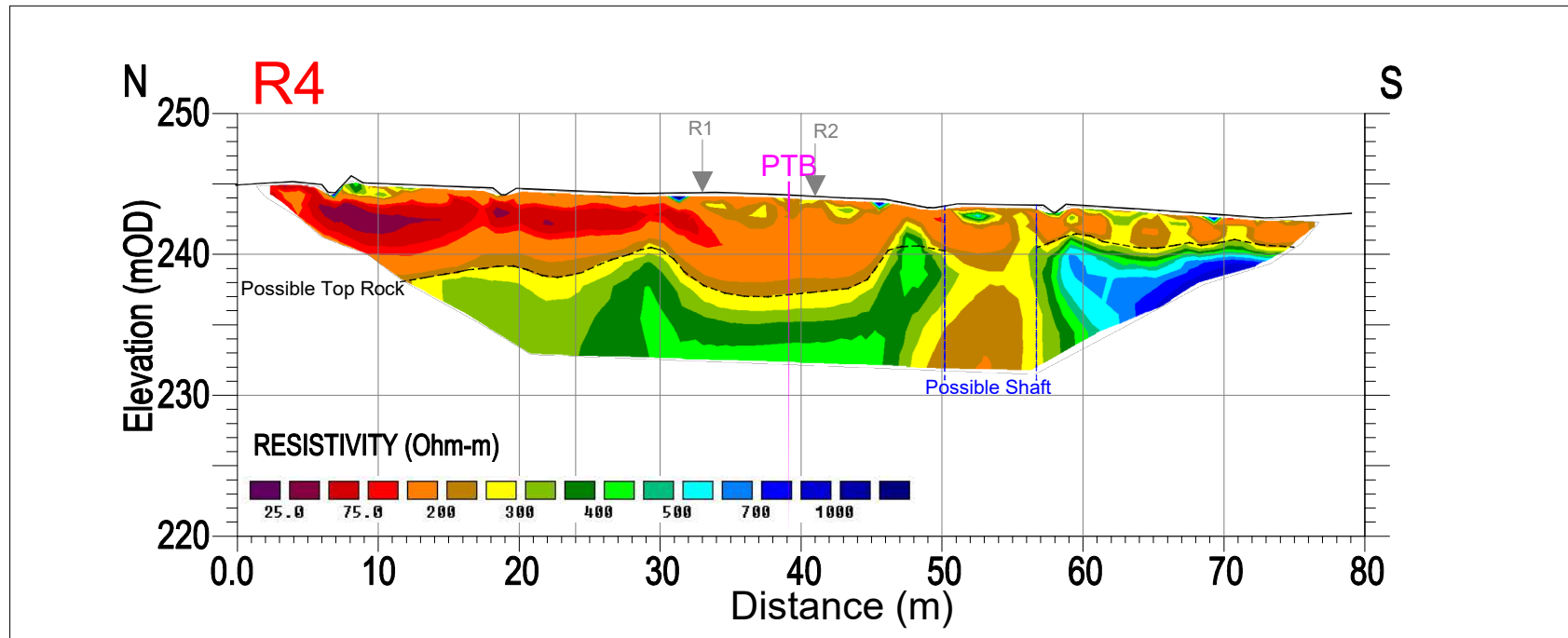
SCALE 1: 500



- LEGEND:**
- PTB Proposed Turbine Base
 - Possible shaft location
 - Possible adit location
 - Possible Top of ROCK
 - PBH1 Proposed Borehole Location

RESULTS AND INTERPRETATION - R4

SCALE 1: 500



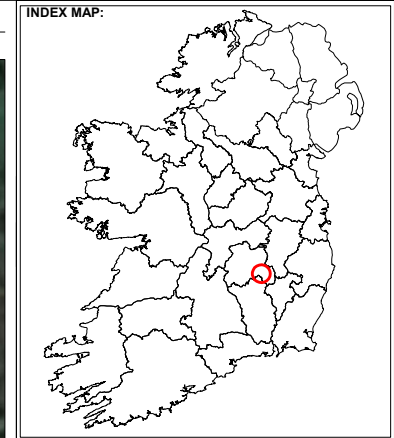
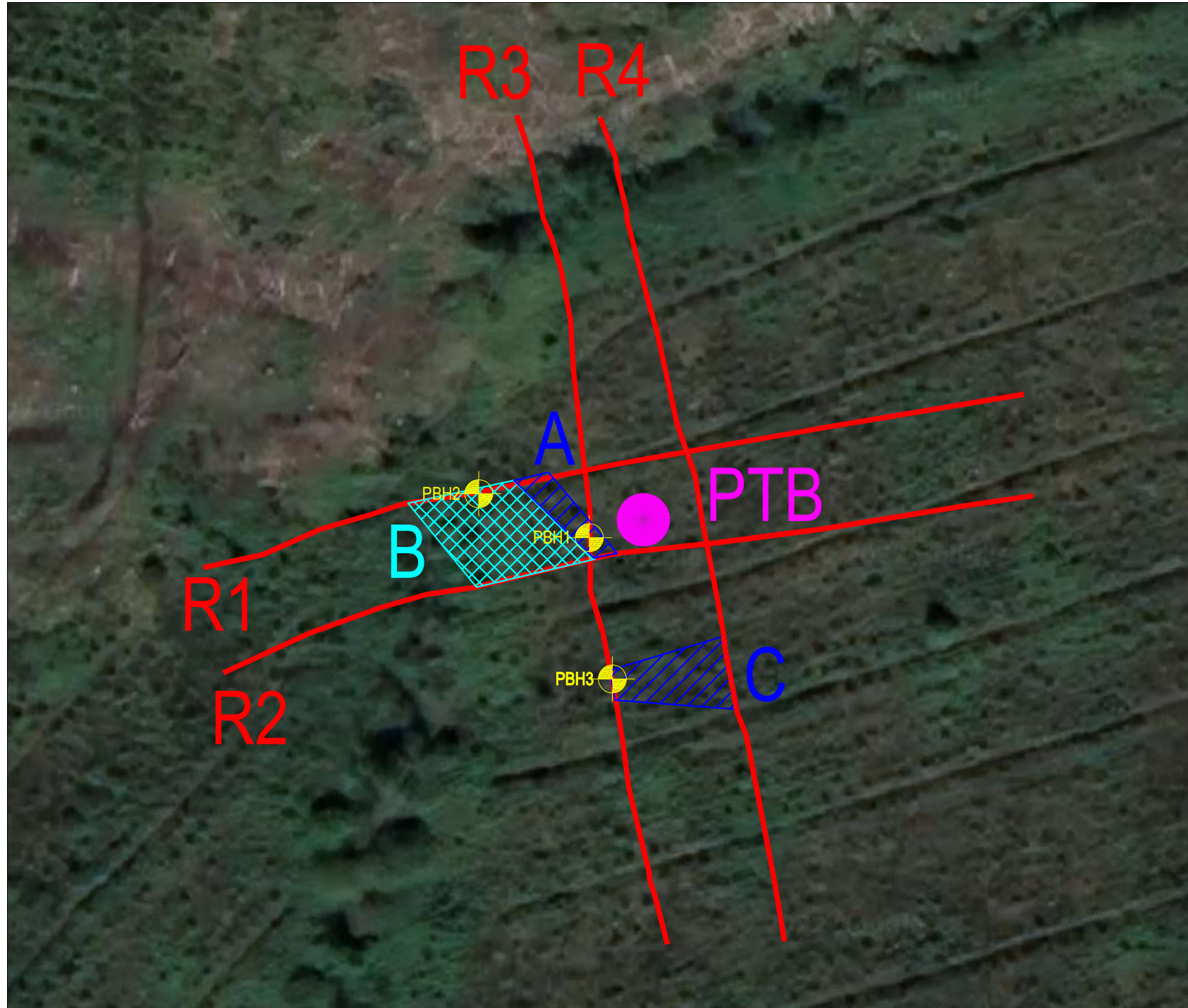
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PROJECT:	THE SWAND WIND TURBINE GEOPHYSICAL SURVEY		
CLIENT:	SLR CONSULTING		
DRAWING NO:	AGP22027_03		
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DATE:	09-03-2023		
Version:	Date:	Drawn By:	Checked:
01	15-08-2022	TL	IS
02	09-03-2023	TL	IS



- LEGEND:
- R1 2D resistivity profile
 - PTB Proposed Turbine Base
 - ▨ Possible Shaft - Zone A
 - ▩ Possible Adit - Zone B
 - ▨ Possible Shaft - Zone C
 - PBH1 Proposed Borehole Location

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PROJECT:	THE SWAND WIND TURBINE GEOPHYSICAL SURVEY		
CLIENT:	SLR CONSULTING		
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02	09-03-2023	TL	IS

