

**AGP25025\_01**

**REPORT  
ON THE  
GEOPHYSICAL INVESTIGATION  
AT  
CARRIGEEN CABLE ROUTE  
FOR  
CARRAIGIN POWER LIMITED**



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**12<sup>TH</sup> JANUARY 2026**

## ***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.*

<b>PROJECT NUMBER</b>	AGP25205		
<b>AUTHOR</b>	<b>CHECKED</b>	<b>REPORT STATUS</b>	<b>DATE</b>
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## 1. EXECUTIVE SUMMARY

APEX Geophysics Limited was requested by Carraigin Power Limited to carry out a geophysical investigation along part of the proposed Carrigeen cable route, Co. Roscommon, using Ground Penetrating Radar (GPR).

The objectives of the investigation were to provide information on the pavement construction detail and possible presence and thickness of peat below the road pavement along the cable route.

The Geological Survey of Ireland (GSI) soils map for the area indicates the route is predominantly underlain by till derived from limestone. Cut over raised peat is indicated towards the west and laterally within 100 m of the route towards the east of the area of investigation. The GSI bedrock map for the area indicates the area of investigation is underlain by the Boyle Sandstone Formation in the west followed by Limestone of the Ballymore, Croghan and Bricklieve Formations in the east.

The geophysical investigation was carried out over 5 sessions between the 18<sup>th</sup> of November and 17<sup>th</sup> December 2025 and involved the acquisition of 11,400 m of GPR data along local and regional roads using GPR antenna frequencies ranging between 1600 MHz and 40 MHz to resolve shallow and deep planar reflections associated with the pavement construction and subgrade.

• SECTION 1:	0 – 8,410 m	Lane1, Eastbound	(8,410 m)
• SECTION 2:	9,650 – 9,990 m	Lane1, Eastbound	(250 m)
• SECTION 3:	15,130 – 17,430 m	Lane1, Eastbound	(2,300 m)
• SECTION 4:	18,660- 19,180 m	Lane1, Eastbound	(520 m)

Fourteen Russian samples (RS01 – RS14) and ten Soft Ground Probes (SGP01 – SGP10) were carried out as part of the investigation in accessible land adjacent to the road to confirm the presence and thickness of peat underlying the road pavement. Peat thickness varying between 0.58 m and 4.83 m below ground level (bgl) were recorded in the samples. The results were correlated with reflections from the GPR data interpreted as the base of the peat layer.

The findings of the investigation are presented as 2D longitudinal sections for Sections 1 - 4 in APPENDIX A: Drawings and tabulated in Pavement Construction Summary Tables in Appendix B.

Two areas of Peat underlying the road construction have been identified in the west of the area of investigation between chainages 0 – 1295 m and 2,056 - 4,610 m. The base of peat ranges from 1.3 – 4.3 m bgl with average thickness of 1.8 m below the pavement subbase.

The findings from this investigation should be reviewed upon completion of any intrusive investigations.

## 2. INTRODUCTION

APEX Geophysics Limited was requested by Carraigin Power Limited to carry out a geophysical investigation along part of the proposed Carrigeen cable route, Co. Roscommon, a project which will see the construction of new underground infrastructure to provide a grid connection between a proposed renewable energy development in the Ballinagare/Elphin area and the existing Flagford 220 KV Substation, Ballinadrehid, Co. Roscommon.

The proposed cable route is c. 21.5 Km in length and predominantly follows along local and regional roads. There is a requirement to carry out a geophysical investigation along c. 11.5 Km of the route using Ground Penetrating Radar (GPR).

### 2.1 Survey Objectives

The objectives of the investigation were to:

- Determine the pavement construction detail.
- Identify the presence and thickness of peat underlying the pavement construction.

### 2.2 Site Background

The pavement investigation was carried out with Ground Penetrating Radar (GPR) over 5 sessions between the 18<sup>th</sup> of November and 17<sup>th</sup> December 2025, along the near side wheel path of Lane 1 in the eastbound direction at the following sections (Figure 2.1):

- |              |                   |                  |           |
|--------------|-------------------|------------------|-----------|
| • SECTION 1: | 0 – 8,410 m       | Lane1, Eastbound | (8,410 m) |
| • SECTION 2: | 9,650 – 9,990 m   | Lane1, Eastbound | (250 m)   |
| • SECTION 3: | 15,130 – 17,430 m | Lane1, Eastbound | (2,300 m) |
| • SECTION 4: | 18,660- 19,180 m  | Lane1, Eastbound | (520 m)   |

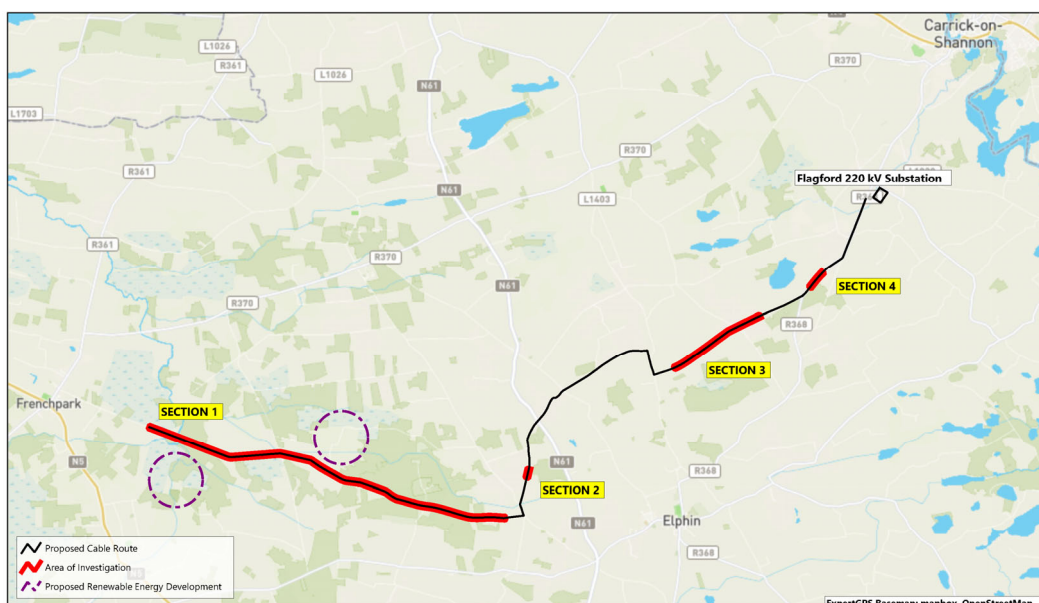


Figure 2.1: Site Investigation Location map (Geophysical investigation locations shown in red).

### 2.3 Soils

The Geological Survey of Ireland (GSI) soils map for the area (Figure 2.2) indicates the route is predominantly underlain by till derived from limestone. Cut over raised peat is indicated in the west and in close proximity to part of the route in the east of the area of investigation.

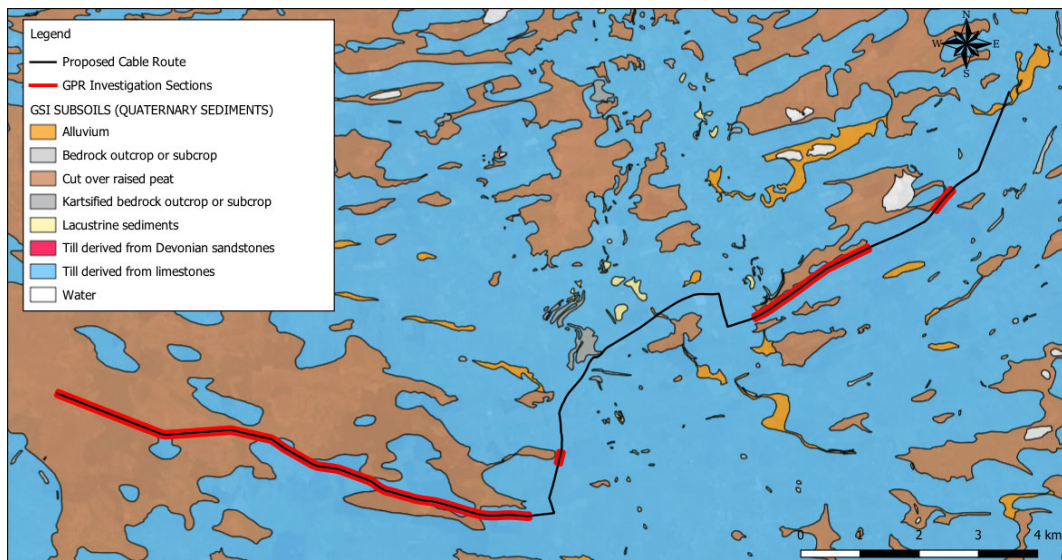


Figure 2.2: GSI Soils map (GPR investigation Sections shown in red).

### 2.4 Geology

The GSI 1:100k 2025 bedrock map for the area (Figure 2.3) indicates the area of investigation is underlain by the Boyle Sandstone Formation in the west and Limestone of the Ballymore, Croghan and Bricklieve Formations further east.

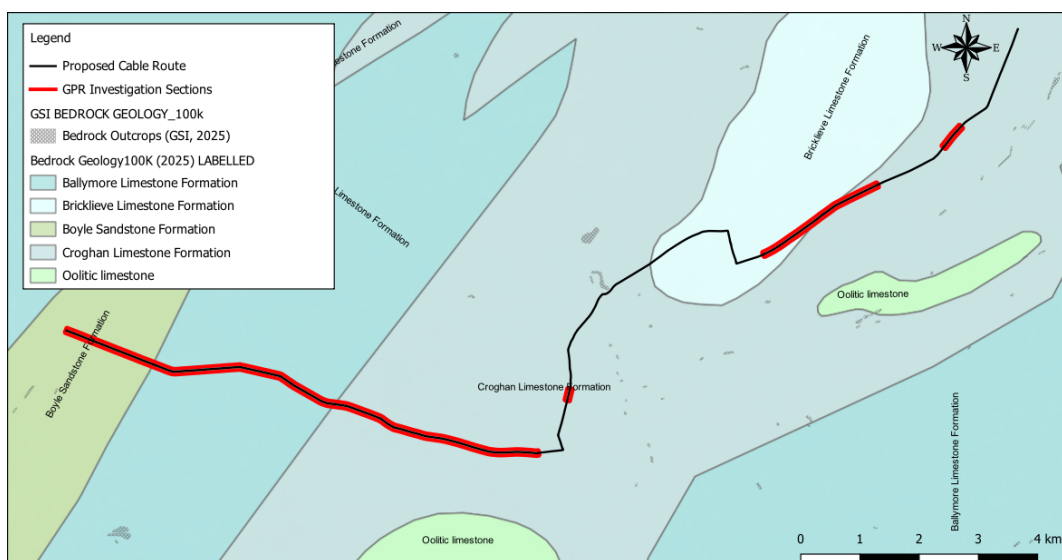


Figure 2.3: Bedrock Geology map (GPR investigation Sections shown in red).

## 2.5 Direct Investigation Data

Direct investigation consisting of Russian Sampling and Soft Ground Probing were carried out as part of the investigation in accessible land adjacent to the road to confirm the presence and thickness of peat underlying the road pavement. No other intrusive investigation data was available at the time of producing this report. Where additional intrusive data becomes available the findings from the geophysical investigation should be reviewed accordingly.

Fourteen Russian samples (RS01 – RS14) were carried out in areas where the road pavement is underlain by PEAT. Russian Sampling consists of manually pushing a chamber type sampler (Figure. 2.4) into the ground to retrieve an undisturbed soil sample from specified target depths. The base of Peat may be identified where underlying soils are sufficiently soft to allow penetration of the sampling chamber. Peat thickness varying between 0.58 m and 4.83 m bgl were recorded in the samples.



Figure 2.4: RS\_01 – The base of peat was encountered at 3.20 m bgl, underlain by soft white shell marl.

Ten Soft Ground Probes (SGP01 – SGP10) were carried out to confirm the presence of peat in areas where the ground was too stiff to allow Russian sampling and recorded soft ground at depth's varying between 0.1 and 0.4 m bgl.

## 2.6 Survey Rationale

Ground Penetrating Radar (GPR) works by sending radio waves into the ground and measuring the time of the reflected wave. Reflections occur where different material properties exist.

Pavement construction materials are generally well controlled and provide an effective target for the GPR technique. GPR has been used extensively in the determination of pavement construction detail as it provides continuous layer information which can be correlated to more intrusive core data.

GPR has also been used extensively in the determination of peat thickness in both raised bog as well as upland blanket bog and has been proved to be extremely accurate. Where peat has a high inorganic content (organic soil rather than pure peat) the penetration is reduced, and the peat base may not be fully resolved. Where a conductive material such as clay or ash overlies the peat, the signal will be attenuated, and the base of the peat layer may not be resolved.

The base of the peat is normally underlain by materials with significantly different properties to the peat itself. This in turn produces a strong signal from the base of the peat enabling accurate thickness measurements to be made.

Further information on the detailed methodology of the geophysical method employed in this investigation is given in **APPENDIX C: DETAILED METHODOLOGY**.

*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.*

### 3. RESULTS

GPR profiling involved the acquisition of 11,400 m of GPR data along local and regional roads using GPR antenna frequencies ranging between 1600 MHz and 40 MHz to resolve shallow and deep planar reflections associated with the pavement construction and subgrade, APPENDIX A: Drawing AGP25205\_01.

These data were combined and analysed to produce the following interpreted 2D sections:

- |              |                   |                  |           |
|--------------|-------------------|------------------|-----------|
| • SECTION 1: | 0 – 8,410 m       | Lane1, Eastbound | (8,410 m) |
| • SECTION 2: | 9,650 – 9,990 m   | Lane1, Eastbound | (250 m)   |
| • SECTION 3: | 15,130 – 17,430 m | Lane1, Eastbound | (2,300 m) |
| • SECTION 4: | 18,660- 19,180 m  | Lane1, Eastbound | (520 m)   |

The interpreted sections are presented as a series of drawings in APPENDIX A: Drawings AGP25205\_02 – AGP25205\_12. The Investigation locations are presented in Figure 1 overlain with contoured thickness of peat below the pavement construction.

Corresponding 2D Longitudinal sections of interpreted layers have been presented with a flat datum (100 X vertical exaggeration) in Figure 2. Material type and appropriate GPR velocity are assigned to planar reflections identified in the survey based on information available at the time of survey such as site observations, Russian Samples, soft ground probes and GSI soils distribution maps.

Depth and thickness estimates associated with interpreted layers are summarized in APPENDIX B: Pavement construction summary charts.

Two areas of peat underlying the road construction have been identified in the west of the area of investigation between chainages 0 – 1295 m and 2,056 - 4,610 m. The base of peat ranges from 1.3 – 4.3 m bgl with average thickness of 1.8 m below the pavement subbase.

#### 3.1 Data Quality

In general, GPR data acquired along the pavement with higher antenna frequencies such as 1600 & 500 MHZ were of good quality and resolved planar reflections associated with the bound bituminous material and underlying road construction.

GPR data acquired with lower antenna frequencies (250 & 100 MHz), typically used to penetrate deeper into the subgrade were of poorer quality and did not resolve the base of Peat at depths greater than c. 2.5 - 3.0 m bgl due to attenuation of the GPR signal. Further investigation was carried out across areas with poor GPR signal penetration with a very low frequency antenna (40 MHz) which can typically image peat depth in excess of 10 m bgl, however it was also affected by signal attenuation and did not resolve the base of the peat.

GPR signal attenuation is typically caused by presence of materials with high electrical conductivity such as clay, ash and clinker and it is possible that the original road construction incorporated similar materials into the base layer.

Where the base of peat was not resolved with GPR, additional Russian samples were acquired to determine the peat thickness. The base of peat where interpolated between Russian samples is presented on the 2D sections as a dashed black line.

Examples of GPR data acquired on site are given in Figures 3.1 to 3.3.

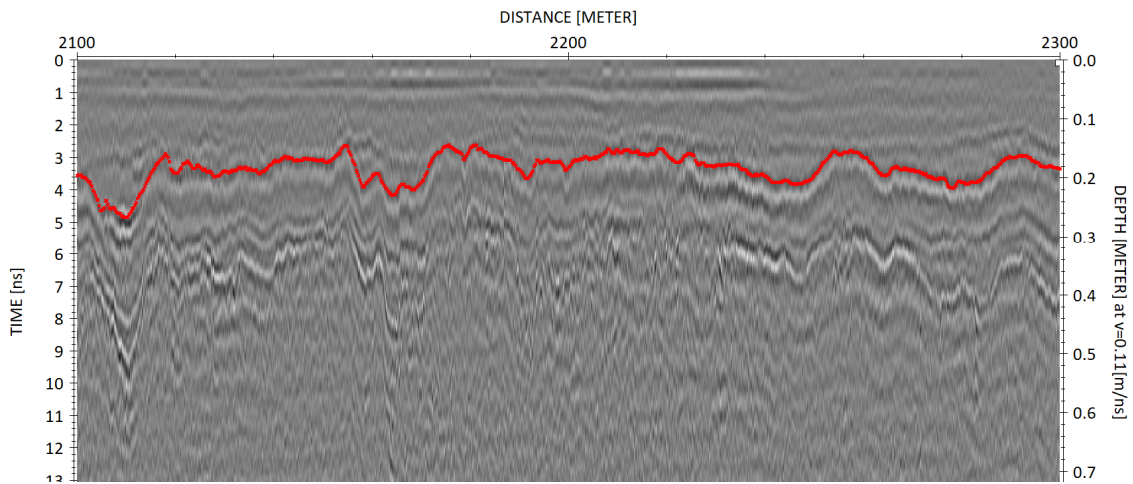


Figure 3.1: Example of 1600 MHz data acquired along Section 1 between Chainage 2100 and 2300 m. A high amplitude planar reflection (red line), interpreted as the base of bound bituminous material has been resolved from c. 0.14 m – 0.27 m bgl.

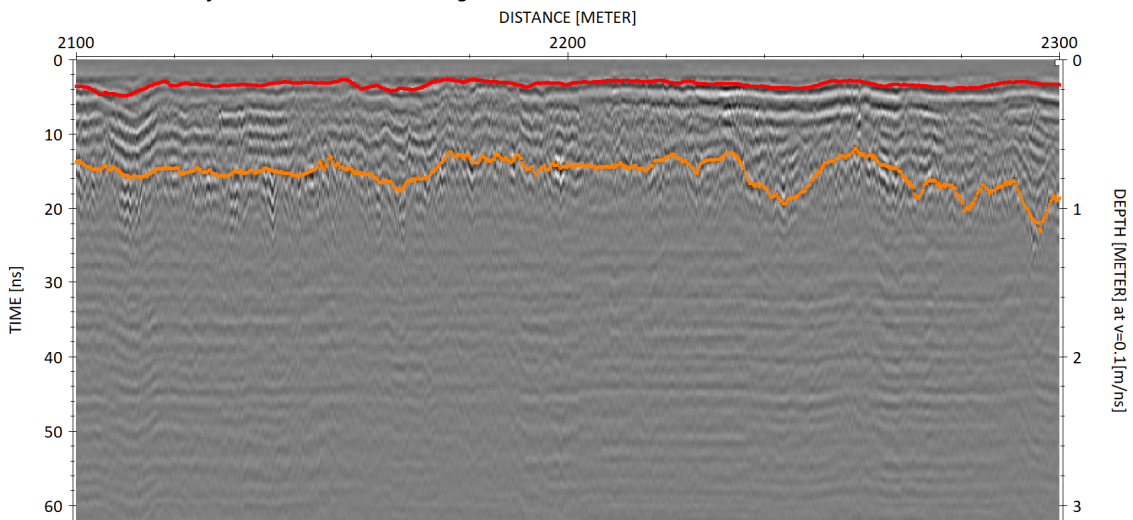


Figure 3.2: Example of 500 MHz data acquired along Section 1 between Chainage 2100 and 2300 m. A high amplitude planar reflection (orange line), interpreted as the base of subbase material has been resolved from c. 0.6 m – 1.20 m bgl.

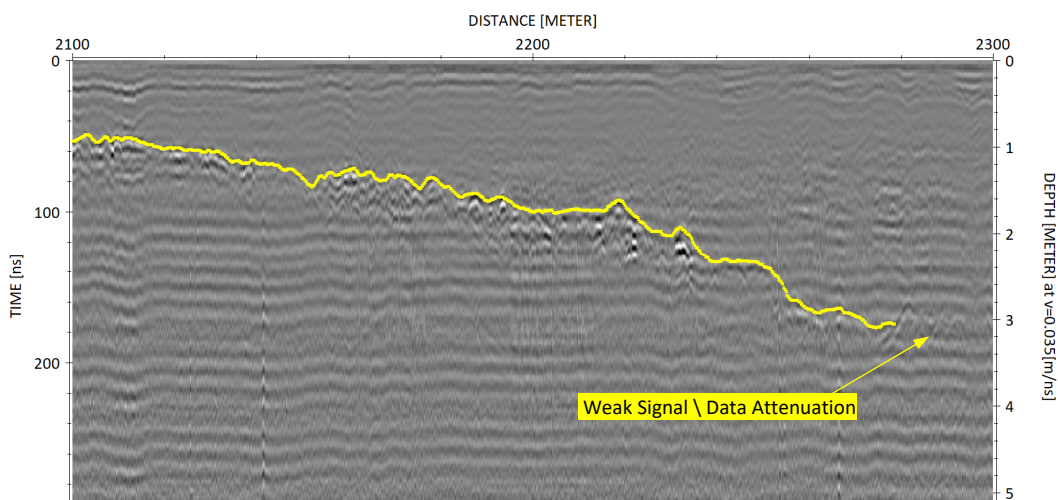


Figure 3.3: Example of 100 MHz data acquired along Section 1 between Chainage 2100 and 2300 m. A high amplitude planar reflection (yellow line), interpreted as the base of PEAT displays attenuation at depths greater than 3.0 m bgl.

#### **4. RECOMMENDATIONS**

The findings from this investigation should be reviewed upon completion of any intrusive investigations.

## REFERENCES

Transport Infrastructure Ireland 2020;  
'Pavement Assessment, Repair and Renewal Principles'  
AM-PAV-06050, Appendix F: Ground Penetrating Radar

GSI, 2018;  
Bedrock Geology 1:100,000 Shapefile. <http://www.gsi.ie/Mapping.htm>

GSIa, 2019;  
Quaternary Subsoils Shapefile. <http://www.gsi.ie/Mapping.htm>

Harry M. Jol 2009;  
'Ground Penetrating Radar: Theory & Applications'

Reflex-Win v.8.5 2017;  
'Sandmeier Geophysical Research'

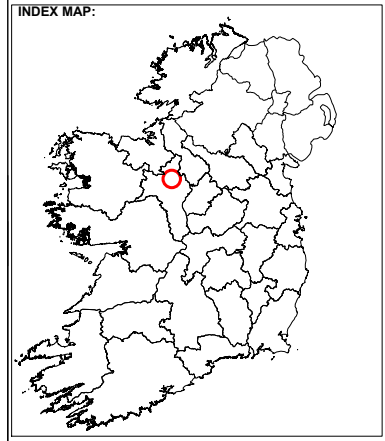
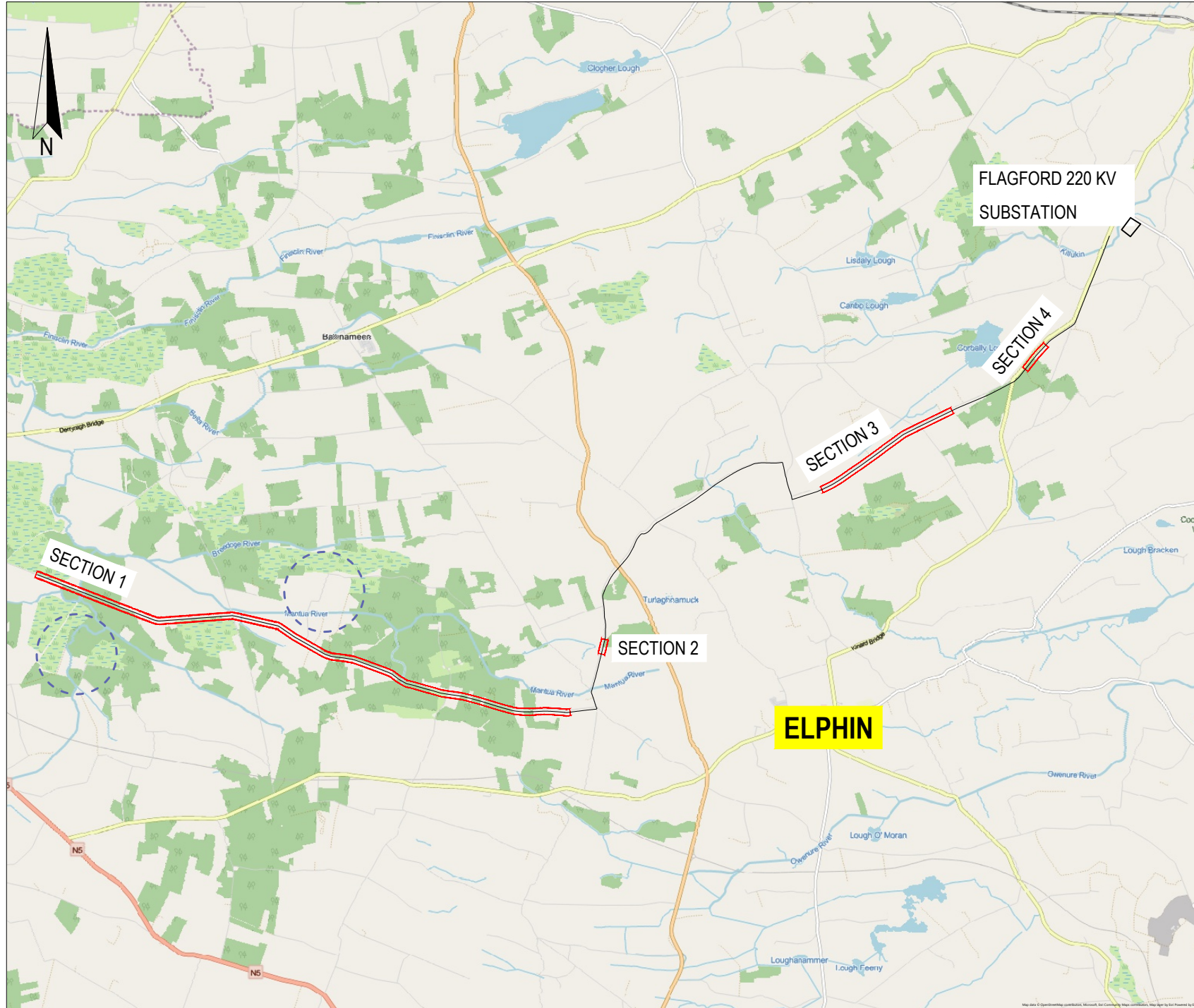
ExpertGPS v.8.52 2023;  
'TopoGrafix 1998 -2023'

## APPENDIX A: DRAWINGS

The data derived from the investigation has been presented in the following drawings:

<b>AGP25205_01 Geophysical Investigation Locations</b>	1:80,000 @ A3
<b>AGP25205_02 GPR Section 1 (Chainage: 0 - 1200 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_03 GPR Section 1 (Chainage: 1200 - 2400 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_04 GPR Section 1 (Chainage: 2400 - 3600 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_05 GPR Section 1 (Chainage: 3600 - 4800 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_06 GPR Section 1 (Chainage: 4800 - 6000 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_07 GPR Section 1 (Chainage: 6000 - 7200 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_08 GPR Section 1 (Chainage: 7200 - 8410 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_09 GPR Section 2 (Chainage: 9650 - 9900 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3 Hz - 1:4000, Vt. 1:40 @ A3
<b>AGP25205_10 GPR Section 3 (Chainage: 15130 - 16400 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3
<b>AGP25205_11 GPR Section 3 (Chainage: 16400 - 17430 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3
<b>AGP25205_12 GPR Section 4 (Chainage: 18660 - 19180 m)</b> FIGURE 1: Geophysical Investigation Locations and Peat Thickness Contours Overlain on Aerial Photo. FIGURE 2: GPR Interpretation - Flat Datum	1:4000 @ A3

GEOPHYSICAL INVESTIGATION LOCATIONS  
SCALE 1:80,000



LEGEND:

- Proposed Cable Route
- Proposed Development
- Area of Investigation - Sections 1- 4

The information displayed here is to be used in conjunction with AGP25205\_01 Report on the Geophysical Investigation at Carrageen Cable Route, Co. Meath for Carraigin Power Limited., APEX Geophysics Ltd. 12<sup>th</sup> January 2026.

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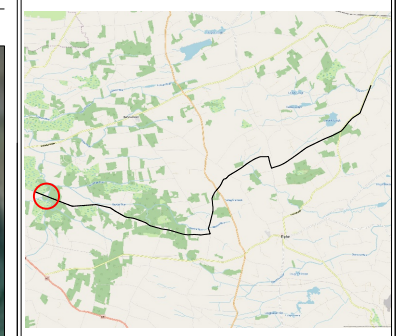
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CLIENT: CARRAIGIN POWER LIMITED			
DRAWING NO: AGP25205_01			
SCALE: AS INDICATED @ A3			
DATE: 12-01-2026			
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FIGURE 1: GPR SECTION 1 (CHAINAGE: 0 - 1200 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

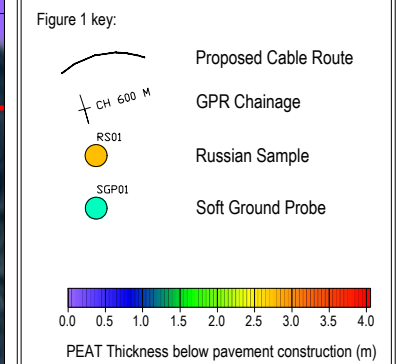


FIGURE 2: GPR SECTION 1 (CHAINAGE: 0 - 1200 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

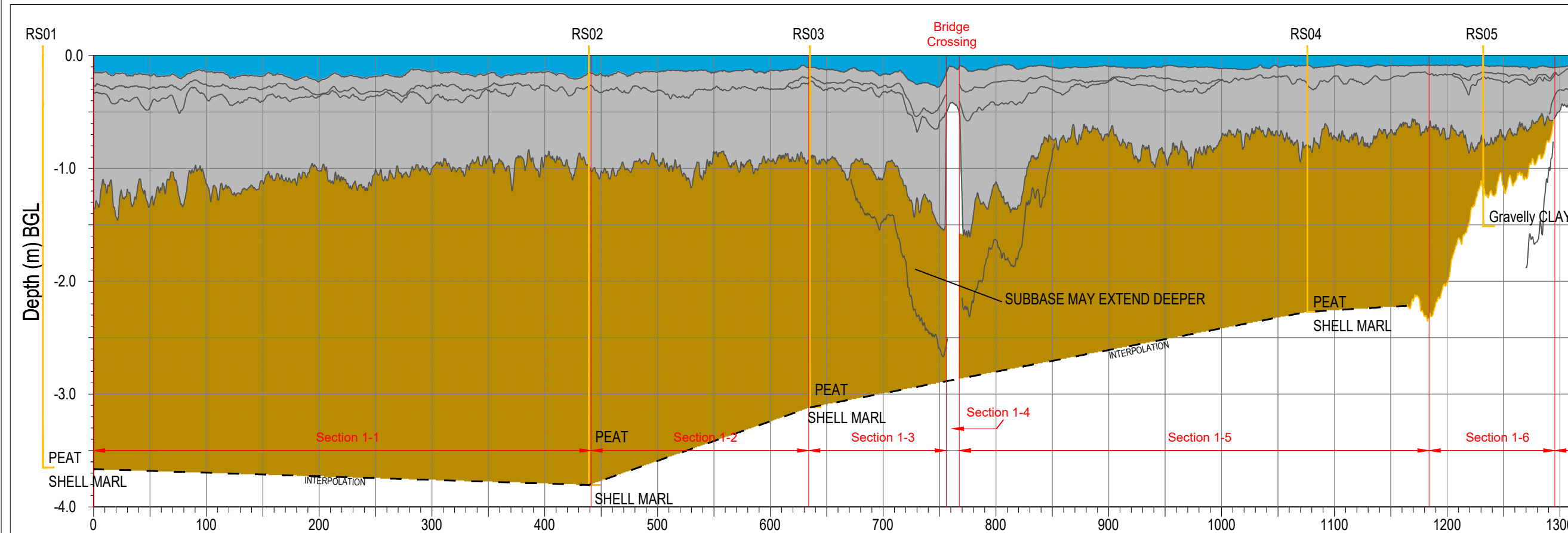
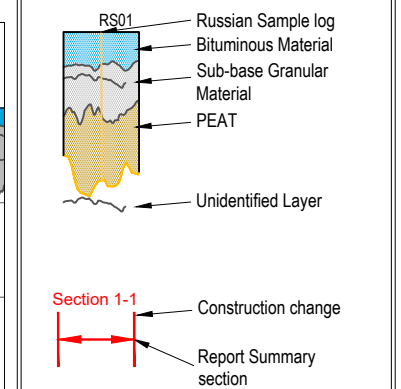


Figure 2 key:



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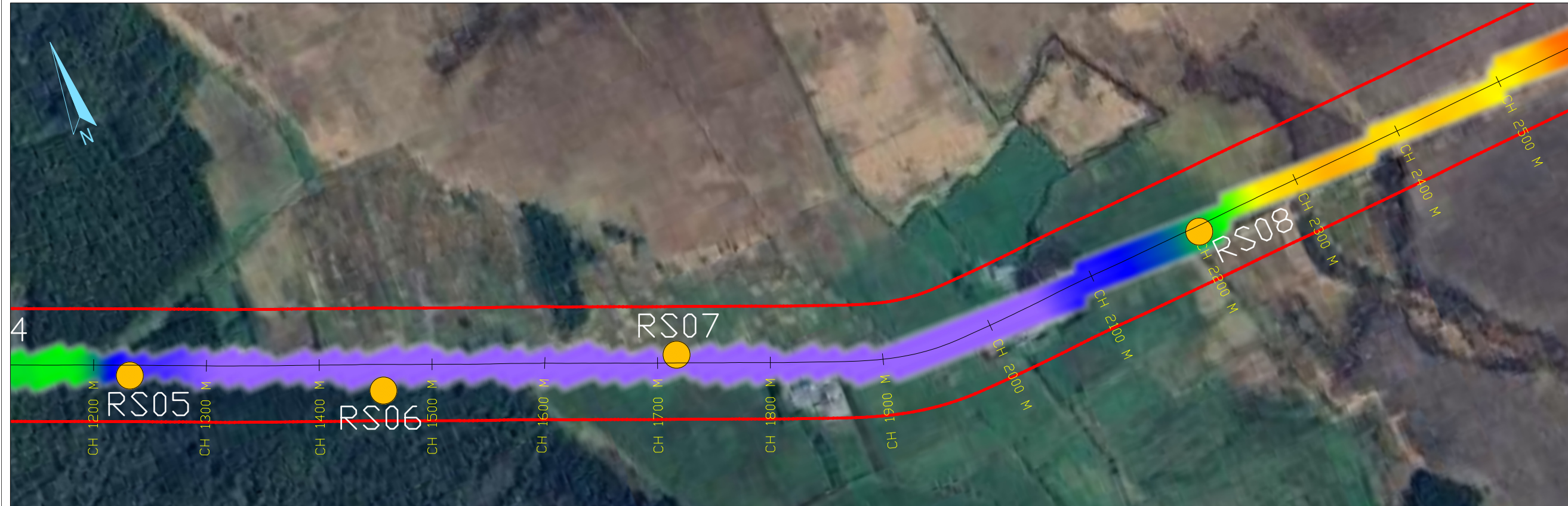
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GEOPHYSICAL INVESTIGATION  
CLIENT: CARRAIGIN POWER LIMITED  
DRAWING NO: AGP25205\_02  
SCALE: AS INDICATED @ A3  
DATE: 12-01-2026

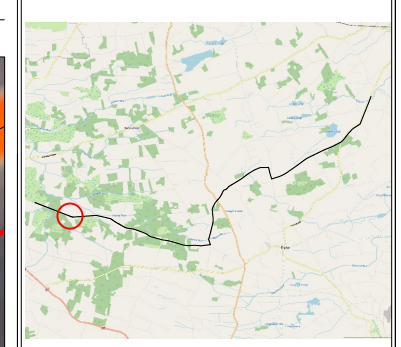
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FIGURE 1: GPR SECTION 1 (CHAINAGE: 1200- 2400 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



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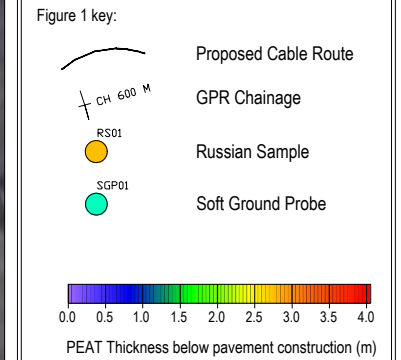


FIGURE 2: GPR SECTION 1 (CHAINAGE: 1200- 2400 m) - GPR INTERPRETATION - FLAT DATUM

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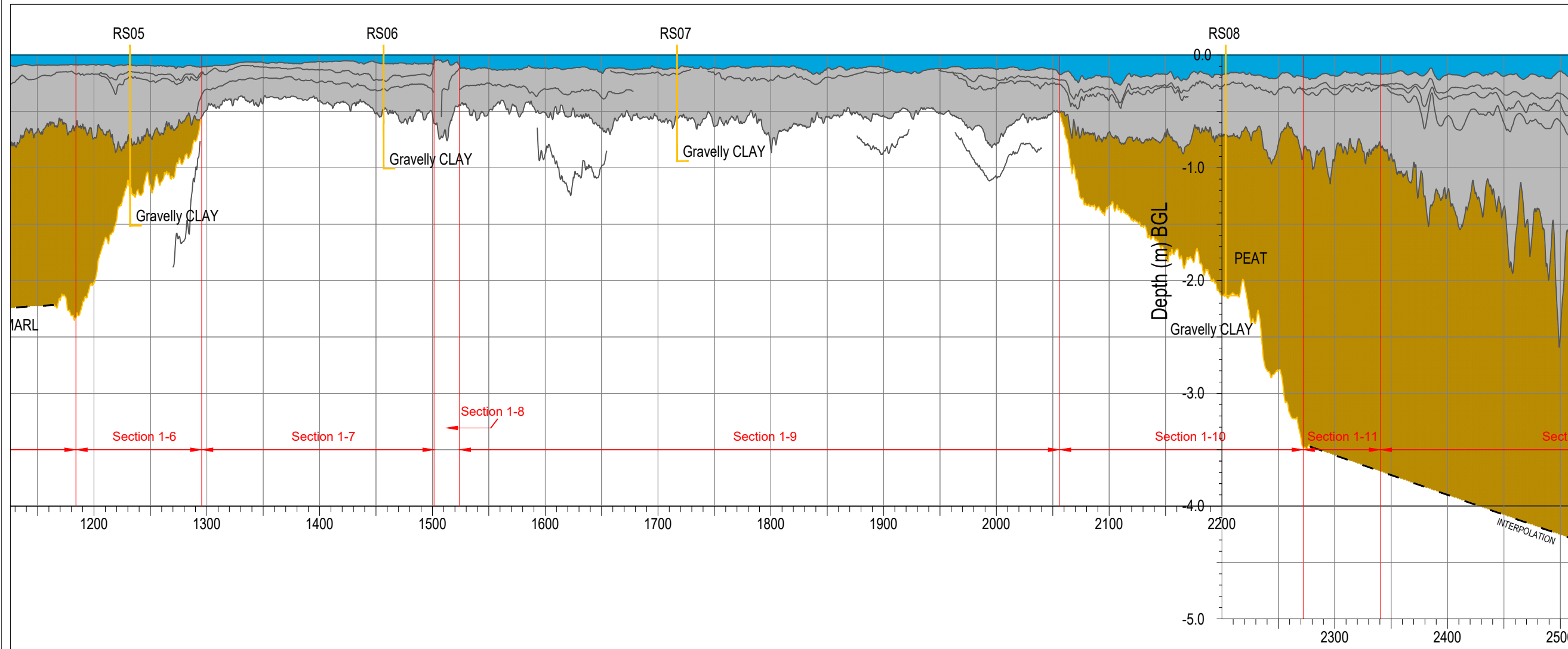
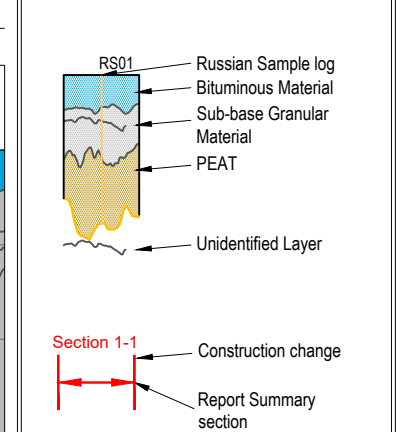


Figure 2 key:



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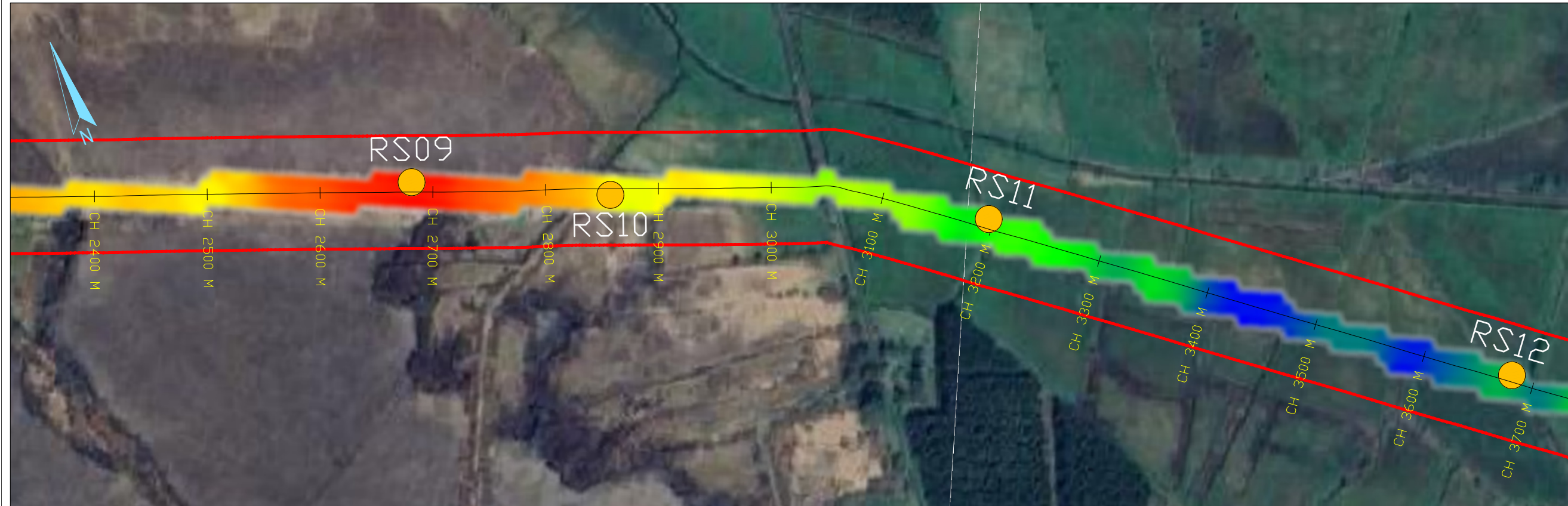
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GEOPHYSICAL INVESTIGATION  
CLIENT: CARRAIGIN POWER LIMITED  
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SCALE: AS INDICATED @ A3  
DATE: 12-01-2026

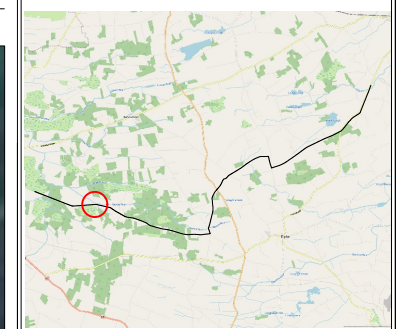
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FIGURE 1: GPR SECTION 1 (CHAINAGE: 2400 - 3600 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

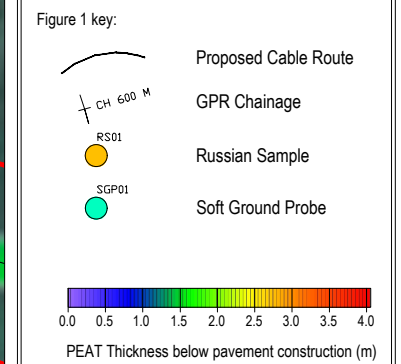


FIGURE 2: GPR SECTION 1 (CHAINAGE: 2400 - 3600 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

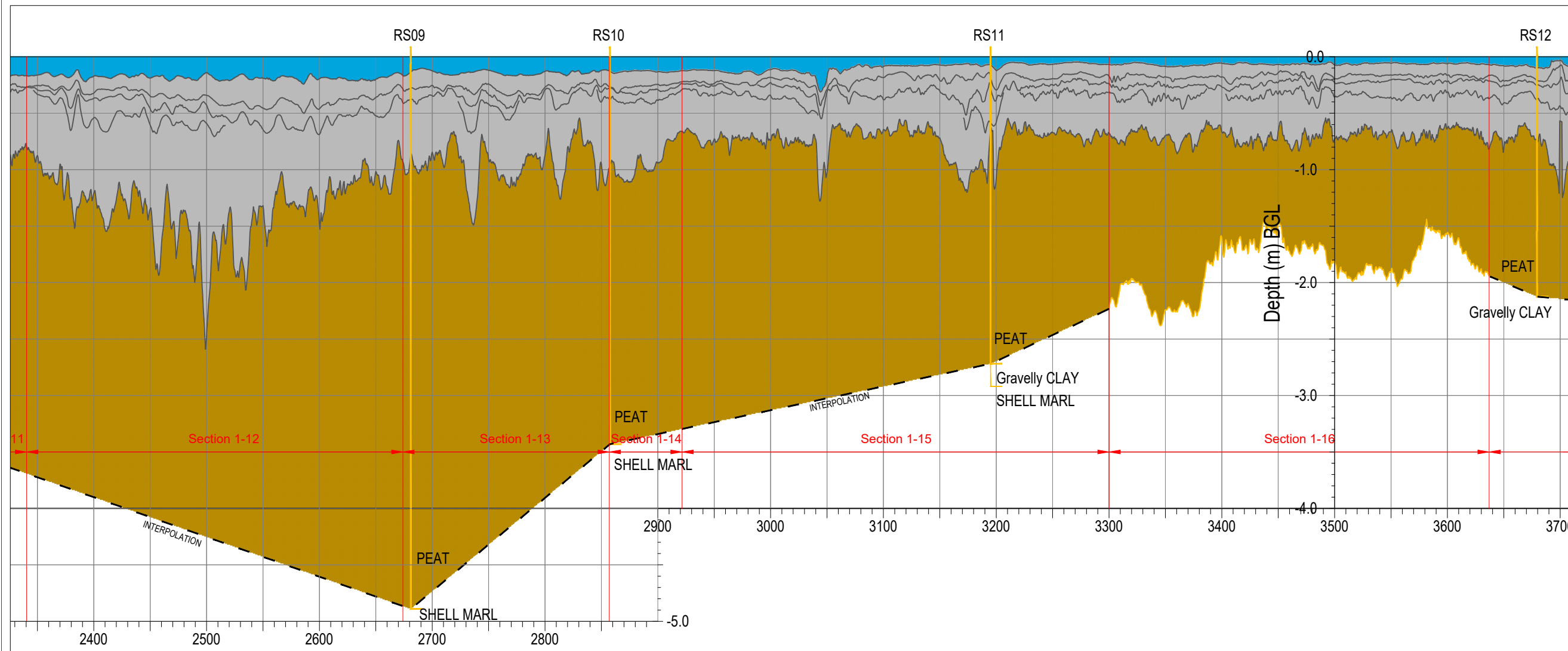
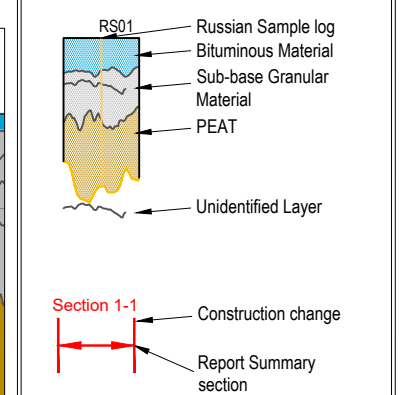


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CLIENT: CARRAIGIN POWER LIMITED

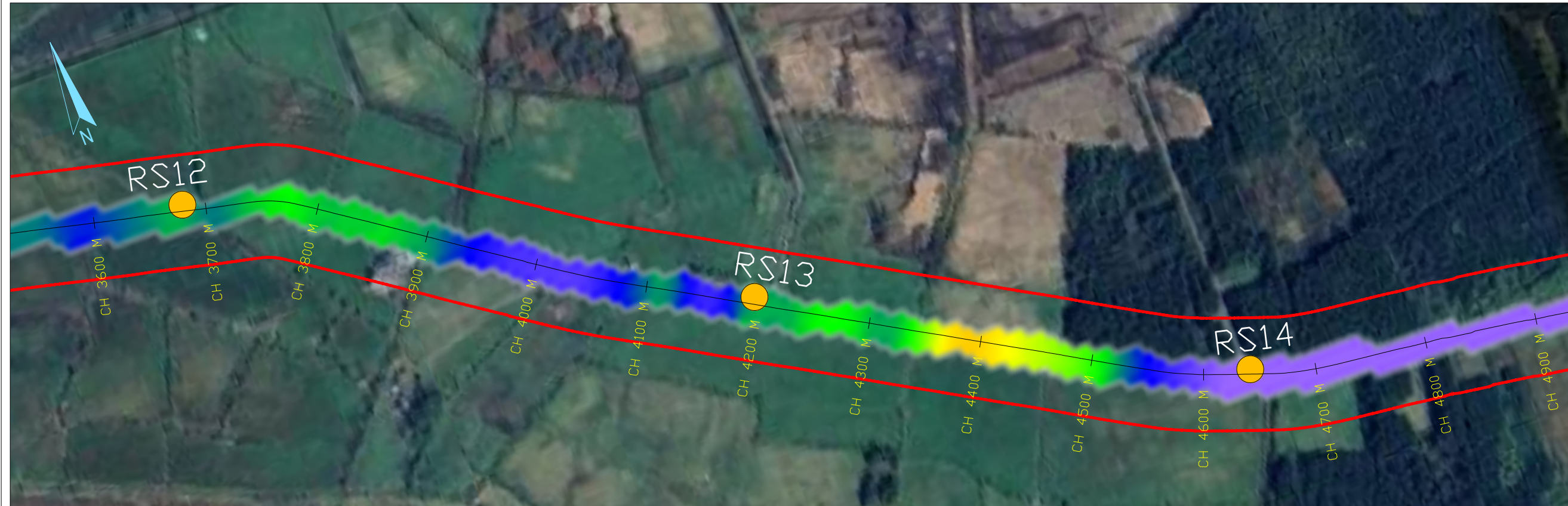
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SCALE: AS INDICATED @ A3

DATE: 12-01-2026

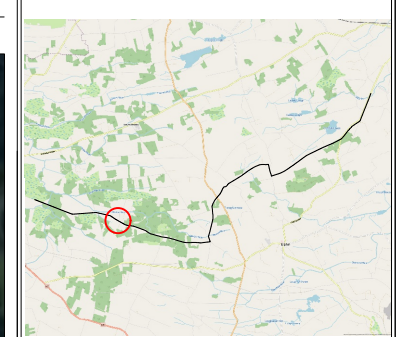
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 1 (CHAINAGE: 3600 - 4800 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

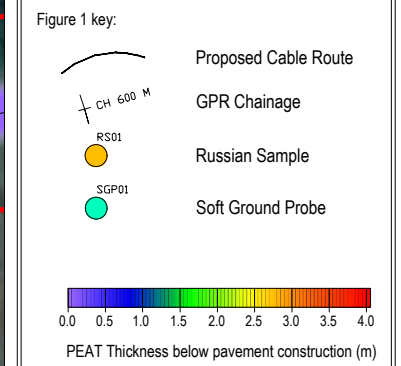


FIGURE 2: GPR SECTION 1 (CHAINAGE: 3600 - 4800 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

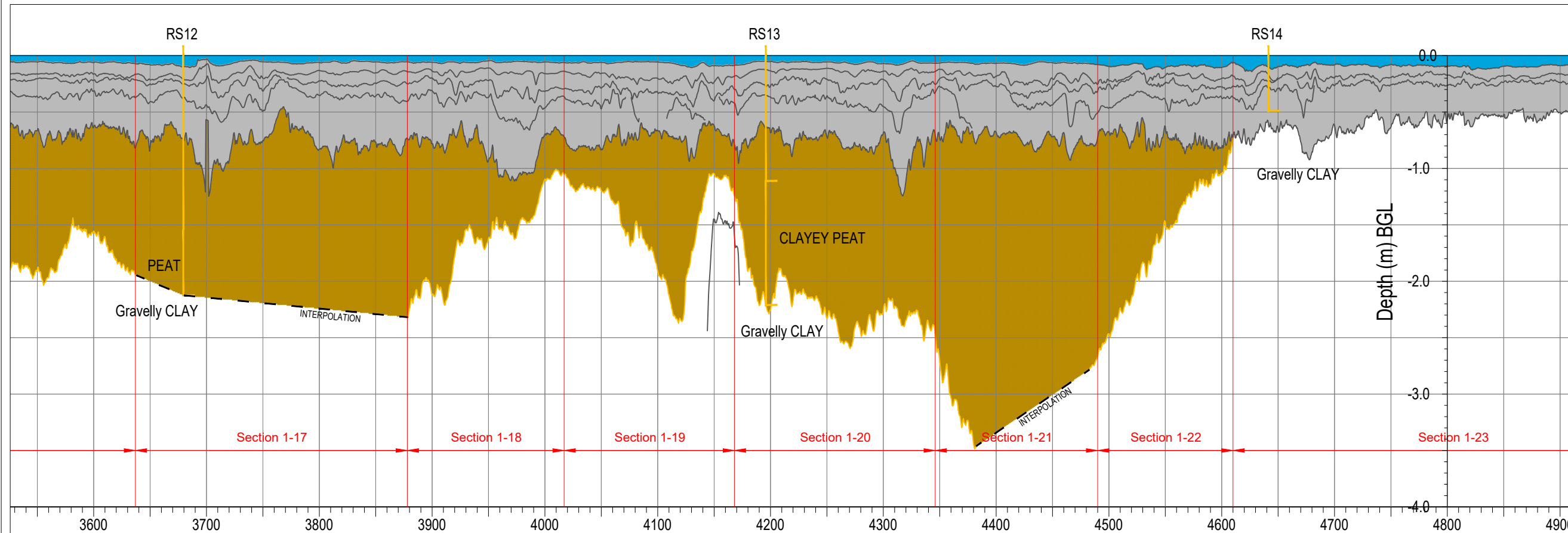
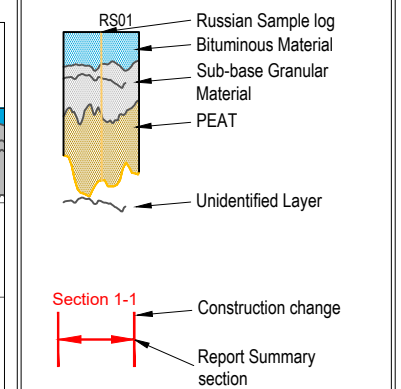


Figure 2 key:



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PROJECT: CARRIGEEN CABLE ROUTE  
GEOPHYSICAL INVESTIGATION  
CLIENT: CARRAIGIN POWER LIMITED

DRAWING NO: AGP25205\_05  
SCALE: AS INDICATED @ A3

DATE: 12-01-2026

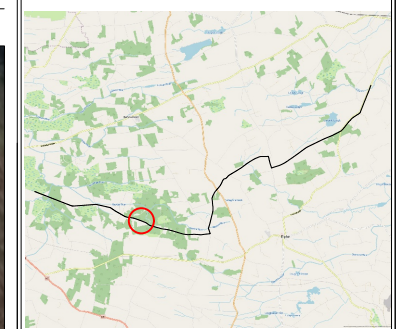
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 1 (CHAINAGE: 4800 - 6000 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

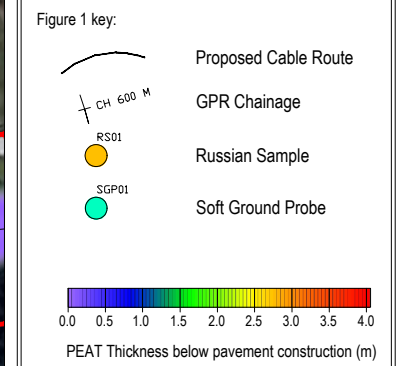


FIGURE 2: GPR SECTION 1 (CHAINAGE: 4800 - 6000 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

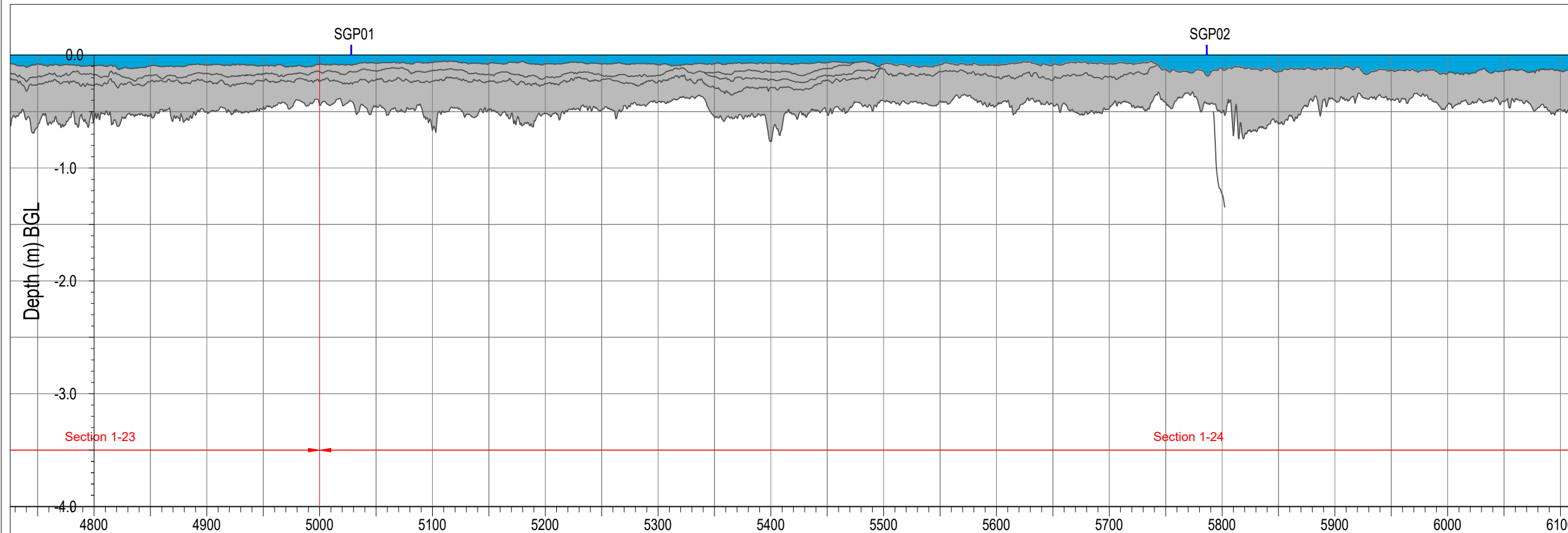
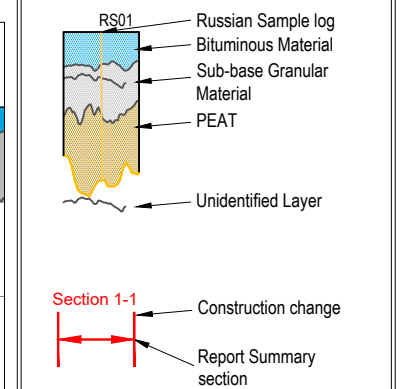


Figure 2 key:



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GEOPHYSICAL INVESTIGATION

CLIENT: CARRAIGIN POWER LIMITED

DRAWING NO: AGP25205\_06

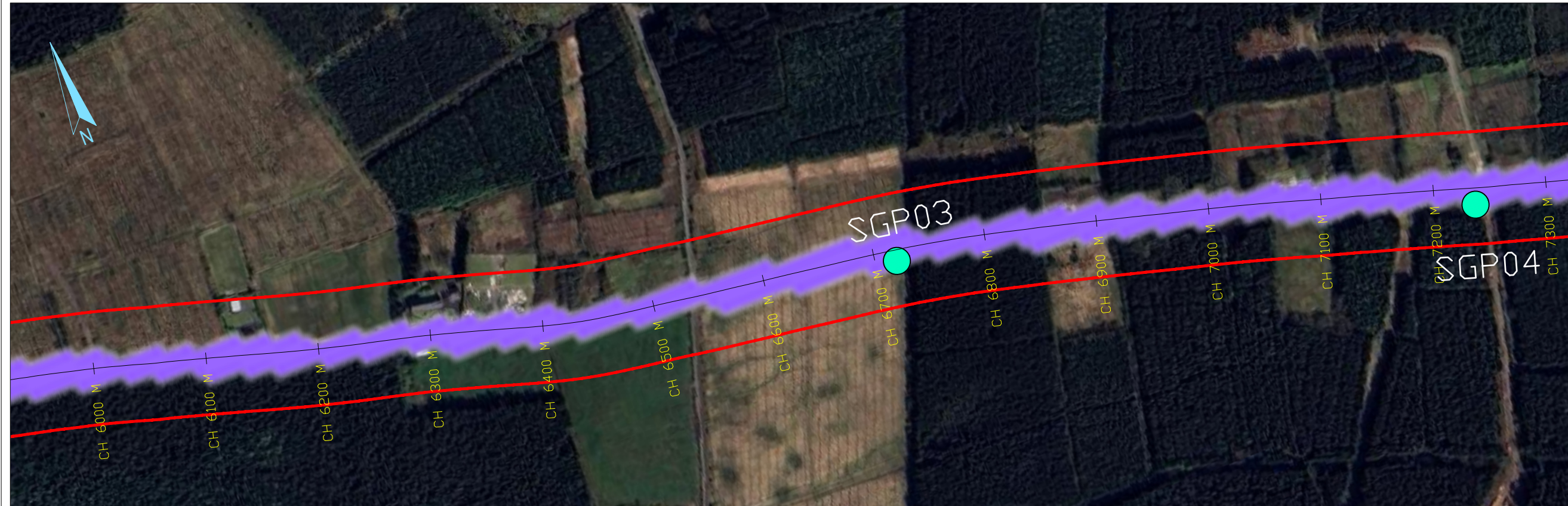
SCALE: AS INDICATED @ A3

DATE: 12-01-2026

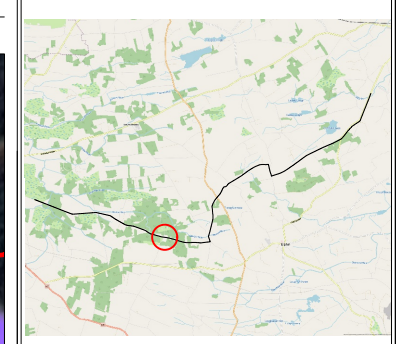
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 1 (CHAINAGE: 6000 - 7200 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

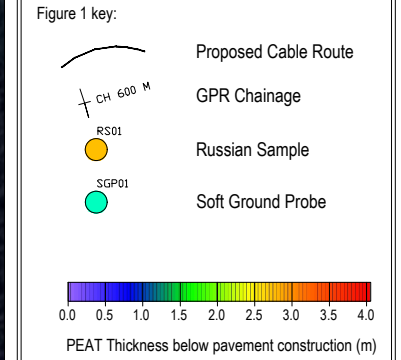


FIGURE 2: GPR SECTION 1 (CHAINAGE: 6000- 7200 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

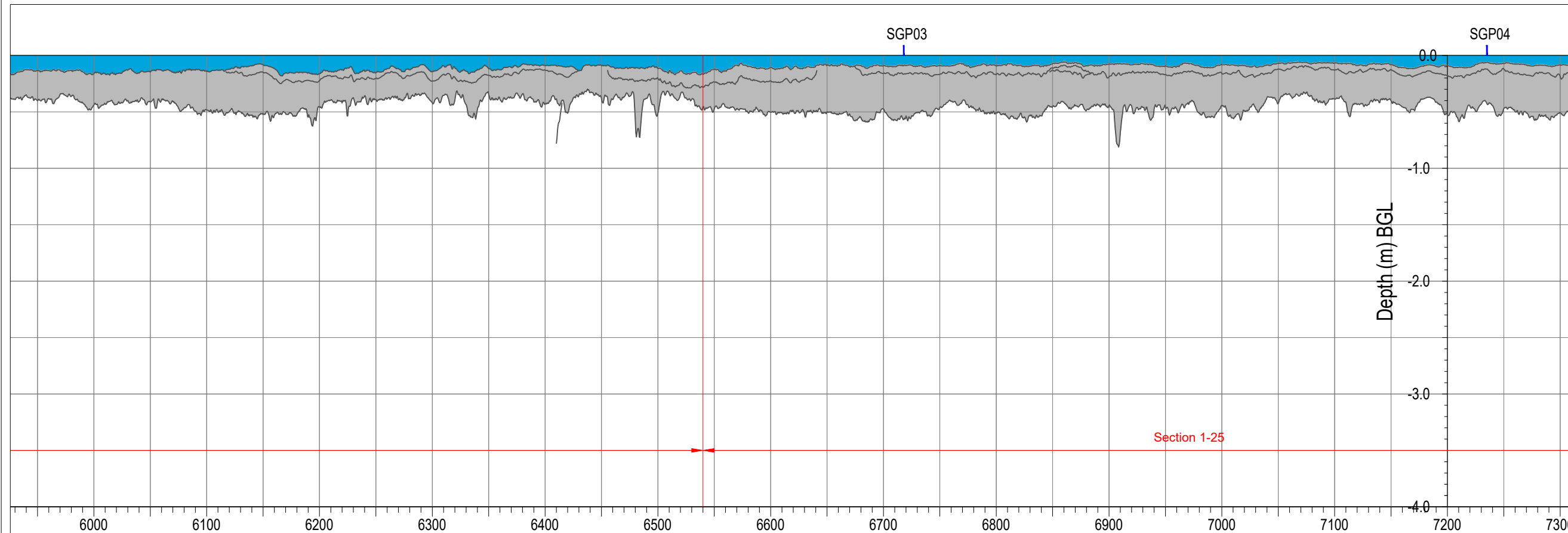
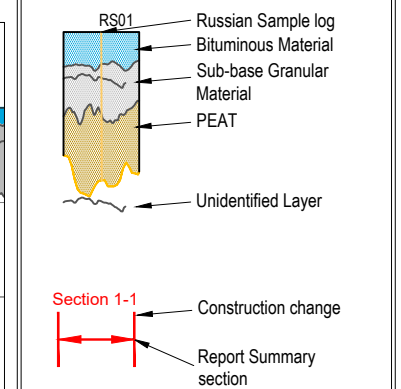


Figure 2 key:



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CLIENT: CARRAIGIN POWER LIMITED

DRAWING NO: AGP25205\_07

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DATE: 12-01-2026

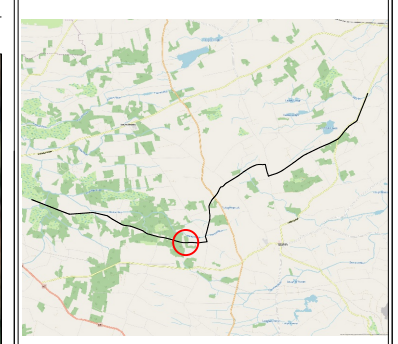
Version:	Date:	Drawn By:	Checked:
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FIGURE 1: GPR SECTION 1 (CHAINAGE: 7200 - 8410 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

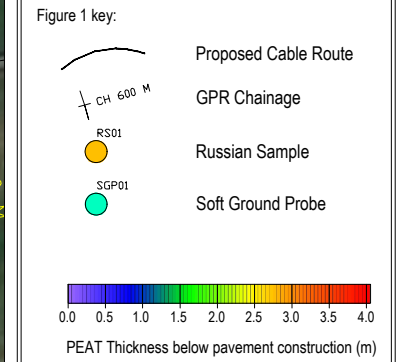


FIGURE 2: GPR SECTION 1 (CHAINAGE: 7200 - 8410 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

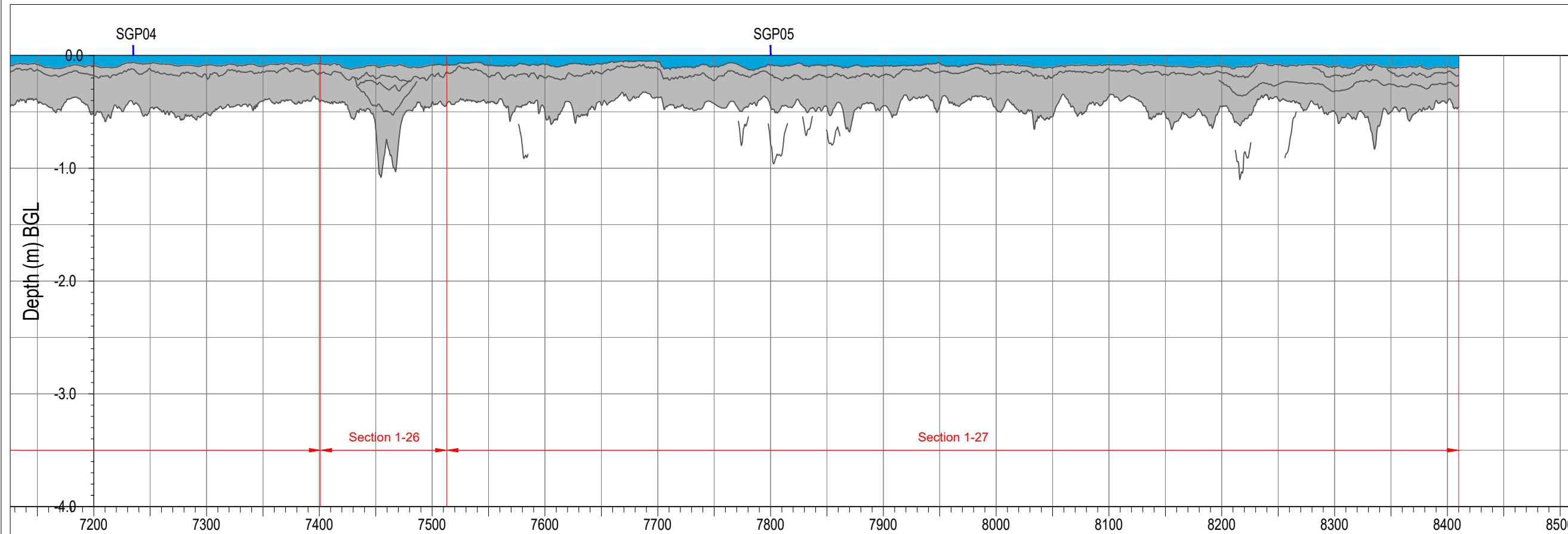
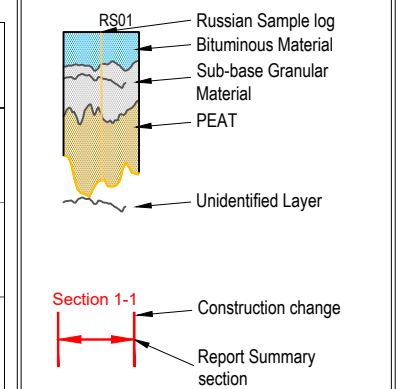


Figure 2 key:



The information displayed here is to be used in conjunction with AGP25205\_01 Report on the Geophysical Investigation at Carrigen Cable Route, Co. Meath for Carrigen Power Limited., APEX Geophysics Ltd. 12<sup>th</sup> January 2026.



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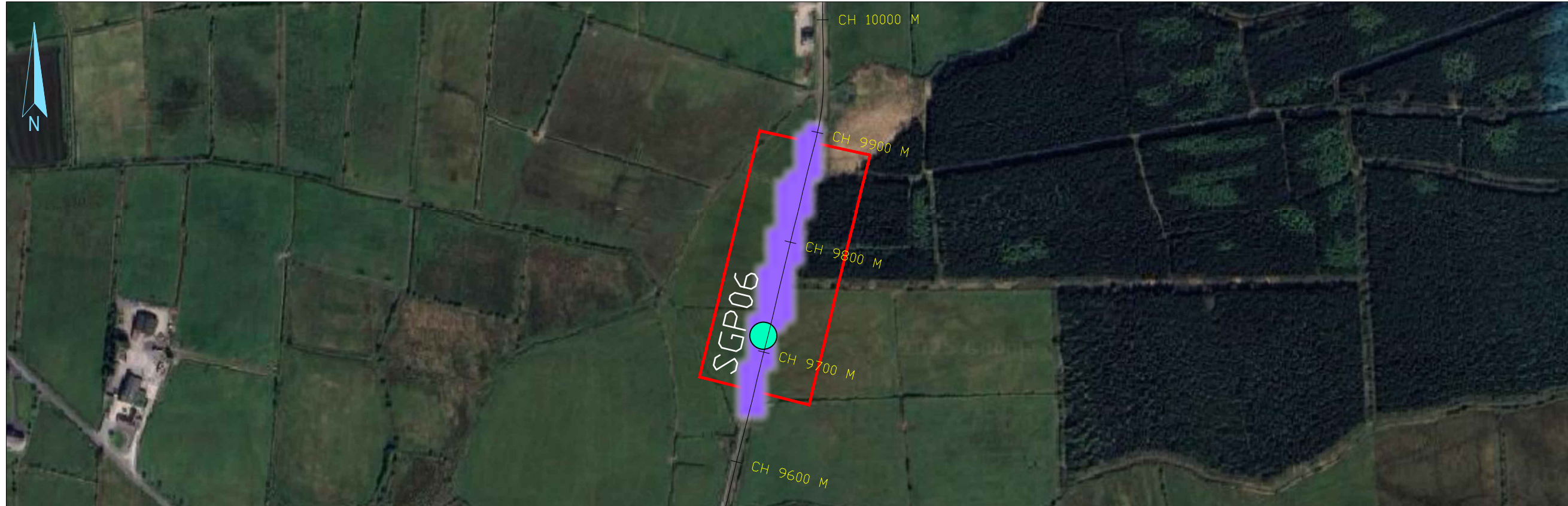
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CLIENT: CARRAIGIN POWER LIMITED  
DRAWING NO: AGP25205\_08  
SCALE: AS INDICATED @ A3  
DATE: 12-01-2026

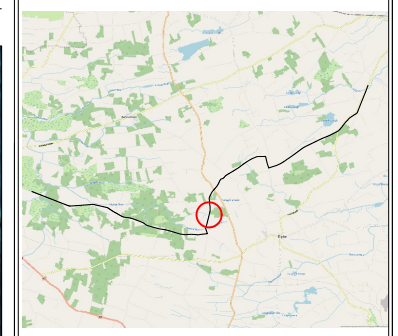
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 2 (CHAINAGE: 9650 - 9900 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

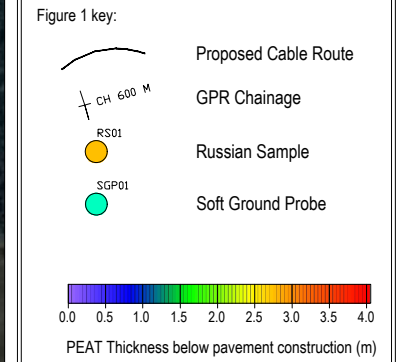


FIGURE 2: GPR SECTION 2 (CHAINAGE: 9650 - 9900 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

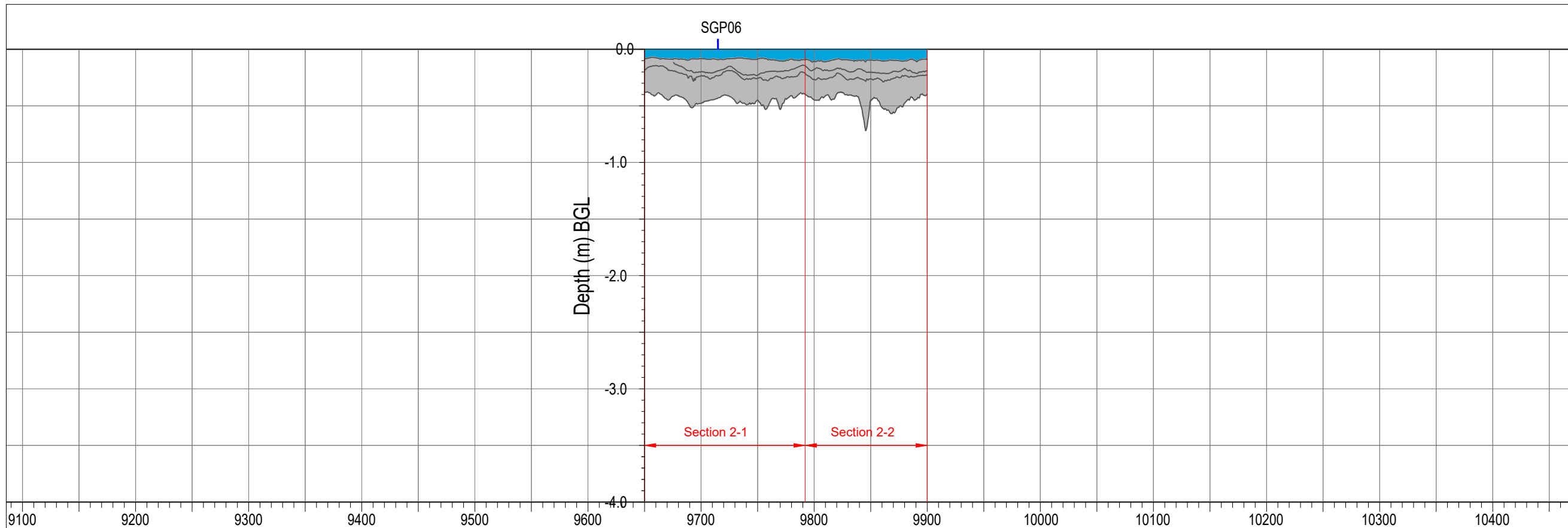
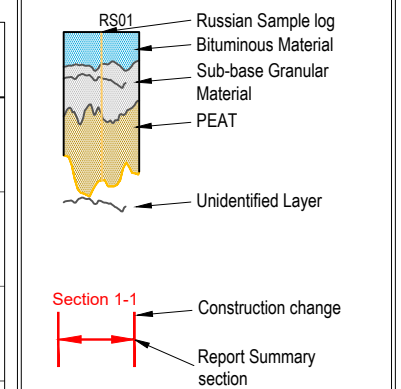


Figure 2 key:



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DRAWING NO: AGP25205\_09  
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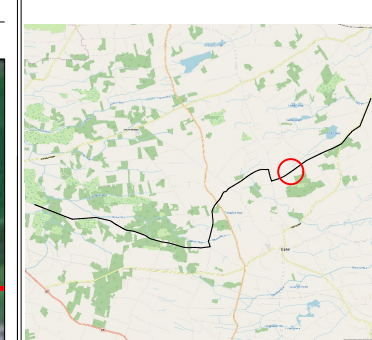
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 3 (CHAINAGE: 15130 - 16400 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

Figure 1 key:

- Proposed Cable Route
- GPR Chainage
- Russian Sample
- Soft Ground Probe

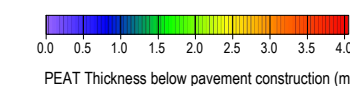
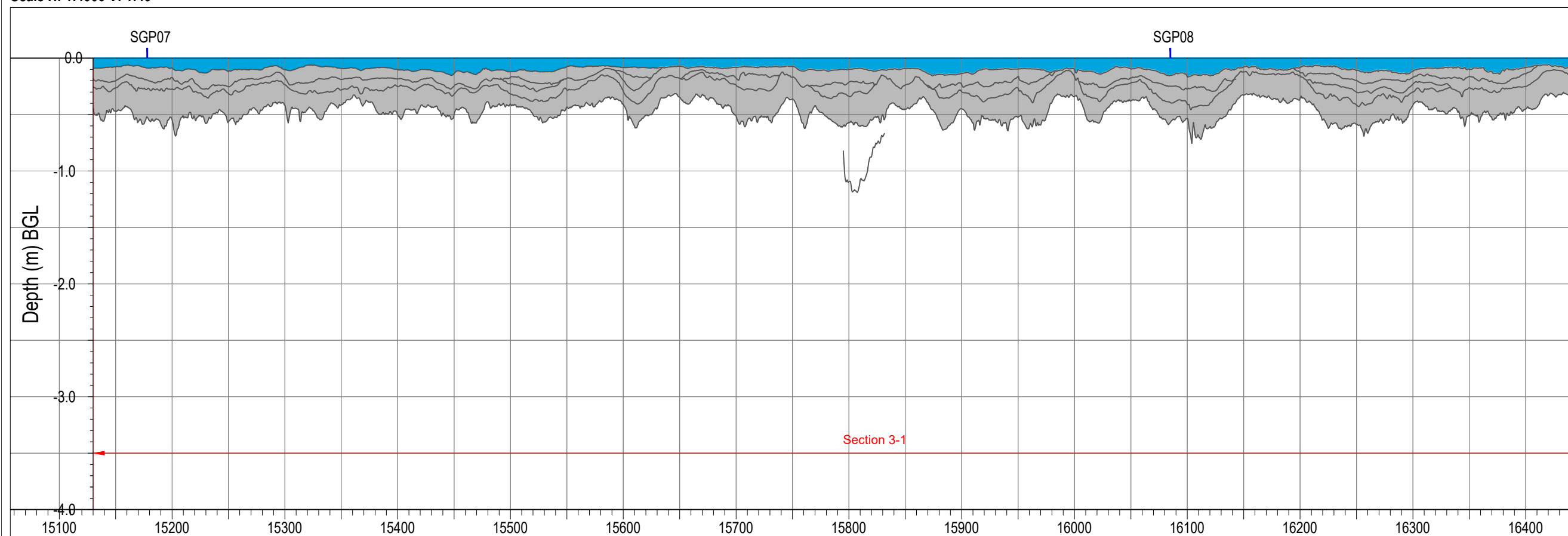


Figure 2 key:

- Russian Sample log
- Bituminous Material
- Sub-base Granular Material
- PEAT
- Unidentified Layer
- Section 1-1
- Construction change
- Report Summary section

FIGURE 2: GPR SECTION 3 (CHAINAGE: 15130 - 16400 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40



The information displayed here is to be used in conjunction with AGP25205\_01 Report on the Geophysical Investigation at Carrigeen Cable Route, Co. Meath for Carrigeen Power Limited., APEX Geophysics Ltd. 12<sup>th</sup> January 2026.



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DRAWING NO: AGP25205\_10

SCALE: AS INDICATED @ A3

DATE: 12-01-2026

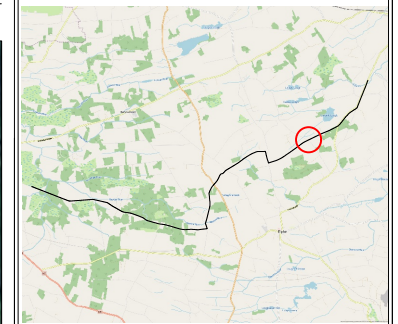
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 3 (CHAINAGE: 16400 - 17430m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

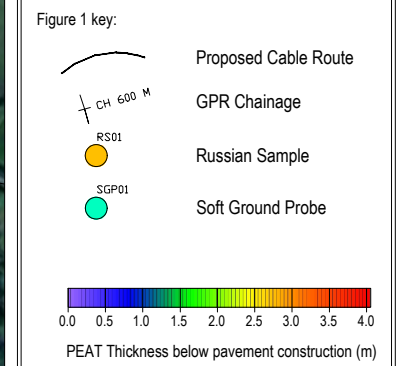


FIGURE 2: GPR SECTION 3 (CHAINAGE: 16400 - 17430 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

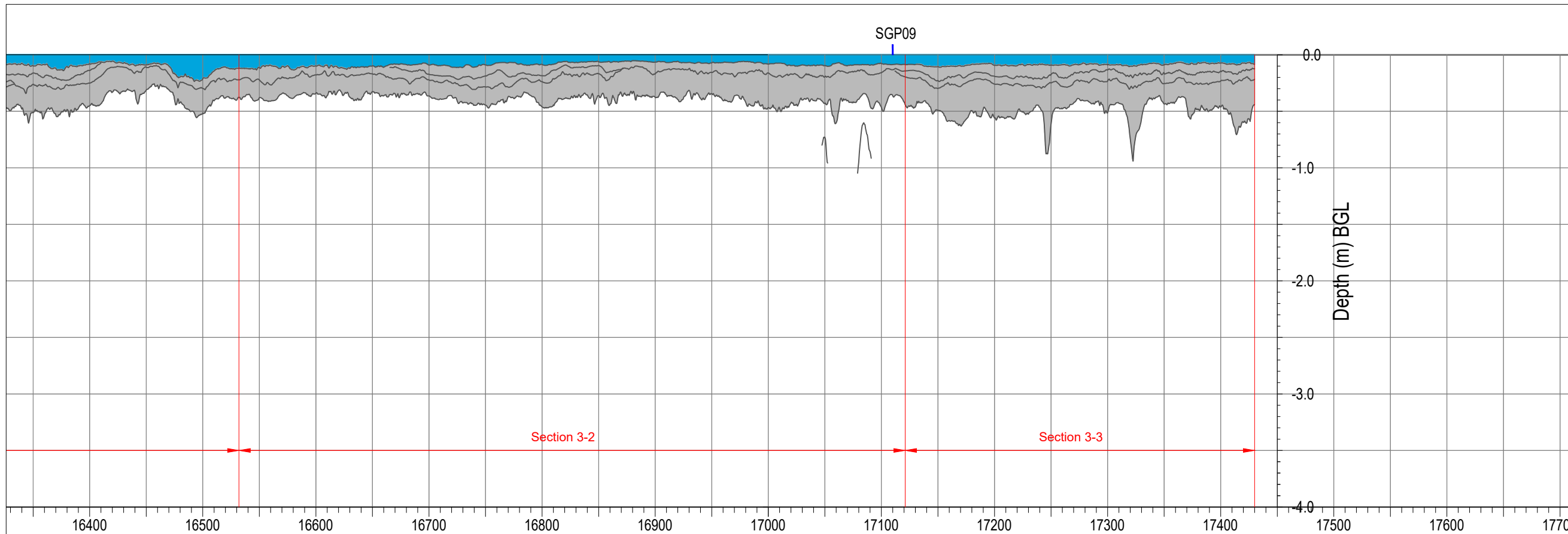
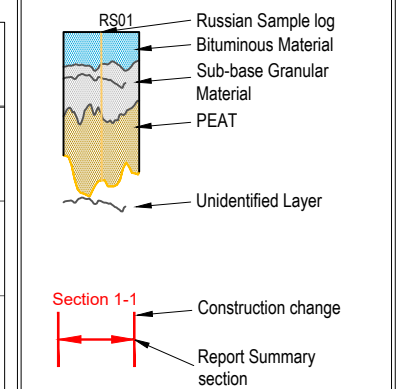


Figure 2 key:



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DRAWING NO: AGP25205\_11

SCALE: AS INDICATED @ A3

DATE: 12-01-2026

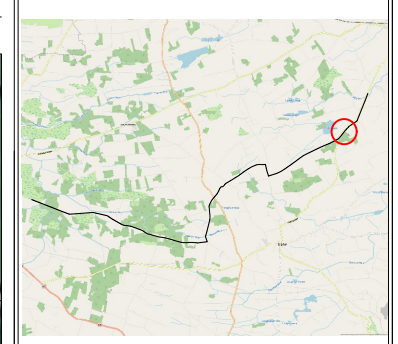
Version:	Date:	Drawn By:	Checked:
01	12-01-2026	IS	TL

FIGURE 1: GPR SECTION 4 (CHAINAGE: 18660 - 19180 m) - GEOPHYSICAL INVESTIGATION LOCATIONS AND PEAT THICKNESS CONTOURS OVERLAIN ON AERIAL PHOTO

Scale 1:4000



INDEX MAP:



LEGEND:

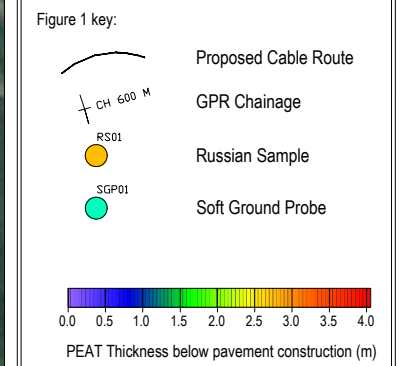


FIGURE 2: GPR SECTION 4 (CHAINAGE: 18660 - 19180 m) - GPR INTERPRETATION - FLAT DATUM

Scale H: 1:4000 V: 1:40

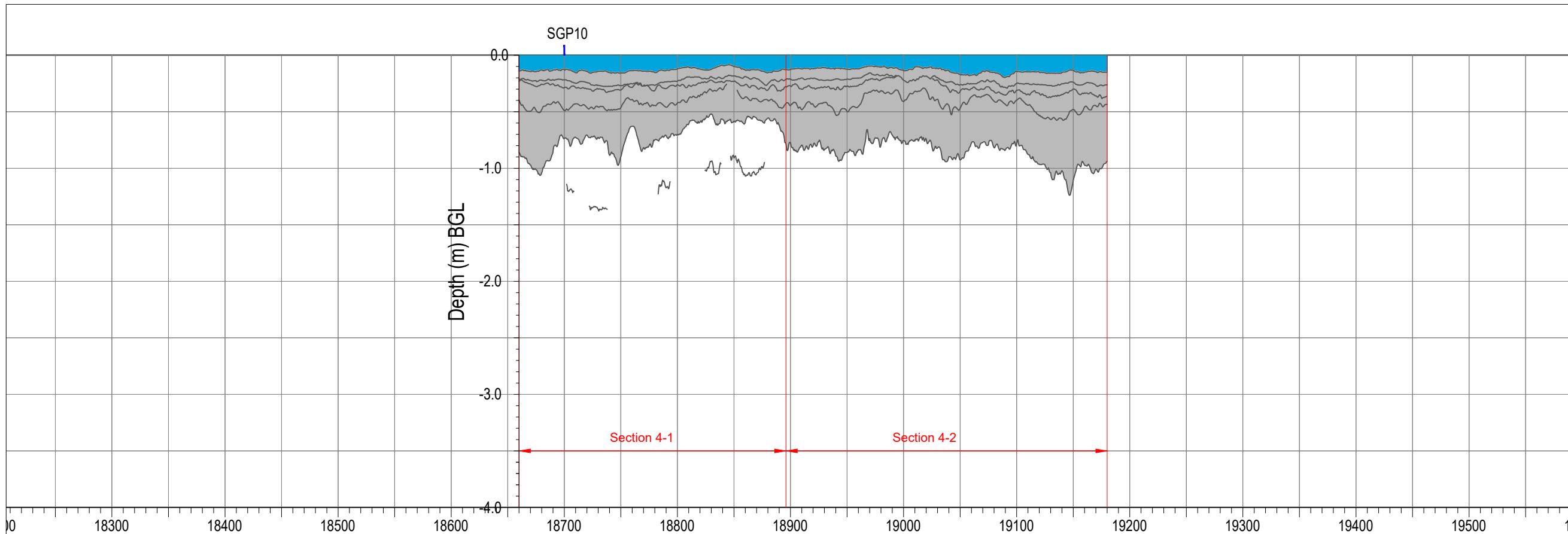
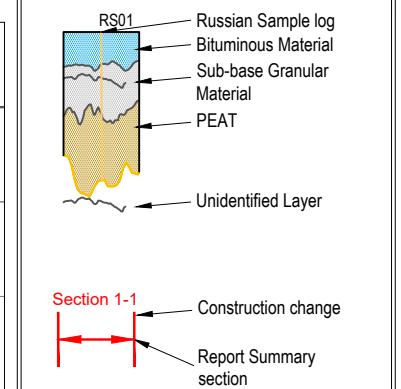


Figure 2 key:



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**APPENDIX B: PAVEMENT CONSTRUCTION SUMMARY TABLES**

**Section 1: Lane 1 Eastbound**

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			PEAT DEPTH			REPORT SECTION
start (m)	end (m)	easting ITM	northing ITM	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	
	0	575476.3	790645.4										
0.0	441.0	575887.4	790486.0	0.117	0.233	0.170	0.834	1.459	1.076	3.664	3.805	3.735	SECTION 1-1
441.0	634.0	576067.2	790415.8	0.086	0.188	0.140	0.847	1.171	0.968	3.122	3.798	3.460	SECTION 1-2
634.0	756.0	576180.8	790371.3	0.102	0.281	0.167	0.514	1.547	1.089	2.886	3.122	3.003	SECTION 1-3
756.0	767.5	576191.5	790367.1	0.091	0.155	0.110	0.414	0.517	0.449	na	na	na	SECTION 1-4
767.5	1184.0	576579.5	790215.9	0.078	0.140	0.100	0.517	1.609	0.829	2.119	2.864	2.483	SECTION 1-5
1184.0	1295.5	576683.1	790174.7	0.082	0.121	0.094	0.511	0.864	0.680	0.569	2.332	1.324	SECTION 1-6
1295.5	1501.5	576875.4	790100.7	0.051	0.105	0.071	0.357	0.612	0.444	na	na	na	SECTION 1-7
1501.5	1524.0	576896.3	790092.6	0.040	0.092	0.063	0.438	0.761	0.614	na	na	na	SECTION 1-8
1524.0	2056.0	577403.0	789957.4	0.091	0.173	0.120	0.400	0.867	0.561	na	na	na	SECTION 1-9
2056.0	2272.0	577618.4	789973.0	0.141	0.267	0.184	0.496	0.966	0.723	0.512	3.482	1.908	SECTION 1-10
2272.0	2340.5	577686.7	789977.6	0.144	0.217	0.175	0.738	1.143	0.862	3.455	3.691	3.572	SECTION 1-11
2340.5	2674.0	578019.3	790002.4	0.115	0.243	0.182	0.739	2.590	1.331	3.691	4.865	4.278	SECTION 1-12
2674.0	2857.0	578201.8	790016.5	0.102	0.171	0.141	0.542	1.491	0.947	3.435	4.890	4.190	SECTION 1-13
2857.0	2921.5	578266.1	790020.5	0.121	0.148	0.131	0.657	1.113	0.930	3.298	3.435	3.367	SECTION 1-14
2921.5	3300.0	578638.6	789979.0	0.046	0.312	0.098	0.545	1.278	0.741	2.233	3.298	2.861	SECTION 1-15
3300.0	3637.0	578967.1	789903.9	0.046	0.089	0.065	0.541	0.860	0.701	1.434	2.383	1.853	SECTION 1-16
3637.0	3878.0	579185.5	789811.1	0.030	0.104	0.064	0.453	1.247	0.766	1.941	2.319	2.188	SECTION 1-17
3878.0	4017.0	579300.0	789732.4	0.043	0.071	0.058	0.577	1.113	0.825	1.007	2.319	1.637	SECTION 1-18
4017.0	4168.0	579430.2	789656.0	0.052	0.106	0.070	0.580	0.938	0.734	1.043	2.374	1.478	SECTION 1-19
4168.0	4346.0	579584.9	789568.1	0.045	0.085	0.063	0.579	1.243	0.786	1.242	2.596	2.207	SECTION 1-20
4346.0	4490.0	579710.1	789496.8	0.053	0.086	0.067	0.572	0.928	0.732	2.479	3.487	3.086	SECTION 1-21
4490.0	4610.0	579816.7	789442.2	0.059	0.124	0.091	0.549	0.870	0.738	0.729	2.667	1.644	SECTION 1-22
4610.0	5000.0	580199.5	789374.7	0.058	0.141	0.092	0.390	0.923	0.572	na	na	na	SECTION 1-23
5000.0	6540.0	581635.6	788851.2	0.052	0.185	0.101	0.298	0.766	0.453	na	na	na	SECTION 1-24
6540.0	7401.0	582469.6	788643.5	0.058	0.167	0.088	0.323	0.812	0.472	na	na	na	SECTION 1-25
7401.0	7513.0	582577.7	788614.4	0.071	0.123	0.094	0.397	1.082	0.547	na	na	na	SECTION 1-26
7513.0	8410.0	583471.0	788584.0	0.046	0.133	0.089	0.322	0.831	0.459	na	na	na	SECTION 1-27

**Section 2: Lane 1 Eastbound**

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			PEAT DEPTH			REPORT SECTION
start (m)	end (m)	easting ITM	northing ITM	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	
8410.0	9650.0												
9650.0	9792.0	583963.6	789579.1	0.070	0.106	0.087	0.372	0.533	0.444	na	na	na	SECTION 2-1
9792.0	9900.0	583989.3	789684.0	0.084	0.112	0.098	0.377	0.720	0.459	na	na	na	SECTION 2-2

**Section 3: Lane 1 Eastbound**

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			ESTIMATED PEAT DEPTH			REPORT SECTION
start (m)	end (m)	easting ITM	northing ITM	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	
9900.0	15130.0												
15130.0	16532.0	588399.9	792702.5	0.057	0.236	0.101	0.256	0.755	0.469	na	na	na	SECTION 3-1
16532.0	17121.0	588921.0	792974.8	0.051	0.135	0.085	0.311	0.609	0.389	na	na	na	SECTION 3-2
17121.0	17430.0	589198.9	793109.9	0.065	0.110	0.087	0.360	0.941	0.502	na	na	na	SECTION 3-3

**Section 4: Lane 1 Eastbound**

CHAINAGE		COORDINATES		BITUMINOUS MATERIAL			SUBBASE MATERIAL			PEAT DEPTH			REPORT SECTION
start (m)	end (m)	easting ITM	northing ITM	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	min. depth (m bgl)	max. depth (m bgl)	avg. depth (m bgl)	
17430.0	18660.0												
18660.0	18896.0	590410.8	793879.8	0.084	0.160	0.132	0.519	1.064	0.718	na	na	na	SECTION 4-1
18896.0	19180.0	590599.9	794091.5	0.095	0.198	0.135	0.657	1.239	0.860	na	na	na	SECTION 4-2

## APPENDIX C: DETAILED METHODOLOGY

An investigation using Ground Penetrating Radar (GPR) was commissioned to investigate the site.

### 4.1 Ground Penetrating Radar (GPR)

Ground penetrating radar is effective at determining the presence of layer detail within pavement construction by assessing the amplitude and phase of reflected signals from internal boundaries. The amount of reflected energy varies when there is a discontinuity caused by separation or the presence of a different material type. Changes in material type and/or the presence of discontinuities significantly alters the reflected energy.

GPR Pavement investigation is effective at resolving material boundaries (manmade or geological) but is limited in the determination of the exact nature of the boundaries. When combined with a targeted pavement coring/ trial pitting program any ambiguities on layer type can be resolved and an accurate longitudinal cross section can be generated.

### 4.2 Principles

Ground Penetrating Radar (GPR) is a reflective electro-magnetic technique that involves the transmission of high frequency radio waves (typically 100 to 1600MHz) into the ground and recording the subsequent reflections.

These pulses are transmitted with a high repetition rate as the antenna is moved along the ground and the reflected pulses build up a cross section (time series) of the sub-surface. Partial reflections of the electromagnetic pulse occur at the boundaries of materials with different dielectric properties.

By understanding the material types under investigation, specifically the electromagnetic pulse velocity, it is possible to convert the reflected time series to an accurate depth section, using:

$$\text{Depth [m]} = \text{Velocity [m/ns]} * \text{Reflected Time} * 0.5$$

The velocity and depth of penetration of the GPR signal depends on the electrical properties of the material with highly conductive materials showing a low penetration due to high absorption rates. Clay-rich and water saturated materials have a lower penetration than gravelly and dry soils. Signal penetration and resolution limits are also governed by the centre frequency of the transmitted electromagnetic pulse. High frequencies give good resolution and shallow penetration. Lower frequencies give lower resolution and deeper penetration.

The presence of metal such as in reinforced concrete will often act as a barrier to GPR signals (independent of frequency) and in such cases the resolution of deeper layers of subbase / subgrade may not be possible.

### 4.3 Data Collection

GPR data were acquired with MALA and GSSI GPR systems. Antenna frequencies of 1600 MHz, 500 MHz, 250 MHz & 100 MHz were collected across the specified pavement sections with supplementary 40 MHz data acquired along Section 1. The use of these frequencies enables accurate resolution of the road construction layers, as well as providing good penetration into the deeper subbase and subgrade materials.

Data collection was controlled by an Electronic Distance Measuring (EDM) system linked to the hub of the survey vehicle. This enables a highly accurate, independent measuring system to be used to ensure data are collected at the specified intervals. Data were collected at 0.25 m centres along the road pavement. Digital marks are placed on the data at predefined locations to determine the extents of the sections to be investigated.

#### 4.4 Data Processing

GPR data was collected as continuous longitudinal profiles as described above. The processing and location of subsurface features was achieved by using a proprietary processing software (ReflexWin V.8.5)

The following processing was applied to the data prior to picking planar reflectors:

- Spatial relocation (data merge with surveyed positions)
- Temporal relocation (depth correction)
- Frequency band pass filtering
- Amplitude recovery gain (time dependant gain)
- Noise removal (background removal)

#### 4.5 GPR System Calibration

##### Distance

The horizontal resolution of the GPR data, i.e., distance between successive GPR pulses/traces was controlled by an Electronic Distance Measuring (EDM) wheel with an in-built incremental encoder attached to the survey vehicle wheel hub and GPR antenna. The system was calibrated against a reference length to achieve a highly accurate, independent measuring system to ensure that data was collected at an interval of 0.25 m. This allowed for acquisition of sufficient density GPR data at traffic speed along the carriageway to resolve sub surface features.

##### Depth

GPR reflections are recorded in two-way travel time (nanoseconds) from the antenna to the reflector. In order to convert the reflected time series to an accurate depth section an accurate estimate of the GPR velocity through the sub-surface material must be determined.

Russian samples carried out adjacent to the investigation sections were incorporated into the GPR data for calibration purposes. Analysis of the GPR arrivals with respect to the coring information yield a PEAT layer velocity of 0.12 m/ns.

The velocity of the GPR signal through pavement construction materials was estimated with respect to experience gained from previous pavement investigations to calculate material thickness. A GPR wave velocity of 0.1- 0.11 m/ns was used in the determination of thickness measurements associated with subbase material within the pavement construction.