Offshore Wind Power Limited

West of Orkney Windfarm Onshore EIA Report

Volume 2, Supporting Study 15: Abnormal Load Assessment (ALA)

WO1-WOW-CON-EV-RP-0115: Approved by S.Kerr
Document Control 20/10/2023

ASSIGNMENT L100632-S06
DOCUMENT L-100632-S06-A-REPT-015

XODUS

West of Orkney Windfarm

Abnormal Loads Assessment

West of Orkney Windfarm

August 2023

SYSTRA

DOCUMENT CONTROL SHEET

IDENTIFICATION TABLE	
Client/Project owner	Xodus
Project	West of Orkney Windfarm
Study	Abnormal Loads Assessment
Type of document	Report
Date	17/08/2023
Reference number	300726-ALA-R001
Number of pages	21

APPROVAL					
Version	**Name**		**Position**	**Date**	**Modifications**
R003	Author	Glen Moon	Principal	17/08/2023	Following client review
	Checked by	Glen Moon	Principal	17/08/2023	
	Approved by	Alan Devenny	Projects Director	17/08/2023	

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1. INTRODUCTION

1.1 General

1.1.1 SYSTRA Ltd (SYSTRA) has been appointed by Xodus Group Ltd (the Client) to prepare an Abnormal Loads Assessment (ALA) for the delivery of transformer units to the proposed substation associated with the West of Orkney Windfarm, which would be located on the west side of the A9, close to the existing Spittal Converter Station in Caithness. The transformer units will be the largest pieces of plant transported to the onshore substation. **Figure 1** shows the indicative location of the onshore substation.

Figure 1. Indicative Onshore Substation Location

1.2 Port of Entry

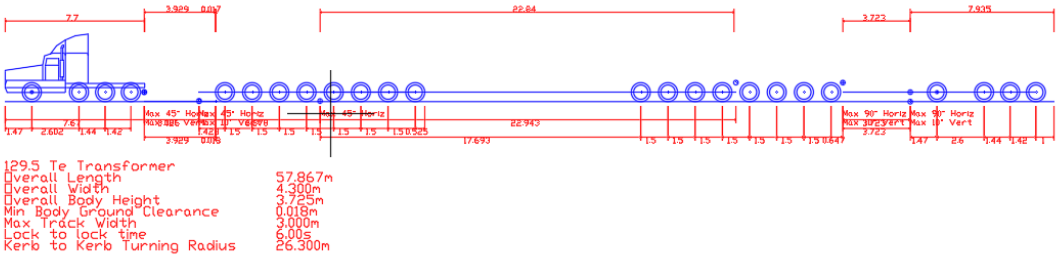
1.2.1 The ALA assumes that the port of delivery for the transformer unit(s) will be from Scrabster, which is located 3.2km to the north of Thurso, Caithness. The Port regularly accommodates abnormal loads, and the immediate route from the port to the A9 has been upgraded in recent years to accommodate large wind turbine components. Analysis on the route from Scrabster is provided in Section 2.1.

1.2.2 The route from the Port of Wick has also been assessed. This shows that it is not suitable for delivery of the transformer unit, but it could be potentially used for smaller components. Analysis on the route from Wick is provided in Section 2.2.

1.3 Abnormal Load Vehicle

1.3.1 SYSTRA has tested the Abnormal Loads vehicle shown in **Figure 2**.

Figure 2. Abnormal Loads Vehicle



1.3.2 The vehicle has an overall length of 57.9m, and an overall width of 4.3m. It has a maximum track width of 3m, and a kerb-to-kerb turning radius of 26.3m.

1.3.3 The vehicle tested has been configured to transport a 129.5te transformer. Offshore Wind Power Limited (OWPL) (developer of the West of Orkney Windfarm) has yet to confirm the final transformer specifications. This will be undertaken as part of the detailed design for the Project. The ALA will need to be updated if transformers larger than 129.5te are required, which could require a longer vehicle with a greater number of axles.

1.4 Abnormal Loads Route

1.4.1 Two routes have been assessed within this report, from the harbours at Scrabster and Wick.

Route from Scrabster

1.4.2 The assessed route from Scrabster is as follows:

- From Scrabster, the transport vehicle will travel south on the A9 to the junction with the A836, where it will turn left to continue on the A9 into Thurso.
- The vehicle will follow the A9 through Thurso, making a tight-right turn at the end of A9 Olrig Street, and then a tight-left turn at the end of A9 Triall Street onto A9 Sir George's Street.
- The route will then continue south on the A9 for approximately 9km, until the junction with the A882, where the vehicle will make a right turn, to continue on the A9.
- The route will continue south on the A9 for approximately 3.5km, before making a right-turn turn into the substation site.

1.4.3 **Figure 3** shows the assessed abnormal loads route, along with the identified pinch-points at which swept-path analysis has been undertaken. The abnormal load would travel from Thurso in the north, to the substation in the south of the figure.

Figure 3. Abnormal Loads Route from Scrabster

1.4.4 The identified Pinch Points are:

- **PP01** - The A9 / A836 priority junction
- **PP02** - The right-hand turn on the A9 in Thurso, from Olrig Street onto Traill Street.
- **PP03** - The left-hand-hand turn on the A9 in Thurso, from Traill Street onto Sir George's Street.
- **PP04** - The right-turn from the A9 onto the A9 at the A9 / A882 priority junction.

1.4.5 Should the largest abnormal load vehicle arrive from the south, then junction improvements will also be required at the A9 / substation access priority junction. The set of drawings in **Appendix C** show the required junction layout, along with visibility splays and swept-path analysis.

1.4.6 Should the largest abnormal load vehicle arrive from the north (as is most likely), then the existing junction is suitable, and no changes are required.

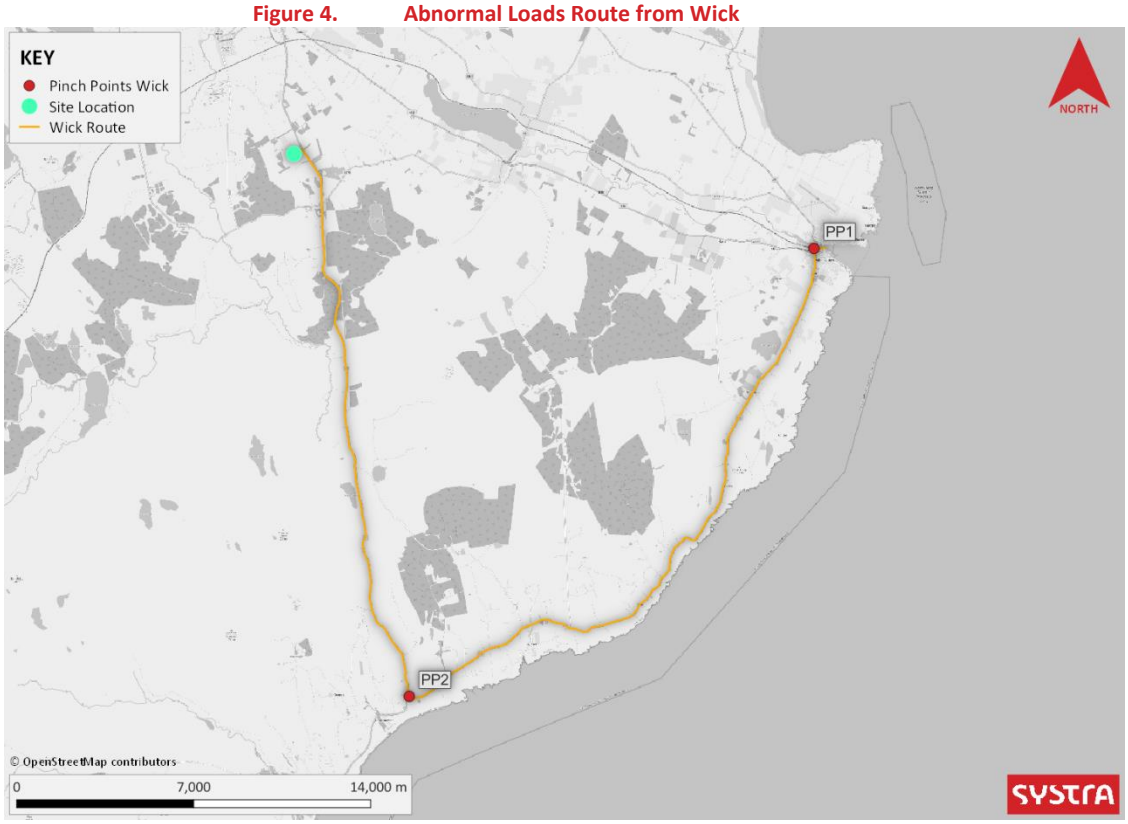
Route from Wick

1.4.7 The assessed route from Wick is as follows:

- From the port, the vehicle would join Martha Terrace, and travel west through the Williamson Street mini-roundabout, which has been levelled to allow abnormal loads to drive straight over the central island.
- The route continues west on Martha Terrace / River Street to the A99 Bridge Street / River Street / Cliff Road roundabout, where the vehicle would make a sharp left turn to join A99 Cliff Road heading south.
- The vehicle would continue south on the A99 for ~27km to the A9 / A99 priority junction at Latheron, where the vehicle would turn right and head north on the A9.
- The route then continues north on the A9 for a further 24km to reach the substation location.

1.4.8 **Figure 4** shows the assessed abnormal loads route, along with the identified pinch-points at which swept-path analysis has been undertaken. The abnormal load would initially travel south from Wick to reach the A9, before heading back north to reach the substation location.

Figure 4. Abnormal Loads Route from Wick



1.4.9 The identified Pinch Points are:

- **PP1** - The A99 Bridge Street / River Street / Union Street / A99 Cliff Road / Station Road roundabout
- **PP2** - The A9 / A99 priority junction at Latheron.

2. SWEPT PATH ANALYSIS

2.1 Route from Scrabster

2.1.1 This path provides a summary of the swept-path analysis that has been undertaken on the route from Scrabster. Swept Path drawings are provided in **Appendix A**.

2.1.2 **Figure 5** shows the A9 / A836 priority junction (PP01)

Figure 5. A9 / A836 priority junction

2.1.3 **Figure 5** shows that the delivery vehicle will make a sweeping left-turn to continue on the A9. The junction is relatively unconstrained, and there is open space on both sides of the road.

2.1.4 The swept-path analysis shows that the assessed delivery vehicle can make this manoeuvre within the existing highway boundary:

- No street-furniture will need to be temporarily removed.
- No temporary paving will be required.
- No third-party land will be required.

2.1.5 **Figure 6** shows the right-hand turn on the A9 in Thurso, from Olrig Street onto Traill Street (PP02).

Figure 6. A9 Olrig Street looking towards Traill Street

2.1.6 **Figure 6** shows that the right-turn is constrained by buildings in close proximity on all sides of the road, with footways providing potential additional space for the manoeuvre.

2.1.7 The swept-path analysis shows that:

- Two sections of guardrails and a traffic signal head on the west side of the A9 will need to be temporarily removed.
- The delivery vehicle will over-run two areas of footway (on the north and west sides) of the A9.

2.1.8 The analysis shows that the no third-party land will be required.

2.1.9 **Figure 7** shows left-hand turn on the A9 in Thurso, from Traill Street onto Sir George's Street (PP03).

Figure 7. A9 Traill Street looking north, with Sir George's St on right

2.1.10 **Figure 7** shows that the A9 at this point is relatively wide, and there are fewer constraints than for the preceding right-turn.

2.1.11 The swept-path analysis shows that:

- Two bollards and two signal heads will need to be temporarily removed from the centre of A9 Traill Street.
- Two bollards and a signal head will need to be temporarily removed from the centre of A9 Sir George's Street.
- The delivery vehicle will over-run the small refuge islands in the centre of A9 Traill Street and Sir George's Street.

2.1.12 The analysis shows that the no third-party land will be required.

2.1.13 **Figure 8** shows right-turn from the A9 onto the A9 at the A9 / A882 priority junction (PP04).

Figure 8. A9 / A882 priority junction

2.1.14 **Figure 8** shows that this movement is relatively unconstrained, with a favourable turning angle, and there is a right-turning lane on the southbound A9 that provides additional road space.

2.1.15 The swept-path analysis shows that:

- Two bollards and a road sign will need to be temporarily removed from the centre of the A9 (south arm).
- The delivery vehicle will over-run the small central splitter island in the centre of the A9 (south arm).

2.1.16 The analysis shows that the no third-party land will be required.

2.1.17 **Table 1** summarises findings from the swept path exercise undertaken.

Table 1. Summary of Required Mitigation Measures

PINCH POINT	STREET FURNITURE REMOVAL	TEMPORARY PAVING	THIRD PARTY LAND
PP01 – Left turn on A9 at A9 / A836 Junction	None anticipated.	None anticipated.	None anticipated.
PP02 – Right turn within Thurso on A9	Temporary removal of 2no. Pedestrian guardrails and 1 no. traffic signal head.	Areas of temporary paving required to allow transport to mount footway.	None anticipated.
PP03 – Left Turn within Thurso on A9	Temporary removal of 4no. bollards and 3 no. traffic signal heads.	Areas of temporary paving required to allow transport to over-run two refuge islands.	None anticipated.
PP04 – Right Turn on A9	Temporary removal of 2no. bollards and 1 no. road sign.	Areas of temporary paving required to allow transport to over-run central splitter island on A9 south.	None anticipated.

2.2 Route from Wick

2.2.1 This path provides a summary of the swept-path analysis that has been undertaken on the route from the Port of Wick. Swept Path drawings are provided in **Appendix B**.

2.2.2 **Figure 9** shows the A99 Bridge Street / River Street / Union Street / A99 Cliff Road / Station Road roundabout (PP1).

Figure 9. A99 Bridge St/ River Street / Union Road / A99 Cliff Rd roundabout

2.2.3 **Figure 9** shows that the delivery vehicle will need to make a tight left-turn from River Street to A99 Cliff Road. The turn is constrained by the row of houses on the south side of River Street, and by the wall and War Memorial on the west side of A99 Cliff Road. In addition, there is ~3m high retaining wall on the east side of A99 Cliff Road.

2.2.4 The swept-path analysis shows that the assessed delivery vehicle will not be able to make this manoeuvre. Further analysis suggests that a vehicle of up to 35m in length will be able to make the left turn, so the Port of Wick may be suitable for the delivery of smaller components.

2.2.5 For completeness, the PP2, the A9 / A99 priority junction has been assessed with the transformer delivery vehicle.

2.2.6 **Figure 10** shows the A9 / A99 priority junction at Latheron (PP2), where the vehicle would need to turn right from the A99 onto the A9 (PP2).

Figure 10. A9 / A99 junction at Latheron

2.2.7 **Figure 10** shows that the right-turn is relatively unconstrained, and the A9 meets the A99 at a favourable angle.

2.2.8 The swept-path analysis shows that:

- The vehicle would need to over-run the small central splitter island on the A9, and two bollards would need to be temporarily removed.
- There is minor over-run and oversail of the footway on the south side of the A9.
- There is oversail of a small area of potential third-party land on the north-east side of the junction. This may not be required for smaller vehicles.
- The delivery vehicle will over-run the footway on the west side of the A9.

2.2.9 In conclusion, the abnormal loads route from the Port of Wick is likely to be suitable for loads of up to 35m in length, but will not be able to accommodate transformer delivery vehicles of the scale anticipated.

3. CONCLUSION

3.1.1 It is considered that a technically feasible route between Scrabster harbour and the proposed onshore substation site exists for the transportation of abnormal loads, using the 57.9m vehicle that has been assessed, as shown in **Figure 2**.

3.1.2 The transport vehicle can be accommodated with minor changes to street furniture, and the reinforcement / ramping of small areas of footway and traffic islands / pedestrian refuges.

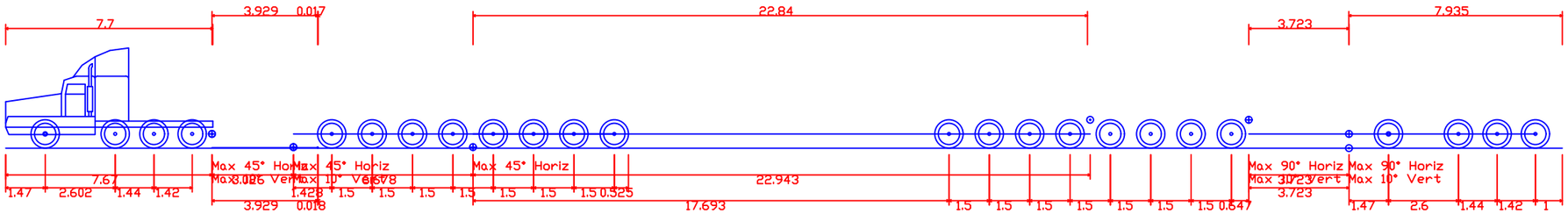
3.1.3 This analysis will need to be updated should a larger transport vehicle be required. This should be undertaken when further information / more certainty is available regarding the transformers which will be used on site. Suitable transporter vehicles and configurations will then be identified. If the vehicles were more onerous than that tested, then the swept path analysis would be re-run.

Further suggested measures

- The movement of all abnormal loads will be discussed and agreed with The Highland Council, Transport Scotland and Police Scotland through the standard abnormal loads procedures.
- All abnormal load movements will be restricted outwith the peak hours when existing traffic flows on the route will be low.
- Information on the movement of abnormal loads will also be provided to the local press to help inform the public.
- Local residents / businesses along the route will be informed when the abnormal loads will be travelling along the route to ensure that interaction between the local community and abnormal load delivery vehicles is minimised.
- Advance temporary warning signs will be installed at various points along the abnormal loads route to advise drivers that abnormal loads will be operating on the route with dates and times provided. The purpose of the signs is to provide driver information which will allow people to either avoid the area until the convoy has passed, take an alternative route or to proceed with caution.
- If a road closure is required, arrangements will be put in place to facilitate local access to properties / businesses on the closed route and to ensure safe passage of any emergency vehicles which may require access.
- To further improve driver information, Transport Scotland will be approached as operators of Variable Message Signs on the trunk road network to investigate whether existing signs could be used to warn road users of abnormal loads and to warn them of potential delays.

3.1.4 The abnormal loads route from the Port of Wick is considered to be suitable for loads of up to 35m in length, but will not be able to accommodate transformer delivery vehicles of the scale anticipated.

APPENDIX A: ROUTE FROM SCRABSTER - SWEPT PATH ANALYSIS



129.5 Te Transformer

Overall Length	57.867m
Overall Width	4.300m
Overall Body Height	3.725m
Min Body Ground Clearance	0.018m
Max Track Width	3.000m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	26.300m

Notes:

1. Do not scale from drawing
2. All dimension in meters unless otherwise stated

SYSTRA
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Tel: 0131 460 1847

Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment Transport Vehicle Specification

Drawn	Checked	Approved
AMS	GM	AD
Original drg. size	Date	Scale
A3L	11/04/23	1:500
Drawing Status	Drawing Number	Rev.
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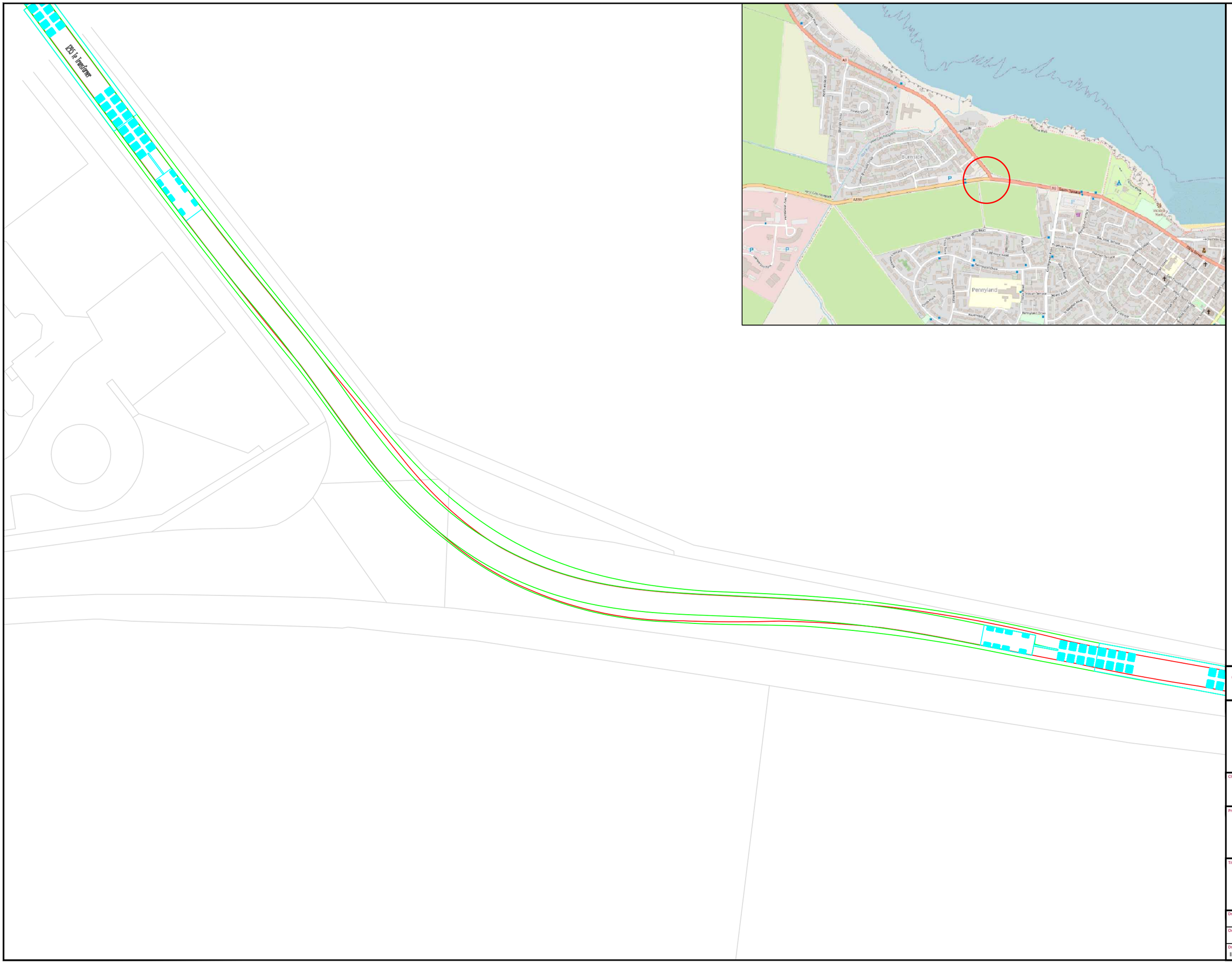

Notes:

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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment PP01

Drawn	Checked	Approved
AMS	GM	AD
Original drg. size	**Date**	**Scale**
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Drawing Status	**Drawing Number**	**Rev.**
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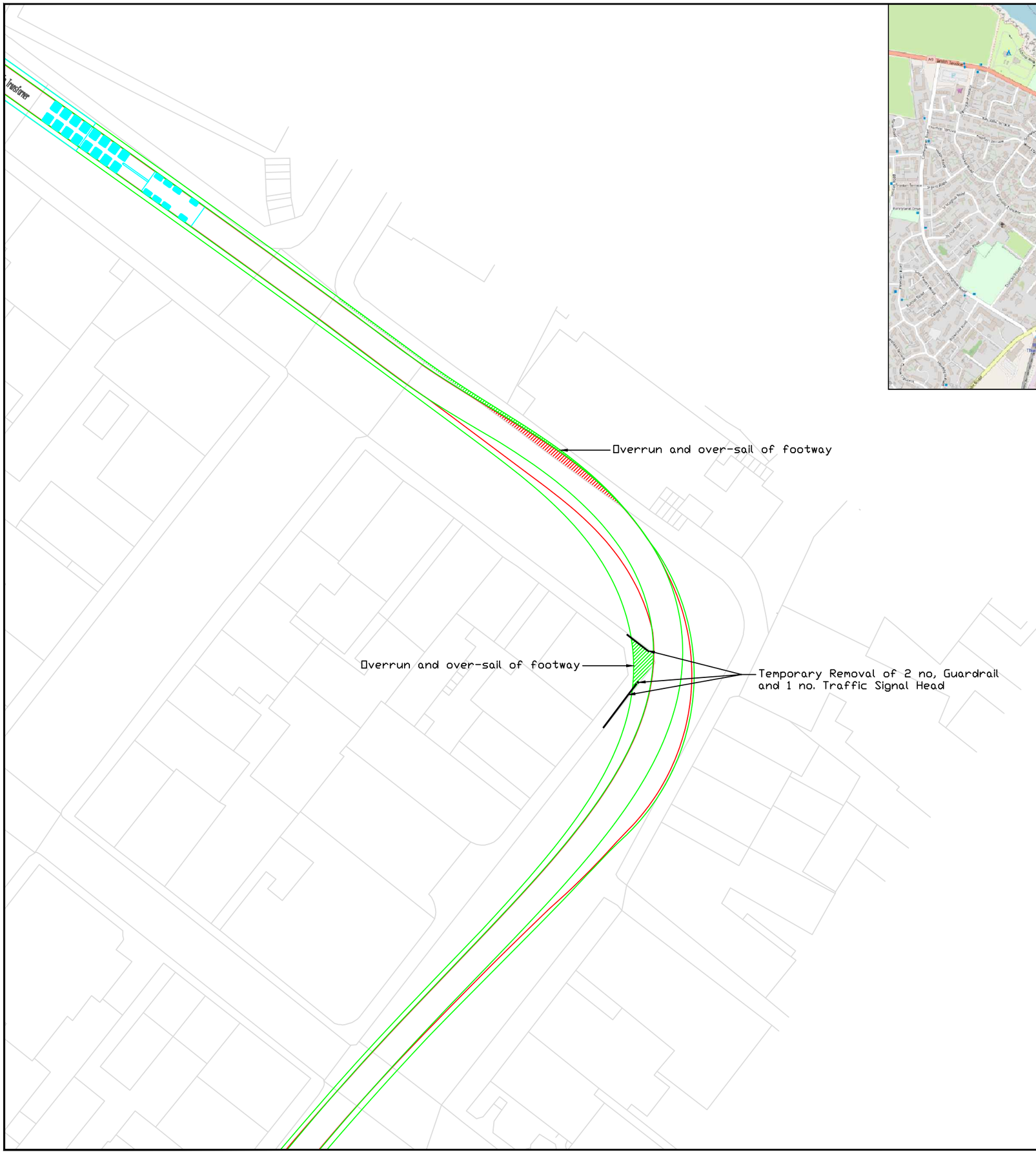

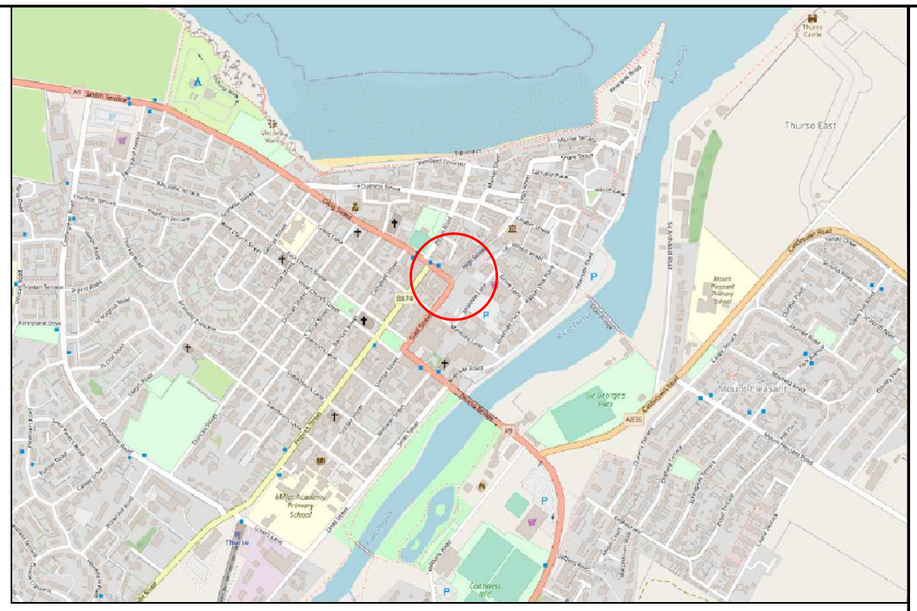

Notes:

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2. All dimension in meters unless otherwise stated

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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment PP02

Drawn	Checked	Approved
AMS	GM	AD
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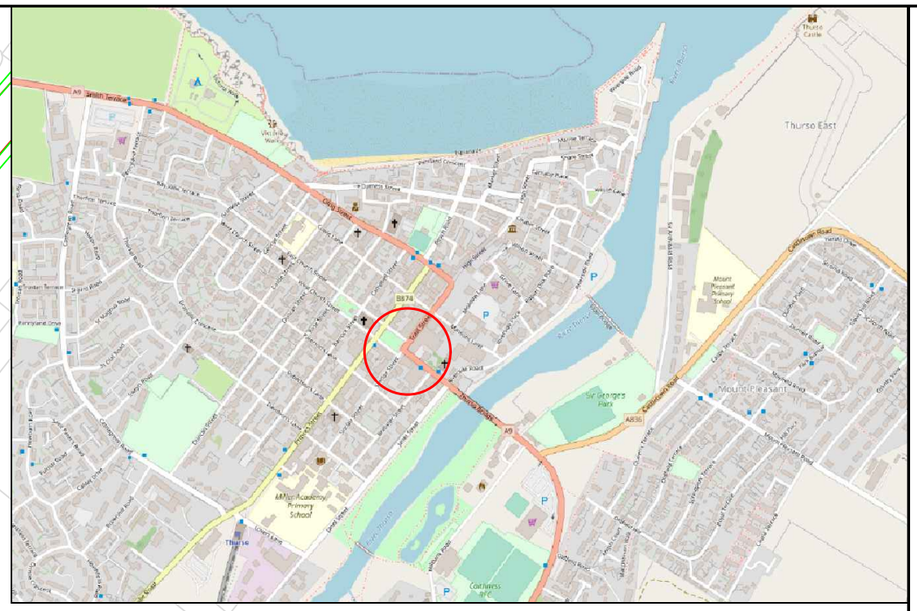

Temporary Removal of 2 no. Traffic Signal Heads and 2 no. Traffic Bollards

Temporary Removal of 1 no. Traffic Signal Heads and 2 no. Traffic Bollards

Notes:

1. Do not scale from drawing
2. All dimension in meters unless otherwise stated

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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment PP03

Drawn	Checked	Approved
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Original drg. size	Date	Scale
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Drawing Status	Drawing Number	Rev.
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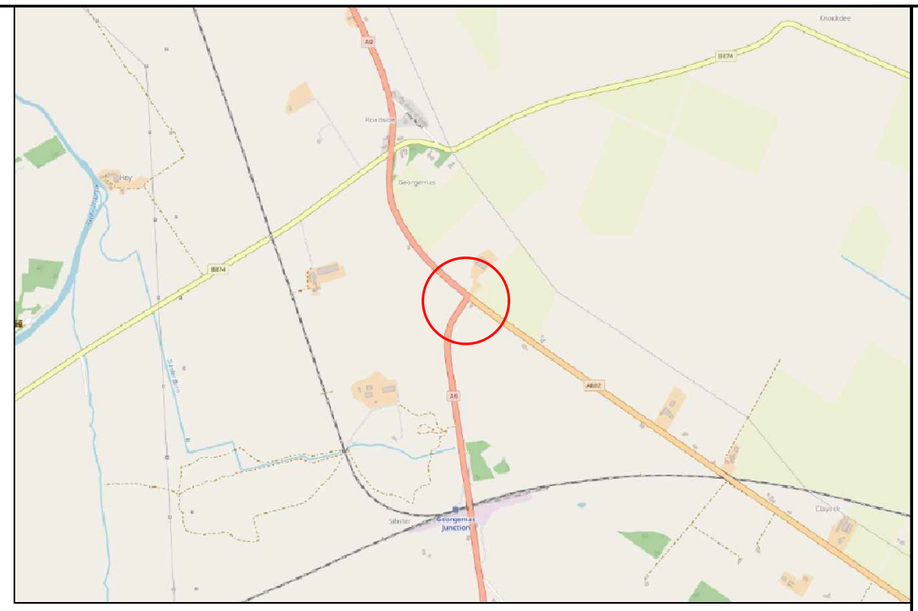

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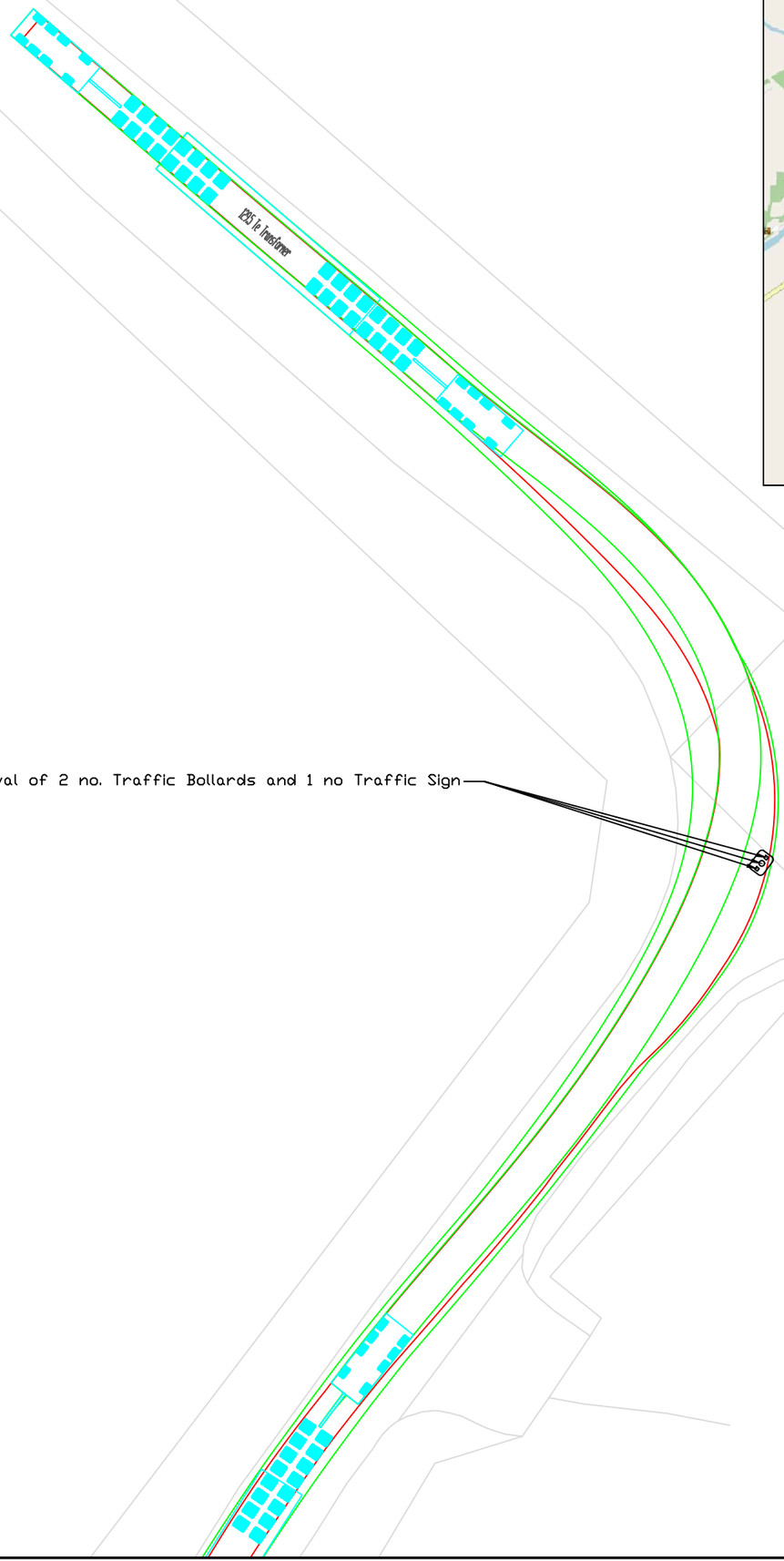
2. All dimension in meters unless otherwise stated



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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment PP04

Drawn	Checked	Approved
AMS	GM	AD
Original drg. size	**Date**	**Scale**
A3L	11/04/23	1:500
Drawing Status	**Drawing Number**	**Rev.**
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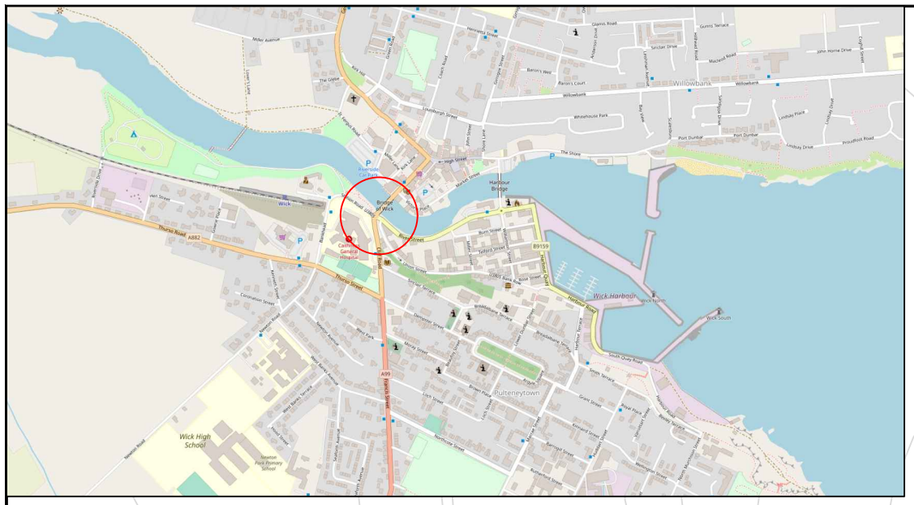
APPENDIX B: ROUTE FROM WICK - SWEPT PATH ANALYSIS



Overrun and Over Sail of Building Extents, Retaining Wall, Footway and Carriageway

Retaining Wall of ~3m in Height

1235 Te Transformer

Notes:

1. Do not scale from drawing
2. All dimension in meters unless otherwise stated

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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment
Wick Route
PP01

Drawn	Checked	Approved
AMS	GM	AD
Original drg. size	**Date**	**Scale**
A3L	12/05/23	NTS
Drawing Status	**Drawing Number**	**Rev.**
INFORMATION	1	-

Overrun and Over Sail of Verge / Footway

Temporary Removal of 2no. Traffic Signs

Overrun and Over-Sail of Splitter Island

Over Sail of Verge

Overrun and Over Sail of Verge

1250 kVA Transformer

Notes:

1. Do not scale from drawing
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Client: Xodus

Project: West of Orkney

Title: Abnormal Loads Assessment
Wick Route
PP02

Drawn	Checked	Approved
AMS	GM	AD
Original drg. size	Date	Scale
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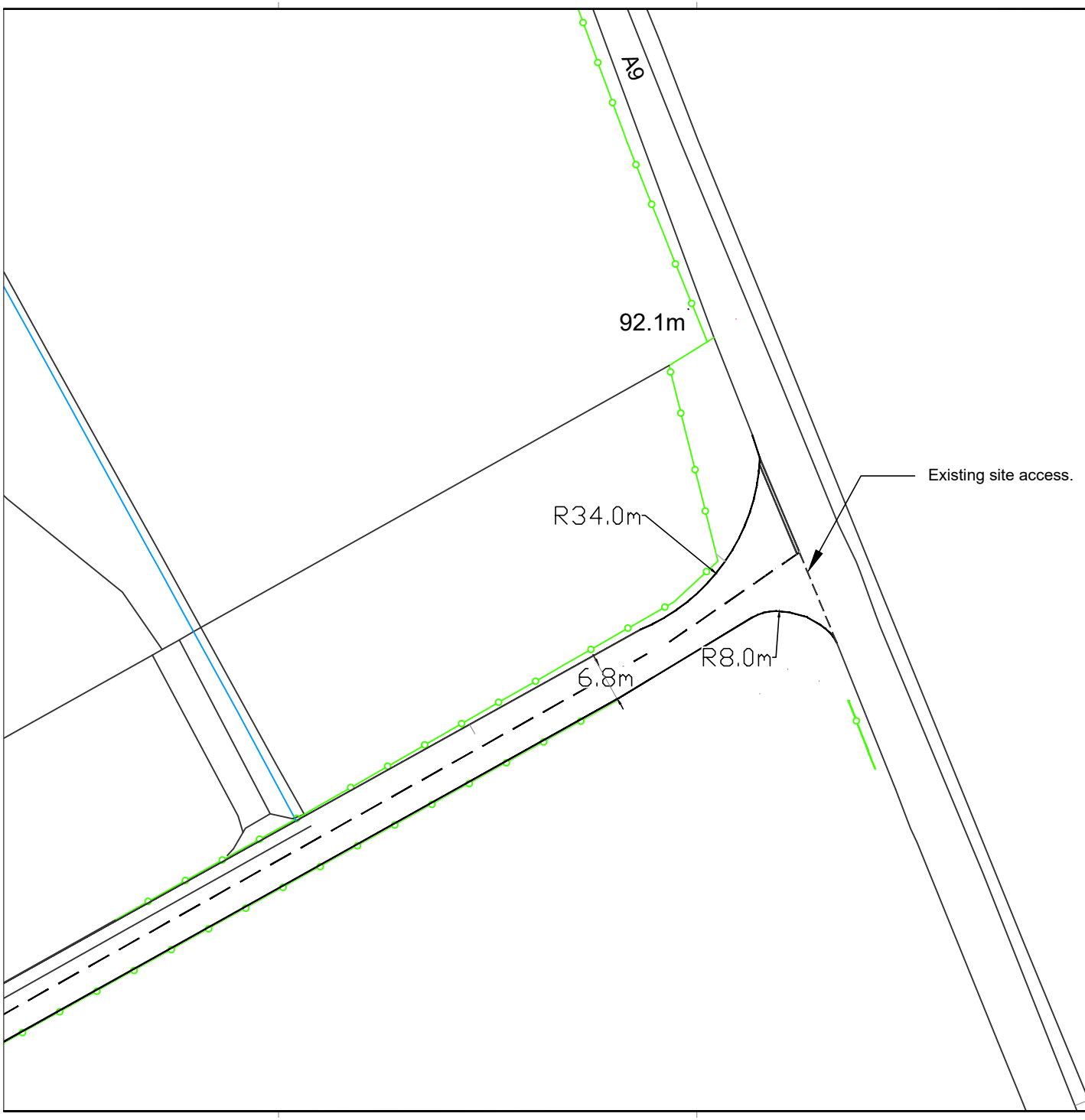
Drawing Status	Drawing Number	Rev.
INFORMATION	2	-

APPENDIX C: A9 / SUBSTATION JUNCTION DRAWINGS



Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

N

Proposed Type 1 Surfacing or similar material

Fencing

Proposed Hard Strip

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Client: Offshore Wind Power Limited

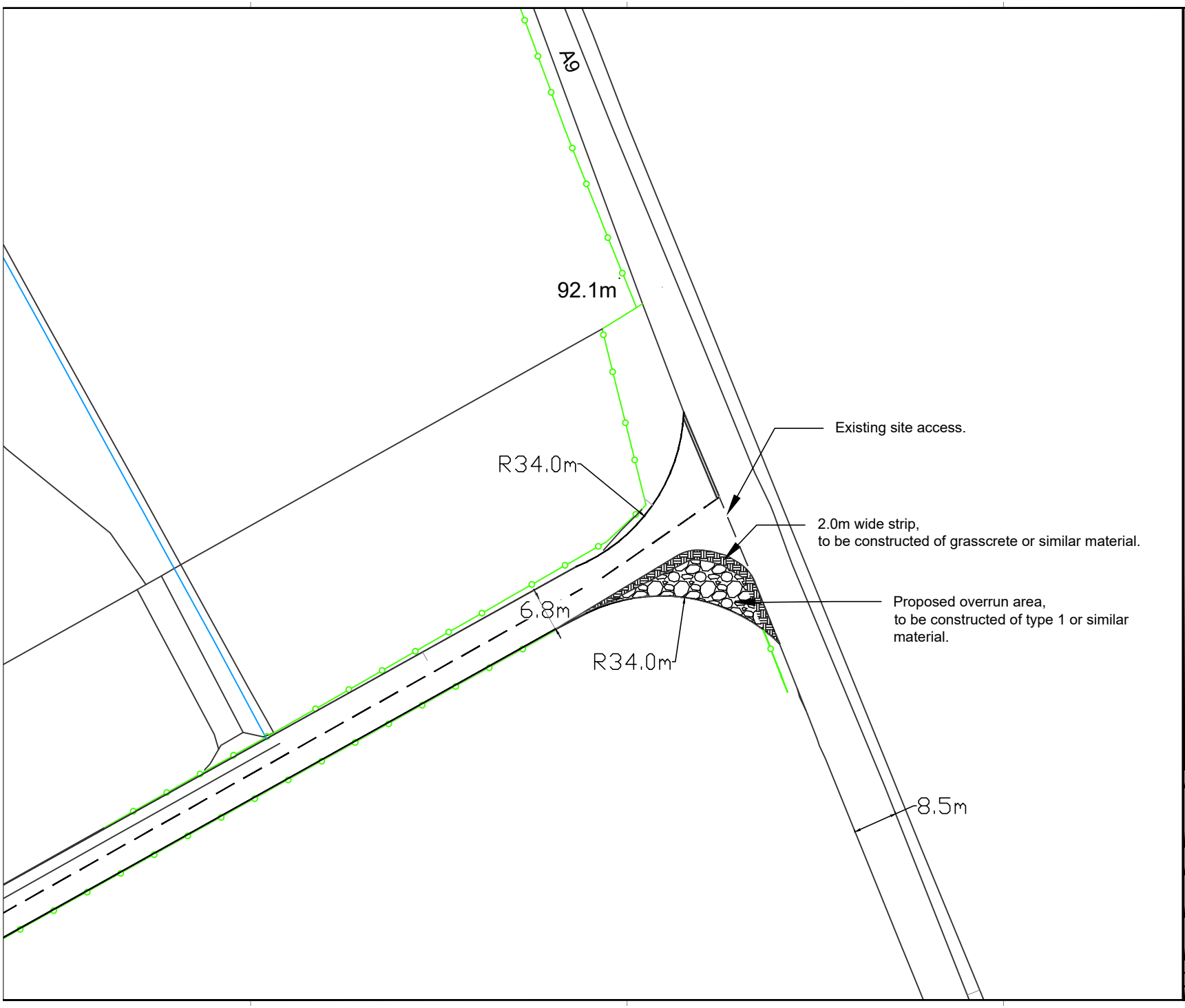
Project: West of Orkney Windfarm

Title: A9 / Access Road Existing Layout

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:1000

Drawing Status	Drawing Number	Rev.
Preliminary	GL02	



Notes:

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N

Proposed Type 1 Surfacing or similar material

Fencing

Proposed Hard Strip

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Client: Offshore Wind Power Limited

Project: West of Orkney Windfarm

Title: A9 / Access Road
Proposed Modifications
General Layout

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
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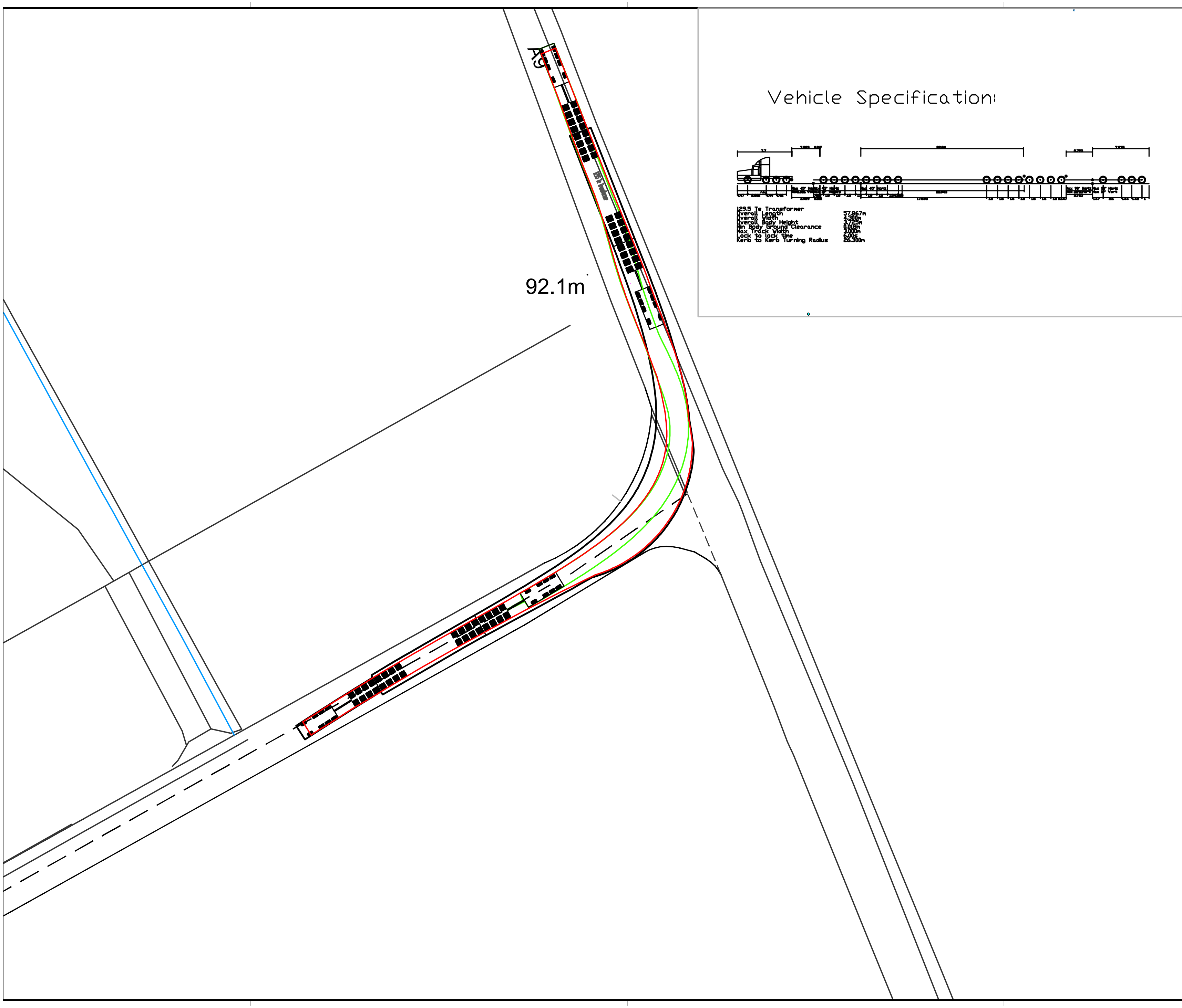
Drawing Status	Drawing Number	Rev.
Preliminary	GL01	



Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

Key:

- Outline of Vehicle Body (green)
- Outline of Vehicle Wheels (red)

Rev.	Date	Revision details	Drawn	Checked	Approved

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Project: West of Orkney Windfarm

Title: Swept Path Analysis Sheet 4 of 4

Drawn	Checked	Approved
CG	GM	GM
Original drg. size	**Date**	**Scale**
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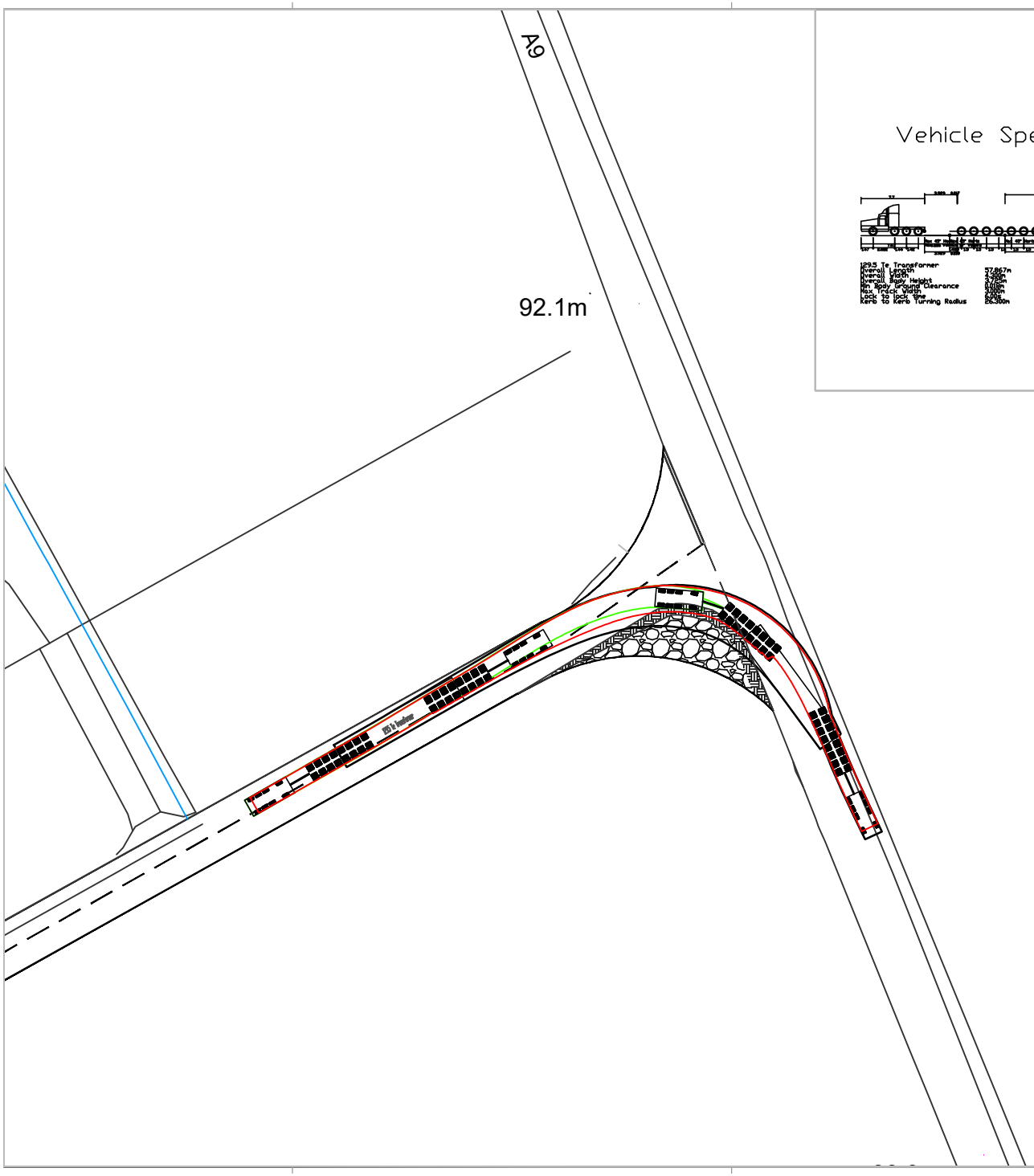
Drawing Status	Drawing Number	Rev.
Preliminary	SPA 04	



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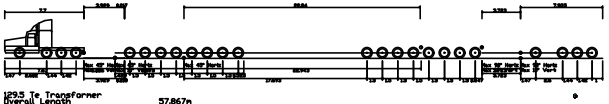

129.5 Te TransFarmer	
Overall Length	57.867m
Overall Width	4.300m
Overall Body Height	3.775m
Min Body Ground Clearance	0.810m
Max Track Width	3.000m
Lock to lock time	6.0s
Kerb to Kerb Turning Radius	26.300m

Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

Key:

- Outline of Vehicle Body
- Outline of Vehicle Wheels

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Client: Offshore Wind Power Limited

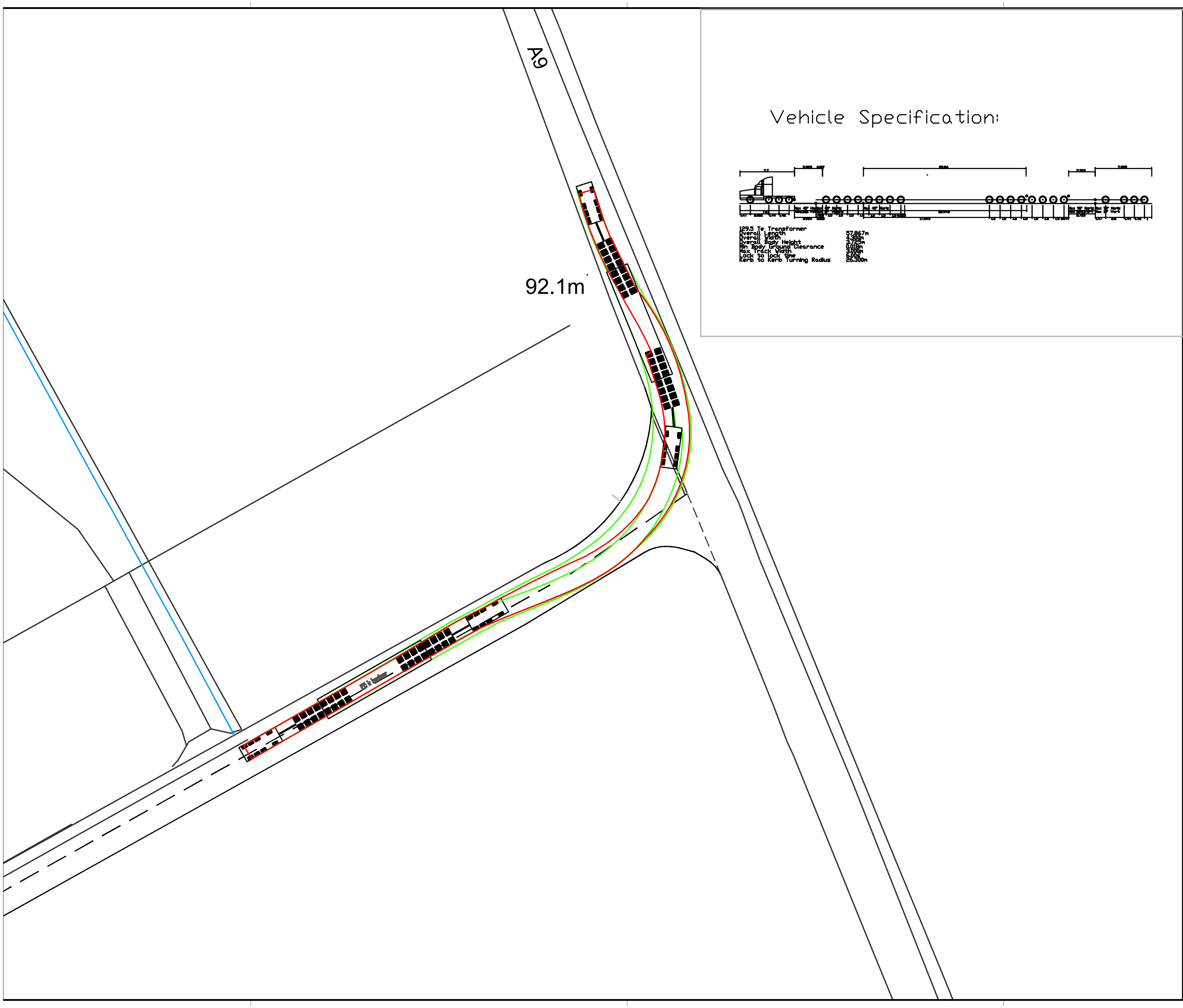
Project: West of Orkney Windfarm

Title: Swept Path Analysis Sheet 1 of 4

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:500

Drawing Status	Drawing Number	Rev.
Preliminary	SPA 01	



Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

N

Key:

Outline of Vehicle Body

Outline of Vehicle Wheels

Rev.	Date	Revision details	Drawn	Checked	Approved

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Client
Offshore Wind Power Limited

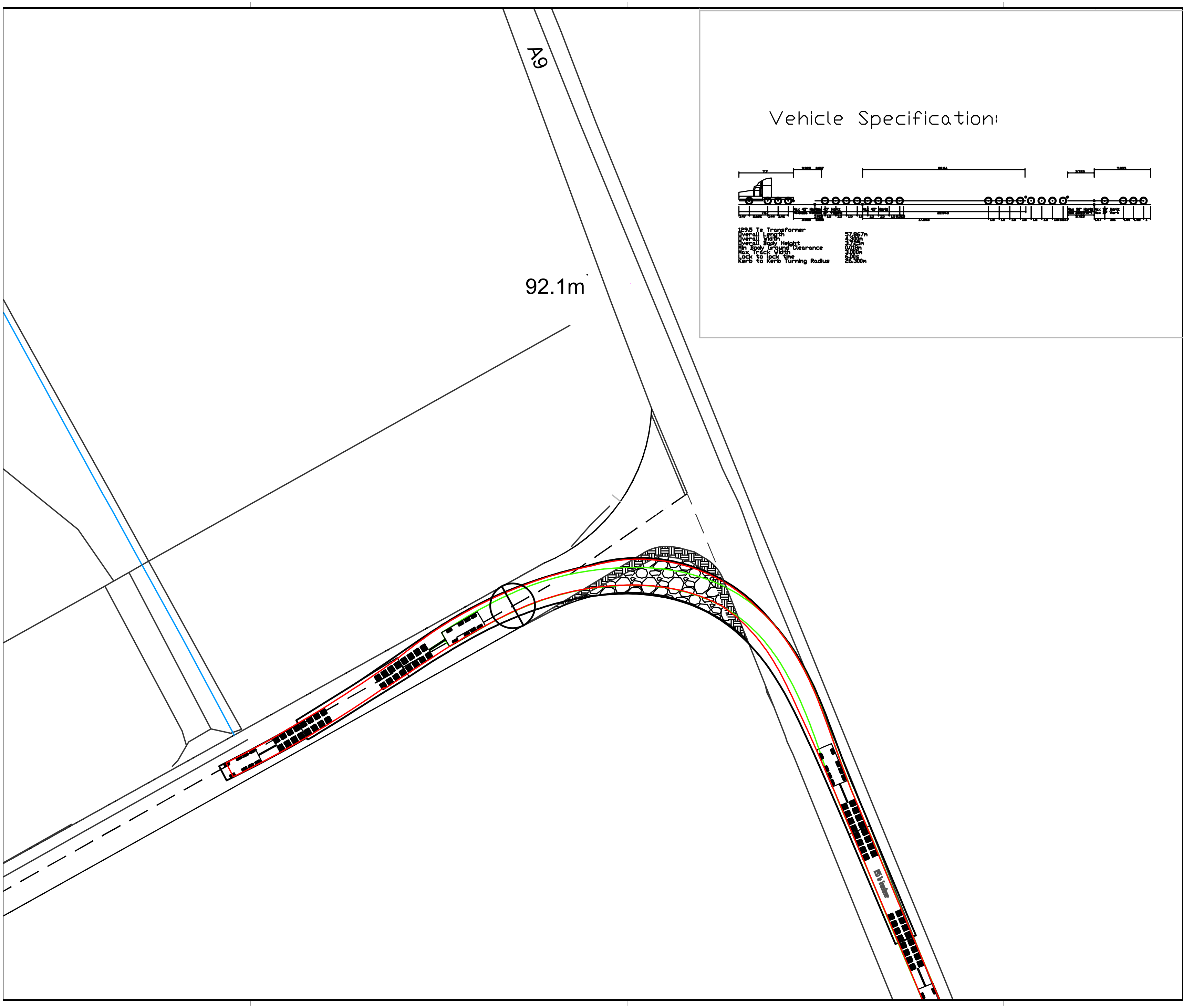
Project
West of Orkney Windfarm

Title
Swept Path Analysis
Sheet 2 of 4

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:500

Drawing Status	Drawing Number	Rev.
Preliminary	SPA 02	



Vehicle Specification

129.5 Te Transformer

Overall Length	57.867m
Overall Width	4.300m
Overall Body Height	3.725m
Min Body Ground Clearance	0.018m
Max Track Width	3.000m
Lock to lock time	6.00s
Kerb to Kerb Turning Radius	26.300m

Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

Key:

- Outline of Vehicle Body
- Outline of Vehicle Wheels

Rev. Date Revision details Drawn Checked Approved

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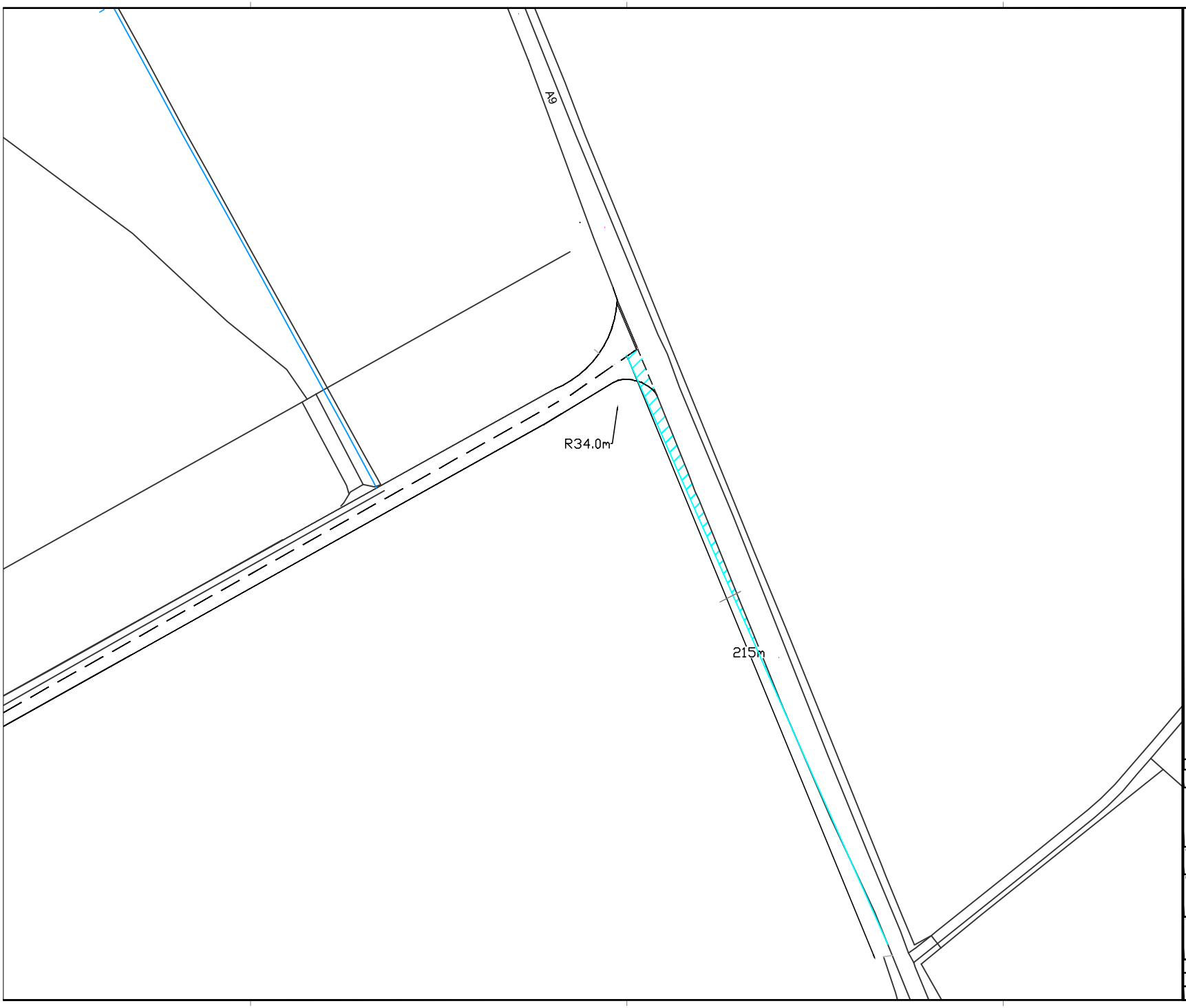
Project: West of Orkney Windfarm

Title: Swept Path Analysis
Sheet 3 of 4

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:500

Drawing Status	Drawing Number	Rev.
Preliminary	SPA 03	



Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

Key:

Visibility Sight line

Visibility Envelope

Rev	Date	Revision details	Drawn	Checked	Approved

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Client: Offshore Wind Power Limited

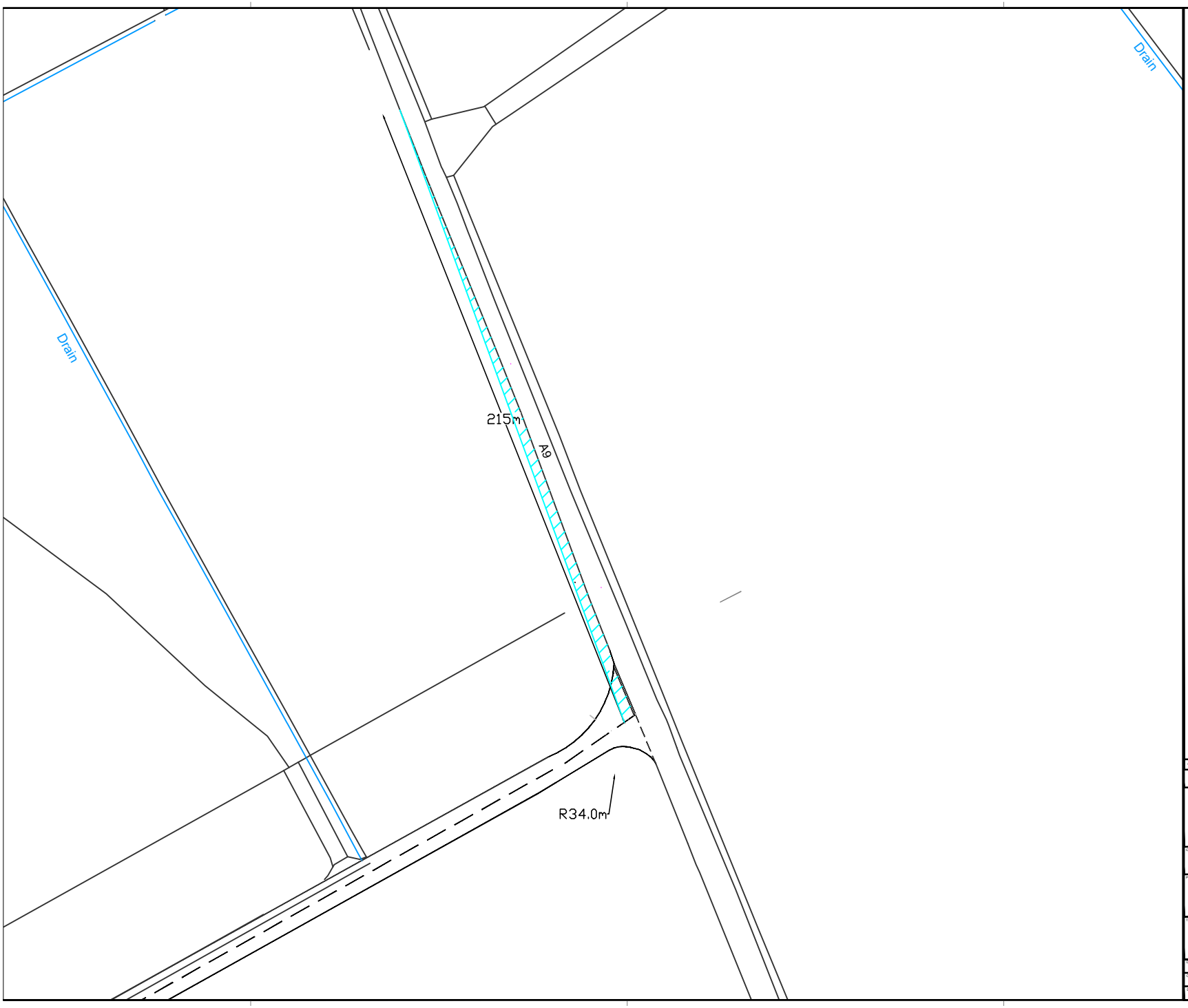
Project: West of Orkney Windfarm

Title: Visibility Splay 4.5m x 215m Sheet 1 of 2

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:500

Drawing Status	Drawing Number	Rev.
Preliminary	VS01	



Notes:

1. Do not scale from drawing
2. All dimensions in metres unless otherwise stated

Key:

Visibility Sight line

Visibility Envelope

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Project: West of Orkney Windfarm

Title: Visibility Splay 4.5m x 215m Sheet 2 of 2

Drawn	Checked	Approved
CG	GM	GM

Original drg. size	Date	Scale
A1	July 23'	1:500

Drawing Status	Drawing Number	Rev.
Preliminary	VS02	

TABLE OF ABBREVIATIONS

Table 2: Table of Abbreviations

Site No.	Location.
ALA	Abnormal Loads Assessment
km	Kilometres
M	Metres
OWPL	Offshore Wind Power Limited
PP	Pinch Point
te	Tonnes equivalent

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

A diverse group of results-oriented people, we are part of a strong team of professionals worldwide. Through client business planning, customer research and strategy development we create solutions that work for real people in the real world.

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