APPENDIX A PLANNING SECRETARY APPROVAL OF THIS TRAFFIC MANAGEMENT PLAN

Department of Planning, Housing and Infrastructure

Our ref: SSD-9255-PA-85

David McKay
Project Controls Manager
ACEN Australia
96b Bridge Street
Uralla, NSW, 2358

14/08/2026

Subject: New England Solar – Revised Traffic Management Plan

Dear Mr. McKay,

I refer to your submission requesting review and approval of the revised Traffic Management Plan (Rev 9.0) for Stage 1b, Stage 2a, Stage 3b and Stage 4a, in accordance with Schedule 3, Condition 6 of the Development Consent for the New England Solar (SSD-9255).

I note the Traffic Management Plan (Rev 9.0):

- has been prepared in consultation with, and to the satisfaction of TfNSW and Uralla Regional Council;
- confirms that no work is required in the proposed alternate port of origin delivery route; and
- contains the information required by the conditions of approval.

Accordingly, as nominee of the Planning Secretary, I approve the Traffic Management Plan (Rev 9.0, dated 12 August 2026).

Please ensure you make the document publicly available on the project website at the earliest convenience.

If you wish to discuss the matter further, please contact Wayne Jones on (02) 6575 3406.

Yours sincerely



Iwan Davies
Director
Energy Assessments

As nominee of the Planning Secretary

APPENDIX B STAKEHOLDER CORRESPONDENCE

From: Nav Prasad (TRAFFIC SAFETY)
Date: Wednesday, 12 August 2026 at 9:04 am
To: David Pollington; Tim Greenaway; Yuan Wong
Cc: Brendan Pegg; Aleks Tancevski; Rachel Cumming; Alexandra Long; Steven Cooper; Shaun Fairweather
Subject: FW: New England Stage 2 Transformer to site

Hi Tim and Yuan,

Thank you for meeting with TfNSW to discuss and resolve the temporary works required on the classified road network to facilitate the OSOM movements.

As discussed, six locations have been identified where minor temporary works are required, including the temporary removal of signs and/or traversing median islands to enable the OSOM movements.

Given that the OSOM movements are scheduled for September and the program is time-critical, TfNSW will arrange for its Regional Maintenance Teams to modify the identified signs so they can be temporarily removed when required. No further action is required from ACEN in this regard. However, TfNSW recommends that ACEN undertake a preliminary inspection prior to the OSOM movements to confirm that all identified signs have been made removable.

TfNSW previously raised concerns regarding the potential for OSOM loads to damage median islands, as they are not designed to be driven over. However, given that this is a one-off movement and that the development consent requires the applicant to bear the cost of any damage to public infrastructure, TfNSW will permit the OSOM movements to traverse the identified medians.

To monitor any impacts, TfNSW's Regional Maintenance Teams will photograph the median islands before and after the OSOM movements to document and assess any damage.

The table below provides a summary of the works required at each of the locations.

Item	State road intersection/access point	Proposed works	TfNSW response
1	Pinch Point 09 - LEFT TURN Bathurst St &	• 1 x sign temporarily removed	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made

	Bellmore St BREWARRINA	• Partial traversal of median strip	removable. This will allow the leading pilot vehicle to remove the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment
2	Pinch Point 24 -RIGHT TURN Barwan St & Killarney St NARRABRI	• 3 x signs temporarily removed • Partial traversal of median strip	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made removable. This will allow the leading pilot vehicle to remove the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment
3	Pinch Point 25 - LEFT TURN Killarney St &	• 1 x sign temporarily removed	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made removable. This will allow the

	Tibbereena St NARRABRI	• Partial traversal of median strip	leading pilot vehicle to remove the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment
4	Pinch Point 27 - THROUGH ROUNDABOUT Newell Hwy NARRABRI	• 2 x signs temporarily removed • Partial traversal of median strip	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made removable. This will allow the leading pilot vehicle to remove the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment
5	Pinch Point 28 - LEFT TURN @ ROUNDABOUT	• 3 x signs temporarily removed	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made removable. This will allow the leading pilot vehicle to remove

	Newell Hwy & Kamilaroi Hwy NARRABRI	• Partial traversal of median strip	the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment
6	Pinch Point 30 - LEFT TURN Conadilly St & Warrabungle St GUNNEDAH	• 2 x signs temporarily removed • Partial traversal of median strip	• TfNSW through its Regional Maintenance Teams will arrange for the sign to be made removable. This will allow the leading pilot vehicle to remove the sign to allow the movement to be made. On completion of the turn the rear pilot will reinstall the sign. • TfNSW through its Regional Maintenance Teams will take photographs of the median before and after the OSOM movement occurs to monitor any damage to the median. **Overall TfNSW comment:** Items resolved no further comment

Considering the information above, TfNSW advises that the submitted TMP for the OSOM movement of the transformer has satisfactorily addressed TfNSW requirements and TfNSW has no further comments.

Should you require any further information please contact Nav Prasad at development.renewables@transport.nsw.gov.au

Kind regards,

Nav Prasad
Land Use Planner

Transport Planning

Planning, Integration and Passenger
Transport for NSW

T E
Level 4, 4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150

NSW GOVERNMENT Transport for NSW

From: Toni Averay
Date: Monday, 27 July 2026 at 3:02 pm
To: Yuan Wong; Uralla Mayor
Cc: Sarah Donnan; Darryl Myers; Scott Green; Wendy Westbrook
Subject: RE: NES2 - Consultation with USC regarding OSOM transportation of transformer

Dear Yuan

I wish to confirm that Council considers that the proposed OSOM transport route and the associated SSD Traffic Management Plan provide satisfactory arrangements for the section of the transport route within Uralla Shire.

Council notes that these arrangements remain unchanged from those previously consulted on in relation to the delivery of major project components to the site.

Specifically, Council notes that there are no proposed changes to:

- the transport route within Uralla Shire Council's local government area; or
- the access arrangements, intersections, road usage, or traffic management measures within Uralla Shire that were previously discussed with Uralla Shire Council.

Best regards

Toni Averay
General Manager
Uralla Shire Council | PO Box 106 Uralla NSW 2358
p 02 6778 6302 |
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APPENDIX C ACCESS ROAD CONDITION INSPECTION

Project Name:	New England Solar	**Area:**	Barleyfields Road (North) and Big Ridge Road
Inspector Name:		**Date:**	
Inspector Signature:		**Time:**	

Item #	Chainage	Category (minor, major)	Description	Management	Target completion date

Notes:

Category should be assigned as follows:

- Minor – defects that do not create material risk to road users, including isolates potholes, bleeding from heat, minor rutting, minor drainage issues, damaged signage, guide posts or linemarkings.
- Major – defects that create material risk to road users and will continue to deteriorate, including concentrated or extensive potholes, major rutting.

Management should be assigned as follows (or otherwise as designated by a suitably qualified person):

- Isolated potholes – Cold mix patch. Remove loose DGB20 from larger potholes before applying cold mix patch.
- Concentrated or extensive potholes – lime stabilisation and re-seal.
- Minor rutting – monitor and re-assess during next inspection. Conduct lime stabilisation and re-seal if required.
- Major rutting – lime stabilisation and re-seal affected area.
- Bleeding from heat – treatment to reactivate seal (e.g. Gilsabind) and add aggregate.
- Corrugation or potholes on unsealed road – maintenance grading.
- Accumulation of gravel or scour adjacent unsealed road – drainage maintenance and profiling.
- Signage, guide posts and linemarking – repair or replace as required.
- Other – manage as recommended by a suitably qualified engineer.

Target completion date should be assigned as follows:

- Cold mix patch – 1 week.
- Other minor works including repairing signage – 1 week.
- Maintenance on unsealed road – 1 to 2 weeks.
- Lime stabilisation and re-seal – 6 weeks.
- Treatment to reactivate seal and add aggregate – 6 weeks.

APPENDIX D DRAFT THM12 PAVEMENT MANAGEMENT SYSTEMS

CONTRACT REPORT CR-2000/66
December 2000

Contract Report CR-2000/66

Draft TMH12
Pavement Management Systems:
Standard Visual Assessment
Manual for Unsealed Roads
Version 1

Authors: D Jones and P Paige-Green

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DOCUMENT RETRIEVAL PAGE			REPORT No: CR-2000/66
Title: Draft TMH12: Pavement Management Systems: Standard Visual Assessment Manual for Unsealed Roads (Version 1)			
Authors: D Jones and P Paige-Green			
Client: COLTO	**Client Report No:** CR-2000/66	**Date:** December 2000	**Distribution:** Client Confidential
Project No: 9400/9431/TIJ21	**Programme:** Infrastructure Engineering		**ISBN:**

Preface:

TMH12 provides guidelines for the visual assessment of the condition of unsealed roads at network and/or project level for use in unsealed road management systems. A modular approach to information collection is introduced. Attributes of distress are defined and requirements for training and calibration of visual assessors, quality control, assessment procedures and road segment information data are specified. The different assessment parameters are classified and detailed descriptions of degree and distress, including photographic plates illustrating each condition, for each parameter are given. Examples of assessment forms are provided. Simple guidelines on material identification using an engineering geological classification are included.

The use of the data collected in management systems and maintenance management planning falls outside the scope of the document.

Keywords: Unsealed roads, Road Management System, Road Assessment

Proposals for implementation:

This document has been issued in Draft format under CSIR cover for a limited period. Comments should be forwarded to D Jones who will compile a comments register for discussion by the working group. The document will be updated, if required, and released under a Committee of Transport Officials (COTO) cover in the standard TMH format.

Related documents:

TMH9, TRH22

Signatures:

Language editor:	Technical reviewer:	Prog Manager: B Verhaeghe	Information Centre:	Division Director: P Hendricks

TERMS OF REFERENCE

The objectives of this project were to:

- Identify the inputs that need to be collected to ensure that the GRMS's in use can operate cost-effectively and that the outputs can be used with confidence;
- Prepare a document to guide assessors of unsealed roads, which fulfils the needs of the various road authorities in South Africa.
- Incorporate modularity into the system identifying the absolute minimum requirements and various other alternatives to comply with the requirements of the various management systems in use.
- Provide uniformity in unsealed road assessment in South Africa.

ACKNOWLEDGEMENTS

This manual was compiled by the Division of Roads and Transport Technology of the CSIR on behalf of the South African Committee of Transport Officials (COTA). The contributions of the following individuals in the preparation of the document is gratefully acknowledged:

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TABLE OF CONTENTS

A. GENERAL INFORMATION 1
A.1. Introduction 1
A.1.1 Terminology 1
A.1.2 Information to be Collected – The Modular Approach 2
A.1.3 Structure of the Manual 3
A.2. Attributes Of Distress 3
A.2.1 General 3
A.2.2 Types of Distress 3
A.2.3 Degree 4
A.2.4 Extent 6
A.2.5 Examples of the use of Degree and Extent 7
A.3. Training and Calibration of Visual Assessors 8
A.4. Quality Control 9
B. UNSEALED ROAD ASSESSMENT 10
B.1. Introduction 10
B.2. Purpose 10
B.3. Defining Segments 11
B.4. Assessment Forms 11
B.5. Assessment Procedure 12
B.6. Road Information 13
B.6.1 Material Type 13
B.7. General Information 14
B.8. Parameters to be Assessed 14
B.8.1 General Performance 15
B.8.2 Moisture Condition 15
B.8.3 Gravel Quantity/Layer Thickness 16
B.8.4 Gravel Quality and Influencing Factors 18
B.8.5 Road Profile/Shape 21
B.8.6 Drainage from the road 23
B.8.7 Riding Quality and Influencing Factors 26
B.8.8 Dust 30
B.8.9 Trafficability 34
B.8.10 Potholes 36
B.8.11 Rutting 38
B.8.12 Erosion 40
B.8.13 Corrugation 43
B.8.14 Loose Material 45
B.8.15 Stoniness 47
B.8.16 Slipperiness and Skid Resistance 51
B.8.17 Cracks 54
B.8.18 Isolated Problems 56
B.8.19 Maintenance Action 59
B.9. Dust Palliative/Chemical Stabiliser Treatments 59
B.10. Material Sampling 59
B.11. Use of Data 60
C. GLOSSARY 62
D. TYPICAL ASSESSMENT FORMS 65

E. MATERIAL IDENTIFICATION 70
F. REFERENCES 72
F.1. Other Relevant Documentation 72

A. GENERAL INFORMATION

A.1. Introduction

This document provides national guidelines for the visual assessment of the condition and performance of unsealed roads for use in gravel road management systems, maintenance programming and the monitoring of experiments. Sealed flexible and rigid pavements should be assessed in accordance with TMH 9[1], the Department of Transport Manual for visual assessment of pavement distress: Part 2[2] and TRH 6[3].

Visual assessments on any road can be used to determine:

- Condition indices
- Maintenance and rehabilitation needs
- Priorities at network level

Assessment of the condition of unsealed roads differs significantly from that of sealed roads: unsealed roads are highly dynamic systems with the appearance and condition varying almost from day to day. Although sealed roads are also dynamic systems, the rate of change of typical performance characteristics is much slower and annual observation is generally sufficient to identify changes and provide timeous inputs for maintenance intervention activities. This is considerably more difficult for unsealed roads, and for routine use the visual assessment is most applicable for determining:

- Regravelling requirements
- Whether current blading frequencies are sufficient
- Whether the gravel on the road is suitable for the traffic and environment and what type of distress is typical of the road/gravel combination

Unlike sealed roads, the performance of unsealed roads depends primarily on the functional characteristics. Localised structural failures are usually “repaired” during routine grader maintenance (occasionally spot regravelling is necessary) whereas structural failures of sealed roads require intensive repair to restore functional performance.

This manual is intended for persons undertaking visual assessments of the condition of unsealed roads for:

- Input for gravel road management systems
- Project level assessments for specific roads
- Ad hoc assessments of road condition after significant events (e.g. severe rainfall)
- Training of assessors to rate unsealed roads in a consistent and repeatable manner
- Assessing the condition of specific roads during experiments

A.1.1 Terminology

Various terminologies are used for roads where vehicles travel directly on the natural material (i.e. the road has no formal surfacing). Terms include earth and dirt, usually

applied to roads that are not formally constructed, on in situ material, and gravel, unpaved, unsealed, unsurfaced and metalled, usually applied to roads constructed with an imported compacted gravel layer. Since the concepts discussed in this guide are applicable to all types of roads without a formal surfacing (e.g. bitumen, concrete and block paving), the accepted international term of **unsealed roads** will be used throughout the document.

However, the term **Gravel Road Management System (GRMS)** is widely used and understood and has been retained for use in this document.

A.1.2 Information to be Collected – The Modular Approach

The document has been compiled to allow the content to be adapted for different needs and for different Gravel Road Management Systems (GRMS's). It is therefore not necessary to assess every characteristic illustrated in this manual for every situation. Assessments for strategic network level evaluation require less detailed information than necessary for detailed network level assessments.

Evaluations for **strategic network level analyses** need to provide the information necessary to make strategic decisions such as budgeting, planning and evaluation of the influence of budget constraints on the network performance. Typical characteristics assessed include gravel quantity and quality, road profile and drainage and riding quality, which are necessary for estimating regravelling and maintenance requirements. Evaluations for **detailed network level analyses** include significantly more detail, which can be used for both strategic decision-making at as well as for maintenance planning and budgeting at operational level. In these cases, more information regarding the performance characteristics is collected and both severity and extent are usually assessed. More detail regarding the use and interpretation of the data collected is provided in Section B.11.

By using a modular approach, minimum requirements can be used for most applications whilst more specific requirements are suggested for detailed network level analyses, project level and research activities. The minimum requirements for each province will usually have been identified during development and installation of their specific GRMS.

The information required will dictate the structure and content of the assessment forms used. Each road authority should develop an assessment form for their specific needs. Assessment forms are discussed in more detail in Section B.4.

The following can be achieved by processing the visual assessment data:

(a) Calculation of a **visual condition index** for each assessment length through the combination of the rating for degree and extent for each distress type, together with a weight factor based on the importance of the distress type. The condition index can be used to:

- Give an indication of the condition of each segment of the road assessed.
- Indicate changes in the overall condition of a road network, or individual segments over time.
- Classify a road section into one of five condition categories for statistical or visual presentation, as follows:

VERY GOOD	GOOD	FAIR	POOR	VERY POOR
1	2	3	4	5

(b) Identification of certain required maintenance and/or improvement measures and priorities for use as input for programming and budgeting.
(c) Identification of required maintenance or improvement measures for use at network or project level (implementation) by maintenance teams.

A.1.3 Structure of the Manual

The manual comprises six parts:

- Part A contains general information for the assessor, which should be studied as background to the assessment descriptions in Part B.
- Part B provides detailed guidelines on the functional assessment of unsealed roads and descriptions of the various distress types and descriptions of the various degrees of distress that can be encountered on unsealed roads, the data from which will be used as input for gravel road management systems. The method aims to provide a degree of harmony for capturing relevant information by different road authorities in order that output can be realistically compared. Detailed descriptions and colour photographs of typical examples of each distress type for severity levels 1,3 and 5 are provided.
- Part C contains a glossary of terms used in the document.
- Part D contains examples of assessment forms.
- Part E describes a simple method to assist with identification of material type.
- Part F lists documents referred to in the text.

A.2. Attributes Of Distress

A.2.1 General

The appearance of distress is varied and often extremely complex. The task of describing this is achieved by recording its main characteristics – the so-called attributes of distress. The attributes referred to in this manual are the:

- Type
- Degree
- Extent

These attributes are defined below in general terms. Each of these attributes is described in more detail in Part B. In some cases, information is also provided on the mechanisms and causes of distress.

A.2.2 Types of Distress

The type of distress evaluated will depend on the purpose of carrying out the assessment. The modes of distress needing assessment for strategic network level decisions may differ from those needed for detailed network level decisions. A number of assessment parameters are considered essential for any type of evaluation, while detailed descriptions of distress are often desirable, particularly for detailed network level investigations, project level investigations and research investigations. This manual also

includes other assessment items that have proved useful in research studies and for complementing the more detailed distress attributes and material properties. Typical types of distress encountered on unsealed roads include:

- Loss of gravel
- Potholes
- Rutting
- Erosion
- Corrugations
- Loose material
- Stoniness
- Dust
- Cracking

These can be assessed individually or in terms of their interactive effect on the functional performance of the road together with material properties, road profile, drainage etc. An example of this is the development of corrugations or potholes, which result in deterioration of overall functionality, particularly riding quality. For more detailed investigations, aspects such as cracking or rutting, although not directly related to riding quality for instance, are indicative of material quality or a potentially problematic situation such as periodic slipperiness or water ponding respectively.

A.2.3 Degree

The degree of a particular type of distress is a measure of its severity. Since the degree of distress can vary over the pavement section, the degree to be recorded should, in connection with the extent of occurrence, give the predominant severity of a particular type of distress. The degree is described by a number where:

- Degree 1 indicates the first evidence of a particular type of distress ("slight").
- Degree 3 indicates a warning condition. This would normally indicate that intervention might be required in order to avoid the distress deteriorating to a severe condition.
- Degree 5 indicates the worst degree ("severe"). Urgent attention is required.

The general descriptions of degree of each type of distress are presented in Table A.1. These descriptions relate to the possible consequences of each type of distress and therefore also to the urgency of maintenance or rehabilitation. Degree 0 is recorded if the defect does not occur. Degree 1 generally indicates that no attention is required; degree 3 indicates that maintenance/improvement might be required in the near future, whereas degree 5 indicates that immediate maintenance/improvement is required. Specific classifications for the various types of distress have been compiled, based on these general descriptions (see Part B).

TABLE A1: General description of degree classification

Degree	Severity	Description
0	None	No distress visible
1	Slight	Distress difficult to discern. Only the first signs of distress are visible.
2	Between slight and warning	
3	Warning	Distress is distinct. Start of secondary defects. (Distress notable with respect to possible consequences. Maintenance might be required in near future e.g. potholes can be removed by blading)
4	Between warning and severe	
5	Severe	Distress is extreme. Secondary defects are well-developed (high degree of secondary defects) and/or extreme severity of primary defect. (Urgent attention required e.g. potholes require manual repair).

A flow diagram illustrating the use of the five-point classification system is shown in Figure A.1. The most important categories of degree are 1, 3 and 5. If there is any uncertainty regarding the condition between degrees 1 and 3 or 3 and 5, the defect may be marked as 2 or 4, respectively. This is particularly relevant for research purposes (where frequent visual assessments are carried out), or detailed project level studies.

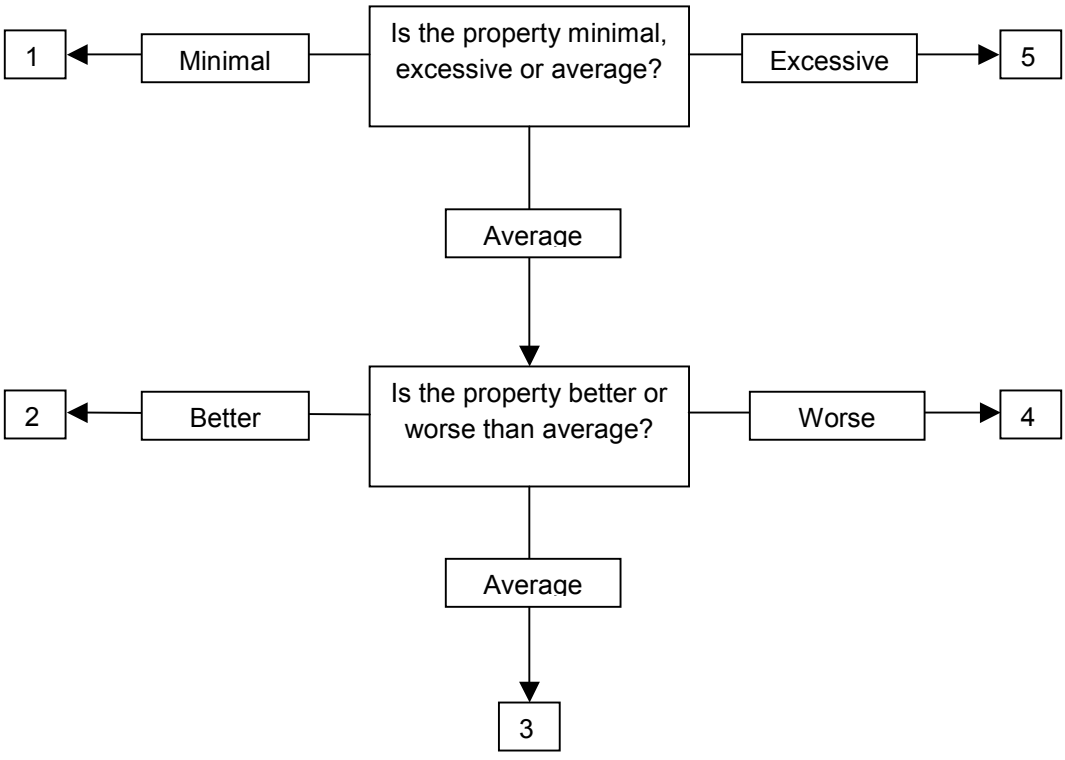


FIGURE A.1: Flow diagram – five point classification system

A.2.4 Extent

The extent of distress is a measure of how widespread the distress is over the length of the road segment. The extent is also indicated on a five-point scale in which the length of road affected by the distress is estimated as a percentage. The general description of the extent classifications is given in Table A.2 and illustrated diagrammatically in Figure A.2.

The extent of the distress should be recorded only for that width of the road affecting the traffic.

TABLE A.2: General description of extent classifications

Extent	Description	Estimate (%)
1	Isolated occurrence, not representative of the segment length being evaluated. They are usually associated with localised changes in the material, subgrade or drainage conditions. Intersections, steep grades or sharp curves may also result in isolated occurrences.	< 5
2		5 – 20
3	Intermittent occurrence, over most of the segment length, or extensive occurrence over a limited portion of the segment length. When occurring over most of the segment length, problems are usually associated with the material quality or maintenance procedures. When occurring over limited portions, the problem is usually a result of local material variations or drainage problems.	20 – 60
4		60 – 80
5	Extensive occurrence. This is usually a result of poor quality or insufficient wearing course material, or inadequate maintenance.	80 - 100

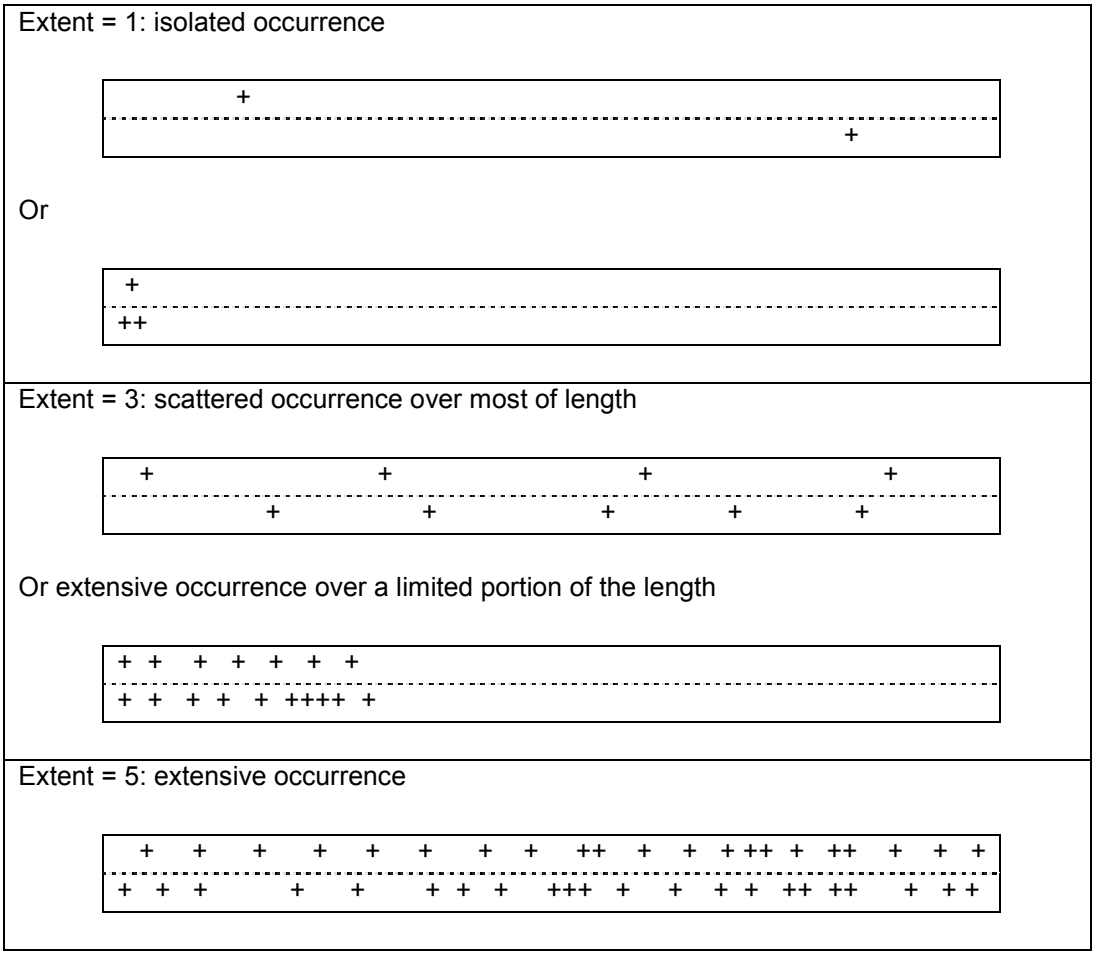


FIGURE A.2: Diagrammatical illustration of extent

Experience has shown that even amongst experienced raters, there is a general tendency to overestimate the extent of defects. This tendency increases with severity of the defect.

Estimation of the extent is not required for strategic network level assessments. However, provision must be made for recording localised problems. The extent is, however, essential for detailed network level assessments, project level assessments and for research purposes.

A.2.5 Examples of the use of Degree and Extent

The following examples illustrate the combined use of degree and extent:

(a) If potholing of degree 5 occurs seldom (i.e. extent 1) and potholing of degree 3 occurs extensively (i.e. extent 5), the degree 3/extent 5 potholing is recorded as the predominant indication of the severity of potholing over the specific road segment in terms of possible maintenance action. In such a case, the degree 5 potholing will be viewed as an area of localised distress requiring routine attention.

(b) If potholing of degree 5 and extent 2, and potholing of degree 1 and extent 4 occurs, degree 5/extent 2 is recorded as the average indication of the problem that is most significant in terms of possible action. (Potholing of degree 1 is not considered significant in terms of possible action.)

(c) For research purposes, the maximum severity possible is of greater interest and not the predominant severity.

A.3. Training and Calibration of Visual Assessors

The accuracy of the visual assessment data depends largely on the knowledge, experience and commitment of the assessors. To minimise the element of subjectivity and to ensure good knowledge of the assessment procedures, it is essential to train and calibrate all assessors before visual assessments are carried out. The intensity and duration of the training session will depend on the experience of the assessors.

It is recommended therefore that an annual training and calibration session be held even if all the assessors were trained during previous years. Changes to guidelines and procedures should also be presented and problems with the previous assessments should be discussed.

The training and calibration programme for assessors should include the following:

- An overview of the objectives of the visual assessment together with a brief description of the data processing procedures and applications of the final results.
- An overview of the causes of the various types of distress. It is essential that the raters understand the causes of the problems to get a realistic rating and to make recommendations on corrective action if required.
- An overview of the method of assessment, including identification of materials, descriptions of various types of distress and ratings for each type. The use of colour slides to show examples is recommended. The visual assessment manual should be studied by all before the training session.
- An overview of the format of the assessment sheet.
- Practical training, assessing at least 10 road segments, preferably in different conditions exhibiting a full range of defects. The method of rating should be discussed on the first segment which should then be rated jointly with further discussion until agreement and understanding is reached. Each assessor should then evaluate each of the remaining segments individually without discussion with other assessors. The assessment forms should then be compared afterwards and any major discrepancies should be discussed. If necessary, more segments should be assessed and discussed individually until acceptable consistency of rating is achieved.

  Problems may be encountered with the estimation of remaining gravel particularly where subgrade is extensively exposed. Assessors may consider the exposures as an imported wearing course, thereby overestimating the gravel quantity/layer thickness. The assessors therefore need to be aware of the need to interpret the road environment and characteristics in distinguishing between imported gravel wearing course and subgrade/road formation.

  It is recommended that, during the practical training, those attributes for which estimates of actual depths and sizes are required should be physically measured to enhance/check the capability of accurate quantitative assessment.

In addition, it is advisable for each project leader to meet with all the assessors within days after the start of the formal assessment to check the initial assessments.

It is essential that raters go through this process of training prior to any visual assessment programme. Post assessment calibrations have shown that where assessors were inadequately trained, the assessment has had to be redone. Where the original assessment was done on contract, they have had to redo it at their own cost.

A.4. Quality Control

An independent assessment of at least 10 to 15 per cent of the gravel road network should be carried out within one week of the roads being assessed to ensure that the study was carried out to an acceptable standard and to ensure that the raters have been consistent.

The following issues should be considered during the quality control exercise:

- Roads totalling between 10 and 15 per cent of the network should be selected, ensuring a good representation of the entire network. The results of the previous years assessment should be used to refine the selection in order that the majority of the roads selected are likely to have a visual condition index in the 3 to 5 bracket. Larger variations between raters are likely on roads in poor condition than on roads in good condition.
- The raters should not be informed of which roads are included in the quality control assessment.
- The person undertaking the quality control assessment should attend the training session together with the other raters.
- Based on the raters' plans, the selected roads should be assessed by the quality control rater within one week of the original assessment. This will ensure that the roads will be in a similar condition when being assessed.
- The results of the original and quality control assessments should be statistically compared. The variation should not exceed 15 per cent. It should be noted that, due to the subjective nature of visual assessments on unsealed roads, the practitioner undertaking the quality control assessment might not necessarily be correct. This will be revealed if different results are obtained by the quality control assessor to that of each of the original raters. If this occurs, the quality control assessment will have to be repeated. Alternatively, if discrepancies of more than one unit occur on two of the essential fields on the assessment form, the original assessment should be queried.
- If the variation in results exceeds the acceptable limit, the assessment forms should be compared to determine where the discrepancy occurs. If it is derived from the entire assessment, the rater and quality controller (and the client if quality control is also contracted out) should visit the sites to understand the discrepancy. If the fault lies with the rater, the assessment will have to be repeated. The rater should either be replaced or retrained.

B. UNSEALED ROAD ASSESSMENT

B.1. Introduction

The objective of a gravel road management system (GRMS) is to obtain a general overview of an unsealed road network for budgeting and strategic planning purposes. The system does not usually identify needs at project level, but is used for high-level decision-making. Project level assessments are more detailed than those done for strategic decision making and are carried out on specific roads identified as requiring attention from the GRMS. They can also be used by district staff for routine management activities, or for specific evaluations such as experimentation, feasibility for upgrading and justification for chemical improvement or dust control. The quantity and quality of data collected will differ between assessments depending on the reason for carrying out the assessment. The level of detail is usually far greater at project level than at strategic level. Direct measurement of certain properties and collection of samples for laboratory testing may also be included.

In order to provide reliable outputs and allow direct comparison between projects, it is essential that the data used in a GRMS is consistent and of high quality. The data capture also needs to be repeatable and done in the most cost-effective manner.

For most project level assessments, the items identified as desirable provide additional value to the essential items. Those items identified as optional need only be collected if required.

With independent road authorities in the provinces, a uniform procedure for the collection of data will allow direct comparisons between the strategic and tactical decisions made in the different provinces.

B.2. Purpose

The data collected for use in the gravel road management system should provide the road authority with objective information to assist with strategic and tactical decision making. This includes aspects such as:

- An indication of the current level of service provided by the network
- The cost of maintaining the current level of service
- The cost of an improvement in service
- An indication of the social and economic impact of these improvements
- The effect of current polices on the future levels of service
- Prioritising roads to be upgraded to sealed standard
- Frequency of blading and regravelling
- Distribution of funds between blading and regravelling
- Benefits from predictions

B.3. Defining Segments

In order to cost-effectively evaluate unsealed roads, it is necessary to segment them into manageable units. Each segment should be relatively uniform in terms of its material type and general performance and should be about 5 km long. They should not be less than 2.5 km to avoid the collection of excessive and repetitive data, unless the segment will be used for experimentation or where a variety of different materials is used. For ease of use and application, the start and end-points of each segment should be related to fixed datum points (e.g. intersections, bridges etc), but this is often not possible on rural roads, in which case, durable marker boards should be erected. The segments remain fixed.

Defining segments in the urban environment is carried out on a different basis. Segment lengths are relatively short and are typically defined by intersections.

The increasing availability, affordability and accuracy of Global Positioning Systems (GPS) technology, will in future allow the specification and easy relocation of arbitrary datum points (e.g. every 5 km, or the change of gravels).

B.4. Assessment Forms

The information required by various road authorities will dictate the parameters used on and layout of the form. A number of examples of assessment forms are provided in Part D. Many authorities already have standard forms, but the examples could be used as a basis for upgrading these or developing new forms for those authorities that do not have any. In keeping with the modular approach advocated in this document, it is recommended that the following minimum information be captured for any assessment. As the intensity of the analysis increases, additional or more information needs to be captured. This is illustrated in the sequence of the four forms in Part D

- Gravel quantity/layer thickness
- Gravel quality and influencing factors or estimates of selected material properties
- Road profile/shape as an assessment of water shedding capacity
- Road drainage in terms of removal of water from roadside
- Riding quality/safety and influencing factors
- Dust
- Trafficability
- Moisture condition

Additional information fields can be added to the forms to suit the individual requirements of any road authority.

It is critical that the data collection form has the same reference to the segment identification as the data inventory. All data must be captured on a standard data sheet to ensure consistency and completeness.

B.5. Assessment Procedure

The successful implementation of a GRMS relies on accurate and repeatable data. These data are captured during the periodic visual assessment of the entire gravel road network. At network level, there is a large volume of data to be collected and assessment needs to be carried out in as short a time as possible.

The results of the assessment are recorded on field assessment forms, which are the links between the rater and the GRMS or any other use. The assessment can be enhanced if the rater has a clear understanding of the desired output of the GRMS. (i.e. will the data be used primarily for strategic planning purposes, or will more tactical applications be derived from them?)

Visual assessments should preferably be carried out in the dry season, as many of the important defects are not easily identified when the road is wet. The dry season is also longer than the wet season over most of South Africa allowing a longer window for this data collection. If detailed assessments are made throughout the year, then cognisance should be taken of the recent weather conditions. Surveys should, however, be completed as quickly as possible to ensure repeatability and to exclude seasonal influences. For GRMS data collection, the daily length of survey should generally not exceed 130 km, based on the ability to assess three segments of 5 km each per hour in an 8-hour day. Shorter daily lengths may be expected if the condition of the road is very variable, in the case of shorter segment lengths, or if detailed assessments are being made.

The assessors should drive at a speed not exceeding 40 km/h when gathering data and should include at least one stop on each segment for a closer assessment of the material quality, layer thickness and general performance. However, for detailed or research assessments, assessors should initially drive over the length of the segment in both directions at a speed not exceeding 20 km/h. While driving, suitable locations for detailed visual assessments and sampling should be identified. The assessment of defects is generally restricted to the trafficked portion of the carriageway and excludes the shoulders and windrows left during blading.

Suitable safety precautions should be taken at all times.

Individual road authorities may require more frequent stops for information gathering and material assessment and sampling. During these stops, actual gravel thickness may be determined. The accuracy of the assessor's rating will generally be influenced by the frequency of stops made, this frequency depending on the condition of the road and its variability. During assessment of the first segment, more stops will probably be required in order to relate the appearance of the road from within the vehicle while moving to that when stationary. Additional stops may be required on segments showing isolated areas of severe distress. The assessor should leave the vehicle during the stops to examine the road more closely. The use of a geological pick during the assessment is recommended.

Unlike assessments for GRMS input, that are carried out at regular intervals (usually annually), detailed assessments may be carried out on a more ad hoc basis. For problem evaluation, a once off assessment may suffice, while for experimentation purposes, frequent assessments over a period will be required. In these types of

assessments, data that is more detailed is often required, which implies that more time needs to be spent on the selected segments.

The first road segment to be evaluated in any assessment requires a thorough orientation to adjust the assessors to the prevailing conditions, because the position of the sun (preferably from the rear), the amount and variability of cloud cover and a wet surface will influence the visibility of the defect (e.g. dust and corrugations). This may entail doubling back in order to acquire sufficient data.

As detailed network level and project level assessments require more detail than network level assessments, it is rarely possible to undertake them only from a moving vehicle. More measurements and material sampling are often required and the locations for these activities should be predetermined or selected once on site. The assessment is usually best carried out by walking the road in both directions.

During the visual assessment of segments, dots can be made on the assessment form in the appropriate positions to indicate the degree of any type of distress that is observed. At the end of the segment, these dots are used to mark a predominant degree of distress for each type of defect. All fields on the form must be completed (none, where no distress is observed) to ensure that no assessment parameters have been overlooked. After completing the form, the assessor should also check road segment information (i.e. correct start and finish information, etc).

B.6. Road Information

The information regarding each road and its segments is required for the data inventory. These are summarised in the list below. They are stored in the GRMS database. Only road number, start and end kilometre of the segment are required on the assessment form.

- Road number
- Start km of segment
- End km of segment
- Node description
- District/region
- Weinert N-value
- Terrain
- Road type (i.e. earth, gravel, treated)
- Design road width
- Traffic data (this will vary from authority to authority)
- Material type (this may change during the life of the road)

It is important, however, that any obvious changes, particularly in the road width, material type or traffic volume, are captured on the form during the assessment and reflected in the section inventory. Fields to check these items can be included on the assessment form if required.

B.6.1 Material Type

Basic classification of the material type is used by some road authorities in conjunction

with the gravel quality (e.g. clay, sand and gravel) to predict performance in their GRMS's. Typical material properties (e.g. grading modulus, plastic limit, various particle size fractions) are linked to standard material types as input parameters for algorithms in the GRMS to predict gravel loss and blading frequencies. In other GRMS's, material type is used purely as a check of the road inventory information.

The general classification of materials minimises laboratory testing and is the most practical method for estimating material property inputs for network level evaluations. However, calibration of the material properties will be necessary for each area. The best results would be obtained by carrying out laboratory testing on representative samples removed from the road, but the resources required usually render this prohibitive. Regravelling of roads over time will make material properties available for more accurate determinations. Accurate identification of the material type is not always necessary and it is suggested that the more general engineering geological classification developed by Weinert[4] be used. Commonly used road construction materials are classified into their engineering geological groups in Table B.1 below.

TABLE B.1: Engineering geological classification and example materials

Group	Material type
Basic crystalline	Dolerite, andesite, basalt, diabase, gabbro, norite
Acid crystalline	Granite, felsite, rhyolite, gneiss
High silica	Chert, quartzite, quartz porphyry
Arenaceous	Sandstone, arkose, conglomerate
Argillaceous	Shale, mudstone
Diamictites	Tillite, breccia
Pedocretes	Ferricrete, calcrete, silcrete, dorbank
Transported	Sand, river gravel

A simple material identification procedure is included in Part E. This is based on the quantity of quartz and the ability of the rater to identify it with a magnifying glass.

B.7. General Information

The general information that needs to be captured includes the name of the evaluator, the date of the evaluation, the road and section numbers and their start and end km's.

B.8. Parameters to be Assessed

The following road characteristics should be assessed as a minimum in a GRMS assessment:

- General performance
- Moisture condition
- Gravel quantity/layer thickness
- Gravel quality and influencing factors or estimates of selected material properties
- Road profile/shape as an assessment of water shedding capacity

- Road drainage in terms of removal of water from roadside
- Riding quality and influencing factors
- Dust
- Trafficability
- Isolated problems
- Maintenance action required

Some road authorities may require additional information for specific needs. For example:

- A road authority that plans to use sand cushioning as a maintenance option for controlling corrugations would need to capture additional information regarding this defect.
- A road authority with ready access to in situ stone processing equipment (e.g. Rockbuster) would need more information on stoniness.

Under certain circumstances, e.g. when assessing in remote areas, it may be cost-effective to assess the road in more detail than would normally be necessary. The extra time involved is minimal compared to the disadvantages of having to return to the site at a later date to gather additional information.

B.8.1 General Performance

An estimate of the general performance should be made. This should be representative of how the travelling public would view the condition and performance of the road. This parameter is recorded for possible use as a crosscheck with any visual condition index calculated from the full assessment (e.g. if general condition is rated as good, but corrugations are rated as severe over most of the road, a misjudgement has been recorded). It can also be used as a first indication of the overall performance of the road network.

General performance is assessed on a scale of **one** to **five** (where one is very good and five is very poor) primarily in terms of driver and passenger comfort and the drivers perception of safety. It should be estimated after driving the segment before the detailed assessment is carried out in order to eliminate any bias that may result after completing the detailed assessment.

B.8.2 Moisture Condition

The moisture condition affects the visual assessment of properties such as dust, corrugations, loose material and skid resistance. It is therefore necessary to estimate the moisture condition for later use if there are queries regarding the influence of any of these properties.

Assessment of the condition is limited to a subjective rating of "**wet**" (damp) or "**dry**" taking the consequences into account (e.g. the road will not be wet if dustiness is significant). Disturbance of windrows or loose material will usually indicate whether the material is wet.

In project level or experimental assessments, more accurate indications of moisture content may be required and can be obtained by sampling the material, placing it in a sealed container and determining the moisture content gravimetrically in an oven. Output from this type of assessment will be the percentage moisture by dry mass of the soil.

B.8.3 Gravel Quantity/Layer Thickness

Most unsealed roads are constructed with a wearing course of about 150 mm of compacted selected gravel. Under traffic and environmental influences, this gradually wears away and requires periodic replacement. If it is not replaced, the subgrade is exposed to traffic. This material is usually unsuitable as a wearing course and results in trafficability problems and shear failures. In flat areas, drainage of water away from the road will be retarded or even impeded.

The rate of gravel loss is a function of the material properties and the traffic. However, as the traffic increases, or the material quality deteriorates, this annual loss increases significantly. The rate also increases if profile and drainage are poor

During the visual assessment, it is necessary to estimate whether sufficient gravel remains to provide adequate service until the next assessment period. This requires actual measurements of the layer thickness, or judgement by the rater taking into account the material quality, traffic and any evidence of subgrade exposure.

Gravel quantity is either rated on a five-point scale as described in Table B.2, or physically measured on the road by excavating small holes in the wheel tracks. This should be done at a sufficient frequency (e.g. 5 holes on a 5 km segment) to determine a representative average for the segment. Output from the assessment will be millimetres of material remaining. It should be noted that the direct measurement of layer thickness is essentially a measure of the severity of gravel loss, while estimation of the subgrade exposure represents an extent. Although the former is the optimum solution, the latter is a more readily obtained proxy for the severity.

TABLE B.2: Visual assessment of gravel quantity

Rating	Descriptor	Description	mm
1	Plenty	Good shape, and no stone protrusion	>125
2	Sufficient	No exposures of subgrade, but some stone protrusion	100 – 125
3	Isolated exposures	Less than 25 per cent exposure of the subgrade	50 – 100
4	Extensive exposures	Up to 75 per cent exposure of the subgrade	25 – 50
5	None	75 to 100 per cent exposure*	0 – 25
* Total exposure of subgrade should not be confused with plenty of gravel			

When visually assessing gravel thickness, adequate cover of material over pipe drains and culverts can be a good indicator, bearing in mind that all culverts/pipes should have sufficient cover to protect the structures from traffic loads. Exposure of pipe drains, culverts and bedrock indicates neglect of the road and inadequate gravel cover. The same applies to stone exposure. If it is assumed that the surface of the road was level after compaction, the height of stones above the surrounding road surface will give an indication of the amount of gravel that has been lost.

When less than 25 per cent of the imported gravel wearing course material remains, but the exposed subgrade material appears to be performing adequately, the gravel quantity should still be rated as “none” to ensure that the road is prioritised for regravelling by the GRMS.

GRAVEL QUANTITY



Degree 1

X	**2**	**3**	**4**	**5**

Plenty



Degree 3

1	**2**	**X**	**4**	**5**

Isolated exposures



Degree 5

1	**2**	**3**	**4**	**X**

None

B.8.4 Gravel Quality and Influencing Factors

The performance of an unsealed road depends primarily on the quality of the gravel used to construct the wearing course. The properties contributing to good gravel are particle size distribution and cohesion. The gravel should have a range of particle sizes ranging from very fine up to about 40 mm in order to provide a strong framework of stones interlocked by a tight matrix of fines. An excessive number of large stones results in poor riding quality and difficulties with maintenance. The fines need to have some plasticity to provide cohesion when dry. However, plasticity should not be so high that the road becomes slippery and impassable when wet. Optimally, samples of the gravel should be tested for these properties in a laboratory. However, this is usually not feasible during annual assessments and a more subjective evaluation will usually suffice. Training and calibration before the assessment will minimise the subjectivity.

Gravel quality is rated on a five-point scale, as described in Table B.3.

TABLE B.3: Visual assessment of gravel quality

Rating	Descriptor	Description
1	Very good	Evenly distributed range of particle sizes and sufficient plasticity that the material will leave a shiny streak when scratched with a pick. No significant cracking, ravelling and/or excessive oversize
2	Good	Minor ravelling or cracking and/or minimal
3	Average	Cracking, loose material or stones clearly visible,
4	Poor	Poor particle size distribution with excessive oversize. Plasticity high enough to cause slipperiness. Ravelling is sufficient to cause loss of traction.
5	Very poor	Poorly distributed range of particle sizes and/or zero or excessive plasticity. Cracking and/or quantity of loose material/stones are significant and affect safety of road user. Excessive oversize.

The factors influencing the rating must also be recorded. The following factors can be marked:

- Excessive clay and/or silt (i.e. plasticity too high)
- Excessive sand – loose with insufficient fines (i.e. plasticity too low)
- Excessive oversize stones and/or loose gravel

Some GRMS's require estimates of the material properties, particularly the plasticity index. This is usually assessed in three categories, e.g. less than 6, 6 to 15 and greater than 15.

Although the gravel quantity may be rated as "extensive exposures" or "none", it is still necessary to rate the related performance. This should be applied to the predominant surface material on the carriageway, whether it is subgrade or the remaining wearing course. This assessment should be carried out in terms of the road users perception of the road and the ability to carry out effective maintenance

GRAVEL QUALITY



Degree 1

X	**2**	**3**	**4**	**5**

Very good



Degree 3

1	**2**	**X**	**4**	**5**

Average



Degree 5

1	**2**	**3**	**4**	**X**

Very poor

GRAVEL QUALITY – INFLUENCING FACTORS



Excessive clay



Loose sand



Excessive oversize

B.8.5 Road Profile/Shape

The profile (shape) of a road has a major impact on the performance of that road. Roads with good profile tend to shed water rapidly avoiding the development of potholes and potentially impassable conditions. Where the profile is flat, water tends to pond in localised depressions resulting in softening of the wearing course and the development of potholes and other deterioration. Failure to timeously repair a flat road will usually result in the development of ruts under traffic. These may become preferential water paths resulting in erosion, accelerated gravel loss and significant deterioration in riding quality.

It should be noted that rutting in unsealed roads is generally the result of loosening and whip-off of material and is only seldom the result of subgrade deformation/settlement. Routine grader blading usually reduces rutting.

The road profile is rated on a five-point scale where one is very good and the trafficked surface will shed water easily, and five is very uneven resulting in potential localised ponding and/or surface drainage occurring in a longitudinal direction. These are defined in Table B.4 and illustrated in Figure B.1. It should be noted that on grades, the impact of the gravel profile becomes less dominant than the actual grade.

TABLE B.4: Visual assessment of gravel profile

Rating	Descriptor	Description
1	Very good shape	Well formed camber (about 3 - 4 per cent)
2	Good shape	Good camber (about 2 per cent)
3	Flat	Some unevenness with camber mostly less than 2 per cent
4	Uneven	Obvious development of irregularities that will impede drainage and form depressions
5	Very uneven	Development of severe irregularities impeding drainage and likely to cause extensive localised ponding. Water tends to flow to the centre of the road or individual lanes

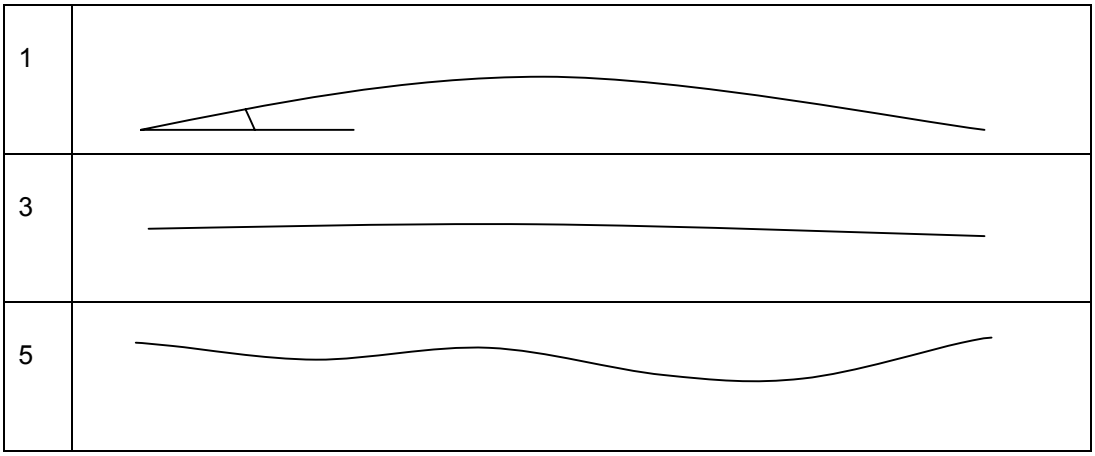


FIGURE B.1 Gravel profile schematics

GRAVEL PROFILE



Degree 1

X	**2**	**3**	**4**	**5**

Very good



Degree 3

1	**2**	**X**	**4**	**5**

Flat



Degree 5

1	**2**	**3**	**4**	**X**

Very uneven

B.8.6 Drainage from the road

There is obviously a strong interrelationship between the road profile discussed previously (drainage off the road) and drainage from the road. However, the profile relates more directly to the capacity of the road to shed water without causing erosion, while drainage from the road relates more closely to the impact of standing water on both the wearing course and underlying road structure. Effective operation of adequate side drains is the predominant aspect to be considered during this rating. This includes removal of water from the zone of influence adjacent to the road as well as erosion effects associated with shoulders and undercutting of the road.

Drainage from the road is rated on a five-point scale where one indicates that the road is well above ground level and has effective side drains leading water away from the road formation. Five is classified as a canal where the road acts as the drainage path in the area. These are defined in Table B.5 and illustrated in Figure B.2. The descriptors are essentially applicable to roads in flat or slightly sloping terrain. Where grades are steeper, roads assessed as degrees 4 and 5 will act as drainage courses during periods of intensive rainfall leading to severe erosion.

TABLE B.5: Visual assessment of drainage/road formation

Rating	Descriptor	Description
1	Well above ground level	Edges of road are at least 300 mm* above natural ground level with effective side drains
2	Slightly above ground level	Road is between 50 and 300 mm above natural ground level. Side drains are present. Stormwater could cross in isolated places.
3	Level with ground	Road is generally at ground level with ineffective side drains. Stormwater could cross in most places.
4	Slightly beneath ground level	Isolated areas of the road are below natural ground level. No side drains are present and localised ponding of water will occur.
5	Canal	Road is the lowest point and serves to drain the entire area.
* If pipes are laid under the road for drainage, then the formation should be at least 500 mm above natural ground level		

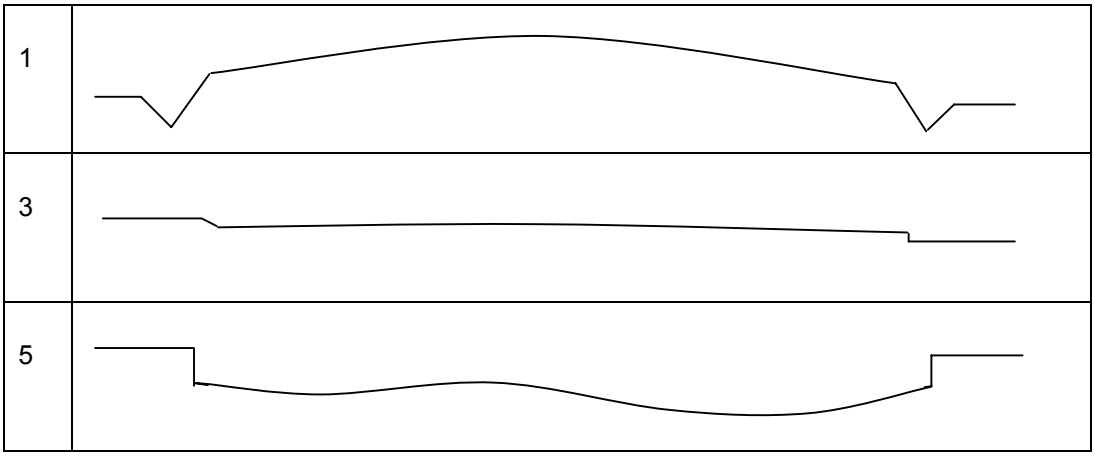


FIGURE B.2: Schematics of road drainage

Additional information may be required on the presence, condition and effectiveness/adequacy of culverts and mitre drains. This will entail written information on the facilities with recommendations on maintenance or upgrading if this is required. In many instances, these are assessed separately during routine maintenance inspections.

DRAINAGE



Degree 1

X	**2**	**3**	**4**	**5**

Well above ground



Degree 3

1	**2**	**X**	**4**	**5**

Level with ground



Degree 5

1	**2**	**3**	**4**	**X**

Canal

B.8.7 Riding Quality and Influencing Factors

The riding quality of the road is probably the major performance parameter affecting driver and passenger comfort and safety. It also has a significant impact on the overall vehicle operating cost associated with the road. Road roughness is best quantified using one of the many items of equipment dedicated to roughness evaluation. However, for the purposes of network assessment, it is usually acceptable to rate the riding quality subjectively.

Road roughness is influenced primarily by maintenance frequency, quality of grader maintenance and material properties. Other factors such as intensive rainfall and heavy seasonal traffic will also have an influence. Certain pavement defects are the direct result of deficiencies in the material properties. These defects influencing riding quality are:

- Corrugation
- Loose material
- Stoniness
- Potholes
- Ruts
- Erosion

More detail is given on these defects in later sections.

Riding quality is most easily rated as a function of the “estimated” comfortable and safe driving speed (unaffected by geometric constraints or road width) that could be driven in a privately owned saloon car. This is estimated while travelling at the speed recommended for visual assessment (40 km/h) and is interpreted as follows (Table B.6):

TABLE B.6: Assessment of riding quality

Rating	Descriptor	Description
1	Very good	Estimated comfortable/safe speed in excess of 100 km/h
2	Good	Estimated comfortable/safe speed between 80 and 100 km/h
3	Average	Estimated comfortable/safe speed between 60 and 80 km/h
4	Poor	Estimated comfortable/safe speed between 40 and 60 km/h
5	Very poor	Estimated comfortable/safe speed less than 40 km/h

Riding quality is usually measured in conjunction with an assessment of the parameters that influence it.

For detailed assessment, appropriate purpose-built equipment (e.g. Linear Displacement Integrator) should be used to provide a quantitative measure. Output from the assessment will be a roughness index over the road segment assessed (e.g. International Roughness Index (IRI) or Quarter Car Index (QI)).

RIDING QUALITY



Degree 1

X	**2**	**3**	**4**	**5**

Very good



Degree 3

1	**2**	**X**	**4**	**5**

Average



Degree 5

1	**2**	**3**	**4**	**X**

Very poor

RIDING QUALITY – INFLUENCING FACTORS



Corrugation



Loose material



Stoniness

RIDING QUALITY – INFLUENCING FACTORS



Potholes



Rutting



Erosion

B.8.8 Dust

Definition and cause

Road dust is the dry solid matter consisting of clay and silt-sized particles that is entrained by wind, the wind shear forces created by vehicles and the interaction of vehicle tyres with the road and which disperses and remains in suspension for a period before eventually falling back to the earth's surface. The aerodynamic shape, tyre size and number of wheels on trucks imply that dust generation by heavy vehicles is more severe than light vehicles.

Problem

Dust is undesirable from a number of points of view including safety (loss of visibility), economic (accelerated gravel loss as a result of the loss of fines), comfort of vehicle occupants, health (respiratory diseases), vehicle damage (filters and exposed moving parts), damage to road side vegetation (crops) and environmental impact (air pollution). Dust is generally considered unacceptable by the travelling public when the vehicle generating the dust cannot be seen by a following vehicle.

Measurement

At network level, assessment of dust is necessary as input for prioritising a potential dust problem and determining the costs of applying a dust palliative. In assessing the dustiness of a road, the moisture condition at the time of assessment plays a major role. Dust generation is influenced by many factors and some subjectivity during assessment is inevitable. The following procedure has been developed in an attempt to bring some uniformity to dust assessment.

For the purposes of strategic network level assessments, dust is usually rated as either **acceptable** or **unacceptable** with safety being the major factor taken into account. If the dust generated by a vehicle is perceived to be dangerous, it should be rated as unacceptable. Dustiness should be rated in the rear view mirror while travelling at 60 km/h. This may require that short distances within the segment are monitored at this higher speed. Wind speed and lighting conditions (position of the sun) can influence rating in this way and should be taken into consideration.

For detailed network level, project level and research investigations, dust is best measured with specialised equipment following a prescribed methodology. However, a visual evaluation as well as a subjective assessment of dust on vehicle occupant comfort will suffice in most instances. This is carried out either by the driver of the vehicle travelling at 60 km/h and using the rear-view mirror to assess the dust generated by the raters vehicle, or by an observer at roadside. Occupant discomfort is judged on the necessity to close windows and ventilation systems. Runs should be made in both directions to determine the effect of the sun, with an average degree recorded (rounded upwards where necessary). Trucks generate significantly more dust than cars and LDVs and ratings will usually be unacceptable on most roads. Dust ratings on roads with a daily high percentage of heavy vehicles (e.g. >30 per cent) should be weighted to unacceptable.

The description of degrees of dustiness is given in Table B.7. The extent of dust is not normally estimated.

TABLE B.7: Degrees of dustiness

Degree	Description
1	No loss of visibility
3	Some loss of visibility – no discomfort
5	Dangerous loss of visibility – significant discomfort

DUST (GRMS assessment)



Degree 1

X		**5**

Acceptable



Degree 5

1		**X**

Unacceptable

DUST (Detailed assessment)



Degree 1

X	**2**	**3**	**4**	**5**

No loss of visibility



Degree 3

1	**2**	**X**	**4**	**5**

Some loss of visibility – no discomfort



Degree 5

1	**2**	**3**	**4**	**X**

Dangerous loss of visibility – significant discomfort

B.8.9 Trafficability

Definition and cause

Trafficability (or passability) is the capacity of a normal saloon car to negotiate the road without losing traction or without excessive use of low gears. The terms trafficability and impassability are used interchangeably throughout this document (however, impassability should not be confused with the inability to overtake in dusty conditions). The mechanism affecting trafficability is the loss of traction between the tyres and the road resulting from the low shear strength of the material. This results in churning of the material and sinking of the vehicle into the weak layer. Sandy materials are more prone to impassability when dry, while clayey materials are strong when dry, but often become impassable when wet. Impassable conditions may result from continued trafficking of slippery roads.

Problem

The primary objective of importing wearing course gravel during the construction of an unsealed road is to provide an all-weather surface. This objective is not met if the material becomes impassable in wet weather. This is often a particular problem with earth roads where in situ materials are used.

Assessment

Impassability is difficult to assess unless the rater actually experiences the condition at its worst. However, evidence of earlier impassable conditions often remains after the event. This includes:

- Deep depressions and evidence of potholes
- Detouring on the shoulders and verges to avoid wet areas
- Spurious material used to fill depressions and to provide temporary traction (often includes vegetation)

For assessment purposes, trafficability is rated as either **acceptable** or **unacceptable**, the latter only being used when definite evidence is observed over a major portion of the segment.

TRAFFICABILITY



Degree 1

X		**5**

Acceptable



Degree 5

1		**X**

Unacceptable

B.8.10 Potholes

Definition and cause

Potholes are round or elongated depressions in the road surface and arise from the following:

- Poor road shape and drainage
- Poor grader operation practice (e.g. plucking of oversize material and destruction of the crown)
- Compaction of material behind oversize stones under wheel loads
- Poor compaction
- Material and moisture variability
- Enlargement of corrugation troughs
- Deformation of weak subgrades and wearing courses
- Subsidence or excavation of animal and insect burrows
- Disintegration of highly cracked roads (i.e. excessive plasticity)
- Disintegration of soft oversize materials
- Dispersive soils

Problem

Potholes play a significant role in the development of roughness on unsealed roads and may cause substantial damage to vehicles if they are allowed to develop and increase in size. The effect of potholes on vehicles depends on both the depth and diameter of the pothole. The potholes, which affect vehicles the most, are those between 250 and 1 500 mm in diameter with a depth of more than 50 to 75 mm.

Once pothole formation has been initiated (irrespective of the cause), the drainage deteriorates, water ponds in the depressions and the potholes are enlarged by traffic. Enlargement occurs through compaction and remoulding of the weakened material (in the wet state) and removal of the material from the hole by the wheels and splashing. Materials with a low soaked strength are thus likely to develop larger and deeper potholes in shorter periods. The influence of drainage on pothole formation is clearly manifested by the general absence of potholes on grades. Potholes are usually worst at the bottom of vertical sag curves, on level road sections with poor shape, and near bridges. The influence of potholes on riding quality is a function of both the degree and extent of the potholing (i.e. many degree 3 potholes have a greater impact on riding quality than a few degree 5 potholes). The descriptions of degrees of potholing are given in Table B.8.

TABLE B.8: Degrees of potholing

Degree	Description
1	Depressions just visible. Cannot be felt in the vehicle
2	<20 mm deep
3	Larger potholes affecting safety - 20 – 50 mm deep
4	50 – 75 mm deep
5	Large, dangerous potholes requiring evasive action - >75 mm deep

POTHOLES



Degree 1

X	**2**	**3**	**4**	**5**

< 10 mm deep



Degree 3

1	**2**	**X**	**4**	**5**

20 – 50 mm deep



Degree 5

1	**2**	**3**	**4**	**X**

> 75 mm deep

B.8.11 Rutting

Definition and cause

Ruts are parallel depressions of the surface in the wheel tracks. They generally form as a result of loss of gravel from the wearing course by traffic abrasion and less commonly by deformation (compaction) of the subgrade and compaction of the wearing course.

Problem

Under local conditions, rutting is usually insignificant in terms of the overall unsealed road surface performance. The probable reason for this is the typically strong, free draining, sandy subgrade prevalent over much of southern Africa, as well as the deep water tables.

Ruts, however, pose potential problems, as they tend to retain rainwater having a negative impact on road safety and also softening the wearing course leading to deformation under traffic. Routine blading of unsealed roads replaces gravel in the ruts and simultaneously compensates for any subgrade deformation that may have occurred. The material graded into the ruts is generally compacted by traffic only when in a moist condition.

Excessively wide roads lead to the formation of definite ruts in both directions, which tend to be deeper than those on roads of normal width (8 m). The probable reason is that lateral movement of vehicles is unnecessary when they pass from both directions and all vehicles travelling in each direction thus consistently travel in the clearly demarcated ruts. This ultimately leads to deep, wide depressions in each direction.

Assessment

Ruts are assessed in terms of their capacity to retain water using a visual estimate of their average depth. If greater accuracy is required, (e.g. for investigation or research purposes) a 2.0 m straightedge and wedge should be used. Because of their high variability, the average of a number of readings should be determined and the rutting in different directions and wheel paths should be provided separately. The descriptions of degrees of rutting are given in Table B.9.

TABLE B.9: Degree of rutting

Degree	Description
1	Rutting is just visible
2	<20 mm deep
3	Rutting between 20 – 40 mm deep
4	40 – 60 mm deep
5	Rutting >60 mm deep affecting directional stability of a vehicle

RUTTING



Degree 1

X	**2**	**3**	**4**	**5**

Just visible



Degree 3

1	**2**	**X**	**4**	**5**

20 – 40 mm deep



Degree 5

1	**2**	**3**	**4**	**X**

> 60 mm deep

B.8.12 Erosion

Definition and cause

Erosion or scour is the loss of surfacing material caused by the flow of water over the road. The ability of a material to resist erosion depends on the shear strength (equal to the cohesion, as the normal stress is zero) under the conditions at which the water flow occurs. If the shear strength of the material is less than the tractive forces induced by the water flowing over the materials, grains will become detached and erosion will occur.

Problem

The result of erosion is runnels (run-off channels) which, when occurring transversely, result in extreme roughness and dangerous driving conditions, and when occurring longitudinally (on grades), form deep "ruts". Associated with this road defect is a significant loss of gravel. Much of this gravel is deposited in the drains and culverts necessitating extensive labour intensive maintenance. Erosion of the wearing course also results in a change in the properties of the material as various fractions of the material are selectively removed.

Assessment

Transverse or diagonal erosion channels can be quantified by their depth and width. However, they are best assessed in terms of their effect on riding quality. Longitudinal erosion channels are assessed in a similar way to ruts by visual estimation or measuring depth with a 2.0 m straight edge and wedge. Assessments should only relate to the trafficked area and not to the side drains. The descriptions of degrees of transverse and longitudinal erosion are given in Tables B.10 and B.11.

TABLE B.10: Degrees of transverse and diagonal erosion

Degree	Description
1	Minor evidence of water damage
2	Seen, but not felt or heard (channels 10 mm deep x 50 mm wide)
3	Can be felt and heard – speed reduction necessary (30 mm x 75 mm)
4	Significant speed reduction necessary (50 mm x 150 mm)
5	Vehicles drive very slowly and attempt to avoid them (>60 mm x 250 mm)

TABLE B.11: Degrees of longitudinal erosion

Degree	Description
1	Evidence of water damage
2	Channels <20 mm deep
3	Channels 20 – 40 mm deep
4	Channels 40 – 60 mm deep
5	Channels >60 mm deep

EROSION – TRANSVERSE



Degree 1

X	**2**	**3**	**4**	**5**

Minor Evidence of water damage



Degree 3

1	**2**	**X**	**4**	**5**

Can be felt and heard – speed reduction necessary – channels 30 mm deep x 75 mm wide



Degree 5

1	**2**	**3**	**4**	**X**

Vehicles drive very slowly and avoid erosion channels – channels > 60 mm deep x 250 mm wide

EROSION - LONGITUDINAL



Degree 1

X	**2**	**3**	**4**	**5**

Evidence of water damage



Degree 3

1	**2**	**X**	**4**	**5**

20 – 40 mm deep



Degree 5

1	**2**	**3**	**4**	**X**

> 60 mm deep

B.8.13 Corrugation

Definition and cause

Corrugations can be either “loose” or “fixed”. Loose corrugations consist of parallel alternating crests of loose, fine-sandy material and troughs of compacted material at right angles to the direction of travel. Fixed corrugations on the other hand consist of compacted crests and troughs of hard, fine sandy-gravel material. Loose corrugations are easily removed by blading, whereas fixed corrugations need cutting or even tining with the grader before the material is re-spread. The wavelength of the corrugations is dependent on the modal speed (i.e. most frequently occurring speed) of the vehicles using the road, with longer wavelengths formed by faster traffic.

Corrugations are caused by the initiation of wheel bounce by some irregularity in the road (or possibly even worn suspension components such as shock absorbers) that results in kick-back of non-cohesive material, followed by compression and redistribution of the wearing course as the wheel regains contact with the road. Only low plasticity materials corrugate significantly, especially those with a high sand and fine-gravel fraction. However, many roads with gravels having plasticity indices of up to nine have produced corrugations. These form when the material is continually spread from the sides of the road back onto the road during grader maintenance. This material is usually deficient in binder (most of it having been blown away with time as dust) and the material forming the corrugations is non-plastic.

Problem

Corrugations are one of the most disturbing defects of unsealed roads causing excessive roughness and poor vehicle directional stability. Corrugations seldom form to any significant extent during the wet season, as the material effectively remains slightly “cohesive” in its wet state through capillary suction and is not adequately mobile to form corrugations. Corrugations are frequently associated with areas of acceleration, deceleration and cornering.

Assessment

Corrugations should be scraped with a geological pick to determine whether they are loose or fixed – this will dictate the type of maintenance that will be required. The severity of corrugations is best assessed from within a moving vehicle at the average speed of the road. The descriptions of degrees of corrugation are given in Table B.12. Dedicated roughness measurement equipment can also be used to determine the road roughness if this level of detail is required.

TABLE B.12: Degrees of corrugation

Degree	Description
1	Not felt or heard in a light vehicle
2	Can be felt and heard – no speed reduction necessary
3	Can be felt and heard – speed reduction necessary
4	Significant speed reduction necessary
5	Drivers select a different path and drive very slowly. Safety is affected

CORRUGATION



Degree 1

X	**2**	**3**	**4**	**5**

Not felt or heard in a light vehicle



Degree 3

1	**2**	**X**	**4**	**5**

Can be felt and heard – speed reduction necessary



Degree 5

1	**2**	**3**	**4**	**X**

Vehicles select a different part of the road and drive very slowly

B.8.14 Loose Material

Definition and cause

Loose material (that material less than 26 mm in size) is formed by the ravelling of the wearing course gravel under traffic. This may be distributed over the full width of the road but more frequently, it is concentrated in windrows between the wheel tracks, or alongside the travelled portion of the road. It is mainly caused by a deficiency of fine material (because of lack of cohesion), a poor particle size distribution (e.g. gap grading) in the wearing course gravel and inadequate compaction. Ravelling is generally worse in the dry season than in the wet season when capillary suction results in apparent cohesion.

Problems

The major problems with roads susceptible to ravelling are:

- The windrows are a safety hazard
- Stones from the loose material may damage vehicles or windscreens
- The rolling resistance of the vehicle is increased by loose material with concomitant increases in fuel consumption and vehicle operating costs
- Windrows of loose material adjacent to the trafficked portion of the road impede surface drainage

Assessment

Loose material is assessed by estimating or measuring its thickness. This is achieved by scraping "paths" through the material to the hard surface with a geological pick and estimating the thickness or measuring it with a straightedge and wedge. The descriptions of degrees of loose material are given in Table B.13.

TABLE B.13: Degrees of loose material

Degree	Description
1	Just visible
2	Loose material < 20 mm thick
3	Loose material 20 – 40 mm thick
4	Loose material 40 – 60 mm thick
5	Loose material > 60 mm thick

Note:

It is important to assess the extent of the loose material as well as the degree in order to differentiate between traffic associated and maintenance associated loose material. Traffic associated loose material is usually limited to windrows, whilst maintenance associated loose material is usually distributed across the road. However, traffic induced windrows should not be confused with windrows left by the grader operator as a source of material for future blading operations. These windrows are usually on the very edge of the road and not along the wheelpaths.

LOOSE MATERIAL



Degree 1

X	**2**	**3**	**4**	**5**

Just visible



Degree 3

1	**2**	**X**	**4**	**5**

Loose material is 20 – 40 mm thick



Degree 5

1	**2**	**3**	**4**	**X**

Loose material is > 60 mm thick

B.8.15 Stoniness

Definition and cause

Stoniness is the relative percentage of material embedded in the road that is larger than a recommended maximum size (usually 37.5 mm). This is one of the few defects that can be controlled, but usually it is not.

The blading process periodically leaves loose stones (larger than 37.5 mm sieve) lying on the surface.

Problem

Excessively stony roads result in the following problems:

- Unnecessarily rough roads
- Difficulty with grader maintenance
- Poor compaction of areas adjacent to stones (leading to potholes and ravelling)
- The development of corrugations
- Thick, loose material is necessary to cover the stones
- Loose stones left after blading are likely to cause vehicle damage and potentially unsafe conditions.

Many geological materials, particularly shale and hornfels, produce flaky or sharp stones under crushing or grid rolling. These can cause extensive damage to tyres and affect the safety of the roads significantly. Some mudrocks may deteriorate rapidly on exposure to the atmosphere from a hard material to a soft, fine-grained “soil”. This causes significant problems, including dust, potholing and rapid gravel loss.

Assessment

Stones can be measured to determine the percentage that the maximum size limit has been exceeded by. This is time-consuming and an estimate of their severity and extent is usually sufficient. It should be noted that the extent of stoniness is usually overestimated by a significant margin. The impact of stoniness on riding quality is best evaluated from a moving vehicle. This can be supplemented by assessing the impact of the stones on the ease of blading. The descriptions of degrees of stoniness are given in Tables B.14 (embedded stones) and B.15 (loose stones). Dedicated roughness measuring equipment can also be used to determine the road roughness if this level of detail is required.

TABLE B.14: Degrees of embedded stoniness

Degree	Description
1	Seen, but not felt or heard in a light vehicle
2	Protruding stones can be felt and heard, but speed reduction not necessary. Blading is not affected.
3	Speed reduction necessary. Road is bladed with difficulty.
4	Protruding stones require evasive action
5	Vehicles avoid protruding stones or drive slowly. Road cannot be effectively bladed.

TABLE B.15: Degrees of loose stoniness

Degree	Description
1	Few loose stones 25 – 40 mm. Driver can change lanes safely
3	Many loose stones 25 - 50 mm or few loose stones > 50 mm. Stones influence drivers actions when changing lanes.
5	Windrows of loose stones 25 – 50 mm or many loose stones >50 mm. Any lateral movement of the vehicle poses a significant safety hazard.

STONINESS - EMBEDDED



Degree 1

X	**2**	**3**	**4**	**5**

Seen but not felt or heard in a light vehicle



Degree 3

1	**2**	**X**	**4**	**5**

Can be felt and heard in the vehicle



Degree 5

1	**2**	**3**	**4**	**X**

Vehicles avoid or drive slowly

STONINESS – LOOSE



Degree 1

X	**2**	**3**	**4**	**5**

Few loose stones 26 – 40 mm. Driver can change lanes safely.



Degree 3

1	**2**	**X**	**4**	**5**

Many loose stones 26 – 50 mm or few loose stones >50 mm. Stones influence drivers actions when changing lanes.



Degree 5

1	**2**	**3**	**4**	**X**

Windrows of loose stones 26 - 50 mm or many loose stones >50 mm. Any lateral movement of the vehicle pose a significant safety hazard.

B.8.16 Slipperiness and Skid Resistance

Definition and cause

Slipperiness is the loss of traction caused by an accumulation of excessively fine or plastic material on the surface of the wearing course in wet conditions. Skid resistance is affected by an excess of loose, fine gravel (between 2 and 7 mm in diameter) that accumulates on the road surface through ravelling under traffic or poor blading practices during dry conditions. This behaves like a layer of ball bearings and the skid resistance is reduced to practically zero. This is especially a problem on corners and at intersections.

Problem

The main problems with slipperiness and skid resistance are the safety implications for road users.

Assessment

Slipperiness is difficult to assess unless the rater actually experiences the condition. However, it can often be evaluated by observing wheel tracks formed during wet weather that are retained in the road after drying and other indicators. Slipperiness is rated as either acceptable or unacceptable. Skid resistance, also rated as either acceptable or unacceptable, should be evaluated in terms of the effect of loose material on vehicle stability and the general impression gained while driving and braking on the dry road. These ratings are summarised in Tables B.16 and B.17

TABLE B.16: Rating of slipperiness

Rating	Description
Acceptable	Exposed and protruding gravel on road surface. No significant cracking (> Degree 3 (Table B.18)). No evidence of tyre impressions remaining on the road surface.
Unacceptable	Smooth clayey surface with few protruding gravel particles. Significant cracking (> Degree 3 (Table B.18)). Evidence of tyre impressions remaining on the road surface. Evidence of compaction and shearing under traffic. Loss of control when driving on a wet surface.
NB The absence of evidence of slipperiness does not necessarily mean that the road will not be slippery. The evidence described above tends to be worn away under traffic within 6-8 weeks, or may be removed by blading.	

TABLE B.17: Rating of skid resistance

Rating	Description
Acceptable	No excessive fine gravel (2-7 mm) in the wheel tracks. Exposed and protruding gravel on road surface. Good directional control when braking.
Unacceptable	Presence of layer of fine gravel (2-7 mm) in the wheel tracks. Loss of directional control when braking.

SLIPPERINESS



Degree 1

X	**2**	**3**	**4**	**5**

Acceptable



Degree 5

1	**2**	**3**	**4**	**X**

Unacceptable

SKID RESISTANCE



Degree 1

X	**2**	**3**	**4**	**5**

Acceptable



Degree 5

1	**2**	**3**	**4**	**X**

Unacceptable

B.8.17 Cracks

Cracks are usually not required as input into GRMS's, but information can be used to support other assessments (e.g. severe cracking is indicative of high plasticity gravels as well as potential for unacceptable slipperiness). These data may also be useful for project level or research assessments.

Definition and cause

Cracking of the wearing course (which usually occurs only during the dry season) is a result of the plasticity being too high or the material being very fine-grained.

Problem

Cracks as such are not a major problem on unsealed roads, but bad cracking may lead to the formation of potholes during the dry season. Materials that crack badly also tend to become slippery when wet. Roads with 100 to 150 mm diameter cracked blocks will often break up under traffic and form potholes.

Assessment

Cracks should be visually assessed on the basis of crack width, which may be measured if necessary as described in Table B.18.

TABLE B.18: Degrees of cracking

Degree	Description
1	Faint – requires close scrutiny
2	Distinct – seen at walking pace
3	Distinct – seen from a moving vehicle
4	Open cracks - ≤ 3 mm wide
5	Open cracks - > 3 mm wide

CRACKS



Degree 1

X	**2**	**3**	**4**	**5**

Faint – Require close scrutiny



Degree 3

1	**2**	**X**	**4**	**5**

Distinct – seen from a moving vehicle



Degree 5

1	**2**	**3**	**4**	**X**

Open cracks - > 3 mm wide

B.8.18 Isolated Problems

During the assessment of unsealed roads, problematic localised areas may be noted. These are such that they should not influence the overall rating of the segment, but a record should be made of the problems for possible later attention. The problem could be indicative of non-uniformity within the segment resulting from different materials, localised drainage problems or excessive material loss. Where isolated problems are identified and indicated as such on the assessment form, it is useful to provide more information in the space allocated on the form for comments.

The isolated problems that should be recorded are:

- Potholes
- Subgrade exposure
- Transverse erosion
- Longitudinal erosion
- Rough areas
- Slippery areas

These problems have been discussed individually in the document.

ISOLATED PROBLEMS



Potholes



Subgrade exposure



Transverse erosion

ISOLATED PROBLEMS



Longitudinal erosion



Rough area



Slippery area

B.8.19 Maintenance Action

During the assessment for GRMS data, the opportunity should be taken to identify possible maintenance action requirements for the segment. Although this would normally be done at project level, the information can be useful to cross-check other parameters rated as well as for overall network level budgeting as a first approximation. Typical maintenance actions include:

- Local repairs – labour intensive spot gravelling often associated with impassability, drainage/erosion problems or removal of excessive oversize material.
- Routine blading – identify the need for continuation of routine blading, or adjustment of the blading programme to be more appropriate to that specific segment.
- Reshaping – where the road profile is incorrect resulting from insufficient or poor maintenance, this option can be marked. Depending on the severity of the problem, reshaping will entail heavy blading with watering and compaction, but could require limited ripping and recompaction in exceptional circumstances.
- Reworking – rip, rebuild to correct width, add additional material and reshape with watering and compaction. Breaking down or removal of oversize material may also be necessary.
- Regravelling – where there is insufficient material to provide the required service until the next assessment, this option should be selected.
- Drainage improvement – where drainage maintenance has been ineffective or insufficient drainage exists, corrective action needs to be taken. This could involve labour intensive clearing and reshaping of side drains and mitre drains, or the installation of new pipes.

Rehabilitation in the traditional sense is not applicable to unsealed roads. Regravelling essentially replaces rehabilitation. The closest possible equivalent is road betterment where geometrics and alignment are improved during the regravelling operation.

B.9. Dust Palliative/Chemical Stabiliser Treatments

Dust palliatives and chemical stabilisers are being increasingly used on unsealed roads to reduce dust and improve material properties, thereby reducing the rate of gravel loss and the number of bladings required per year. Treated segments should be assessed in the same way as untreated unsealed roads. However, comment should be made on whether the product is achieving the purpose for which it was applied (e.g. dust control, improved trafficability) and whether it requires rejuvenation.

B.10. Material Sampling

Material sampling is usually not required for GRMS assessments, but certain road authorities may excavate a hole to measure layer thickness. However, for project level and research investigations, accurate data on the material properties are often required and the materials will have to be sampled from the road. Sampling will usually be required in the following situations:

- Problem identification
- Experimental sections
- If the existing material is to be treated or used as a layer during upgrading of the road

This necessitates the collection of representative samples for laboratory testing. Samples should be removed from holes sufficiently large to provide adequate material for testing according to the method described in TMH5[5]. These holes should be excavated to the full depth of the layer and must have vertical sides. **All material excavated from the hole must be included in the sample.** All sample and observation holes must be repaired by backfilling them with material with similar properties to that excavated. This material should be moistened and compacted into the hole.

B.11. Use of Data

It is not the intention of this document to instruct on the use of the data collected. However, a number of simple preliminary exercises are discussed below.

The primary use of the data collected during the assessment is for input into the gravel road management system. It is thus essential that the visual assessment forms be completed fully and accurately. The success of the decision making process depends on this.

The data collected can be used for determining various indices (e.g. Visual Condition Index (VCI)), similar to that determined for sealed roads as discussed in TRH22[6] (to date there is no TRH document published for GRMS's). It should, however, be noted that comparison of different unsealed road VCI estimates is often not valid in the same way as that for sealed roads. The VCI determined for unsealed roads is a function of the time elapsed since the last regravelling and blading as well as traffic and climatic influences immediately prior to rating. The data collected can also be used:

- As a basis for predicting gravel loss and blading frequency
- For prioritising maintenance actions (e.g. defects with a severity of 4 or 5 should be given immediate attention, while defects with a severity of three should be considered as a warning that will require attention in the near future)
- For monitoring improvement or deterioration in the overall road network as a result of funding fluctuations
- For direct comparisons of the performance of various roads
- For location of specific problems
- As a basis for project level investigations.

For project level and research investigations, the data can be entered into a spreadsheet. The data collected is best assessed by highlighting certain parameters or ratings. This can be rapidly done using simple spreadsheet macros. For instance:

- All segments with corrugation severity ratings in excess of 3 could be highlighted and this could be used to identify possible areas for sand cushioning.
- Highlighting all severity ratings of 4 or 5 could indicate specific segments of road with unacceptably severe problems.

- By combining various ratings and extent, it is possible to prioritise those segments requiring urgent maintenance or upgrading.
- Identify modes of distress for specific roads – i.e. is it material -, maintenance -, or environmentally – related? Remedial measures can then be defined.
- Gravel thicknesses can be plotted over time to indicate the rates of gravel loss for different scenarios.

Further detail regarding the use of data is beyond the scope of this document.

C. GLOSSARY

Assessment segment: An assessment segment is the length of road for which one assessment rating is recorded. In the case of rural road networks, a road link is normally divided into road segments for visual assessment. For urban road networks where road links may be very short, links may be grouped together to form an assessment segment.

Earth road: An unsealed road in which the in situ material is directly travelled by vehicles.

Gravel road: An unsealed road in which an imported material has been placed to provide a riding surface for vehicles.

Gravel Road Management System (GRMS): is part of a Road Management System, which is a set of procedures aimed at maximising the potential serviceability of a road network. These procedures are used by the managers of the road network (usually with the aid of computerised facilities) to evaluate maintenance, improvement and upgrading alternatives, and the establishment of new facilities when needed.

Gravel wearing course: the exposed material imported to protect the foundation from wear by vehicles.

Link: A road link is the length of road from one intersection or interchange to the next.

Overall performance: is a single rating of how the travelling public view the condition and performance of the road. This should include all functional and safety aspects.

Rehabilitation: of unsealed roads generally involves improvement in geometrics as well as pavement structure and materials. Regravelling alone is not regarded as rehabilitation, but as a routine maintenance operation.

Road section: A road section is a length of road with a unique section number (refer to Section A.4.2).

Surfaced road: A road on which a bituminous, concrete or block layer has been placed to provide an all-weather surface for traffic.

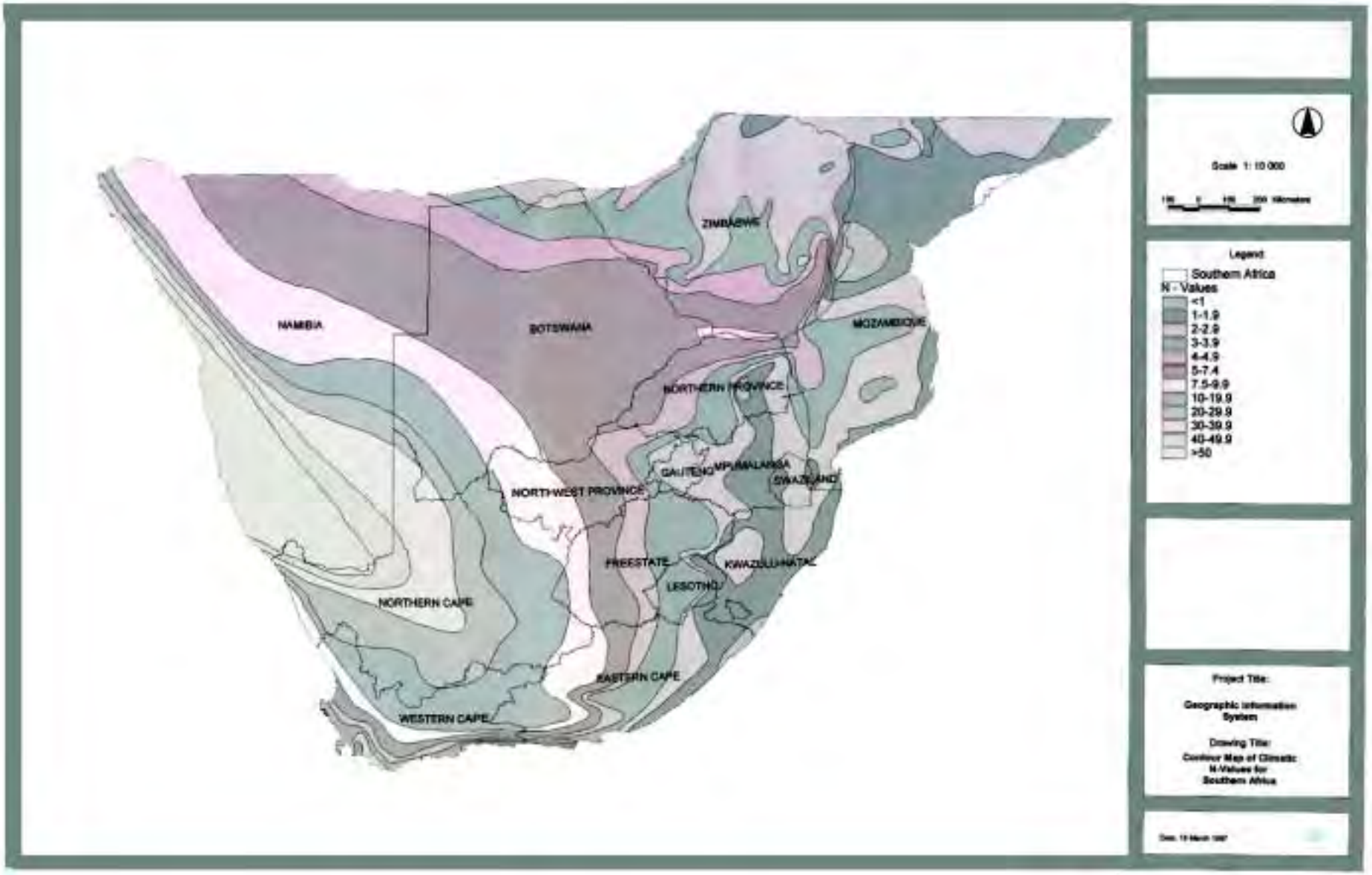
Traffic volume: A single value representative of the quantity of/or type of traffic using a road. Different road authorities use different parameters, e.g. Annual Average Daily Traffic (AADT), Average daily traffic (ADT), Equivalent Vehicle Units (EVU) etc.

"Warning": The condition of various defects is often referred to as "warning". This term indicates a condition that requires some action in the near future and/or a problem that may develop into a more serious one.

Weinert N-value: A climatic index based on evaporation in the warmest month of the year, and annual rainfall. The minerals found during weathering of rocks are a function of the Weinert N-value. A map of Weinert N-values for South Africa is provided in Figure C.1.

Width: Two different road widths need to be considered during visual assessments on unsealed roads.

- Total width, which includes shoulders and is used for calculation of gravel quantities for regravelling
- The trafficked width usually demarcated by windrows at each side, which is used for assessment purposes.


ZIMBABWE
NAMIBIA
BOTSWANA
MOZAMBIQUE
NORTHERN PROVINCE
GAUTENG
MPUMALANGA
SWAZILAND
NORTH-WEST PROVINCE
FREESTATE
KWAZULU-NATAL
LESOTHO
NORTHERN CAPE
EASTERN CAPE
WESTERN CAPE
Scale 1: 10 000
Legend
Southern Africa
N - Values
<1
1-1.9
2-2.9
3-3.9
4-4.9
5-7.4
7.5-9.9
10-19.9
20-29.9
30-39.9
40-49.9
>50
Project Title:
Geographic Information System
Drawing Title:
Contour Map of Climatic N-Values for Southern Africa

D. TYPICAL ASSESSMENT FORMS

Example forms for the following types of assessment are included:

- Form 1 - input for strategic network level assessment
- Form 2 - input for strategic network level assessments with some detailed information for project level maintenance
- Form 3 - input for detailed network level assessment
- Form 4 - evaluation of experimental sections

UNSEALED ROAD ASSESSMENT FORM																						
Evaluator																	Date					
Road No				Section																		
Start km				End km																		
Segment No										Start km							End km					
General performance	1		2		3		4		5		Moisture						Wet				Dry	
Gravel quantity	1	Plenty		2	Sufficient		3	Isolated exposures		4	Extensive exposures		5	None								
Gravel quality	1	Very good		2	Good		3	Average		4	Poor		5	Very poor								
Influencing factors		Clay			Sand			Gravel/stones														
Road profile/shape	1	Very good (4%)		2	Good (2%)		3	Flat		4	Uneven		5	Very uneven								
Drainage from the road	1	Well above ground		2	Slightly above		3	Level with ground		4	Slightly below		5	Canal								
Riding quality/safety	1	Very good (>100 km/h)		2	Good (100 km/h)		3	Average (80 km/h)		4	Poor (60 km/h)		5	Very poor (40 km/h)								
Influencing factors	Corrugation			Loose material			Stoniness			Potholes			Ruts			Erosion					
Dust	1	Acceptable		5	Unacceptable																	
Trafficability	1	Acceptable		5	Unacceptable																	
Isolated problems	Potholes			Subgrade exposure			Transverse erosion			Longitudinal erosion			Rough area			Slipperiness					
Maintenance action	Local repairs			Routine blading			Heavy blading			Regravelling			Reshaping			Drains					
Comments (Not captured in the system)																						
Inventory check																						
Material	Basic Crystalline			Acid Crystalline			High silica			Arenaceous			Argillaceous			Diamictite					
	Metaliferous			Carbonate			Pedocrete			Fer		Cal	Gyp		Sil	Transported					
Road width	<8 m		8-10 m		>10m		Road type			Gravel			Earth			Treated					

UNSEALED ROAD ASSESSMENT FORM

Evaluator												Date			
Road No		Section													
Start km		End km			Position										
Segment No				Start km				End km							
General performance	1	2	3	4	5	Moisture				Wet		Dry			
Gravel quantity	1	Plenty	2	Sufficient	3	Isolated exposures	4	Extensive exposures	5	None					
Gravel quality	1	Very good	2	Good	3	Average	4	Poor	5	Very poor					
Influencing factors		Clay		Sand		Gravel/stones									
Road profile/shape	1	Very good (4%)	2	Good (2%)	3	Flat	4	Uneven	5	Very uneven					
Drainage from the road	1	Well above ground	2	Slightly above	3	Level with ground	4	Slightly below	5	Canal					
Riding quality/safety	1	Very good (>100 km/h)	2	Good (100 km/h)	3	Average (80 km/h)	4	Poor (60 km/h)	5	Very poor (40 km/h)					
Influencing factors	Corrugation		Loose material		Stoniness		Potholes		Ruts		Erosion				
Maintenance action	Local repairs		Blading		Heavy blading		Regravelling		Reshaping		Drains				

	Degree						Extent				
Potholes	0	1	2	3	4	5	1	2	3	4	5
Rutting	0	1	2	3	4	5	1	2	3	4	5
Erosion - transverse	0	1	2	3	4	5	1	2	3	4	5
Erosion – longitudinal	0	1	2	3	4	5	1	2	3	4	5
Corrugation	0	1	2	3	4	5	1	2	3	4	5
Loose material	0	1	2	3	4	5	1	2	3	4	5
Stoniness – embedded	0	1	2	3	4	5	1	2	3	4	5
Stoniness - loose	0	1	2	3	4	5	1	2	3	4	5
Dustiness	0	1	2	3	4	5					
Slipperiness	Acceptable			Unacceptable							
Skid resistance	Acceptable			Unacceptable							
Trafficability	Acceptable			Unacceptable							

Isolated problems	Potholes	Subgrade exposure	Transverse erosion	Longitudinal erosion	Rough area	Slipperiness

Comments

Inventory check

Material	Basic crystalline		Acid Crystalline		High Silica	Arenaceous		Argillaceous		Diamictite
	Metaliferous		Carbonate		Pedocrete	Fer	Cal	Gyp	Sil	Transported
Road width	<8m	8-10m	>10m	Road type	Gravel			Earth		Treated

UNSEALED ROAD ASSESSMENT FORM

Evaluator																		Date			
District														Road No				Section			
Start km			End km											Position							
Segment No										Start km							End km				
General performance	1	2	3	4	5					Moisture							Wet			Dry	
Layer thickness (mm)																					
Layer thickness category	0-25mm					25-50mm				50-100mm				>100mm							
Subgrade exposure	None					Isolated				General											
Gravel quality	Classification					Course				Medium				Fine							
	Max size (mm)					>50				25-50				13-25				<13			
	Estimated PI					<6				6-15				>15							
Road profile/shape	1	Very good (4%)				2	Good (2%)			3	Flat			4	Uneven			5	Very uneven		
Drainage from the road	1	Well above ground				2	Slightly above			3	Level with ground			4	Slightly below			5	Canal		
Riding quality/safety	1	Very good (>100 km/h)				2	Good (100 km/h)			3	Average (80 km/h)			4	Poor (60 km/h)			5	Very poor (40 km/h)		
Influencing factors	Corrugation					Loose material				Stoniness				Potholes				Ruts			Erosion
Maintenance action	Local repairs					Blading				Heavy blading				Regravelling				Reshaping			Drains

	Degree							Extent				
Potholes	0	1	2	3	4	5		1	2	3	4	5
Rutting	0	1	2	3	4	5		1	2	3	4	5
Erosion - transverse	0	1	2	3	4	5		1	2	3	4	5
Erosion – longitudinal	0	1	2	3	4	5		1	2	3	4	5
Corrugation	0	1	2	3	4	5		1	2	3	4	5
Loose material	0	1	2	3	4	5		1	2	3	4	5
Stoniness – embedded	0	1	2	3	4	5		1	2	3	4	5
Stoniness - loose	0	1	2	3	4	5		1	2	3	4	5
Dustiness	0	1	2	3	4	5						
Slipperiness	Acceptable			Unacceptable								
Skid resistance	Acceptable			Unacceptable								
Trafficability	Acceptable			Unacceptable								

Isolated problems	Potholes	Subgrade exposure	Transverse erosion	Longitudinal erosion	Rough area	Slipperiness

Comments

Inventory check

Material	Basic crystalline		Acid Crystalline		High Silica	Arenaceous		Argillaceous		Diamictite		
	Metaliferous		Carbonate		Pedocrete	Fer	Cal	Gyp	Sil	Transported		
Road width	<8m	8-10m	>10m	Road type	Gravel		Earth		Treated			

UNSEALED ROAD ASSESSMENT FORM

Evaluator						Date/time						
Project		Road No			Section			Position				
Material					Slope			Moisture				
Climate					Terrain	F	R	M	Traffic	L	M	H
Map					Photo's							

Overall	1	2	3	4	5	Dust	@	QI/IRI	@
Gravel depth	1	2	3	4	5	mm			
Gravel quality	1	2	3	4	5				
Drainage (road)	1	2	3	4	5				
Drainage (side)	1	2	3	4	5				
Stoniness (loose)		ι							
Stoniness (fixed)		ι ;							
Potholes		ι ;						Max size	
Rutting		88 99 : ;						Max size	
Loose material		88 99 : ;						Biggest	
Corrugations		L F : ;							
Erosion		L T : ;							
Cracking									
Slipperiness	Y	N							
Skid resistance	Y	N							
Passability	Y	N							
Maintenance									
Road reserve									

Notes

Density	Wet	Dry	NMC	Tin No	GMC	Pos		Sample details
150 mm						LO	LI	
100 mm						C		
50 mm						RI	RO	

E. MATERIAL IDENTIFICATION

In order to benefit from the use of gravel road assessments and management systems, it is essential that the materials used are correctly classified. This need not require a high degree of geological expertise.

This appendix contains a guide, modified after Weinert (1980), to the application of the 'rule of quartz' for rock identification. The guide is based on the assumption that the user is sufficiently familiar with the appearance of quartz and opal (amorphous silica) in rocks to recognize them macroscopically, i.e. with the naked eye or a hand lens (magnification 8 to 10 times). The inspection of the sample must always be done on a freshly crushed face and the following equipment should be available:

- Geological hammer
- Hand lens
- Pocket knife
- A bottle of diluted hydrochloric acid (HCl) is useful for the identification of carbonate materials.

To use the guide, begin with the left-hand column and proceed column by column to the right. Every item must be considered and the reader must keep within the same horizontal division proceeding to the right. This will lead to the group in which the inspected material belongs.

In the column to the right of that of the group names, individual rock names are shown. It is not essential that these rock types are individually identified but they are provided as an aid. Many of these names have been used in the past and will need to be assigned to the wider classification groups proposed.

Quartz, Opal	Texture & mineral composition	Colour and luster	Matrix	Fracture face	Intermixed other components	Additional physical characteristics	Group	Possible rock type	Remarks
All quartz or opal (amorphous silica)	Glassy to vitreous, very dense, uniform	Mostly white, but also many other colours, or colourless; shiny or glossy luster	None	Smooth, conchoidal	None	Very hard, cannot be scratched with pocket knife	High-silica rock	Vein quartz Chert Hornfels	
	Dense	Mostly dark shades of grey		Smooth to slightly rough				Hornfels	
	Granular with grains of varying sizes	Many but shades of grey predominant; luster shiny or glossy	Siliceous	Smooth, breaks equally through grains and matrix				Quartize	Occasionally contains sulphide minerals, e.g. pyrite
		Many but shades of grey predominant; luster dull but individual grains may flicker in sunlight		May be smooth or rough depending on strength of cementing matrix	Variable, depending on host material	Cannot be scratched with pocket knife; voids (honeycomb)	Pedogenic material	Silcrete	Distinction from quartzite often very difficult; seek expert advice
				Breaks run through matrix and the unbroken (sand) grains protrude: fracture face feels rough (sandpaper)	Occasionally single minerals, especially feldspar, and rock fragments	Cannot be scratched with pocket knife but single sand grains may be removed in this way	Arenaceous rock	(Quartzitic) sandstone, grit conglomerate	
Mostly quartz or opal (>50%)	Granular, mostly sand grains	Many colours, lustre dull	Calcareous, ferruginous or clayey	Very rough, feels like sandpaper; grains can be removed with needle or pocket knife	Occasionally feldspar; very rarely other minerals	Matrix can be scratched with pocket knife; calcareous matrix 'boils' in hydrochloric acid (HCl)		Sandstone Gritstone Conglomerate Arkose (if containing Feldspar)	May contain mica or sulphide minerals, especially pyrite
	Granular; alternating thin sheets of quartz and mica	Shades of grey, minerals flicker in sunlight	None	Smooth, parallel with bedding, and rough perpendicular to beds	Occasionally minerals other than quartz and mica	Breaks into platy pieces. Scratched easily with pocket knife on bedding planes		Sandstone Gritstone Conglomerate Arkose (if containing Feldspar)	May contain mica or sulphide minerals, especially pyrite
								Mica Schist	
	Granular, grains of various sorts and sizes	Mostly shades of grey; lustre dull	Clayey, rarely siliceous	Rough, feels like sandpaper, grains can be removed with needle or pocket knife	Contains angular to sub-angular fragments of all sorts of minerals and rocks	Strength may vary considerably. Resistance to scratching variable	Diamicite	Greywacke Tillite Volcanic breccia	Recognition of these rocks often difficult, use should be made of expert advice
	Dense to vitreous fine granular	Red to brown, generally dull but grains flicker in sunlight	Ferruginous	Smooth to rough: when rough it feels like fine sandpaper	None	Very heavy	Metaliferous rock	Ironstone	Occasionally shades of colour vary in fine layers (banded ironstone)
Quart or opal prominent (>10%, <50%)	Vitreous, quartz as single crystals or as clusters may float in vitreous matrix; often signs of flow or turbulence	Mostly shades of red from light to dark but other colours as well; lustre dull to slightly shiny	Dense, rather uniform mass	Rather smooth, quartz grains may produce a degree of roughness		If at all, can only be scratched with difficulty with pocket knife; may contain voids	Acid crystalline rock	Felsite Rhyolite Quartz porphyry	These rocks are not easily identified and expert advice may be required
	Granular, crystalline	Generally light coloured; crystals flicker in sunlight	None	Rough; there may be smooth faces of large crystals		Elongated crystals may be in parallel or sub-parallel arrangements		Granite Gneiss (when parallel arrangement of crystals) Pegmatite	
	Sand grains in very finely grained to dense material	Varying, lustre very dull	Clayey	Rough	Not significant	Scratched easily with pocket knife; feels like blotting paper on wet tongue; gritty feel between teeth when bitten	Argillaceous rock	Mudstone Shale Slate	
					Contains angular to sub-angular fragments of all sorts of minerals and rocks	Strength may vary considerably. Resistance to scratching variable	Diamictite	Greywacke Tillite Volcanic breccia	Recognition of these rocks often difficult, use should be made of expert advice
		White, brown, yellowish-brown, reddish-brown to almost black; lustre generally dull, black parts may flicker in sunlight	Carbonate, iron oxide (red) or iron hydroxide (brown)	Mostly rough, white (carbonate) materials may be rather smooth	Any soil or weathered rock	Scratched easily with pocket knife; white material (carbonate) 'boils' in hydrochloric acid (HCl)	Pedogenic material	Calcrete (white) Ferricrete (other colours)	
Quartz or opal scarce or absent (<10%: can only be detected by looking carefully)	Very finely 'bedded' with very thin bands of elongated lenses of quartz between often wavy layers of micaceous and other very fine-gained and dense material	Mostly shades of grey, brown or greenish: perpendicular to layers slightly flickering in sunlight; parallel to layers noticeably silky	None	Rough perpendicular to layers; smooth parallel to layers	None	Feels soapy on layer planes which are also scratched easily with needle or pocket knife	Argillaceous rock	Phyllite Sericite schist Slate	
	Granular, crystalline, appears to be composed of one type of mineral only	Mostly reddish or red but may also be white; often contains a few dark green to black minerals (hornblende)	None	Rough; there may be faces of large crystals	None	Cannot be scratched with pocket knife but can be with a piece of quartz	Acid crystalline rock	Syenite	
		Mostly white but other colours also possible; general flicker in sunlight				Scratched easily with pocket knife; 'boils' in hydrochloric acid (HCl)	Carbonate rock	Marble	
	Granular, crystalline	Generally dark-coloured but a few types are light-coloured or even white. Crystals flicker in sunlight		Rough		Individual minerals react different to scratching	Basic crystalline rock	Amphibolite Diabase Diorite (light-coloured) Dolerite Gabbro Norite	For identification of exact type of rock obtain expert advice
	Granular, crystalline	Shades of green; lustre shiny; flicker in sunlight		Variable, tending to be smooth		Can be scratched with pocket knife; surface may fee 'soapy'		Serpentinite	
	Vitreous and dense. May contain empty or filled voids. There may be individual crystals (e.g. olivine) in dense material	Dark shades of various colours; lustre shiny to dull	Dense, uniform mass	Smooth to finely textured, rough	Voids may be filled with opal or even quartz besides other minerals (e.g. zeolites, calcite) which are mostly white to light-coloured	None		Andesite Basalt	Sill phases of diabase or dolerite may be very similar to basalt: if in doubt obtain expert advice
	Very dense and sub-microscopically fine-grained	Colour variable but mostly shades of grey or red; lustre dull	None	Rough	None	Scratched easily with pocket knife; feels like blotting paper on wet tongue; silty or butter-like fell between teeth when bitten	Argillaceous rock	Mudstone Shale Slate	
	Very dense and sub-microscopically fine-grained	Colour often white but also shades of grey and others; lustre dull				Scratched easily with pocket knife; 'boils' in hydrochloric acid (HCl)	Carbonate rock	Dolomite Limestone	Limestone 'boils' much more vigorously than dolomite
				May be rough or smooth	Any weathered rock	Can be scratched with pocket knife; 'boils' in hydrochloric acid; may contain voids (honeycomb)	Pedogenic material	Calcrete Dolocrete	Calcrete 'boils' much more vigorously than dolocrete
		Colour brown to reddish or yellowish brown, occasionally almost black; lustre generally dull but may flicker in sunlight when black	None	Rough	None	Nodular structure mostly clearly detectable; broken nodules may contain yellowish, soft, clayey material	Pedogenic material	Ferricrete	
	Dense to granular	Black, may flicker in sunlight				Very heavy, magnetic (affects needle of compass)	Metaliferous rock	Magnetite	
	Dense to fibrous	White to light green				Surface may feel slightly 'soapy'		Magnesite	Since confusion with other decomposition products of mafic minerals may occur, expert advice is recommended

Definitions:
Lustre – the character of light reflected by the minerals/rock
Vitreous – glass-like
Conchoidal – type of fracture with curved, ribbed surface

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APPENDIX E OSOM ROUTE ASSESSMENT

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ACEN
NEW ENGLAND SOLAR

OSOM Transport Management Plan

Date: April 2026
Client: EPEC
Type: TMP
Rev: 4



Table of Contents

01 Overview **7**
- 01.1 Scope of TMP 8
- 01.2 Point of Origin 8
- 01.3 Site 8
- 01.4 Project Equipment 10
- 01.5 Journey Overview 20
- 01.6 LIVE DOCUMENT TMP - Overview 22

02 Route 1.1 - Port Adelaide to Cockburn **27**
- 02.1 Route 1.1 Overview 28
- 02.2 Route 1.1 Rest Stops 52

03 Route 1.2 - Cockburn to Uralla **61**
- 03.1 Route 1.2 Overview 62
- 03.2 Route 1.2 Rest Stops 182

04 HSEQ **187**
- 04.1 Health, Safety and Environment 188
- 04.2 Quality 189
- 04.3 Breakdown Contingency Plan 190
- 04.4 Night Time Travel 192

05 Conclusion **197**
- 05.1 Summary 198
- 05.2 Summary of Road Modifications (Route 1.1) 199
- 05.3 Summary of Road Modifications (Route 1.2) 200
- 05.4 Summary of Road Modifications (Route 1.2 - Cont'd) 202

Revision History

Revision	Date	Details	Prepared	Checked	Approved
1	12/09/2025	INITIAL RELEASE	SK / AK	GM	JJM
2	17/09/2025	UPDATED WITH FEEDBACK FROM EPEC	SK	GM	JJM
3	26/11/2025	PINCH POINT N6 UPDATED	SK	GM	JJM
4	22/04/2026	UPDATED TO ADDRESS TFNSW COMMENTS	IW	JJM	JJM

Disclaimer

This Transport Management Plan has been prepared for the purpose of presenting to relevant transport authorities to obtain permits and permission to travel. It is also designed to be used as a guideline for members of the Ares transport team who are travelling with the load. Information provided within this plan is based on data provided by the Client as well as publicly available information and, to the best of ARES Project Services Pty Ltd's knowledge and experience, is accurate at the time of publication. All proposed routes, methodologies and schedules described in this report are subject to approval and issue of permits from the relevant stakeholders. Transport equipment is based on ARES Project Services Pty Ltd vehicles and trailers. Swept path analysis results may differ if using equipment by third parties.

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Introduction

New England Solar is a 720MW solar and battery project currently being built in stages near Uralla in the NSW / New England region. The project sits across a 2,000-hectare site of mostly cleared grazing land, traversed by an existing 330kV power line owned and operated by TransGrid.

Stage 1 (400MW) commenced generating clean, renewable electricity into NSW and Queensland in 2023. Stage 2 (320MW) and a 200MW/2 hour battery started construction in 2024.

The location is approximately 12km east of the Uralla township, within the Uralla Shire council Region.

ARES have been appointed by our client, One Global Logistics - on behalf of EPEC, to investigate transporting an oversize over-mass (OSOM) power transformer. The transformer will be collected from the offload location at Port Adelaide and deliver to site. This Transport Management Plan (TMP) details the route, methodology, resources and procedures we would use to safely deliver this component.

This TMP is designed for those involved in the project - including those with a limited knowledge of transportation. The report is a comprehensive outline of the nominated route and actions required to safely achieve this delivery.



01

Overview

Project Overview

New England Solar Is an existing solar farm and future clean energy battery storage hub located near Uralla, New South Wales.

Scope of TMP

New England Solar is located in the Uralla shire, approximately 12km east of the city of Uralla in New South Wales.

ARES has been tasked with transport of an oversize, over-mass (OSOM) transformer from discharge at the Port of Adelaide to site. The scope of this TMP will include all roads on the public road network up to the site entrance gate at Uralla.

Point of Origin

Port Adelaide is located 14km north-west of Adelaide, Port Adelaide is the seaport suburb of South Australia's state capital. Founded 175 years ago and is one of South Australia's earliest settlements.

Two exit gates have been identified at the port as possible exit locations. The area surrounding the main gate has been fully measured and deemed as unsuitable for the load to exit from. We will therefore be requesting access to use the existing OSOM gate, which is positioned conveniently in line with the start of Eastern parade. By exiting from this gate, we avoid two complicated turns commencing the journey. The exit from the OSOM gate is illustrated as Pinch Point S01.

Site

Entrance to the New England Solar site is only accessible via Big Ridge Road. Two site entrances have been identified with Site entry #1 being determined as the only feasible option for this load. The load will drive slightly past this gate and position to reverse into the site and continue in reverse to the unload position.

Cargo Dimensions

Component	Qty	Length (m)	Width (m)	Height (m)	Weight (t)
Power Transformer	1	11.08	3.6	4.43	244.0

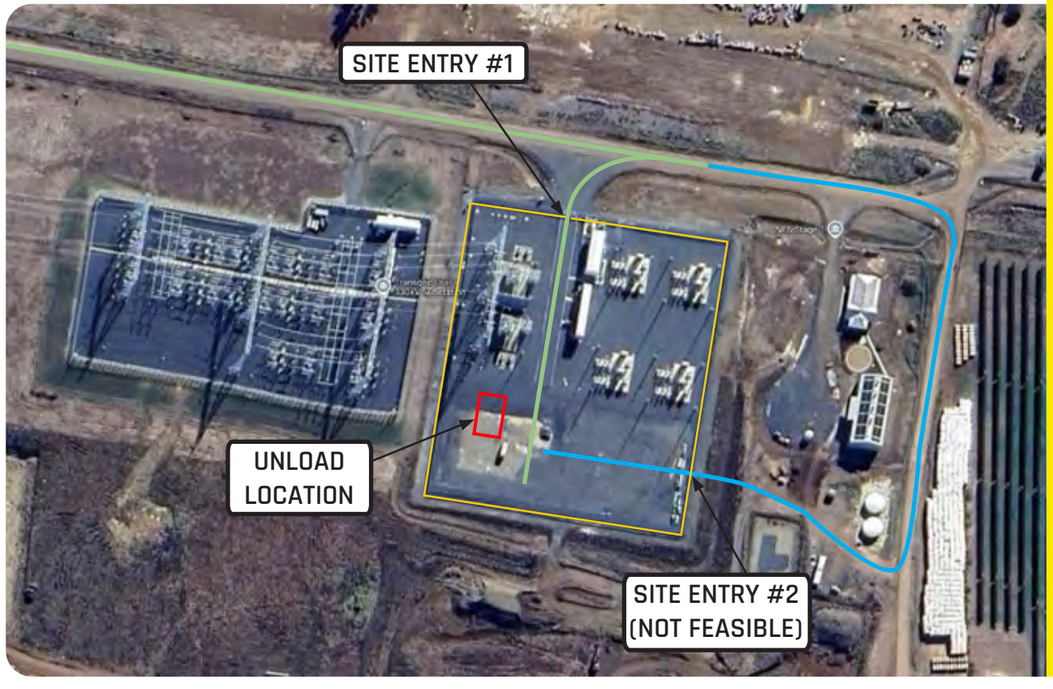
Overall Dimensions

Equipment	O/A Length (m)	O/A Width (m)	O/A Height (m)	O/A Weight (t)
PM-2R8-18R8	46.7	4.3	5.58	354.0
PM-2R8-18R8-BT	59.1	4.3	5.58	378.5
BT-PM-2R8-18R8-BT	71.6	4.3	5.58	403.0
BT-BT-PM-2R8-18R8-BT	84.1	4.3	5.58	427.5



Above: Aerial view of Port Adelaide showing both exit gates. The main gate adds unnecessary difficulty so the OSOM Gate will be choice of exit

Below: Aerial view of New England Solar Site, showing the two evaluated entry methods to the unload location.



Project Equipment

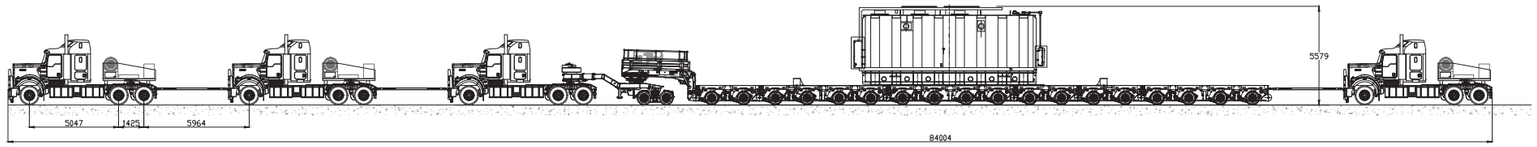


The load will be transported using a conventional prime mover, connected to a Dolly, towing a 18 axle modular platform trailer. The front prime mover will be assisted by a Block Truck pushing from the rear. The dolly / platform configuration results in 20 axle rows distributing the weight to an acceptable figure for transport as shown in the table on the right. The specific end weight in this configuration is 16t per dolly axle row and 16.5t per platform axle row.

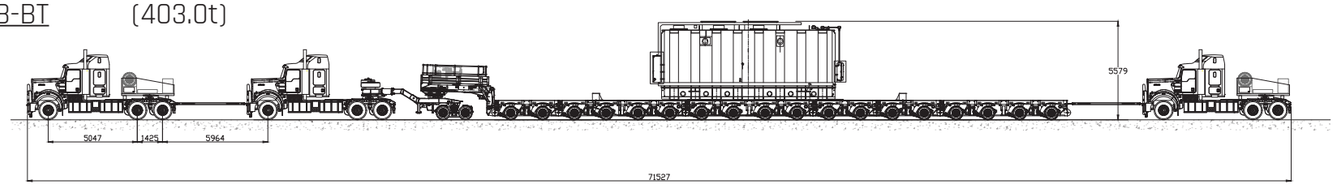
The trailer shown is fully modular with 4-ram fully independent modular steering systems installed. With the command steering setup of the unit, the trailer is capable of turning in all directions and has a minimum turning circle radius of 15.6 metres. All turns contained in this TMP have been calculated using a minimum turn radius of 25 metres, reserving some maneuverability if more is required.

The load will be escorted by pilots and escort vehicles as per the applicable state Transport requirements. Police escorts will be arranged and will provide traffic management for the journey. The load will travel in this configuration for the entirety of the journey through both South Australia and New South Wales. Due to the volume of information contained, this TMP will be broken into state segments. The OSOM transport requirements for each state differs slightly and will be noted in each section as appropriate.

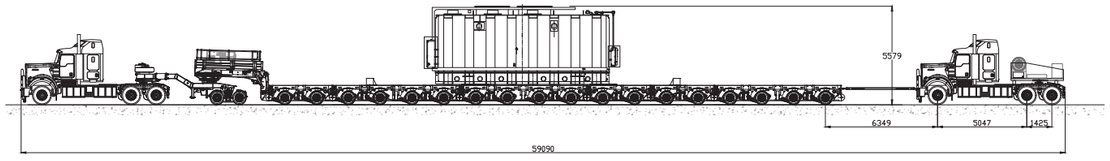
BT-BT-PM-2R8-18R8-BT (427.5t)



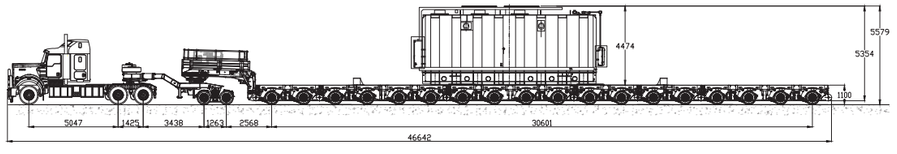
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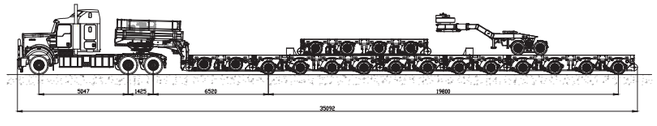
PM-2R8-18R8-BT (378.5t)

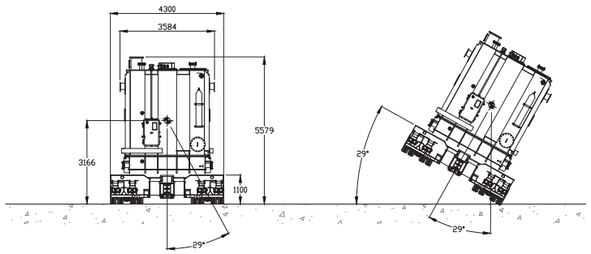


PM-2R8-18R8 (354.0t)



EMPTY TRAVEL (354.0t)



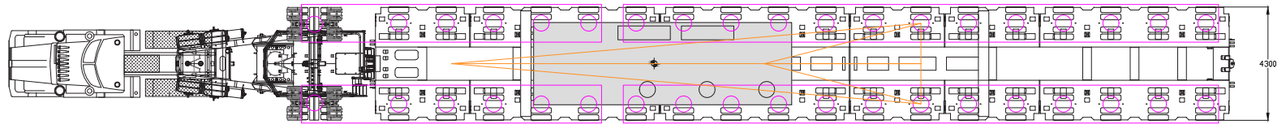


NOTE:
MAX TIPPING MOMENT @ 29 DEGREES WHEN SPREAD TO 4.3M WIDE.
THIS IS DUE TO ROTATION POINT ON AXLE TRUNIONS

TRAILER SPECIFICATION	
PRIME MOVER	
all weights in t (metric tonnes)	**Total**
NUMBER OF ALL AXLE LINES	3.00
GROSSS WEIGHT PER AXLE	N/A
MAX GROSS	25.00
TRUCK WEIGHT	12.00
ADDITIONAL WEIGHT	1.60
MAX PAYLOAD	11.40
ACTUAL PAYLOAD	11.40
TOTAL MASS FOR GROUP	25.00
LOAD STEER	6.50
LOAD DRIVE	18.50
LOAD PER WHEEL	2.31
GROUND BEARING PRESURE t/m2	4.63
OVERALL WIDTH	2450

TRAILER SPECIFICATION	
DOLLY	
all weights in t (metric tonnes)	**Total**
NUMBER OF ALL AXLE LINES	2
GROSSS WEIGHT PER AXLE	16.00
MAX GROSS	32.00
DOLLY WEIGHT	6.00
ADDITIONAL WEIGHT	6.40
PAYLOAD	19.60
ACTUAL PAYLOAD	19.60
TOTAL MASS FOR GROUP	32.00
LOAD PER AXLE LINE	16.00
LOAD PER AXLE	8.00
LOAD PER WHEEL	2.00
GROUND BEARING PRESURE t/m2	4.00
OVERALL WIDTH	4300

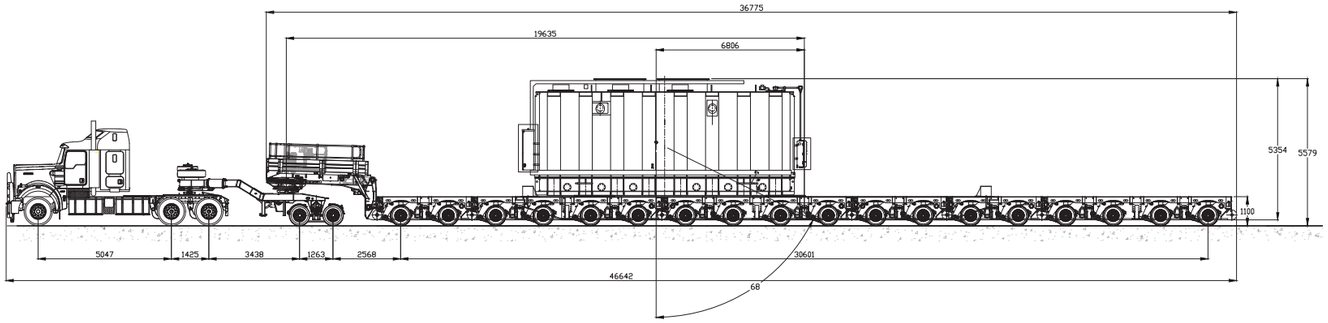
TRAILER SPECIFICATION	
18R8 PLATFORM	
all weights in t (metric tonnes)	**Total**
NUMBER OF ALL AXLE LINES	18
GROSSS WEIGHT PER AXLE	16.73
MAX GROSS	301.05
TRAILER WEIGHT	80.00
ADDITIONAL WEIGHT	4.00
PAYLOAD	217.05
ACTUAL PAYLOAD REQUIRED	213.00
TOTAL MASS FOR GROUP	297.00
LOAD PER AXLE LINE	**16.50**
LOAD PER AXLE	8.25
LOAD PER WHEEL	2.06
GROUND BEARING PRESURE t/m2	4.13
OVERALL WIDTH	4300



TOTAL WEIGHTS	
TOTAL TARE WEIGHT	110.00
MAX TOTAL GCM	358.05
ACTUAL TOTAL GCM	354.00
MAX COMBINATION PAYLOAD	248.05
UNDER OVER	**4.05**
CARGO DETAILS	
LENGTH	11.08
COG LENGTH	5.54
WIDTH	3.58
COG WIDTH	1.79
HEIGHT	4.47
COG HEIGHT	2.30
WEIGHT	244.00
COMBINATION DETAILS	
OVERALL LENGTH	**46642**
OVERALL WIDTH	4300
OVERALL HEIGHT	5574
TRAILER DETAILS	
MAKE	KENNEDY
AXLES	18.00
TYRES PER AXLE	8.00
TARE WEIGHT	84.00
GOOSENECK / HEADER	GN
TRAILER HEIGHT	1100
AXLE LINE SPACING	1800
MAX AXLE LOAD (ONROAD)	15.00
MAX AXLE LOAD (OFF ROAD)	22.50
LOAD PER WHEEL	1.88
MAX GBP t/m2	3.75

PACKING LIST:

3 x 240T HEAVY RATED PRIME MOVERS
1 x 2R8 DRAKE DOLLY
1 x GOOSNECK MODULE cw POWERPACK
3 x 2R8 M500 MODULE
3 x 4R8 M500 MODULE
2 x PUSH PULL BARS
14 x 9t CHAINS
14 x LOAD BINDERS
CAMBER PLATES AS REQURIED



NOTE:
OGLAU TO SPECIFY WHERE THE TRANSFORMER CAN BE LASHED FROM AND RATING OF EACH LASHING POINT. POSSIBLY RUN MULTIPLE LASHINGS FROM SINGLE LASH POINT

REV	DATE	DESCRIPTION	DRN	CHK	APP	REFERENCE DRAWINGS
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ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

DRAWN BY:
DRAWN DATE:
CHECKED BY:

CUSTOMER	EPEC
PROJECT	NEW ENGLAND BESS - 370MVA TRANSFORMER
DRAWING TITLE	URALLA SOLAR FARM
DRAWING NAME	OGLAU_244T_LASHING_R1.DWG
SIZE	A3
SCALE	NTS
SHEET No	1 of 4
REV	01

Plot date: Friday, 12 September 2025 1:54:23 PM

INPUT DATA

TRAILER CONFIGURATION & REAR POTS

TRAILER HEIGHT	(Th)	1100	mm
TRAILER WIDTH	(Tw)	4300	mm
TRAILER LENGTH	(Tl)	36775	mm
TRAILER AXLE LINES	(n)	13	Nos
TRAILER CG	(CG)	950	mm
TRAILER WEIGHT	(Wt)	52.00	mTon
3 OR 4 POINT SUSPENSION	(p)	3	point
ADDITIONAL WEIGHT (BEAM ETC)	(Bw)	12	mTon
PAYLOAD REAR POTS	(PrP)	159.43	mTon
MAX AXLE PRESSURE	(Ap)	16.725	mTon
TYRES PER AXLE	(Tpa)	8	Nos
PRESSURE PER TYRE	(Ppt)	2.09	mTon
MAX SPEED	(V)	70	km/h
MAX ACCELERATION	(a)	5	m/sec
MAX DECELERATION	(d)	8	m/sec
AXLES SUSPENDED	(Sn)	0	Nos
SAFE HYDRAULIC STABILITY	(Shsa)	6.5	deg
SAFE STRUCTURAL STABILITY	(Sssa)	5	deg

CARGO CONFIGURATION

LOAD LENGTH	(Ll)	11080	mm
LOAD HEIGHT (INC BEAMS)	(Lh)	4474	mm
LOAD WIDTH	(Lw)	3584	mm
LOAD WEIGHT	(Wl)	244.0	mTon
PIN DISTANCE	(Pd)	19,635	mm
TRANSVERSE CG	(CGt)	1792	mm out
LONGITUDINAL CG	(CGi)	5540	mm out
LOAD TRANSPARENCY FACTOR	(Tf)	1	
GRAVITATION	(g)	9.81	m/sec2
WINDFORCE	(Wp)	11.80	Kg/m2
CURVE IMPCACT	(Ci)	2%	%
FRICTION COEFICCIENT (SURFACE)	(Mu)	70%	%
FRICTION COEFICCIENT (TRACTION)	(Mu)	70%	%
TRANSVERSE ROAD GRADIENT	(Mgt)	2.00	deg
LONGITUDINAL ROAD GRADIENT	(Mgl)	17.00	deg
CHAIN CAPACITY	(cc)	9.00	mTon Each
CHAINS USED	(cu)	4.00	Nos
TOTAL LASHING CAPACITY	(Tlc)	36.00	mTon

DOLLY CONFIGURATION & FRONT POTS

TRAILER HEIGHT	(Dh)	1100	mm
TRAILER WIDTH	(Dw)	4300	mm
DOLLY USED	(Dl)	YES	mm
TRAILER AXLE LINES	(Da)	5	Nos
TRAILER WEIGHT	(Dwt)	28.00	mTon
MAX AXLE PRESSURE	(Dap)	16.725	mTon
TYRES PER AXLE	(Tpa)	8	Nos
PRESSURE PER TYRE	(Ppt)	2.090625	mTon
PAYLOAD FRONT POTS	(PfP)	0	mTon

BRAKE CAPACITY

WEIGHT ON BRAKES AXLES		336.00	mTon
BRAKE CAPACITY PER TRUNION		9.00	mTon
TOTAL TRUNIONS		36.00	mTon
MAXIMUM BRAKE FORCE @ 100%	(Mbf)	324.00	mTon
ACTUAL BRAKE FORCE (Mbf x Mu)	(Abf)	226.80	mTon

STABILITY

GEOMETRIC STABILITY LONG		68.00	Deg
GEOMETRIC STABILITY TRANS		29.00	Deg

OUTPUT DATA

LONGITUDAL COG PLACEMENT

TWl	= (Wl)	244.00	Tons per m of cargo
TF	= (WL - PrP)	84.58	Weight required to shift forward
SFP	= (TF / TWl) * Pd	6806	Shift forward (mm) of centre rear axle group

LASHING REQUIRED FORWARD

CHAINS FORWARD	8.00	Nos	
HEIGHT OF CHAIN POINT	2.10	m	
LENGTH OF CHAIN	3.10	m	
CAPACITY OF CHAINS	68%	%	
RESTRAINT REQUIRED (inc Fco)	58.56	0.8 G	
CAPACITY OF CHAINS	48.77	mTon	
OVER / UNDER CAPACITY	-9.79	mTon	

LASHING REQUIRED REARWARD

CHAINS REARWARD	4.00	Nos	
HEIGHT OF CHAIN POINT	2.10	m	
LENGTH OF CHAIN	3.10	m	
CAPACITY OF CHAINS	68%	%	
RESTRAINT REQUIRED (inc Fco)	29.28	0.4 G	
CAPACITY OF CHAINS	24.39	mTon	
OVER / UNDER CAPACITY	-4.89	mTon	

STATIC LASHING REQUIRED FORWARD

F	= (Wl + Wa) * Sin (Mgl)	74.85	mTon
N	= (Wl + Wa) * Cos (Mgl)	255.84	mTon
R1	= (((Wl + Wa) * a) / g) + F - (Mu * N)	26.24	mTon
C1	= R1 / cc (if negative NIL req)	2.67	Req

STATIC LASHING REQUIRED REARWARDS

F	= (Wl + Wa) * Sin (Mgl)	74.85	mTon
N	= (Wl + Wa) * Cos (Mgl)	255.84	mTon
R2	= (((Wl + Wa) * d) / g) + F - (Mu * N)	104.52	mTon
C2	= R1 / cc (if negative NIL req)	12.00	Req

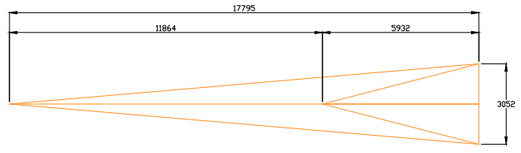
TYPICAL STATIC FRICTION COEFFICIENTS

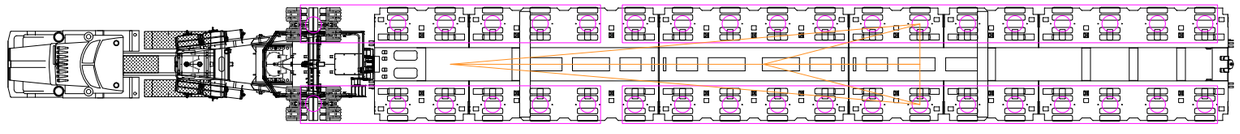
Load surfaces	Friction coefficient	
Wet or greasy steel on steel	0.01 – 0.1	10%
Smooth steel on smooth steel	0.1 – 0.2	20%
Smooth steel on rusty steel	0.2 – 0.4	40%
Smooth steel on timber	0.3 – 0.4	40%
Smooth steel on conveyor belt	0.3 – 0.4	40%
Smooth steel on rubber load mat	0.6 – 0.7	70%
Rusty steel on rusty steel	0.4 – 0.7	70%
Rusty steel on timber	0.6 – 0.7	70%

TIE-DOWN ANGLE EFFECT

The angle effect can be calculated by dividing the height of the load by the length of the lashing between the load and the tie point on the vehicle. The angle effect is the sine of the lashing angle ( ) relative to the horizontal (E = sin .)

NOTE:
3 POT HYDRAULIC SUSPENSION TO BE USED. FRONT POT WILL BE PLUMBED INTO THE MATCHING RAMS FITTED INSIDE GOOSNECK. GOOSNECK TO HAVE STANDARD THREE SETTINGS TO ALLOW FOR DOLLY REMOVAL AND ONSITE ADDITIONAL WEIGHT ON PRIME MOVER DRIVEN AXLES.





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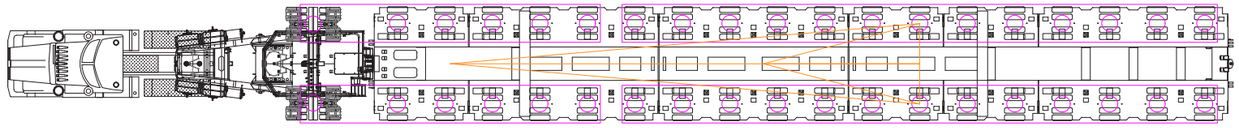
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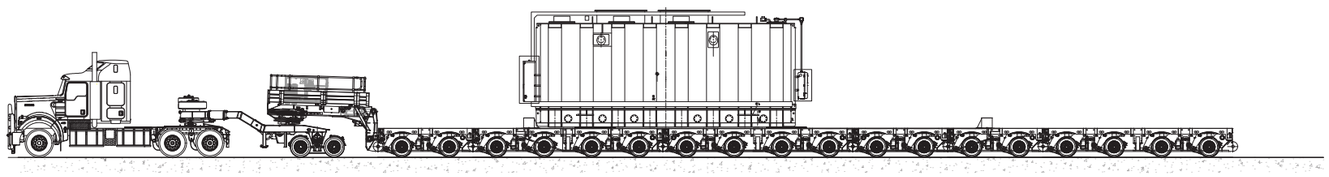
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CUSTOMER	EPEC	SIZE	A3
PROJECT	NEW ENGLAND BESS - 370MVA TRANSFORMER	SCALE	NTS
DRAWING TITLE	URALLA SOLAR FARM	SHEET No	2 of 4
DRAWING NAME	OGLAU_244T_LASHING_R1.DWG	REV	01

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PRIME MOVER	SUSPENSION POT 1 DOLLY AND FIRST 5 AXLE LINES	SUSPENSION POT 2 RHS ON LAST 13 AXLE LINES
		SUSPENSION POT 3 LHS ON LAST 13 AXLE LINES



6.50T 9.25T 9.25T 16.0T 16.0T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T 16.5T

25.0T - APPLIED 25.0T - ACTUAL	32.0T - APPLIED 32.0T - ACTUAL	301.00T - APPLIED 297.00T - ACTUAL

Plot date: Friday, 12 September 2025 1:55:09 PM

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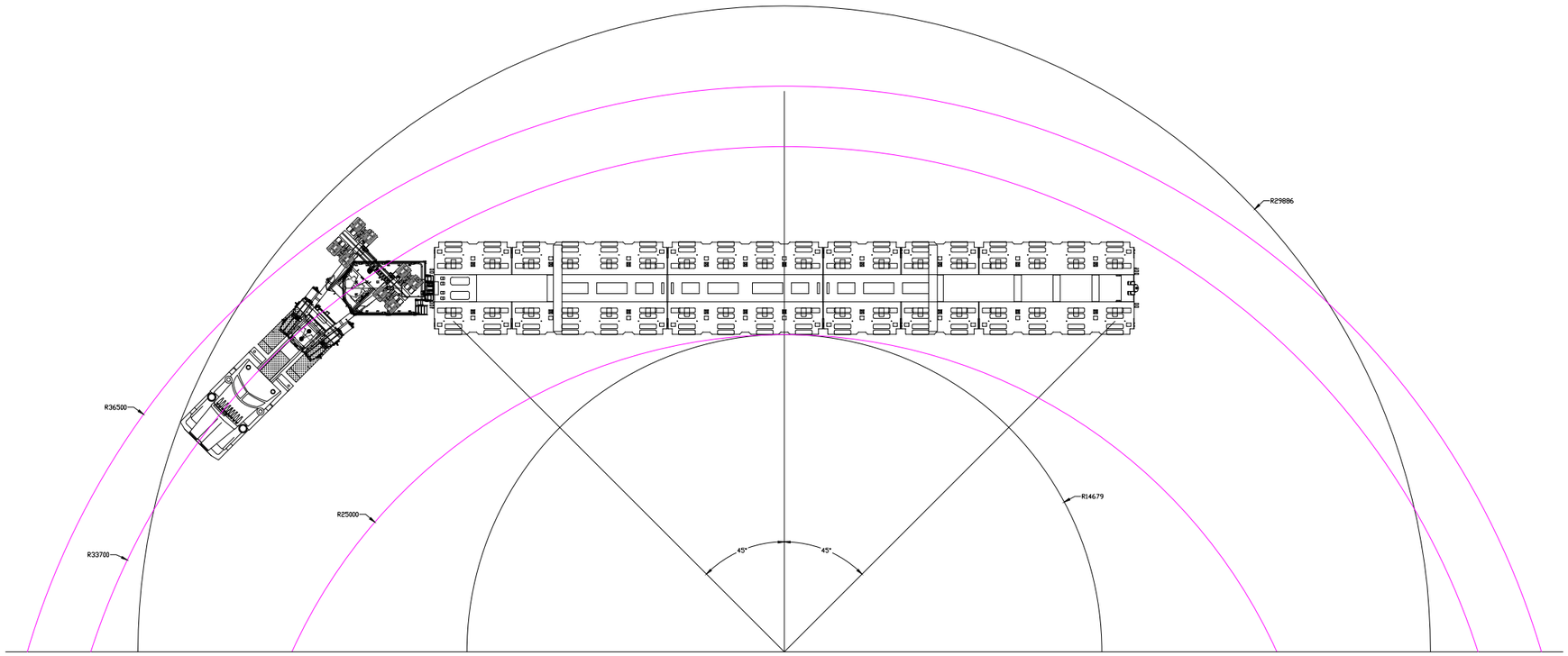
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SIZE	A3
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SHEET No	3 of 4
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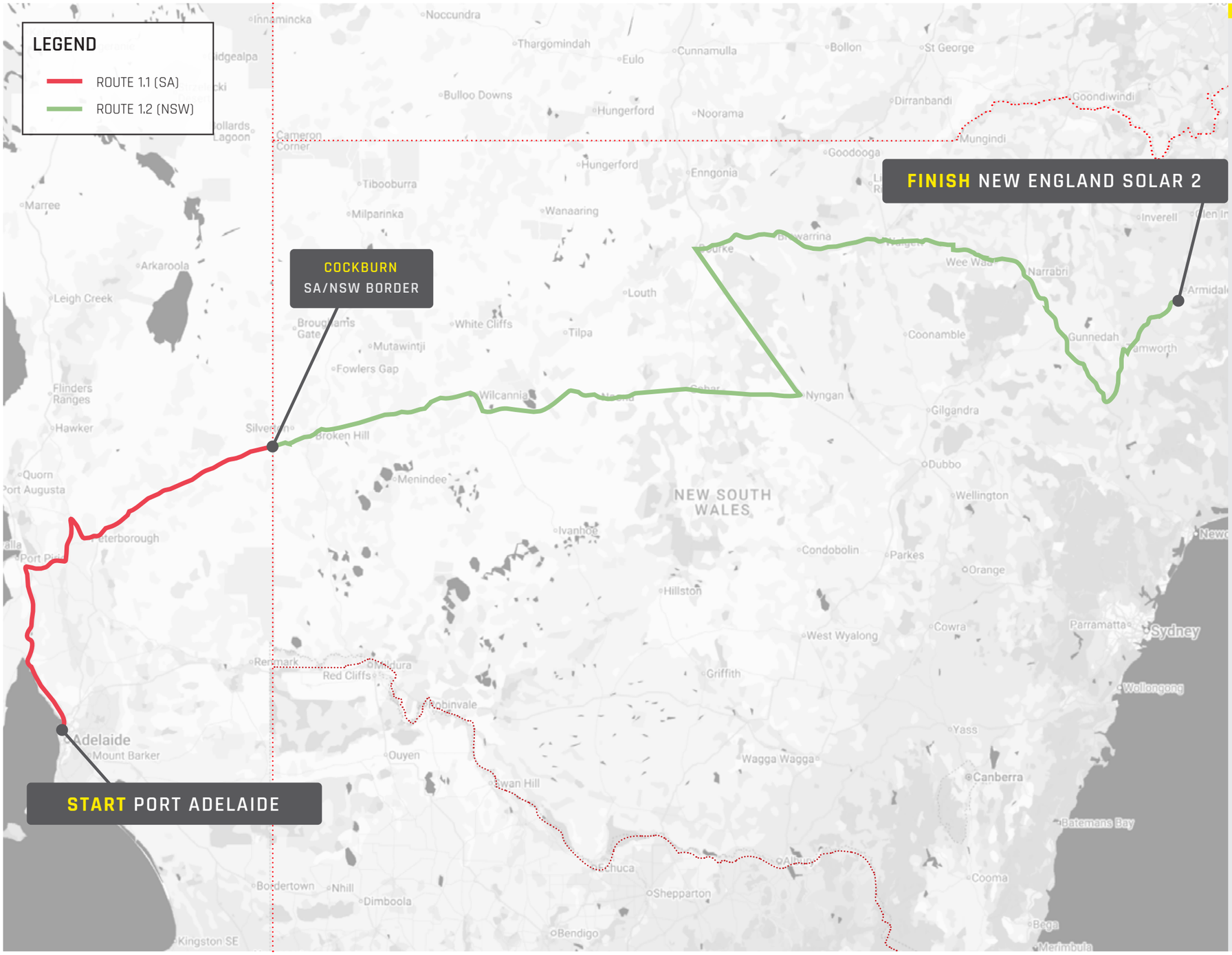
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DRAWING NAME	OGLAU_244T_LASHING_R1.DWG
SIZE	A3
SCALE	NTS
SHEET No	4 of 4
REV	01

Plot date: Friday, 12 September 2025 1:55:53 PM

Journey Overview



ROUTE 1.1 (SOUTH AUSTRALIA)

Port Adelaide to
NSW Border - COCKBURN

555.0 KM

ROUTE 1.2 (NEW SOUTH WALES)

SA Border - Cockburn to
New England BESS Site

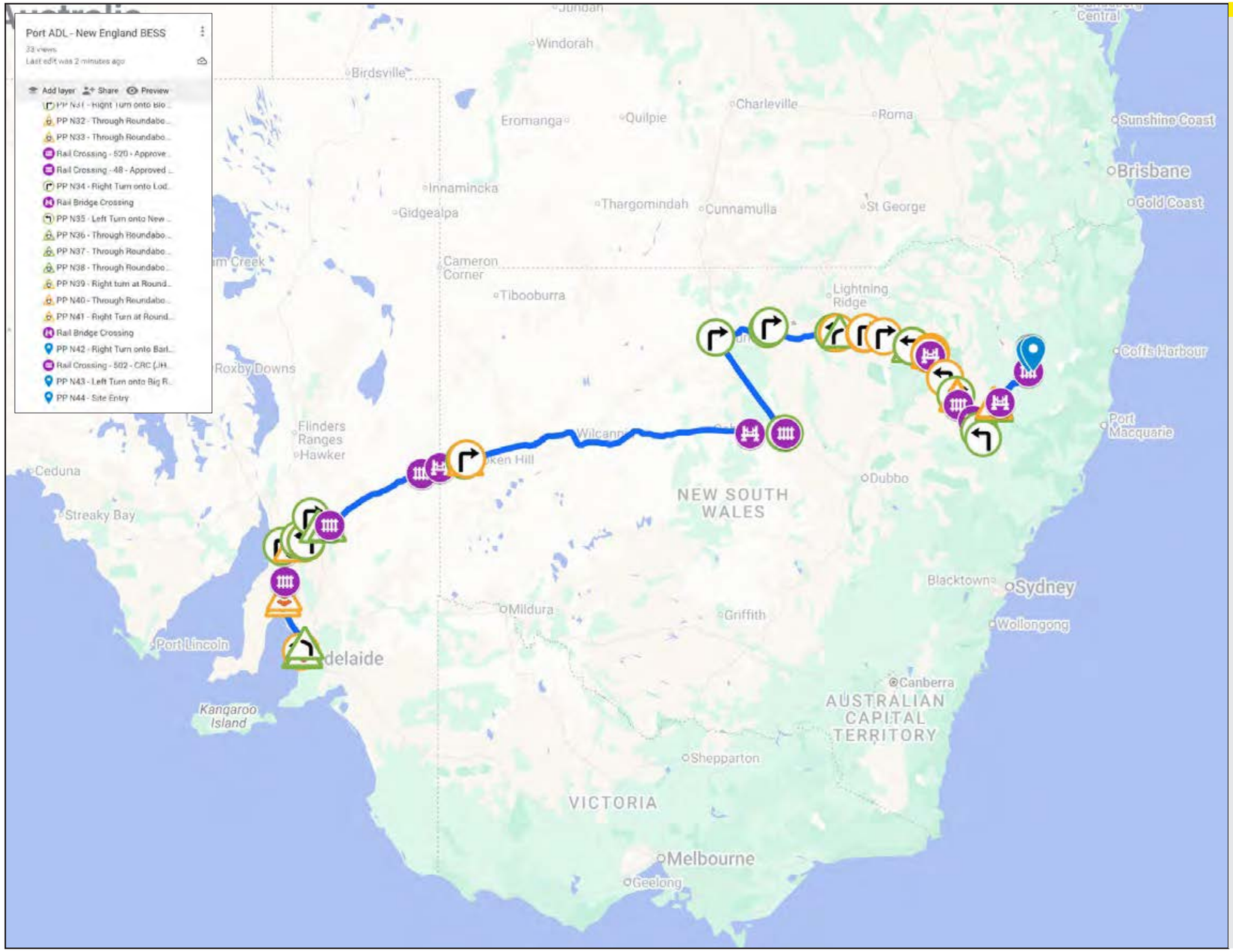
1610.0 KM

TOTAL JOURNEY DISTANCE:

2165 KM

CLICK HERE TO VIEW ONLINE DOCUMENT GOOGLE MYMAPS

LIVE DOCUMENT TMP - Overview



Whilst this PDF document has been created for the process of the various permit applications, a parallel LIVE document is also being created and updated for the travelling team to access during the journey.

All conditions relating to the journey, including Bridge crossing conditions, underpasses requiring caution, rail crossings and rest areas will be contained in this MyMaps document.

A hard copy of this document will be kept as a backup, so if at any time signal is lost, the information will still be available by the travel team off-line. Having a live document ensures that any update - imposed early or late, will be included and available to the team.

This live document will ensure all travel & permit conditions will be followed at all times during the journey.

CLICK HERE TO VIEW ONLINE DOCUMENT GOOGLE MYMAPS

General Route Notes

Port Adelaide to Uralla

Road Quality

Where possible, state roads and highways have been utilized, which are generally designed to a higher specification and able to handle heavier loads and higher volumes of traffic.

A mobile VMS will accompany the load to advise traffic of any slowing zones. Certified pilots will assist with management.

Rest Stops

There are numerous truck rest areas along the State and National Highway networks which are suitable for rest breaks and layovers if necessary. Specific stops deemed suitable to access for a load of this size will be listed at the end of each section following the pinch point pages. Specific timings of these locations will not be outlined in this document as timing will be entirely dependent on weather conditions, freedom of travel, delay times, driver fatigue, NHVR requirements etc.

Overhead Structures

Overpasses and overhead structures have been assessed along the specified route shown. For any nominated obstacle where conditions apply, these conditions will be outlined in the live document and adhered to during the journey, to allow safe passage of the load.

Four overpasses in South Australia have been identified with all having at least one lane above 6.0m vertical clearance. All of these overpasses are located in the initial stages of the journey with the final overpass location in Port Wakefield.

There are also 12 Gantry frames along the route (9 located in SA, 3 in NSW) - all with a vertical clearance of no less than 7.0 metres.

Overhead Power Lines

In general, a travel height below 5.5m is not an issue with respect to power lines. However, loads above 5.2m travel height require a high load permit from the power authorities prior to travel.

An overhead power line survey is being undertaken to determine exact line heights and ascertain if any lines will need to be temporarily or permanently lifted prior to the load going through.

The route travels through the multiple electrical provider regions:
South Australia: SA Power Networks & Electra Net.
New South Wales: Essential Energy.

Bridges and Culverts

Any issue with Bridges which are not rated to support the travel load will be bypassed either using an alternative route, a local bypass or a contra-flow manoeuvre.

Road authorities will assess and advise of any travel conditions over structures. These will include slowing down, and specific positioning as required. Any bridge conditions received will be outlined in the “Live document”. Any approvals received will be printed out as a hard copy and handed to the transport crew prior to the journey commencement.

Rail Crossings

Fifteen rail level crossings have been identified along the route. There are seven crossings in South Australia and 8 in New South Wales. All crossings have been initially deemed passable by our survey. All crossings are subject to approval by the relevant authorities including Aurizon, ARTC and CRC. Six other non level (Bridge) rail crossings exist and will all be subjected to bridge conditions as mentioned previously.

Roadworks

Close liaison with all state authorities will be maintained throughout the transport planning phase. The relevant state Authorities for this route are: SA (TMR) and TfNSW.

Roadworks notes taken on the physical survey (completed 8th August 2025)

A: Road works were underway between Port Wakefield and Snowtown for approximately 5Kms. A check on progress will be required prior to travel. One lane was closed at the time during the physical route survey.

B: There are marked sections of damaged road on the Kamilaroi Highway before and after in the Cryon Pinch Points (N16,N17).

C: Roadworks (Bridgeworks) are present over Spring Creek (north of Narrabri) and are expected to continue until the end of October.

D: Various roadworks locations are underway and currently scheduled between Willow tree and Tamworth.

E: Road damage and roadworks exist along the Moonbi Range section of road. These are scheduled to continue until the end of March 2026.

Approvals

Transport Permits have been lodged with NHVR and Transport Plans will be lodged with the relevant state authorities.

Transport will not be possible until TMPs are approved by state authorities and approved Transport permits are obtained from NHVR.

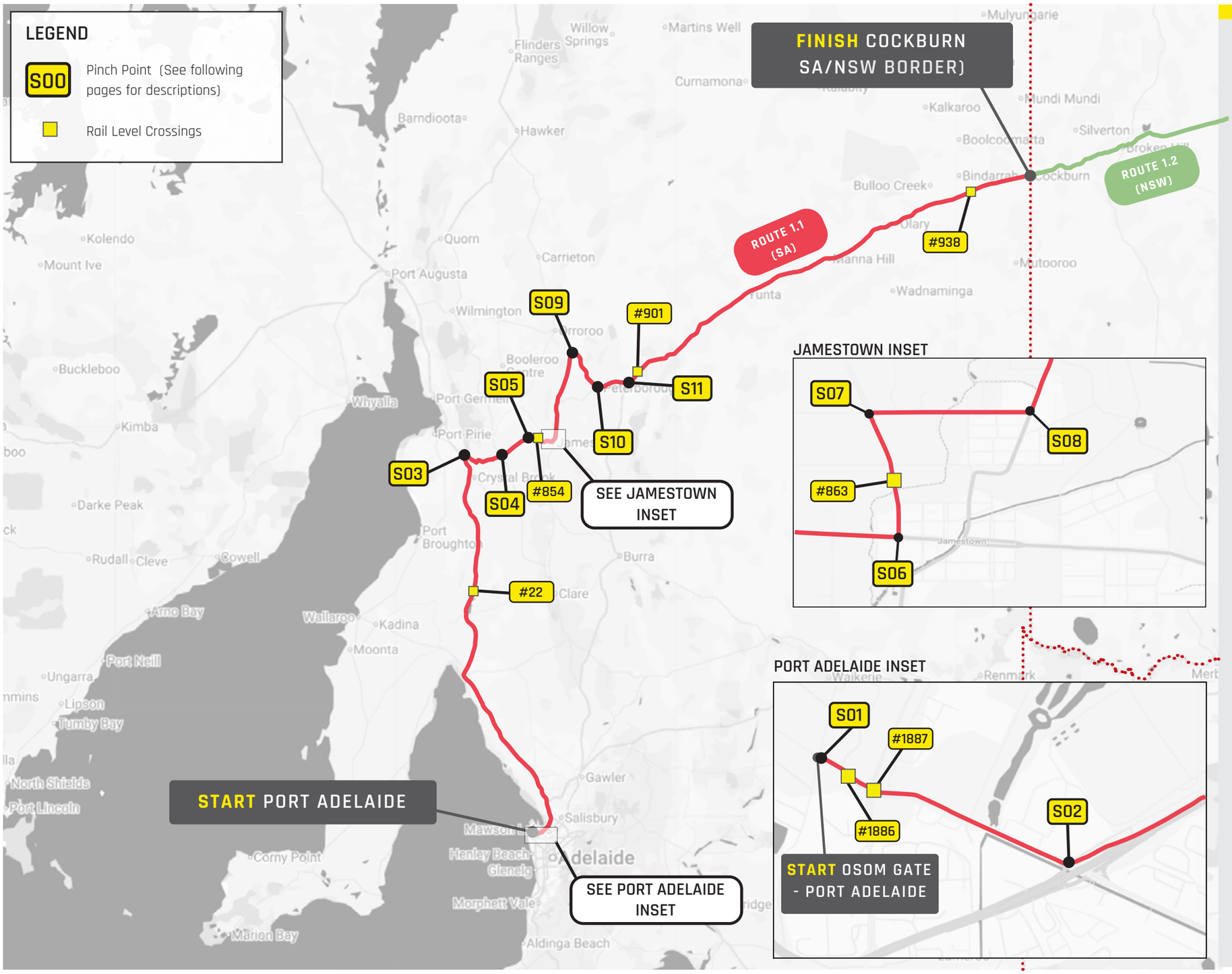


Above: A 250MVA Transformer being transported along the Moonbi range Section, bound for the Uralla site, April 2025.

02

Route 1.1 - Port Adelaide to Cockburn

Route 1.1 Overview



ROUTE 1.1

	START - Port Adelaide
0.0 Km	(S01) Eastern Parade
0.1 Km	Rail level crossing #1886
0.2 Km	Rail level crossing #1887
0.9 Km	(S02) Port River Expwy On-Ramp
4.0 Km	Start of North South Mwy
19.0 Km	Start of Princes Hwy
139.7 Km	Rail level crossing #22
193.7 Km	Rail Bridge crossing #5419
201.7 Km	(S03) Wilkins Hwy
220.9 Km	(S04) Wilkins Hwy
237.0 Km	(S05) Charles St
238.3 Km	Rail Level Crossing #854
248.9 Km	(S06) Clyde St
249.1 Km	Appila Rd
249.4 Km	Rail level crossing #863
250.0 Km	(S07) Boundary Rd
251.1 Km	(S08) RM Williams Way
294.8 Km	(S09) Petersburg Rd
318.0 Km	West Terrace
318.4 Km	(S10) Main St
320.0 Km	Petersburg Rd
333.3 Km	(S11) Barrier Hwy
335.0 Km	Rail level crossing #901
518.7 Km	Rail level crossing #938
552.3 Km	Rail Bridge Crossing #3695
555.0 km	**FINISH - SA/NSW Border**

Pinch Point

S01

PORT EXIT THROUGH GATE
Ocean Steamers Rd
& Eastern Parade
PORT ADELAIDE

ROUTE 1.1

The load will exit Berth 18-20 in Port Adelaide through a limited access gate which opens into the intersection of Ocean Steamers Rd and Eastern Parade. This allows the load to travel in an almost straight line onto Eastern Parade.

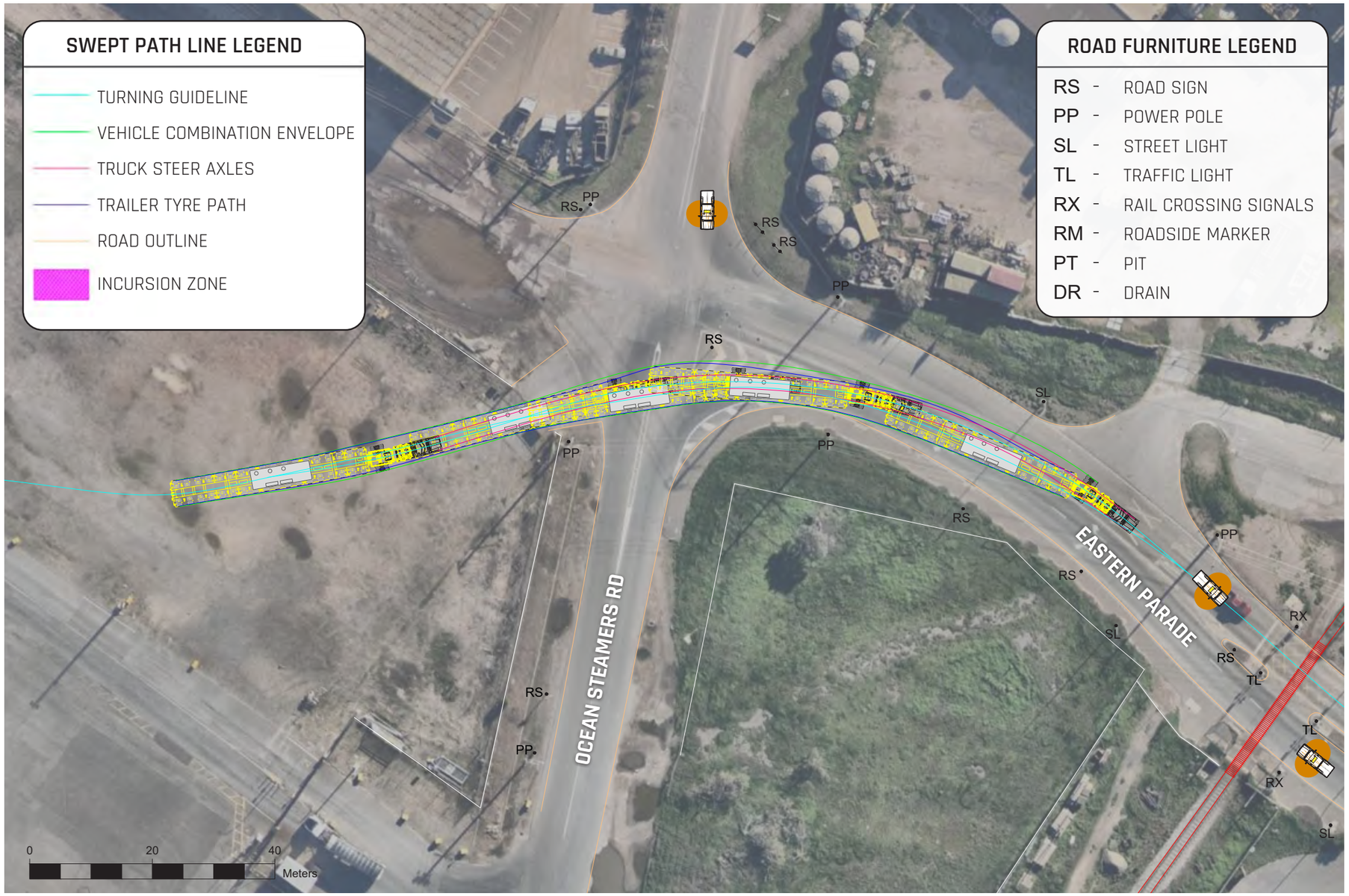
There are multiple power lines located in this area which have all been measured at above 7m, so will not impede the load in any way.

No modifications are required in this location.

Summary of modifications/issues:

- No modifications Required.
- No issues noted.

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DRAWN DATE:	
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CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	S01	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

S02

LEFT TURN
Eastern Parade
& Port River Expwy On-Ramp
GILLMAN

ROUTE 1.1

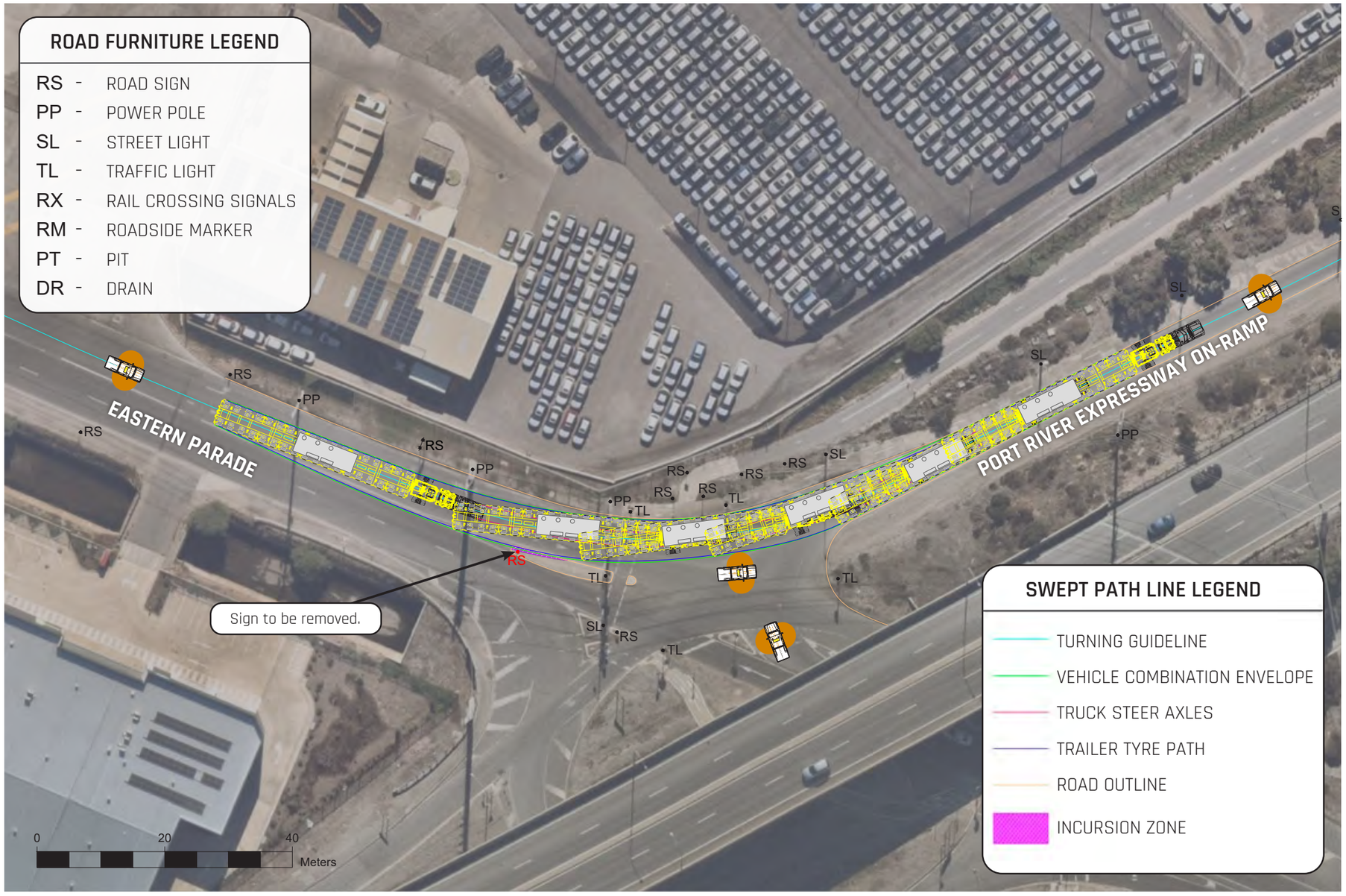
The left turn from Eastern Parade into the Port River Expressway on-ramp has a wide turn radius, however the entry is restricted with an approach island in place. The on-ramp is narrow, with a width of 4.6m from gutter to gutter. With the loaded trailer measuring 4.3m wide, a very precise entry will be required so the load can continue in a straight line along the length of the on-ramp.

To get the load into the required position, the rear of the trailer will cross over the leading edge of the approach island, necessitating the temporary removal of a "Keep Left" sign. This sign has been previously sleeved so removal and replacement should be a straight-forward process. No other modifications are required in this location.

Summary of modifications/issues:

- Temporary removal of 1x sign.
- Minor traffic island incursion will occur.

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DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	S02	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

S03

RIGHT TURN
Princes Hwy (Augusta Hwy)
& Wilkins Hwy
WARNERTOWN

ROUTE 1.1

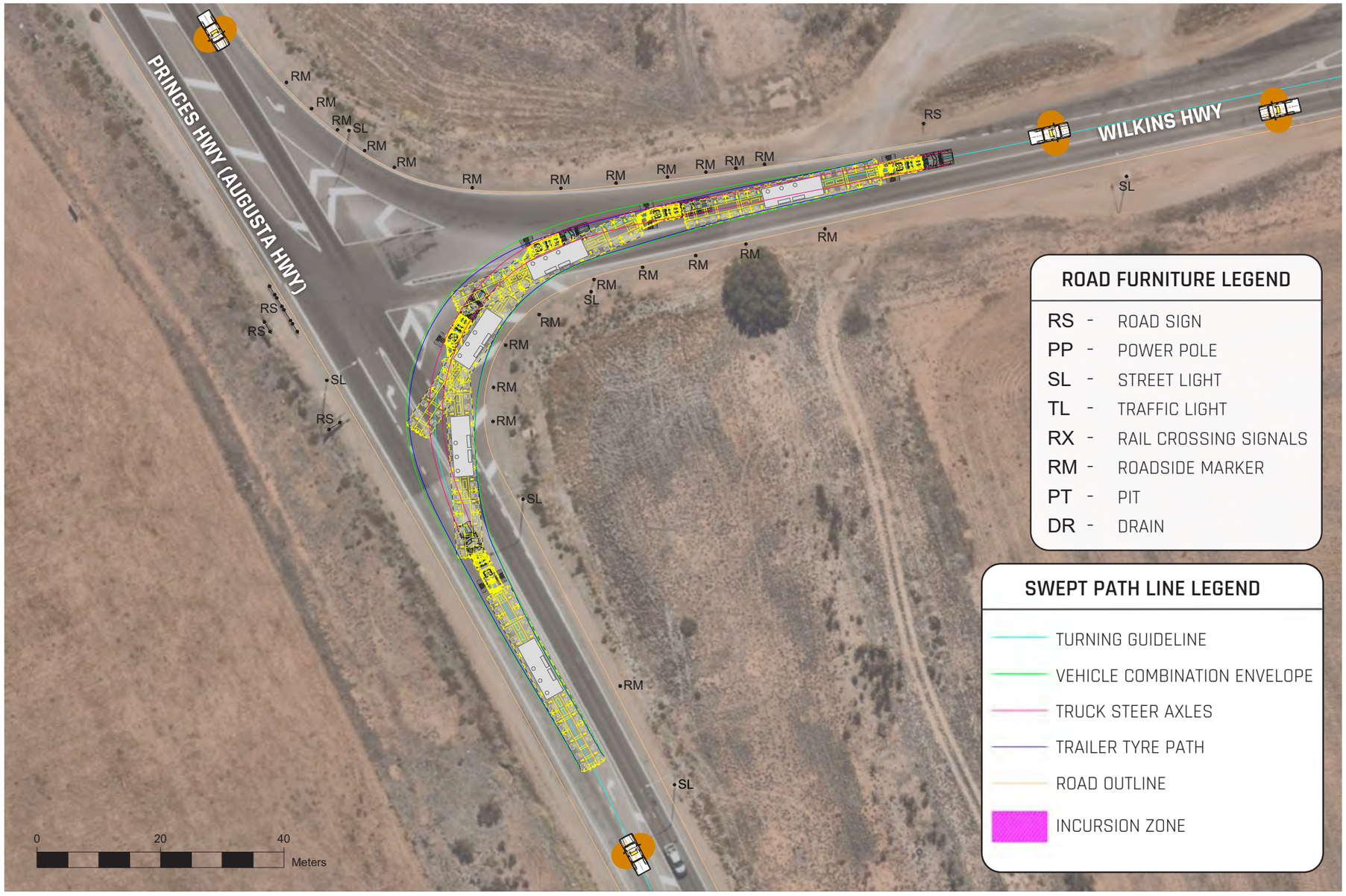
The turn from the Princes Highway into Augusta Highway at Warnertown is in a remote location, so the area is relatively open and unimpeded with an average number of signage and road markers in place.

To navigate the turn with minimal impact, it requires the load to utilize the wrong-side lanes during the apex of the turn and immediately return to the correct side lanes. This approach ensures the load does not leave the sealed road at any time and therefore no impact to roadside furniture occurs.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

(CLICK TO VIEW THIS LOCATION ON GOOGLE MAPS)



ROAD FURNITURE LEGEND

RS	-	ROAD SIGN
PP	-	POWER POLE
SL	-	STREET LIGHT
TL	-	TRAFFIC LIGHT
RX	-	RAIL CROSSING SIGNALS
RM	-	ROADSIDE MARKER
PT	-	PIT
DR	-	DRAIN

SWEPT PATH LINE LEGEND

- TURNING GUIDELINE
- VEHICLE COMBINATION ENVELOPE
- TRUCK STEER AXLES
- TRAILER TYRE PATH
- ROAD OUTLINE
- INCURSION ZONE

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		PROJECT: New England Solar	SCALE NTS
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	DRAWN DATE:	DRAWING NAME: S03	REV
	CHECKED BY:		

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Pinch Point

S04

THROUGH ROUNDABOUT
Wilkins Hwy
& Wilkins Hwy (Park Tce)
GLADSTONE

ROUTE 1.1

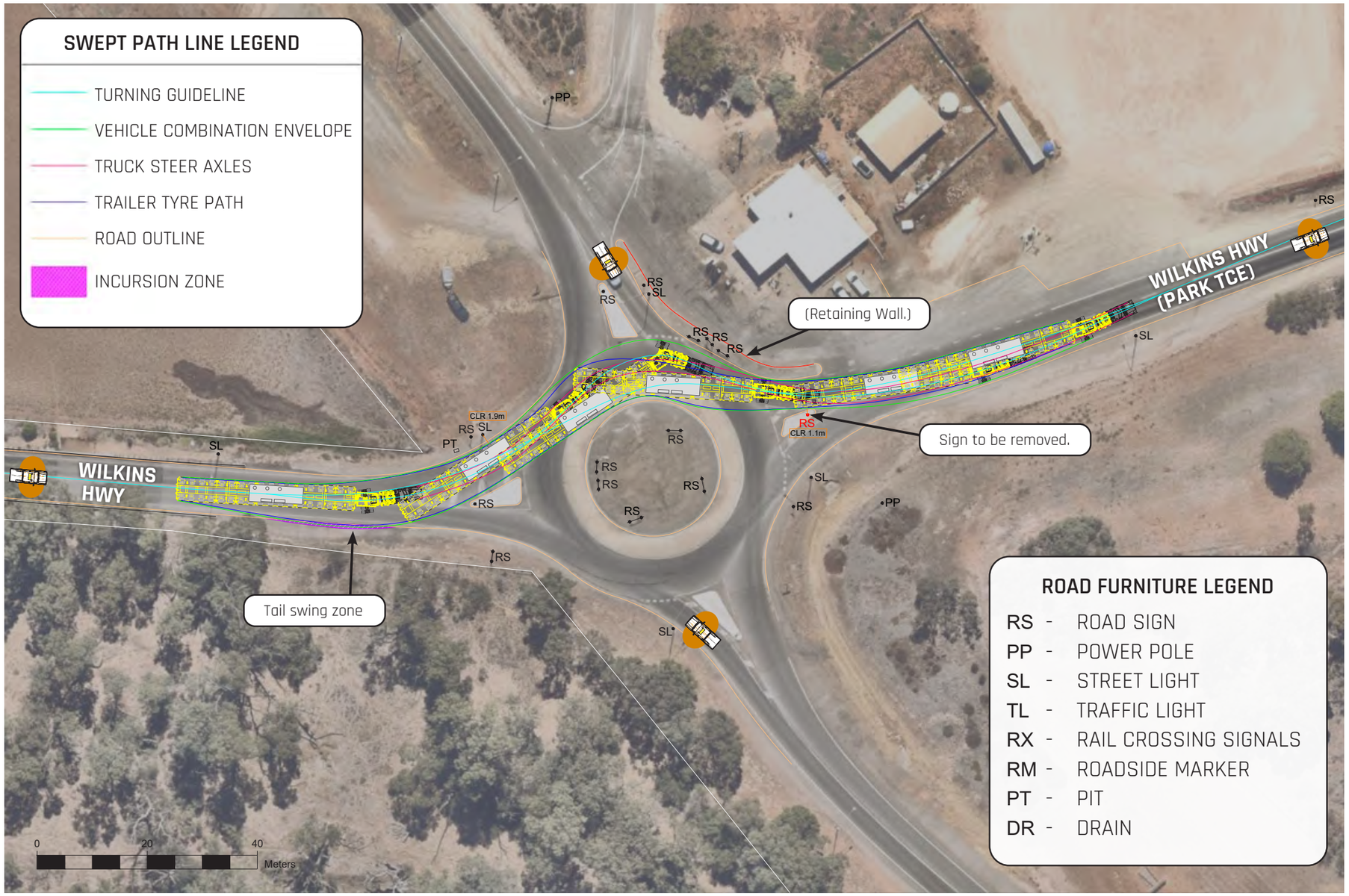
The roundabout located along the Wilkins Highway on the outskirts of the township of Gladstone is quite a large roundabout but the presence of both a street light on the approach side and a fuel station on the north-Eastern corner ads to the level of difficulty. The Fuel station is lower than the road level. There is a loose block retaining wall which tapers up to approximately 600mm high along the N/E length of the island - meaning the load cannot cross this island under any circumstances.

By taking a wide entry and keeping the load as straight as possible in the entry, the load can manoeuvre successfully through this intersection. To assist with some extra margin for error, it is strongly suggested the sign on the exit island be removed beforehand so this area can be crossed if required.

Summary of modifications/issues:

- 1x sign to be temporarily removed.

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DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	S04	REV

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Pinch Point

S05

RIGHT TURN
Wilkins Hwy
& Wilkins Hwy (Charles St)
CALTOWIE

ROUTE 1.1

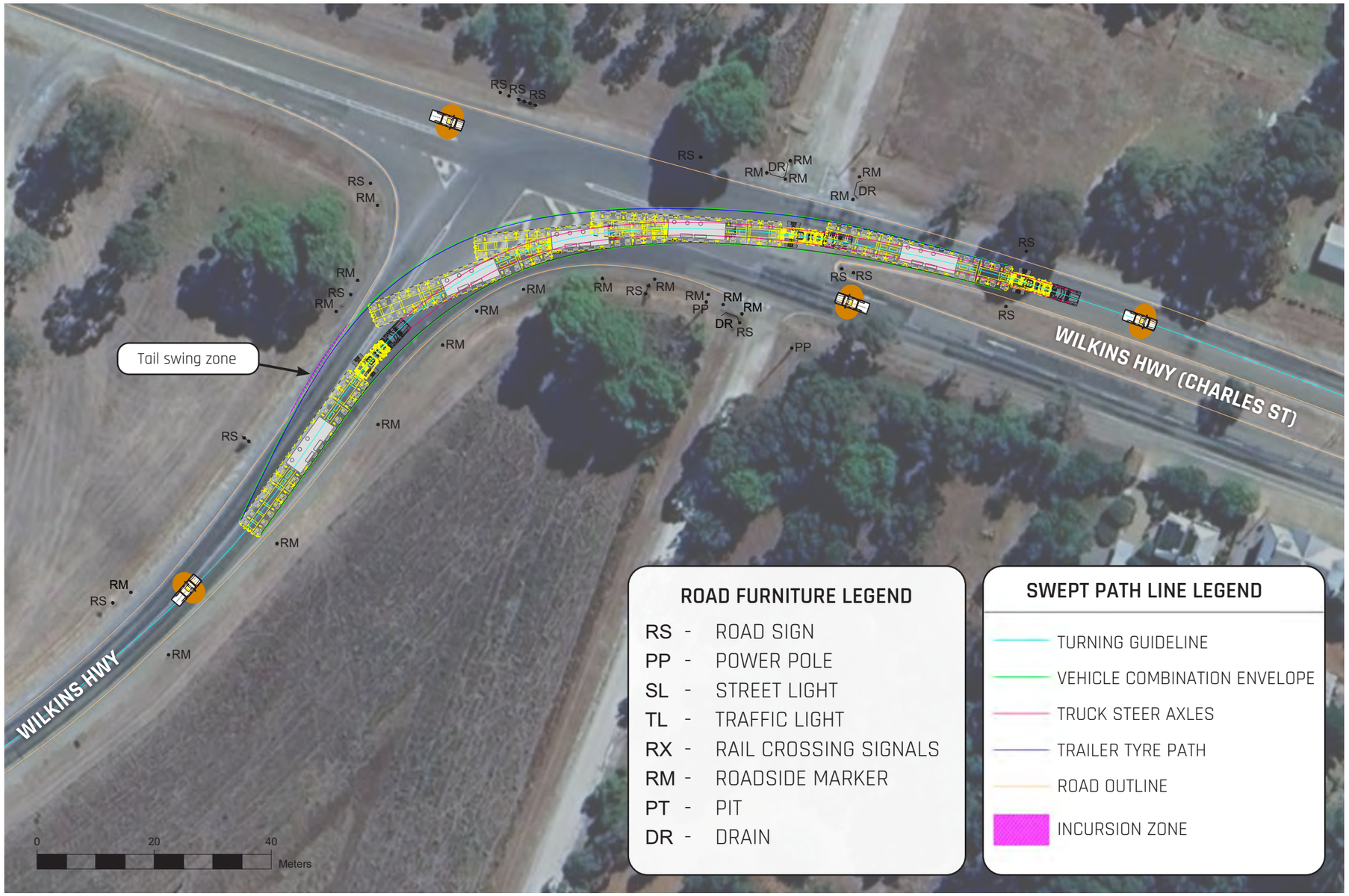
The right turn from Wilkins Highway onto Charles Street in the township of Caltowie has a large open radius so can be maneuvered simply by relocating the load into the wrong-side lanes during the approach, then returning back to the correct lanes during the exit before the median strip island commences.

There will be no impact to roadside furniture. The tail swing will have very minor overshoot of one gravel section on the approach but all axles will remain on sealed road at all times during this turn.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING TITLE:	PINCH POINT	SHEET NO:	
DRAWING NAME:	S05	REV	

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Pinch Point

S06

LEFT TURN
Wilkins Hwy (Ayr St)
& Clyde St
JAMESTOWN

ROUTE 1.1

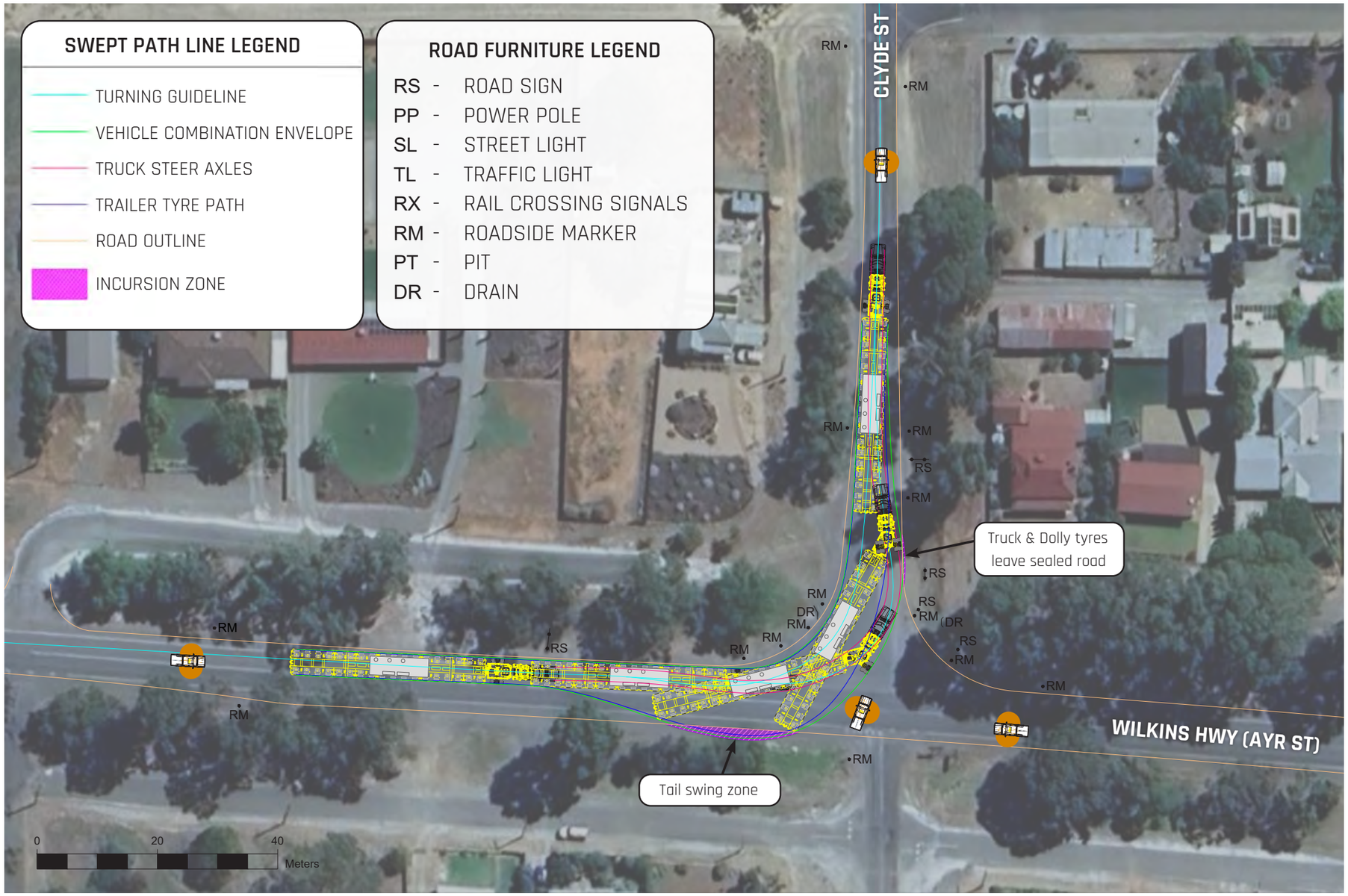
The left turn from Wilkins Highway into Clyde Street (which changes name to Appila Rd) is the first turn onto the OD5 Route as per the SA-DIT website. Both sides of this turn have a number of road markers and signs which can all be avoided. Critically, there is a drain with openings on both the east and west apex of the turn, which must be avoided.

The turn will commence with the load being as close to the left shoulder of the road as possible. All lanes will be required with the rear axle of the trailer leaving sealed road on the southern side of the road at the entry and the Dolly leaving sealed road on the east side in the exit. Both of these areas are clear of any roadside furniture. The overrun zone should be inspected for suitability and - if required, the rear axle raised for this turn.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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	DRAWING NAME:	S06	REV

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Pinch Point

S07

RIGHT TURN
Appila Rd
& Boundary Rd
JAMESTOWN

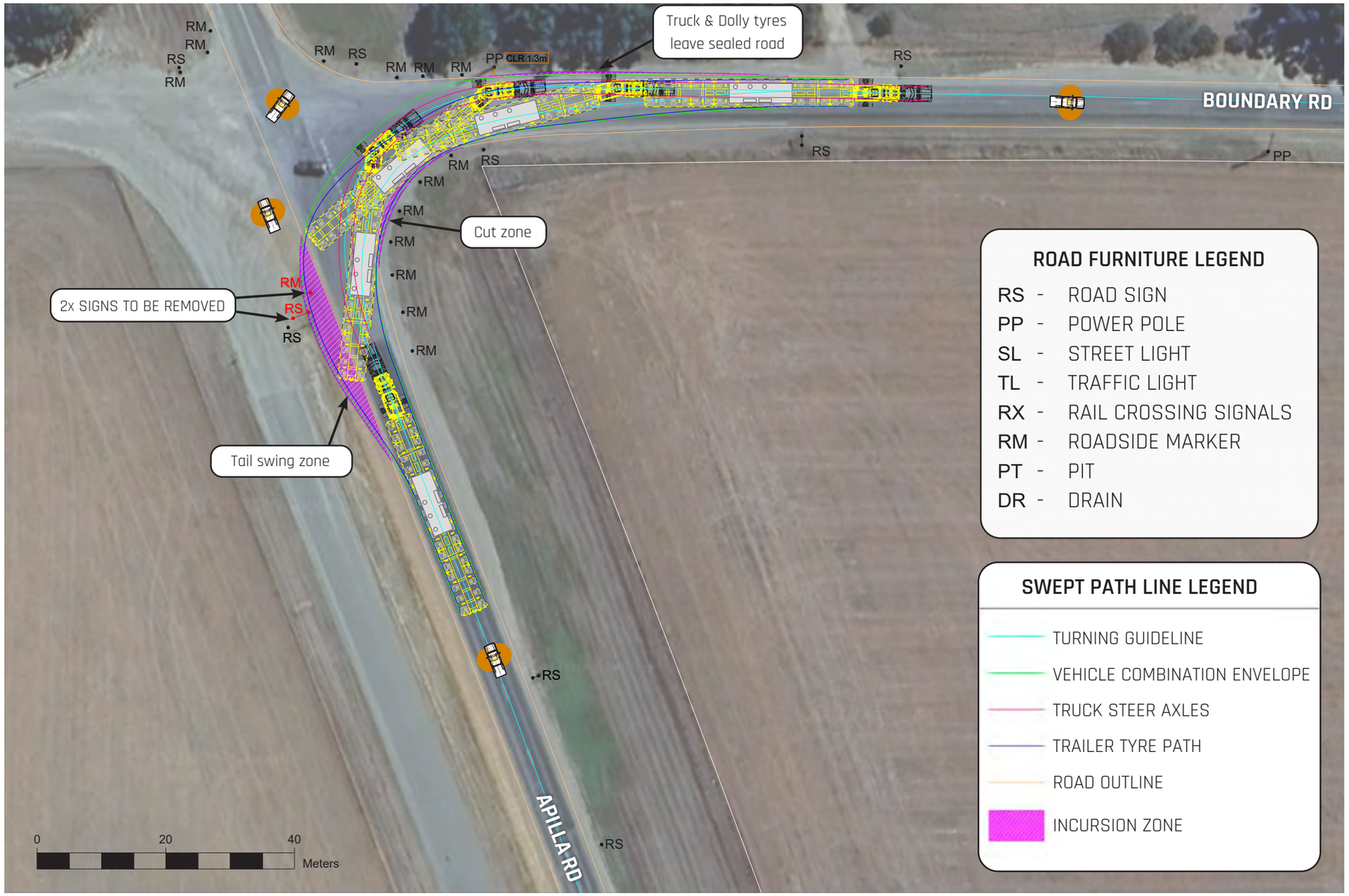
ROUTE 1.1

Although the right turn from Apilla Rd into Boundary Rd is quite open, it will require the load to leave the sealed road to navigate the turn. There is a road sign and road marker located on the left side of Apilla Rd which will be affected by the trailer tail swing, the entire load will cross the gravel section at the apex and then the Dolly wheels will veer slightly off sealed road at the exit point. There is a Power pole located at the exit of the turn, which will have approximately 1.3m of clearance from the load at its closest point.

Summary of modifications/issues:

- 1x sign on left side of Apila Rd to be temporarily removed.
- 1x Road marker will be impacted.
- Load will leave sealed road in 3 places.

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DRAWING TITLE:	PINCH POINT	SHEET NO:	
DRAWING NAME:	S07	REV	

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Pinch Point

S08

LEFT TURN
Boundary Rd
& Mannanarie Rd
JAMESTOWN

ROUTE 1.1

At the intersection of Boundary Rd and Mannanarie Rd, the roads are wide and the turn radius is large, meaning this left turn can be completed without issue.

This left turn will commence in the left lane of Boundary Rd and will swing into the oncoming lanes of Mannanarie Rd, but the load will always remain on the sealed road at all times during the turn. No roadside furniture will be affected during this manoeuvre.

This turn marks the conclusion of our use of the OD5 bypass of Jamestown.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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	DRAWN DATE:		
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Pinch Point

S09

RIGHT TURN
RM Williams Way
& Petersburg Rd
BLACK ROCK

ROUTE 1.1

The right turn from RM Williams Way onto Petersburg Road is located in the Black Rock region. This location is defined using painted islands dividing lanes, which essentially widens the turn and allows us to make this navigable.

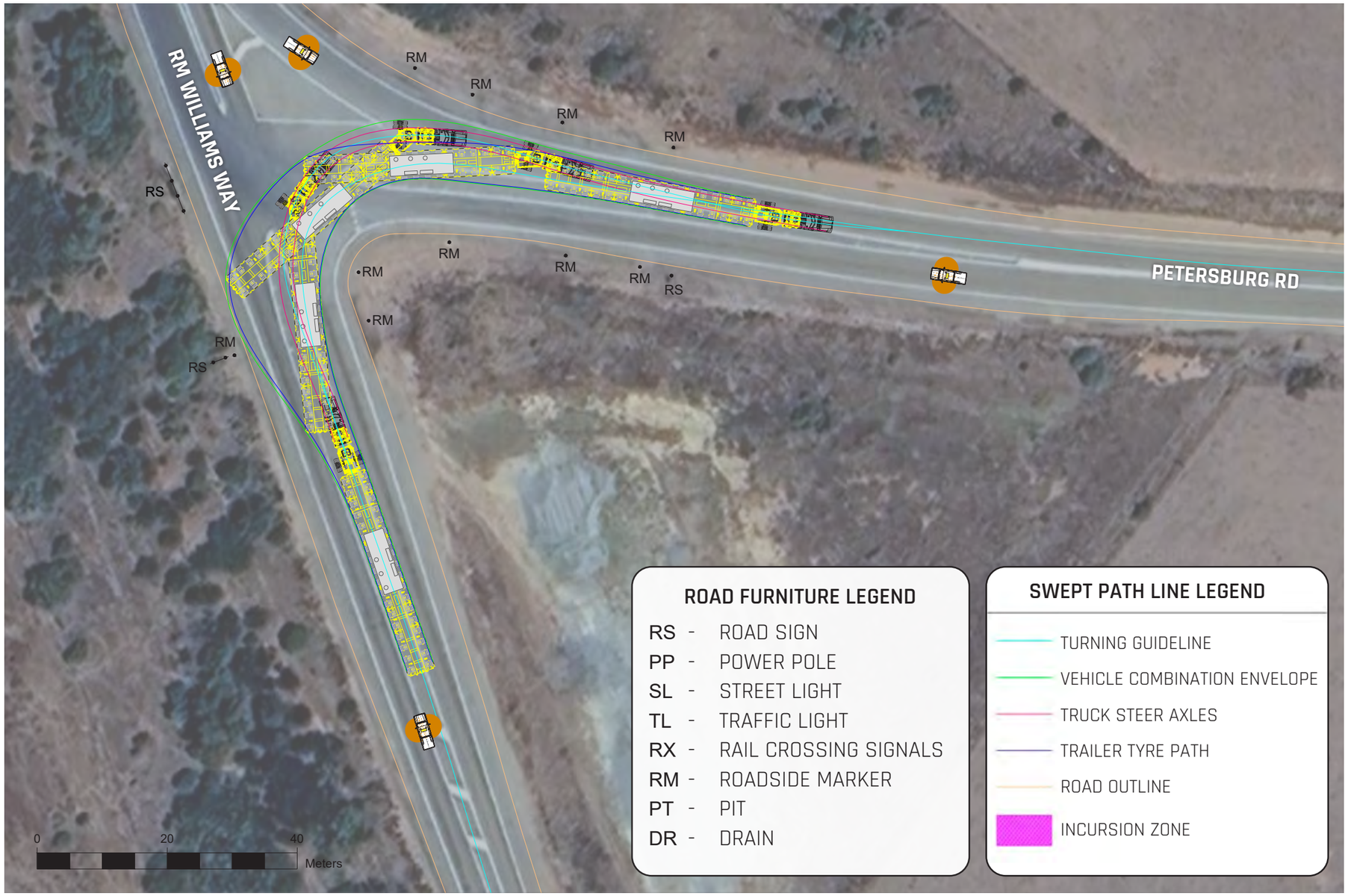
During the approach to the turn, the load will need to cross over partially into the wrong-side lanes and remain there until the exit of the turn, where it will immediately return to the correct lanes again. Being a turn greater than 90 degrees, this early lane crossover is to allow for tail swing and to also allow the turn to commence closer to the apex, eliminating overshoot on the left during the exit.

The load will remain on sealed surface and no roadside furniture will be affected during this turn.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING NAME:	S09	REV	

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Pinch Point

S10

LEFT TURN
West Terrace
& Main St
PETERBOROUGH

ROUTE 1.1

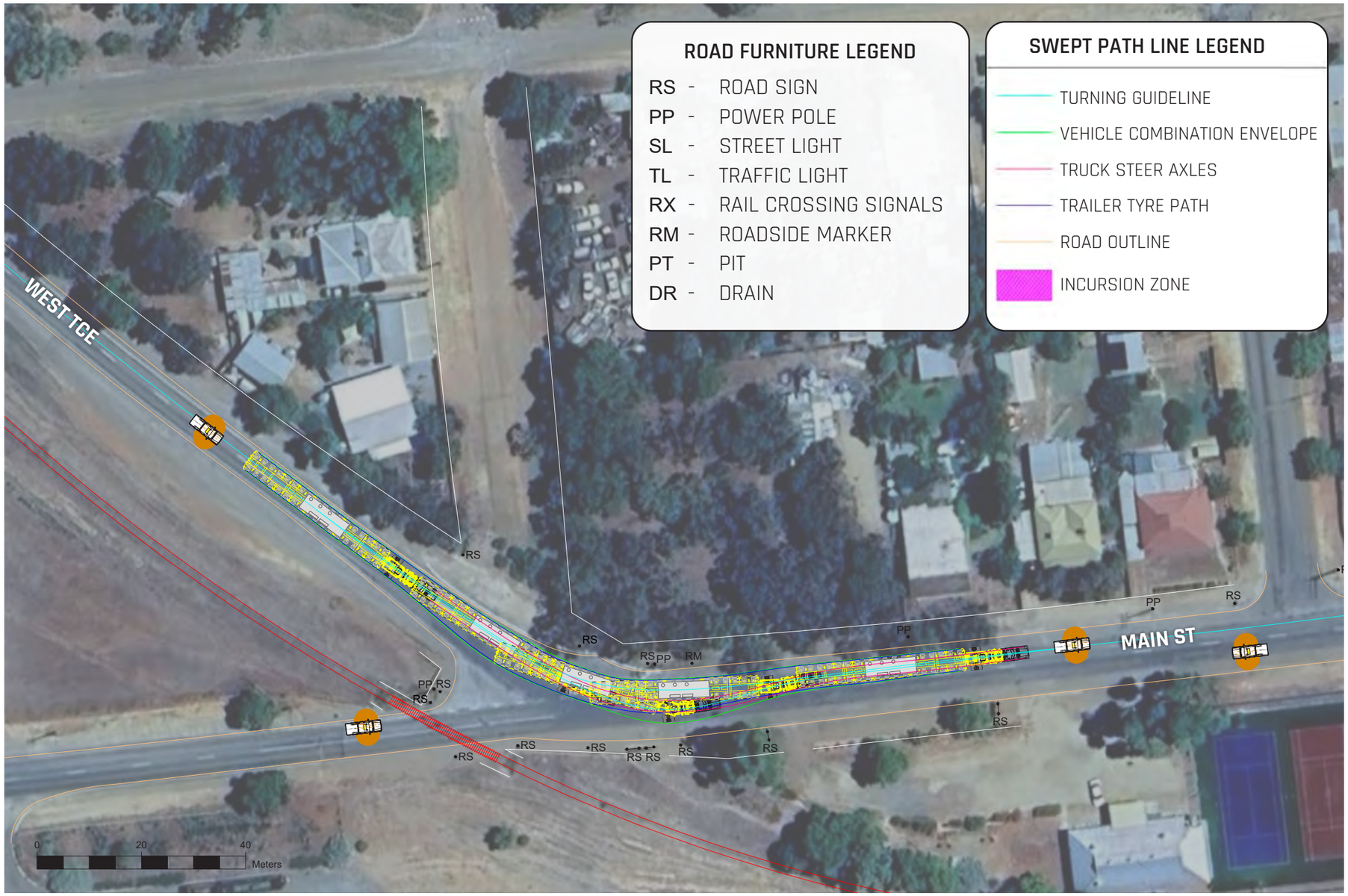
The left turn from West Terrace into Main Street in Peterborough is shallow and has a large turn radius to allow the load to remain on sealed road at all times as shown.

There is a power pole located close to the apex so the truck will cross onto the wrong-side lanes during the exit but will return to the correct side lanes immediately after.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING TITLE:	PINCH POINT	SHEET NO:	
DRAWING NAME:	S10	REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

S11

LEFT TURN
Petersburg Rd
& Barrier Hwy
UCOLTA

ROUTE 1.1

The intersection of Petersburg Road and the Barrier Highway in Ucolta is open and void of cement traffic islands (painted markings only) which will allow the load to make this turn without impact to roadside furniture or leaving the existing sealed road surface.

The trailer will swing into the opposite side lane before the apex of the turn and will continue across a minor portion of the painted island. During the exit of the turn, the load will remain in the correct side lanes. The illustration shows the load aiming for the centreline of the exit as there is a watercourse shortly after the exit of the turn.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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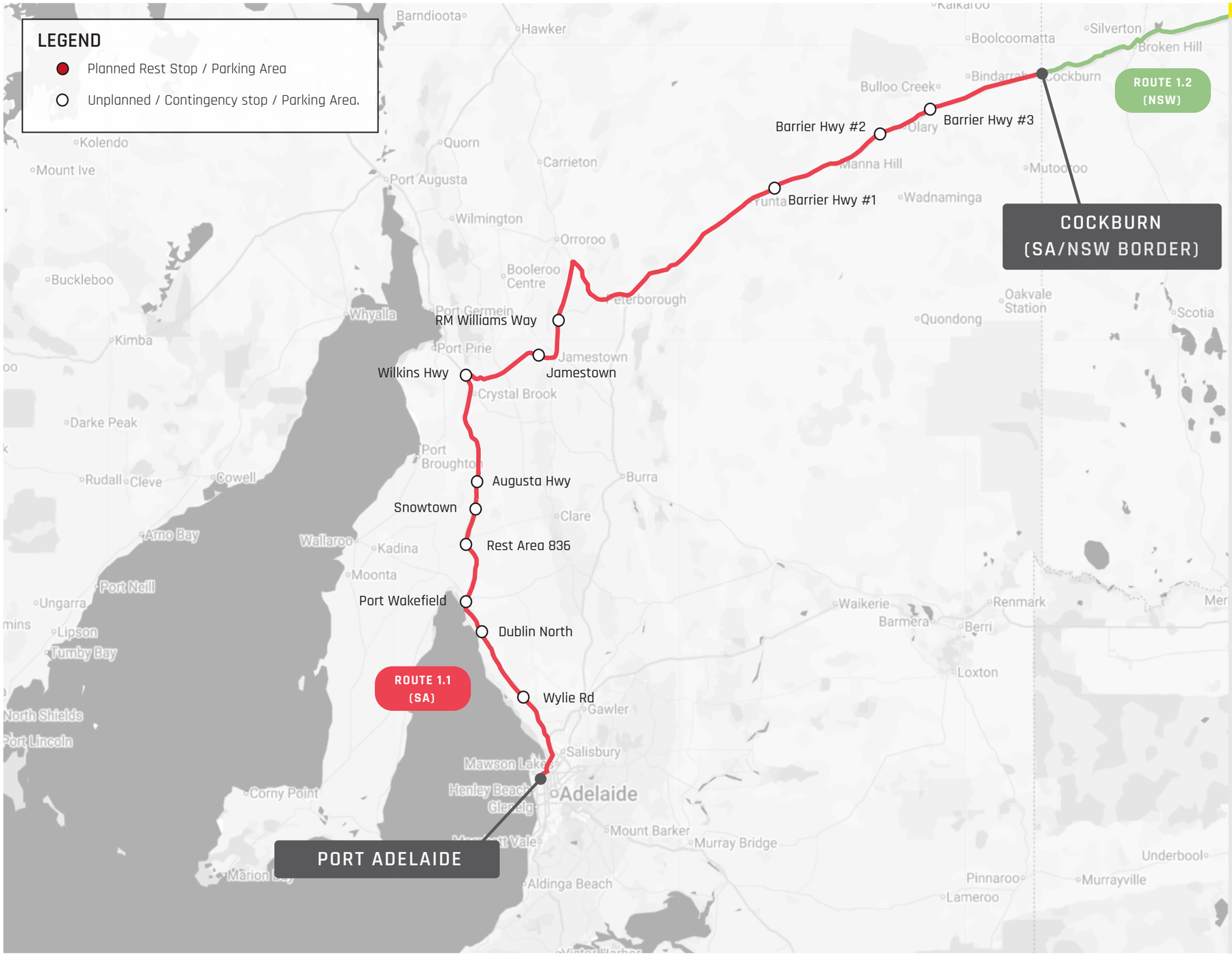
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	DRAWN DATE:		
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Route 1.1 Rest Stops

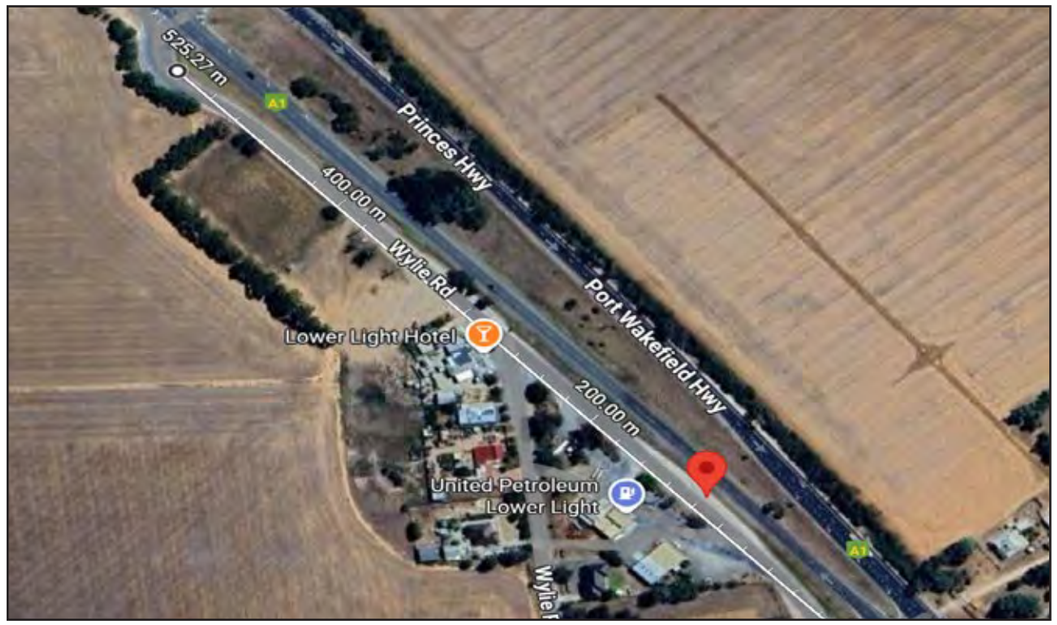


REST STOPS - ROUTE 1.1

No.	DISTANCE BETWEEN	KP	REST STOP NAME
01		42.9	Wylie Rd Pullover Bay United Petroleum
02	33.2	76.1	Rest Area Dublin North
03	16.5	92.6	Pullover Area North of Port Wakefield
04	24.0	116.6	Rest Area 836 South of Lochiel (Opposite Direction)
05	25.3	141.9	Pullover Area North of Snowtown
06	42.1	184.0	Rest Area along the Augusta Hwy
07	17.9	201.9	Rest Area along the Wilkins Hwy after PP 3
08	43.4	245.3	Pullover Area just before Jamestown
09	21.2	266.5	Rest Area along RM Williams Hwy
10	93.2	414.9	Pullover Area along the Barrier Hwy near Yunta
11	60.6	475.5	Rest Area between Manna Hill and Olary
12	37.4	512.9	Rest area between Olary and Mingary
		555.0	**(SA/NSW BORDER)**

01 Rest Area - Wylie Rd United Petroleum

GPS: -34.532825, 138.437823



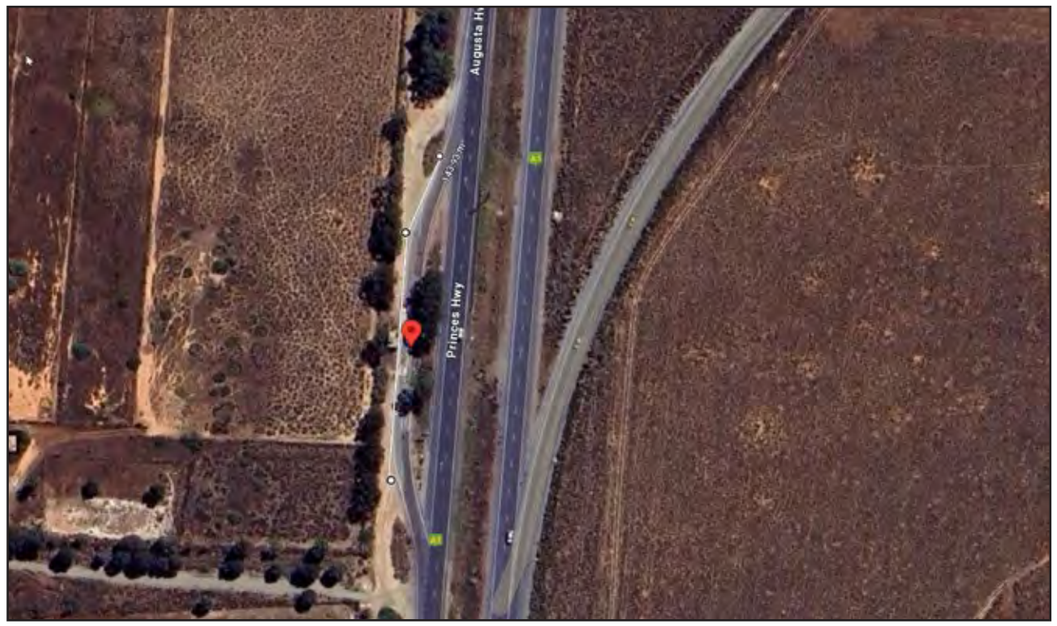
02 Rest Area - Dublin North

GPS: -34.290869, 138.241489



03 Pullover Area - North of Port Wakefield

GPS: -34.169902, 138.154667



04 Rest Area - South of Lochiel (Opposite Direction)

GPS: -33.972091, 138.194541



05 Pullover Area - Shell Roadhouse Snowtown

GPS: -33.773306, 138.212159



06 Rest Area - Augusta Hwy

GPS: -33.204311, 138.560404



07 Rest Area - Wilkins Hwy

GPS: -33.266337, 138.155639



08 Rest Area - Jamestown

GPS: -33.204311, 138.560404



09 Rest Area - RM Williams Hwy

GPS: -33.058979, 138.617058



10 Rest Area - Barrier Hwy #1

GPS: -32.54407, 139.656022



11 Rest Area - Barrier Hwy #2

GPS: -32.309208, 140.219



12 Rest Area - Barrier Hwy #3

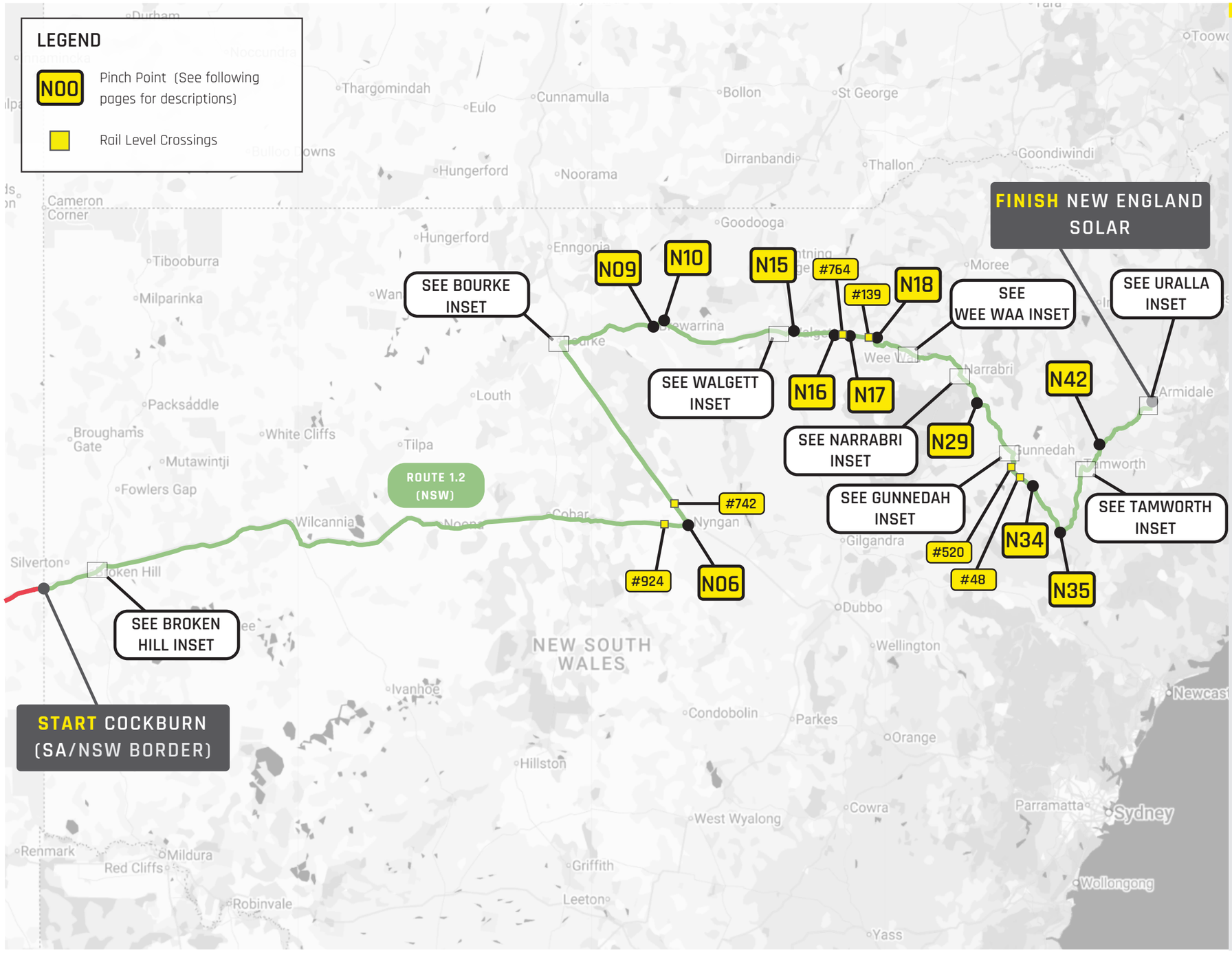
GPS: -32.185938, 140.581207



03

Route 1.2 - Cockburn to Uralla

Route 1.2 Overview



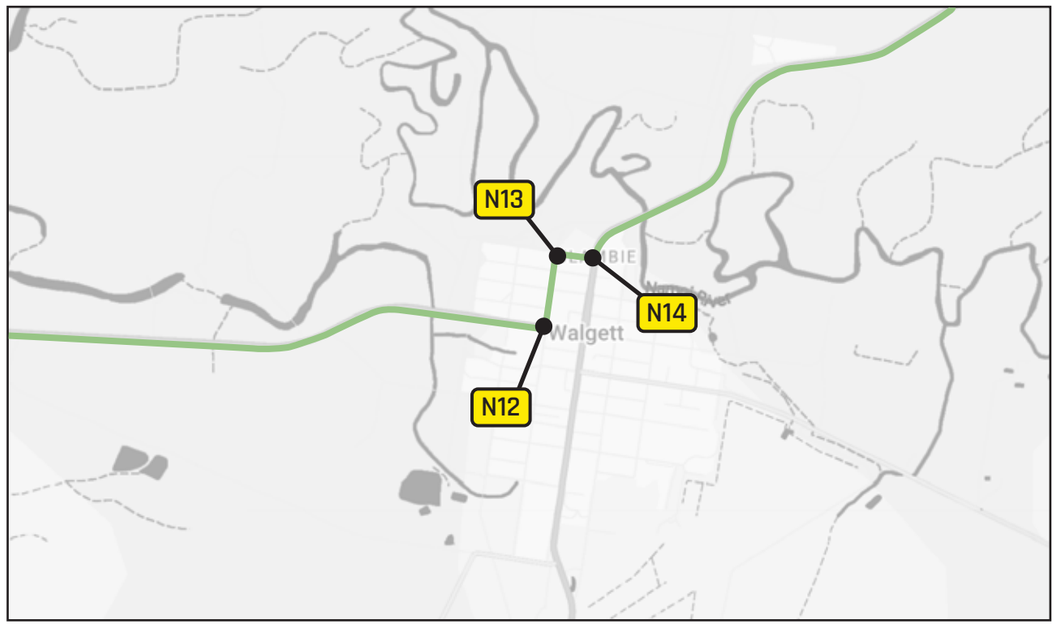
ROUTE 1.2

0.0 km	**START - SA/NSW Border**
39.1 km	**(N01)** Creedon St
40.7 km	**(N02)** Gaffney St
43.3 km	**(N03)** Crystal St
44.8 km	**(N04)** Iodide St
44.9 km	**(N05)** Argent St
626.9 km	Rail level crossing #924
630.1 km	**(N06)** Mitchell Hwy
630.3 km	Rail level crossing #742
831.3 Km	**(N07)** Tarcoon St
831.9 Km	**(N08)** Kamilaroi Hwy
928.8 Km	**(N09)** Bellmore St
937.0 Km	**(N10)** Kamilaroi Hwy
1055.1 Km	**(N11)** Kamilaroi Hwy
1061.6 Km	**(N12)** Peel St
1062.0 Km	**(N13)** Montkeila St
1062.2 Km	**(N14)** Castlereagh Hwy
1066.5 Km	**(N15)** Kamilaroi Hwy
1111.6 Km	**(N16)** Kamilaroi Hwy
1114.0 Km	Rail level crossing #764
1114.1 Km	**(N17)** Kamilaroi Hwy
1148.6 km	Rail level crossing #139
1148.7 km	**(N18)** Kamilaroi Hwy
1203.7 Km	**(N19)** Boolcarrol Rd
1204.0 Km	**(N20)** Mitchell St
1205.1 Km	**(N21)** Maitland St
1205.3 Km	**(N22)** Rose St
1243.6 km	**(N23)** Barwan St
1244.3 Km	**(N24)** Killarney St
1244.6 Km	**(N25)** Tibberina St
1245.2 Km	**(N26)** Dangar Street
1248.0 Km	**(N27)** Newell Hwy
1248.1 Km	Rail level crossing #745
1248.4 Km	**(N28)** Kamilaroi Hwy
1302.6 Km	**(N29)** Kamilaroi Hwy
1339.9 Km	**(N30)** Warbungle St
1340.1 Km	**(N31)** Bloomfield St
1342.8 Km	**(N32)** Kamilaroi Hwy
1343.7 Km	**(N33)** Kamilaroi Hwy
1422.3 Km	**(N34)** Kamilaroi Hwy
1436.6 Km	**(N35)** Loder Street
1503.0 Km	**(N36)** New England Hwy
1504.6 Km	**(N37)** New England Hwy
1504.8 Km	**(N38)** New England Hwy
1505.6 Km	**(N39)** Scott Rd
1507.7 Km	**(N40)** Murray St
1508.0 Km	**(N41)** Marius St
1598.8 Km	**(N43)** Barleyfields Rd
1599.0 Km	Rail level crossing #502
1600.3 Km	**(N44)** Big Ridge Rd
1610.0 KM	**(N45) FINISH - UNLOAD LOCATION**

Broken Hill Inset



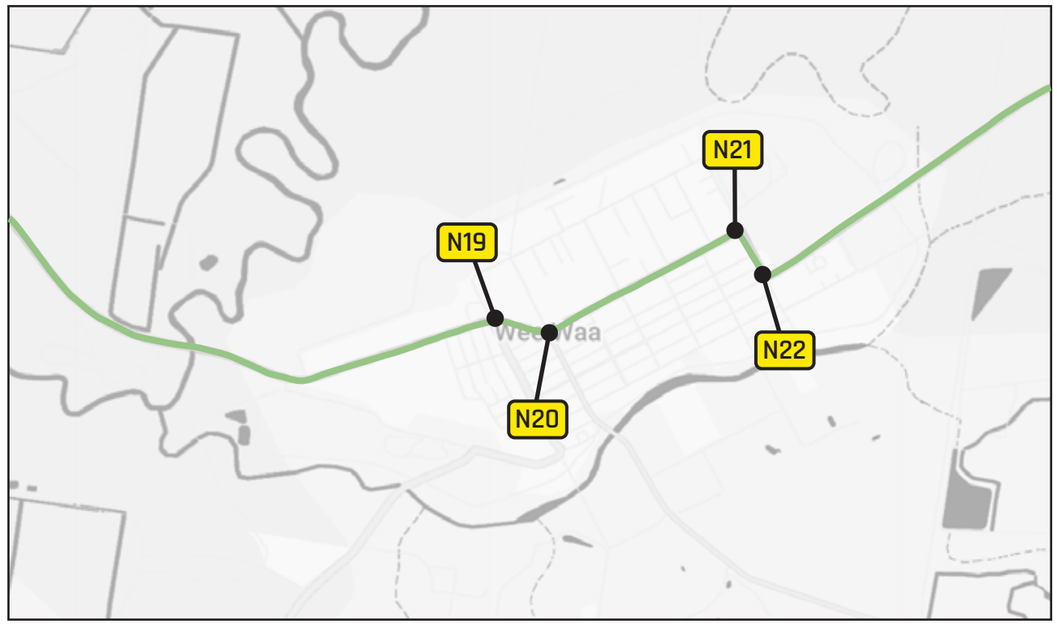
Walgett Inset



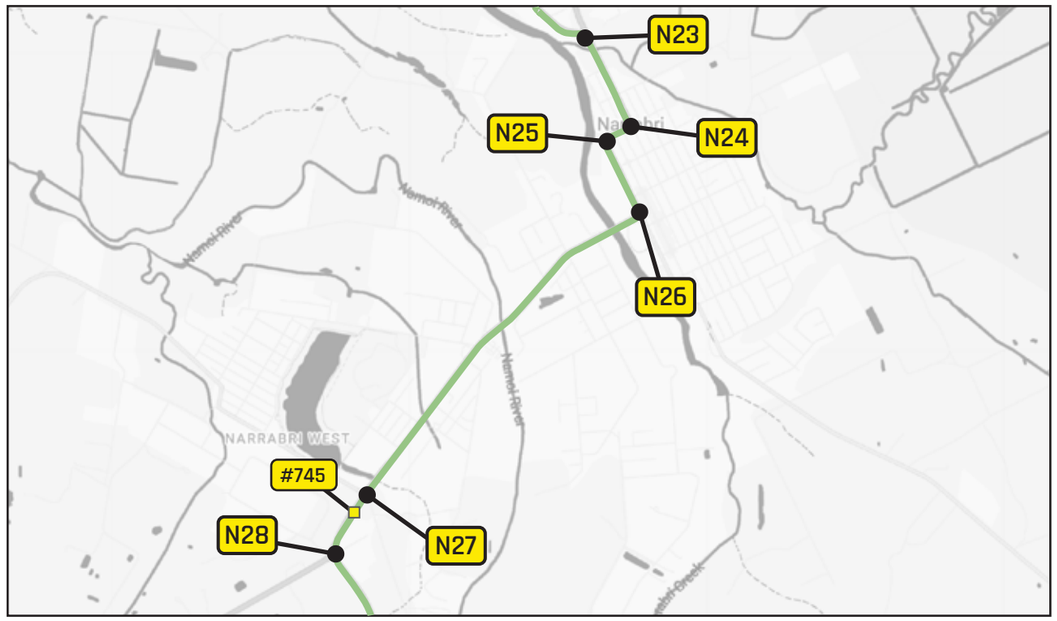
Bourke Inset



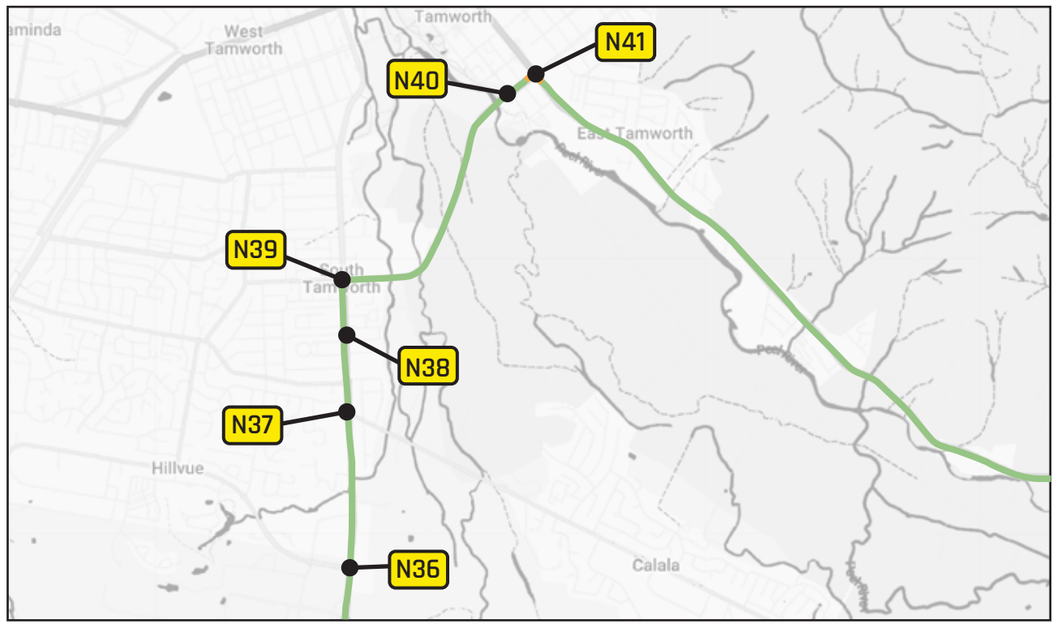
Wee Waa Inset



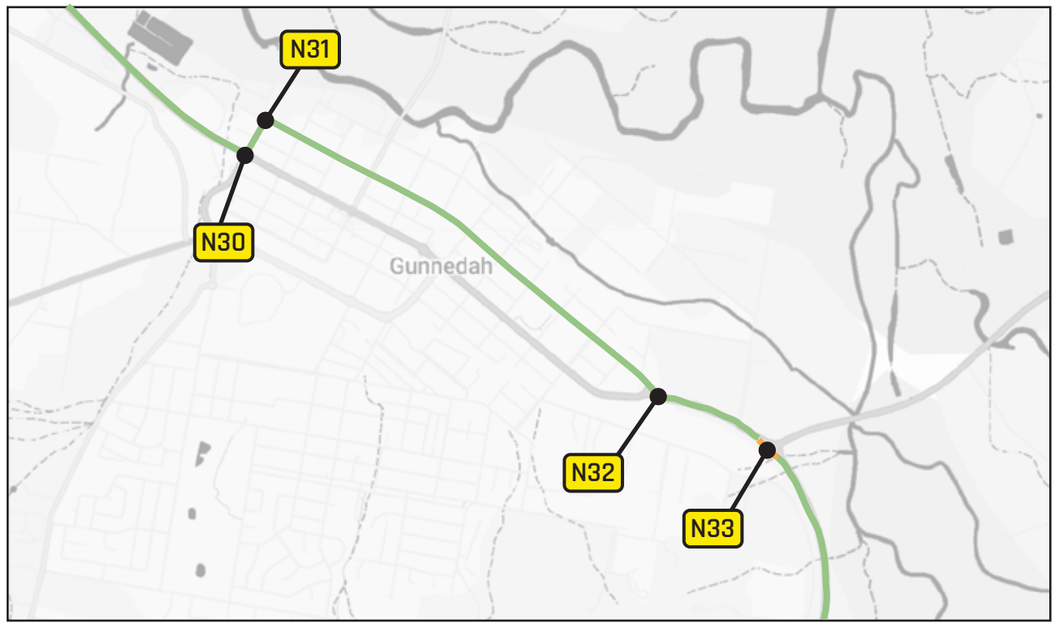
Narrabri Inset



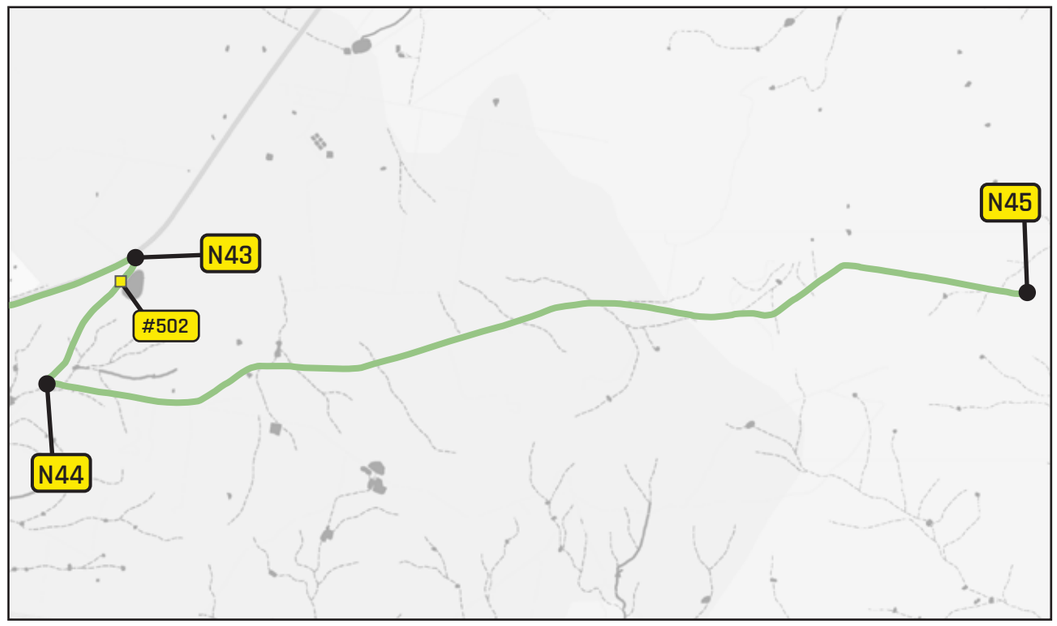
Tamworth Inset



Gunnedah Inset



Uralla Inset



Pinch Point

N01

RIGHT TURN
Barrier Hwy
& Creedon St
BROKEN HILL

ROUTE 1.2

The intersection of Barrier Hwy and Creedon Street has wide roads, so should present no issues for the right turn required at this location.

The load will need to cross into wrong-side lanes in the approach to open the turn radius so the load remains within the sealed road including tail swing.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N01	REV

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Pinch Point

N02

LEFT TURN
Creedon St
& Gaffney St
BROKEN HILL

ROUTE 1.2

Creedon Street in Broken Hill is approximately 15 metres wide, so the left turn into Gaffney Street is possible by commencing the turn as far left as possible and utilizing both lanes of Gaffney street.

Care must be taken as there is a power pole located at the apex of the turn and high vertical gutters exist on all edges. Upon exiting the corner the load will return immediately to the correct lanes.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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Pinch Point

N03

THROUGH ROUNDABOUT
Silver City Hwy
(Crystal St)
BROKEN HILL

ROUTE 1.2

The roundabout at the intersection of Crystal and Bromide streets can be traversed in a straight line by travelling in a contra-flow direction and utilizing the entire concrete section of the roundabout. Providing the area immediately before and after the roundabout is clear of parked cars, interruption to the normal flow of traffic should be minimal.

Immediately following the roundabout, the load will return to the correct lanes. If the shoulder of the road is clear, no modifications will be required at this location.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended as any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Load will travel in a contra-flow direction.

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SCALE	NTS
SHEET NO:	
REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N04

LEFT TURN
Crystal St
& Iodide St
BROKEN HILL

ROUTE 1.2

This left turn has been designed for oversize vehicles, with widened asphalt areas on the inside and outside of the corner. The platform trailer will use these areas to make the turn and will stay on the paved surface at all times.

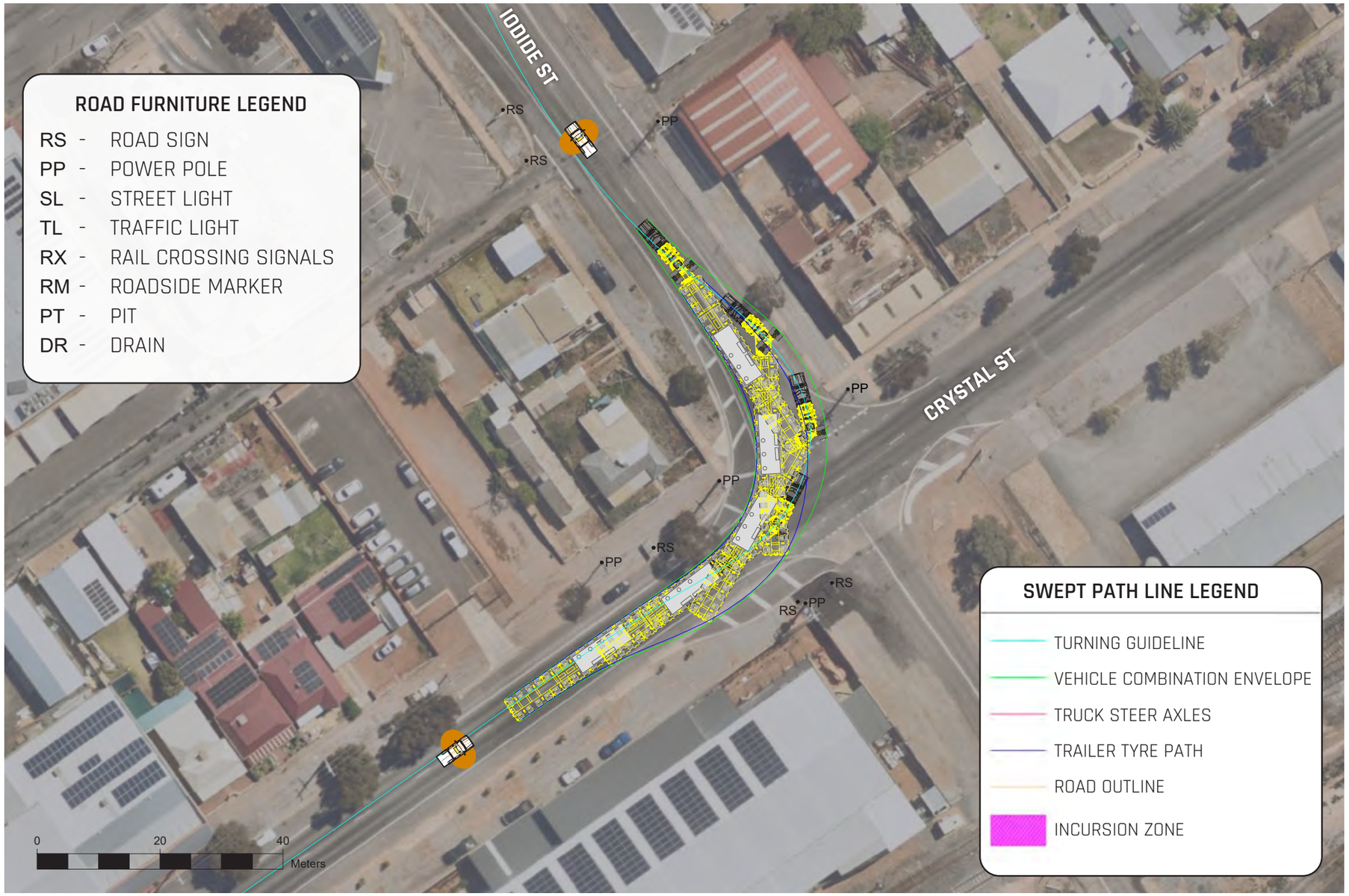
As the prime mover will need to use the full width of Iodide St when turning, police will need to control southbound traffic during the manoeuvre.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended as any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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Pinch Point

N05

RIGHT TURN
Iodide St &
Barrier Hwy (Argent St)
BROKEN HILL

ROUTE 1.2

Due to the presence of concrete median islands on Iodide St, this right hand turn will require the use of the wrong-side slip lane with the trailer to remain as close to the apex as possible where there is widened asphalt. The prime mover and Dolly will need to stay straight and turn as late as possible to allow the back of the platform trailer to clear the traffic islands.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended as any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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SCALE	NTS
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REV	

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Pinch Point

N06

LEFT TURN
Barrier Hwy
& Mitchell Hwy
NYNGAN

ROUTE 1.2

The left turn from Barrier Highway onto Mitchell Highway is tricky because the Barrier highway is quite narrow at this point and allows little tail swing clearance in the turn. The prime mover will need to use the full width of Mitchell Hwy when turning, allowing the rear of the platform trailer to stay on the paved surface.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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Pinch Point

N07

RIGHT TURN
Mitchell Hwy
& Tarcoon St
BOURKE

ROUTE 1.2

The right turn from Mitchell Highway into Tarcoon Street is a shallow and wide turn, meaning that it can be completed with minimal tail swing. With the load crossing the apex in the wrong-side lanes, it means the load never leaves the sealed road at any time.

The load never leaves the sealed road and no roadside furniture are affected in this turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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SWEPT PATH LINE LEGEND

- TURNING GUIDELINE
- VEHICLE COMBINATION ENVELOPE
- TRUCK STEER AXLES
- TRAILER TYRE PATH
- ROAD OUTLINE
- INCURSION ZONE

ROAD FURNITURE LEGEND

RS - ROAD SIGN
PP - POWER POLE
SL - STREET LIGHT
TL - TRAFFIC LIGHT
RX - RAIL CROSSING SIGNALS
RM - ROADSIDE MARKER
PT - PIT
DR - DRAIN

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SIZE:	
SCALE	NTS
SHEET NO:	
REV	

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Pinch Point

N08

RIGHT TURN
Tarcoon St
& Kamilaroi Hwy
BOURKE

ROUTE 1.2

The right turn exiting Tarcoon Street onto the Kamilaroi Highway has a narrow entry road and wide exit point, requiring careful prime mover and trailer positioning and steering to clear.

The load will need to cross into wrong-side lanes in the approach to open the turn radius and the prime mover will remain straight until it can barely clear the northern edge of the road. This will maximize the turn radius and reduce tail swing.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING NAME:	N08	REV	

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Pinch Point

N09

LEFT TURN
Bathurst St
& Bellmore St
BREWARRINA

ROUTE 1.2

The corner of Bathurst Street and Bellmore Street in Brewarrina is wide and open enough to allow the load to turn, however Bellmore street has a traffic island which will require to be driven across during the turn. We will need to use all of the sealed road available.

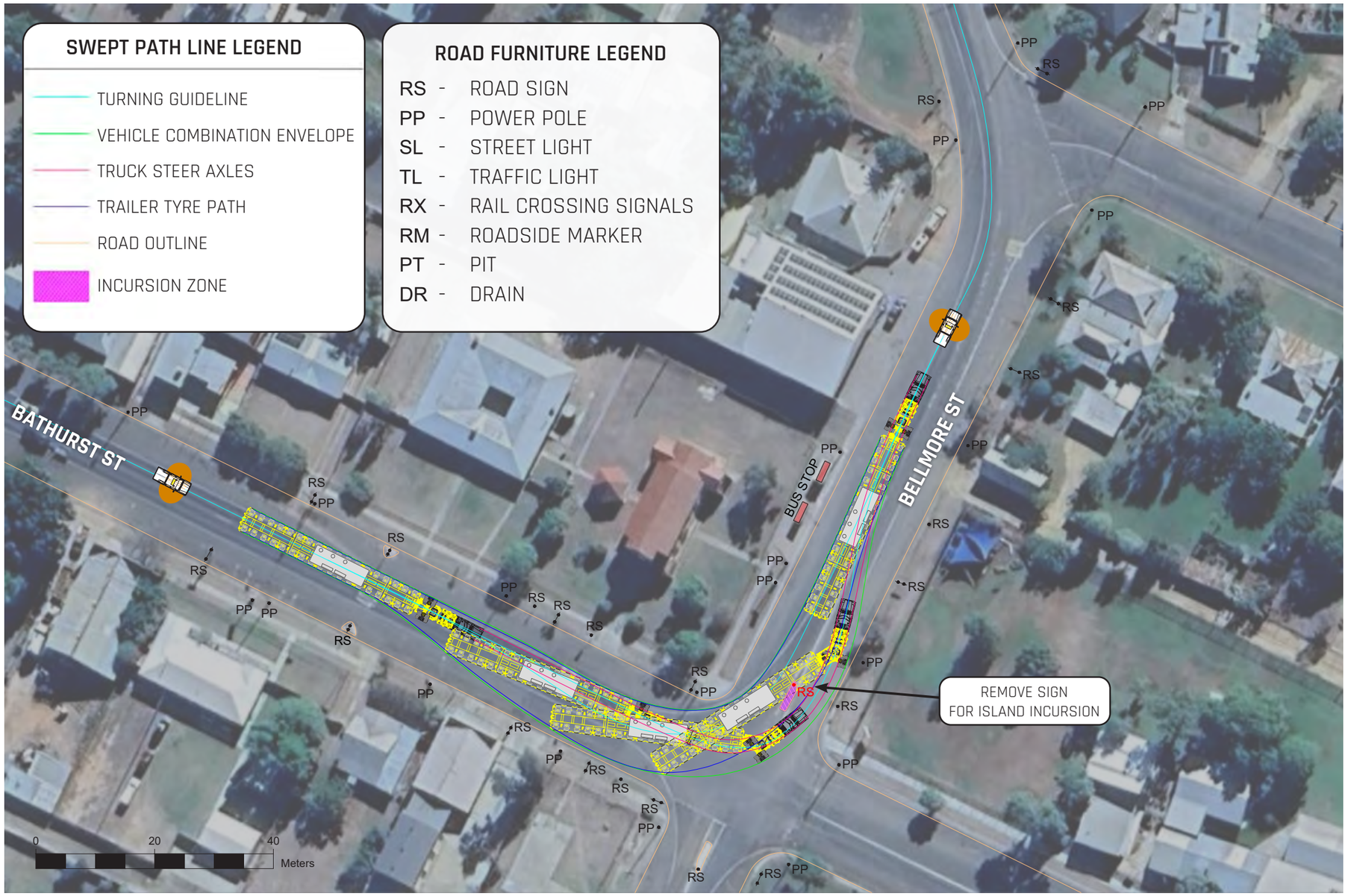
There is 1 sign on the exit traffic island, which will need to be temporarily removed prior to the load turning, and reinstated immediately following. The prime mover will commence it's turn into Bellmore Street using the wrong-side lane and return immediately to the correct side of the road.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 1x sign on the exit island to be removed.
- No issues noted.

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PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N09	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N10

RIGHT TURN
Kamilaroi Hwy

BREWARRINA

ROUTE 1.2

After crossing the Barwon River - just north of Brewarrina, the Kilimaroi Highway continues north for approximately 6.5 kilometres and then makes a right turn heading west towards Walgett. This right turn is a large radius and is in a remote location, so nearby roadside furniture quantity is low.

The load will use all lanes on bot the exit and entry of this turn and will remain on the sealed road at all times. The gravel shoulders are generous but there is a drain in the exit area which must be avoided. This turn should be completed without issue.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Drain in exit must be avoided.

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Pinch Point

N11

RIGHT TURN
Kamilaroi Hwy

WALGETT

ROUTE 1.2

After traveling west for approximately 118 Kilometres, the Kamilaroi Highway makes another right turn to the south towards Walgett.

This location has very few hazards and also offers a convenient pull over area on the approach. The exit area has a branch road entering, providing extra run out area to widen the corner radius.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING TITLE:	PINCH POINT	SHEET NO:	
DRAWING NAME:	N11	REV	

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Pinch Point

N12

LEFT TURN
Wee Waa St
& Peel St
WALGETT

ROUTE 1.2

When the load travels through Walgett, it takes the heavy vehicle bypass to avoid the centre of town. This bypass involves turning left from Wee Waa Street into Peel Street.

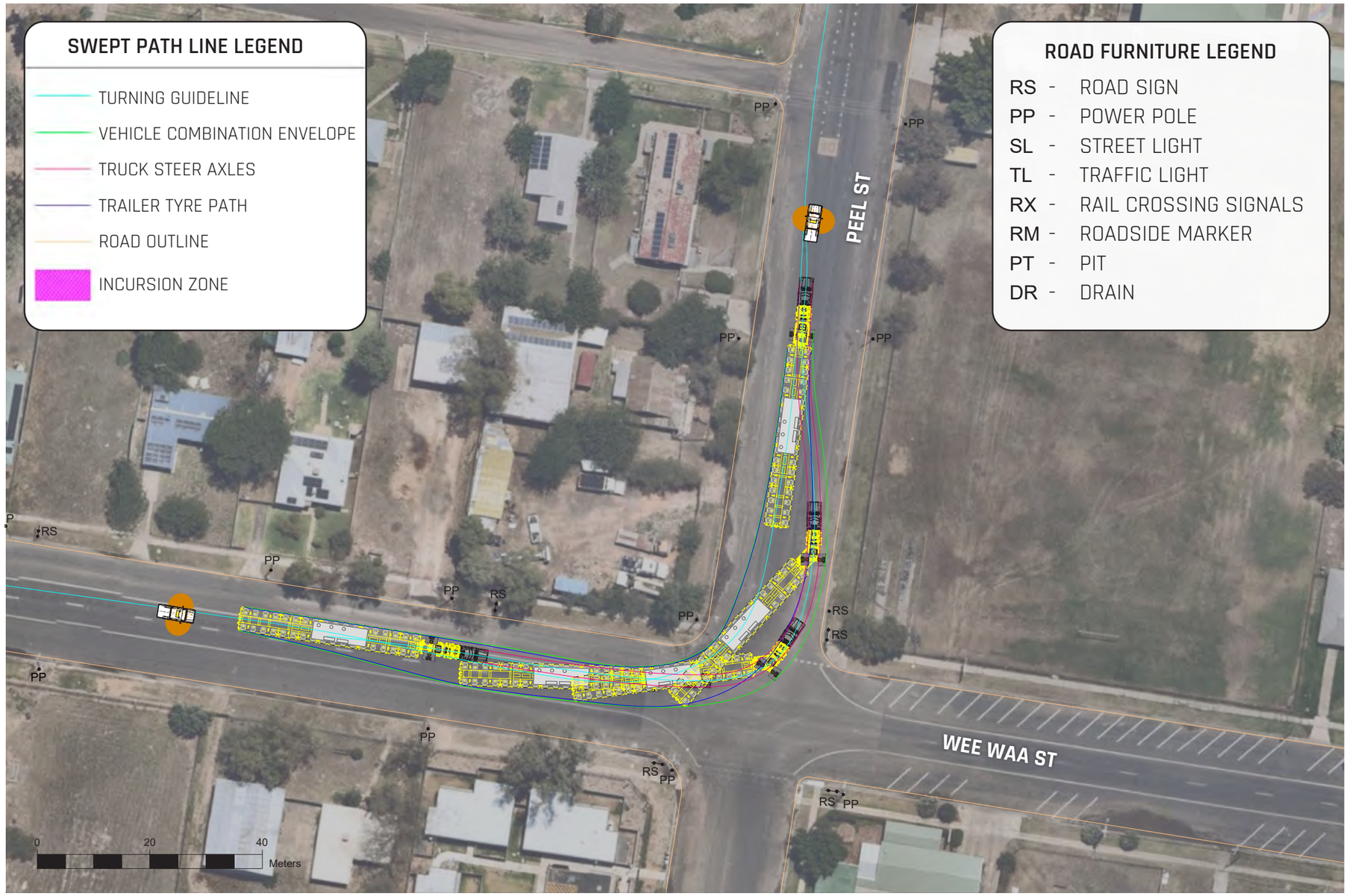
The sealed road are wide in this location, so turning here will not pose any issues aside from requiring all lanes in the entry for tail swing and all of the road in the exit to widen the radius. The load will not leave sealed road at any time during this turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWN DATE:	
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CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N12	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N13

RIGHT TURN
Peel St
& Montkeila St
WALGETT

ROUTE 1.2

The next turn for the Walgett H.V. Bypass required the load to make a right turn from Peel Street into Montkeila Street.

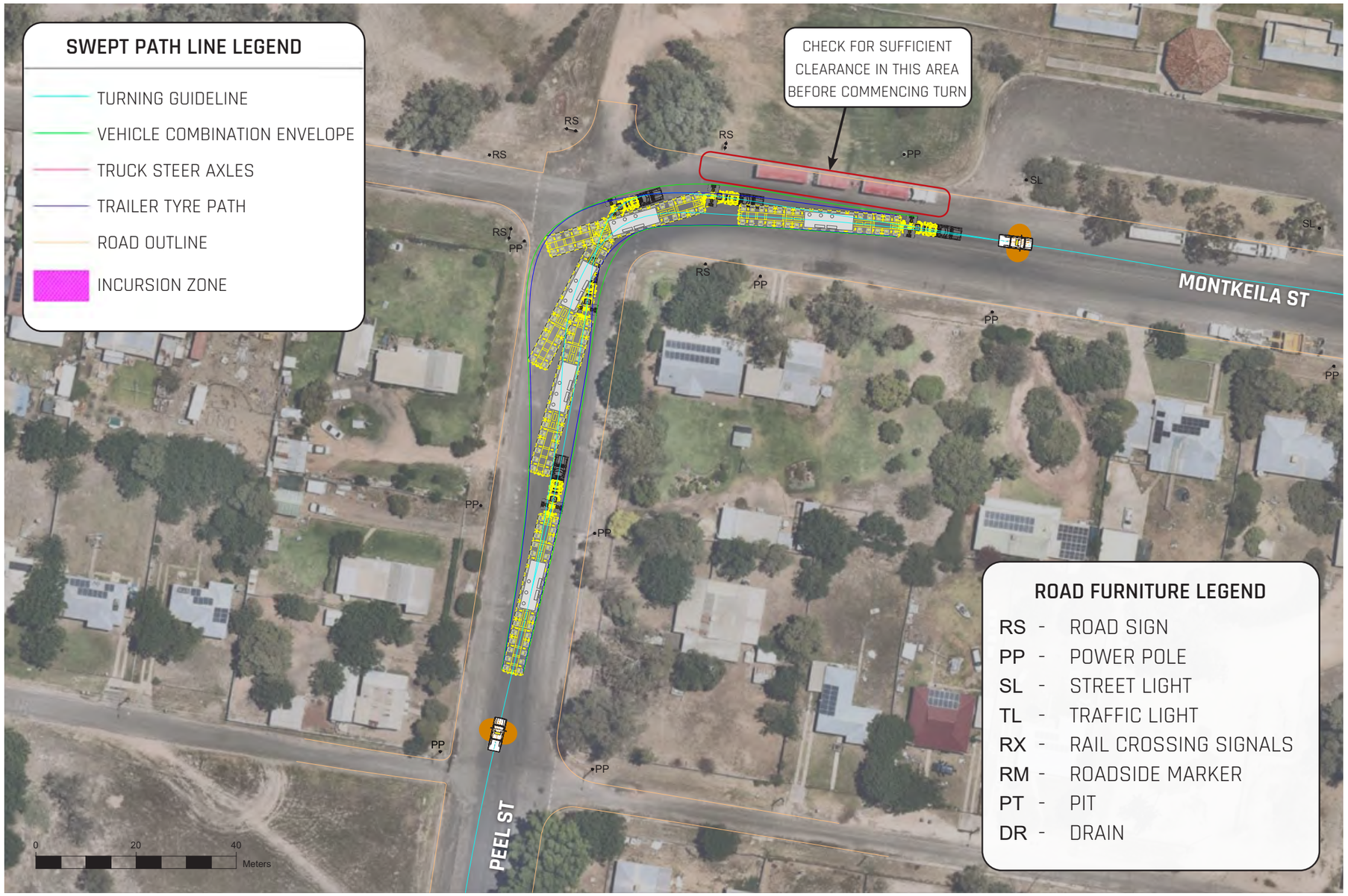
The road is sufficiently wide enough for a successful turn. In Montkeila Street, it is common for heavy vehicles to park or rest in this area - depending on the size of vehicle - sometimes they double park. A check in advance to ensure access in the exit area will be required to ensure a clear exit exists for the turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Check for clearance in Exit area.

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		DRAWING NAME: N13	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N14

LEFT TURN
Montkeila St
& Castlereagh Hwy
WALGETT

ROUTE 1.2

The final left turn of the Walget H.V. bypass involves the load turning left from Montkeila Street onto Castlereagh Highway. Once again, the roads are wide in this location and the turn can be completed with limited issues.

If the load commences the turn closer to the centre line of Montkeila Street, it will allow the load to remain on the left side of the exit island. There area two small sings on the exit island which should be removed in case the load needs to cross this area, however it should not require crossing.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2x island signs removed as a precaution.
- No issues noted.

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PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N14	REV

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Pinch Point

N15

RIGHT TURN
Castlereagh Hwy
& Kamilaroi Hwy
WALGETT

ROUTE 1.2

When the load completes pinch point N14, it travels north on the Castlereagh Highway for just over 4 kilometres, before making a right turn west, back onto the Kamilaroi Highway. This turn is wide open and in a remote area, so the turn will be completed without issue and without tyres leaving the sealed road.

All lanes in this location will need to be used during the turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N15
DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

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Pinch Point

N16

LEFT TURN
Kamilaroi Hwy

CRYON

ROUTE 1.2

The left turn where the Kailaroi Highway changes from an east/west direction to a north/south direction, turning towards Cryon, is remote with very few items of roadside furniture present.

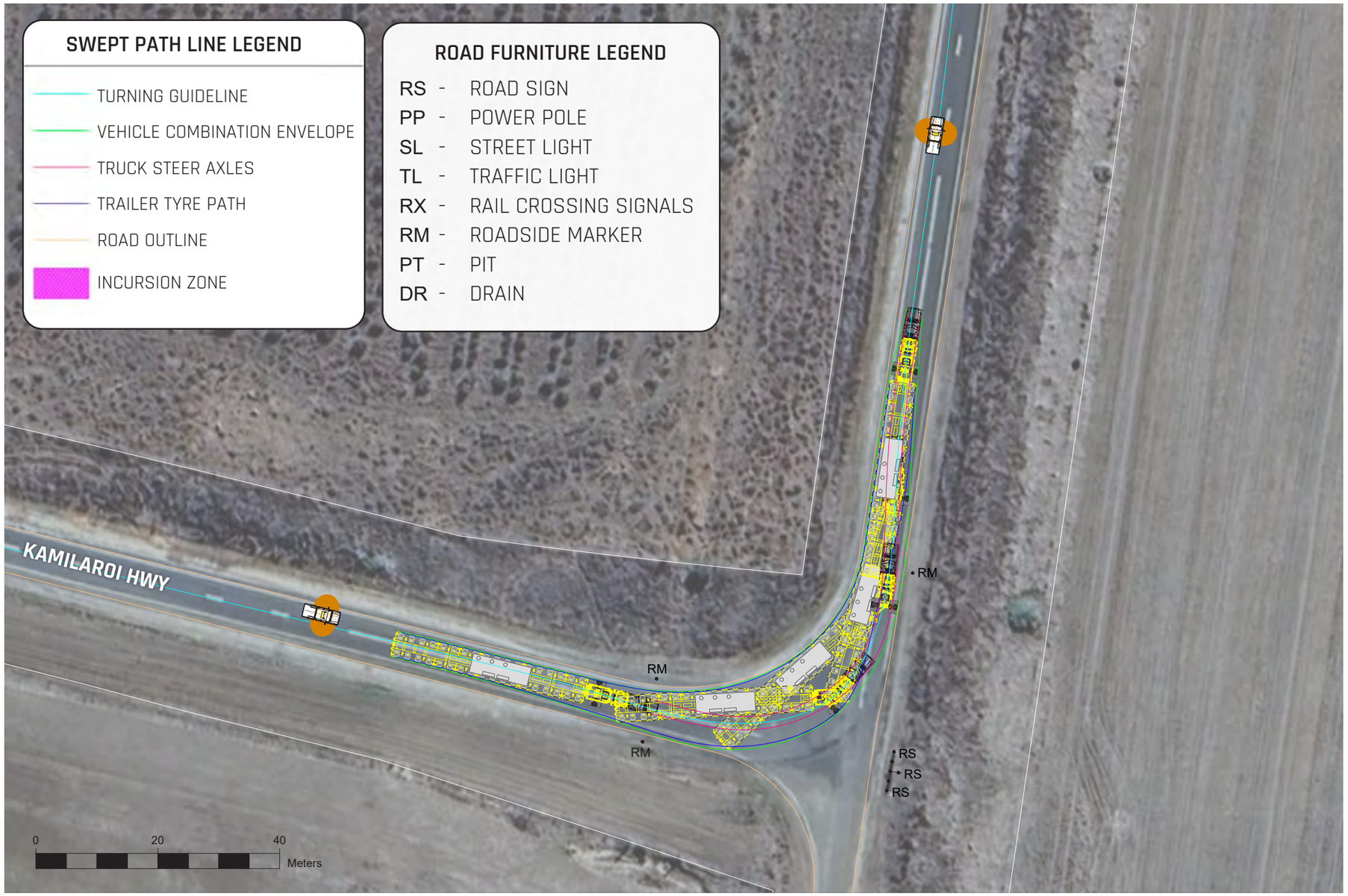
The combination will need to be carefully steered around this corner using all road width available. The load will stay on the paved surface at all times.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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DRAWING NAME:	N16	REV

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Pinch Point

N17

RIGHT TURN
Kamilaroi Hwy

CRYON

ROUTE 1.2

When passing through the township of Cryon, the Kamilaroi Highway makes a right turn, changing direction from North to east immediately after rail level crossing #764.

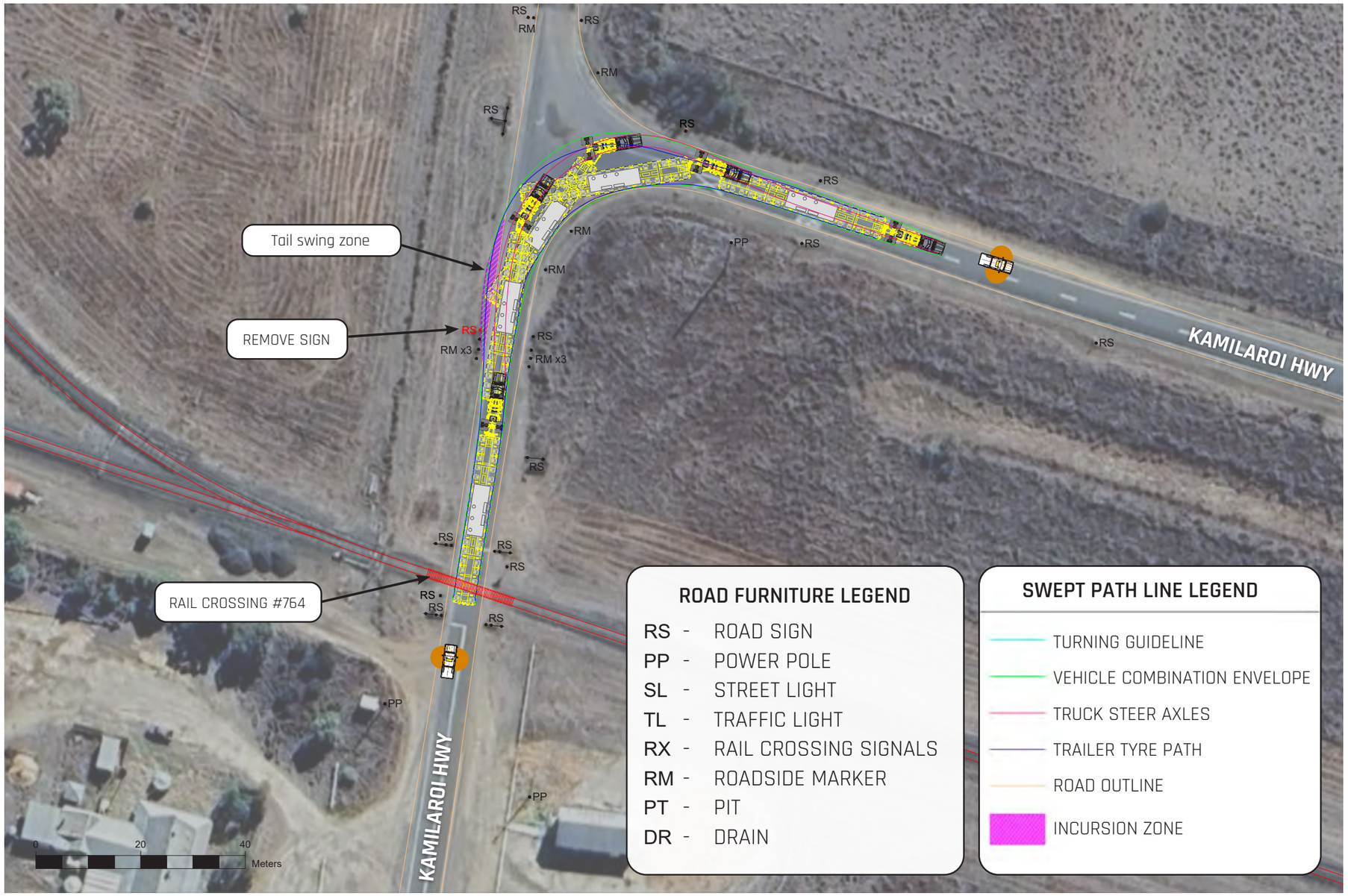
The roads in this area are narrow but the surrounding areas are cleared with gravel, so any overshoot is still contained to gravelled, unsealed road surface. The tail swing of the platform trailer will leave the road slightly, with one road sign requiring removal.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 1x Road sign to be removed.
- Tail will leave sealed road on west side of approach.

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DRAWING NAME:	N17	REV	

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Pinch Point

N18

RIGHT TURN
Kamilaroi Hwy

BURREN JUNCTION

ROUTE 1.2

In Burren Junction, the Kamilaroi Highway changes direction again from east to south immediately after Rail level crossing # 139.

This turn occurs quite close to the rail crossing, so close attention will ensure the trailer clears the crossing area before beginning the turn.

Fortunately the turn radius and roads are sufficiently wide enough to allow the turn to occur with all wheels staying on the paved surface. There will be no roadside furniture affected in this turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- No issues noted.

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		DRAWING NAME: N18	REV

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Pinch Point

N19

RIGHT BEND
Kamilaroi Hwy
(Boolcarrol Rd)
WEE WAA

ROUTE 1.2

The next township the load will pass through is the township of Wee Waa. Through the township, the Kamilaroi Highway initially changes name to Boolcarrol Street.

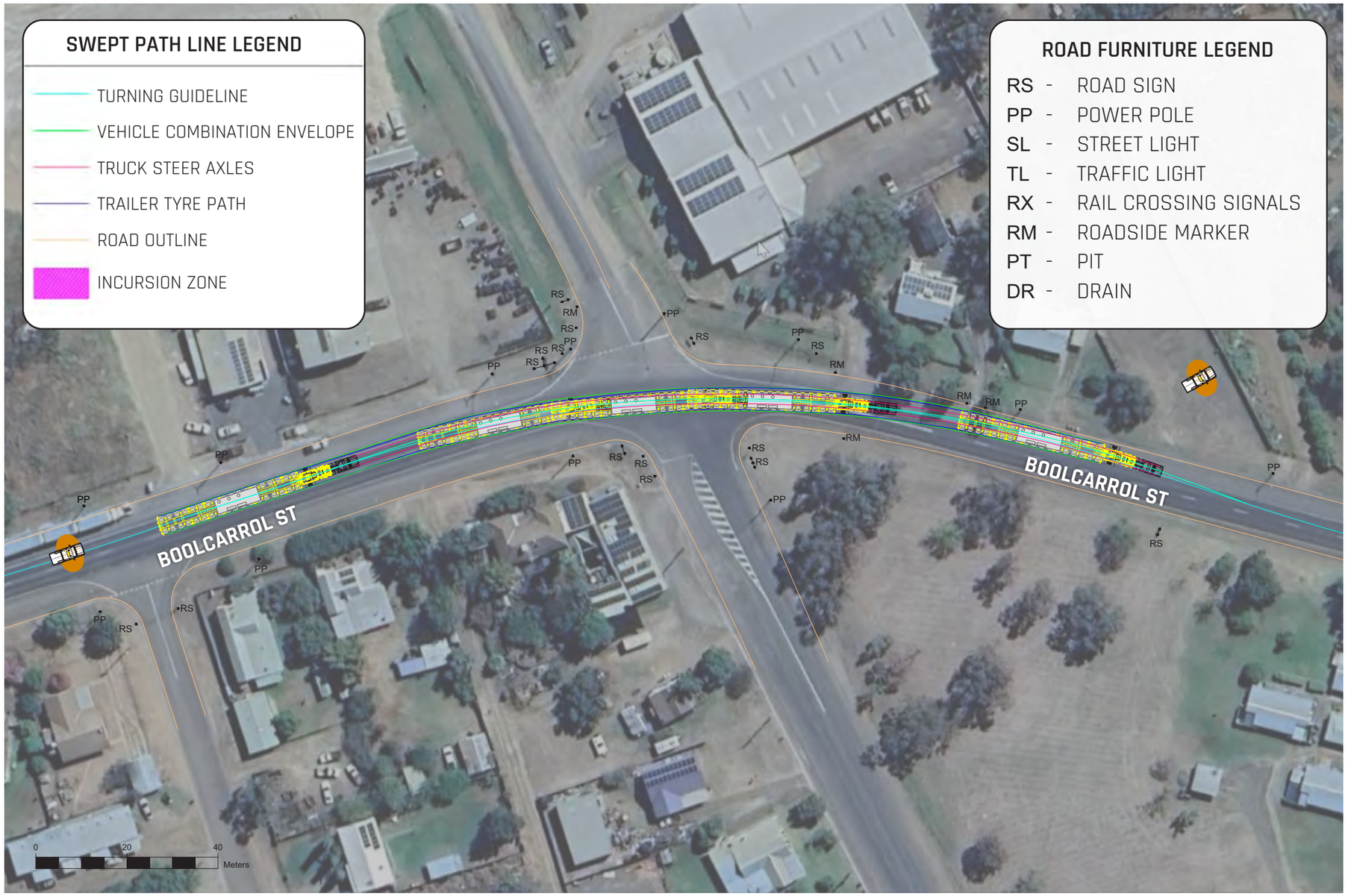
Boolcarrol Street weaves through the western side of the township, initially making a right bend southward. This bend has been assessed and can be successfully completed with no impact to roadside furniture. Although all lanes will need to be used during the turn, the load will not leave sealed road at any time.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Load uses both lanes during turn.

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DRAWING NAME:	N19	REV

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Pinch Point

N20

LEFT BEND
Boolcarrol Rd
& Mitchell St
WEE WAA

ROUTE 1.2

Immediately following the previous right bend (N19), Boolcarroll Road makes a left bend and changes name to Mitchell Street.

After assessment, once again the road is determined to be sufficiently wide and clear to allow the load to pass without leaving the sealed road section but it will require all available lanes to make the turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- All lanes required for turn.

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		PROJECT: New England Solar	SCALE NTS
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	DRAWN DATE:		
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Pinch Point

N21

RIGHT TURN
Mitchell St
& Maitland St
WEE WAA

ROUTE 1.2

Mitchell Street continues eastward through Wee Waa until it ends at Maitland street. Here, the loads will make a right turn, south onto Maitland Street.

The load will require all available lanes to make this turn but will not leave sealed road during the turn. No roadside furniture will be effected.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- All lanes required for turn.

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PROJECT:	New England Solar
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DRAWING NAME:	N21
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DRAWN DATE:	
CHECKED BY:	
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

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Pinch Point

N22

LEFT TURN
Maitland St
& Rose St
WEE WAA

ROUTE 1.2

After travelling along Maitland Street for approximately 250 metres, the load will then make a left turn onto Rose Street.

This intersection is sufficiently wide enough to allow the load to make this turn without leaving the sealed road surface. The load will use all available lanes during this turn. No roadside furniture will be effected.

The illustration shows that it is possible for the load to make this turn, then temporarily pull over immediately to the left to allow any held up traffic to pass.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- All lanes required for turn.

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PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N22	REV

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Pinch Point

N23

RIGHT TURN
Wee Waa Rd
& Barwan St
NARRABRI

ROUTE 1.2

As the load enters Narrabri, the Kamilaroi Highway changes name to Wee Waa Rd before terminating at the intersection of Barwan Street. The load will make a right turn onto Barwan Street as shown in Pinch Point N23.

During this right turn, the load will utilize the wrong-side lanes to make the turn. There are no other issues to note in this location.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Load uses wrong-side lane during turn.

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	CHECKED BY:	DRAWING TITLE: PINCH POINT	SHEET NO:
		DRAWING NAME: N23	REV

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Pinch Point

N24

RIGHT TURN
Barwan St
& Killarney St
NARRABRI

ROUTE 1.2

Travelling through Narrabri, the first turn is a right turn from Barwan Street into Killarney Street.

This intersection is wide enough to navigate, however there is a centre median strip (island) on both streets, which will need to be crossed. Islands have signage which will need to be removed prior to the turn commencing. The wrong-side lanes will be used for this turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 1x sign on Barwan Street centre island to be removed.
- 2x signs on Killarney Street centre island to be removed.
- All lanes will be used to make turn.

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CUSTOMER:	EPEC
PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N24
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

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Pinch Point

N25

LEFT TURN
Killarney St
& Tibbereena St
NARRABRI

ROUTE 1.2

The left turn from Killarney Street into Tibbereena Street has wide shoulders creating a sufficiently open turn to navigate. Through this entire turn, there is a thin median strip separating traffic direction lanes.

The load will cross over this concrete strip at the beginning of the turn, with one sign needing to be temporarily removed and re-instated after turn completion.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 1x sign on Killarney Street to be removed.
- Traversal of part of median strip required.

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DRAWING NAME:	N25	REV

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Pinch Point

N26

RIGHT TURN
Tibbereena St
& Dangar St
NARRABRI

ROUTE 1.2

The left turn from Tibbereena Street into Dargar Street starts in a 4 lane road and turns into a three lane road (including the turning lane, which provides a sufficiently wide intersection for the load.

Most of the turning island is painted on the surface, with a small concrete island with a sign installed on it, both will be avoided by the load.

The load will use the wrong-side lanes for the turn. All roadside furniture will be avoided during the turn. The load will immediately return to the correct lanes at the conclusion of the manoeuvre.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- Load will use all available lanes for turn.

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ARES
www.aresgroup.com.au

CUSTOMER:	EPEC
PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N26
DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N27

THROUGH ROUNDABOUT
Newell Hwy
NARRABRI

ROUTE 1.2

Navigating through the roundabout on the Newell Highway at Old Turrawan Road will be completed in a contra-flow direction as this offers the straightest line of travel.

There is one sign on the approach which will be temporarily removed to allow safe passage through. The rear of the trailer will slightly clip the approach island as it passes through.

Another sign on the exit should be removed as a precaution.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2x Signs to be temporarily removed.
- Load will travel in a contra-flow direction.

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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N27	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N28

LEFT TURN @ ROUNDABOUT
Newell Hwy
& Kamilaroi Hwy
NARRABRI

ROUTE 1.2

Navigating the left turn through the roundabout from the Newell Highway onto the Kamilaroi Highway will be completed in the correct flow direction as this offers the straightest line of travel.

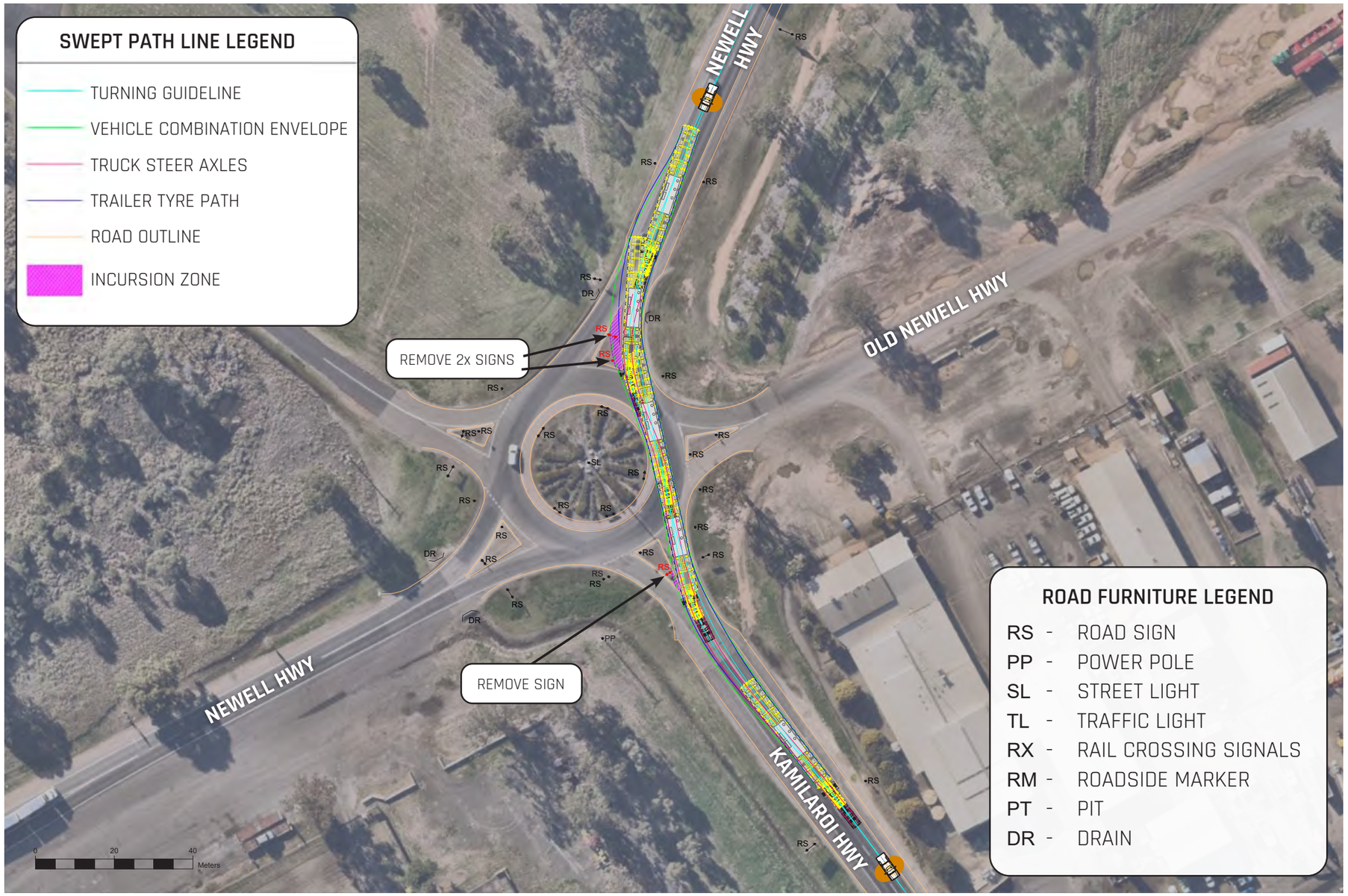
There are two signs on the approach and one sign on the exit which will need to be temporarily removed. All signs are located on the centre islands. These islands will have incursion by the load as indicated.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2x Signs to be removed on the approach island.
- 1x Sign to be removed on the exit island.
- Lane incursion will occur in entry and exit.

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CUSTOMER:	EPEC
PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N28
DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N29

LEFT TURN
Wee Waa St
& Grantham St
BOGGABRI

ROUTE 1.2

The left turn from Wee Waa Street into Grantham Street at Boggabri has sufficient clearance for the load to pass..

The prime mover will need to fully use the width of Grantham St, allowing the rear of the platform trailer to turn as late as possible and avoid running onto the traffic island on Wee Waa St.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications required.
- Load will use all lanes in exit area of turn.

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DRAWN DATE:	
CHECKED BY:	
CUSTOMER:	EPEC
PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N29
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N30

LEFT TURN
Conadilly St
& Warrabungle St
GUNNEDAH

ROUTE 1.2

The left turn at the roundabout from Conadilly Street into Warrabungle Street in Gunnedah has sufficient clearance for the load to pass with four signs being removed and island incursion.

This turn is made so the load avoids travelling through the centre of Gunnedah. All signs on both the approach and exit centre islands will be temporarily removed. These islands will have full incursion by the trailer as shown.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2x Signs to be temporarily removed on the approach centre island.
- 2x Signs to be temporarily removed on the exit centre island.
- Load will use all lanes during exit of turn.

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DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N30	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N31

RIGHT TURN
Warrabungle St
& Bloomfield St
GUNNEDAH

ROUTE 1.2

The right turn from Warrabungle Street into Bloomfield Street in Gunnedah has sufficient clearance for the load to pass with no impact to furniture or infrastructure.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

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CUSTOMER:	EPEC
PROJECT:	New England Solar
DRAWING TITLE:	PINCH POINT
DRAWING NAME:	N31
DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	
SIZE:	
SCALE	NTS
SHEET NO:	
REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N32

LEFT TURN @ ROUNDABOUT
Boundary Rd
& Kamilaroi Hwy
GUNNEDAH

ROUTE 1.2

The left turn at the roundabout from Boundary Road onto the Kamilaroi Highway in Gunnedah has sufficient clearance for the load to pass with no impact. The prime mover and trailer will need to be positioned with care to avoid the traffic islands and kerbs.

This turn concludes the bypass to avoid the centre of Gunnedah.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



SWEPT PATH LINE LEGEND

- TURNING GUIDELINE
- VEHICLE COMBINATION ENVELOPE
- TRUCK STEER AXLES
- TRAILER TYRE PATH
- ROAD OUTLINE
- INCURSION ZONE

ROAD FURNITURE LEGEND

RS - ROAD SIGN
PP - POWER POLE
SL - STREET LIGHT
TL - TRAFFIC LIGHT
RX - RAIL CROSSING SIGNALS
RM - ROADSIDE MARKER
PT - PIT
DR - DRAIN

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		PROJECT: New England Solar	SCALE NTS
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	DRAWN DATE:	DRAWING NAME: N32	REV
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Pinch Point

N33

THROUGH ROUNDABOUT
Kamilaroi Hwy
GUNNEDAH

ROUTE 1.2

The roundabout where the Kamilaroi Highway meets Oxley Highway will be travelled through the wrong lane in a contra-flow direction as this lane is the straightest path.

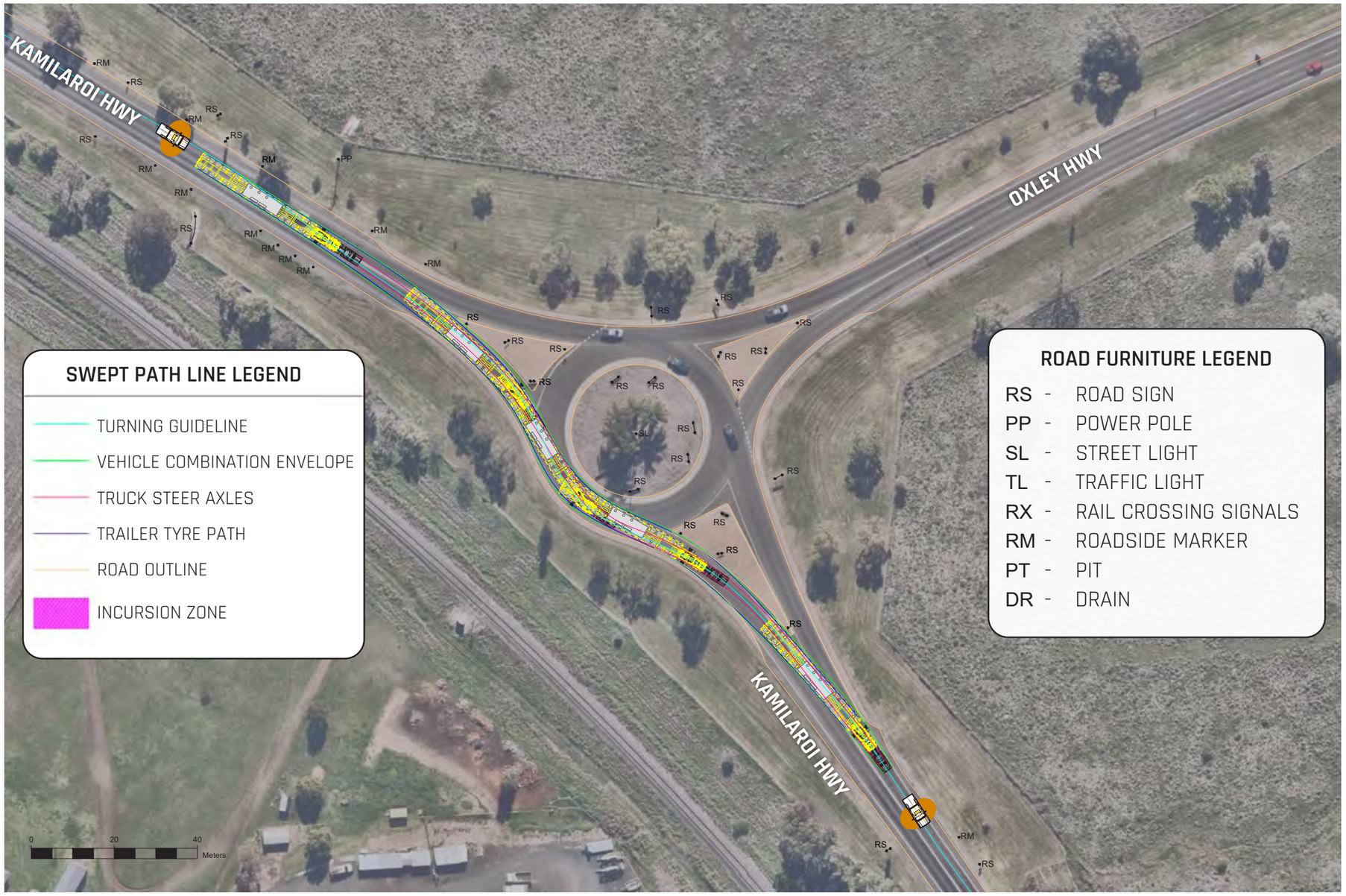
By making this a contra-flow manoeuver, no modifications are required. The combination is able to stay on the paved surface and avoid encroaching upon the traffic islands.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.
- Roundabout will be in a contra-flow direction.

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	DRAWN DATE:	PROJECT: New England Solar	SCALE NTS
	CHECKED BY:	DRAWING TITLE: PINCH POINT	SHEET NO:
		DRAWING NAME: N33	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N34

RIGHT TURN
Lennox St
& Loder St
QUIRINDI

ROUTE 1.2

The right turn from Lennox Street into Loder Street in Quirindi has sufficient clearance for the load to pass with no impact to furniture or infrastructure.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

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DRAWN DATE:	PROJECT:	New England Solar	SCALE NTS
CHECKED BY:	DRAWING TITLE:	PINCH POINT	SHEET NO:
	DRAWING NAME:	N34	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N35

LEFT TURN
Kamilaroi Hwy
& New England Hwy
WILLOW TREE

ROUTE 1.2

The left turn from Kamilaroi Highway into New England Highway in Willow Tree has sufficient clearance for the load to pass only with a small amount of incursion over the Approach concrete island. The centre island is painted only so there is no incursion issue here (even though it is marked).

No impact to furniture will occur.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

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DRAWN DATE:	
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CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N35	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N36

THROUGH ROUNDABOUT
New England Hwy
TAMWORTH

ROUTE 1.2

The roundabout at the intersection of New England Highway and Jack Smyth Drive is navigable with no impact to any infrastructure or existing roadside furniture.

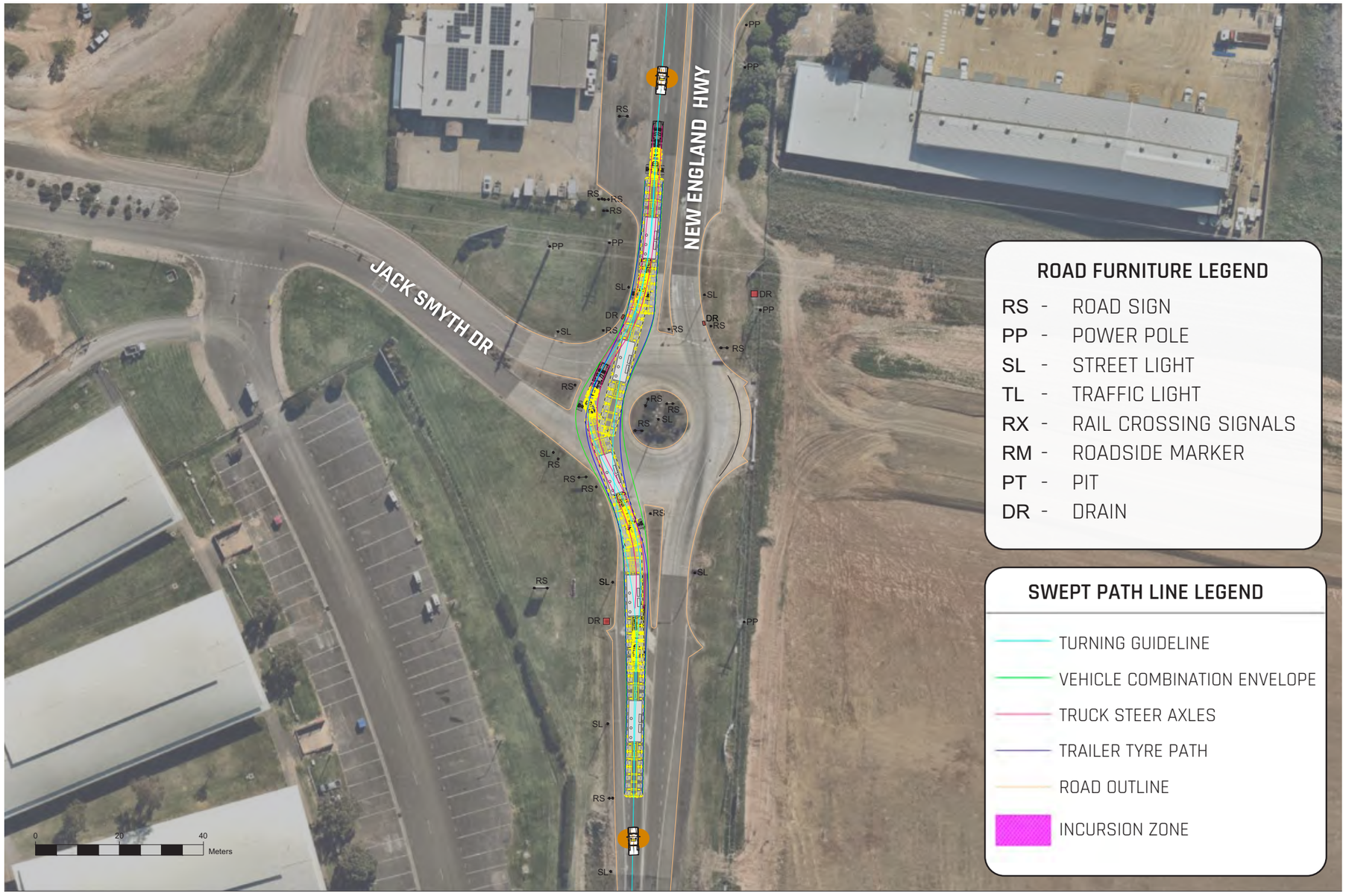
At the exit of the roundabout, there is a drain on the left side which is to be avoided.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- Avoid drain on left during exit.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N36	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N37

THROUGH ROUNDABOUT
New England Hwy
TAMWORTH

ROUTE 1.2

The roundabout at the intersection of New England Highway and Calala Lane is navigable with no impact to any infrastructure or existing roadside furniture.

At the exit of the roundabout, there is a drain on the left side which is to be avoided.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- Avoid drain on left during exit.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N37	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N38

THROUGH ROUNDABOUT
New England Hwy
TAMWORTH

ROUTE 1.2

The roundabout at the intersection of New England Highway and Wilburtree St is navigable with no impact to any infrastructure or existing roadside furniture.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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		PROJECT: New England Solar	SCALE NTS
		DRAWING TITLE: PINCH POINT	SHEET NO:
	DRAWN BY:	DRAWING NAME: N38	REV
	DRAWN DATE:		
	CHECKED BY:		

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N39

RIGHT TURN @ ROUNDABOUT
New England Hwy
& Scott Rd
TAMWORTH

ROUTE 1.2

The roundabout at the intersection of New England Highway and Scott Rd is tighter than the previous locations. To pass this point, the load will need to cross the median strip before the roundabout and contra-flow using the wrong-side lanes. As soon as the turn is complete, the load will return to the right side lanes.

To assist this turn, two signs (one in approach area, one in exit) will need to be removed.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 1x Sign to be temporarily removed in the entry zone.
- 1x Sign to be temporarily removed on the exit centre island.
- Tail swing will occur over grass in approach area.

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	DRAWN BY:	CUSTOMER: EPEC	SIZE:
	DRAWN DATE:	PROJECT: New England Solar	SCALE NTS
	CHECKED BY:	DRAWING TITLE: PINCH POINT	SHEET NO:
		DRAWING NAME: N39	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N40

THROUGH ROUNDABOUT
Scott Rd
& Murray St
TAMWORTH

ROUTE 1.2

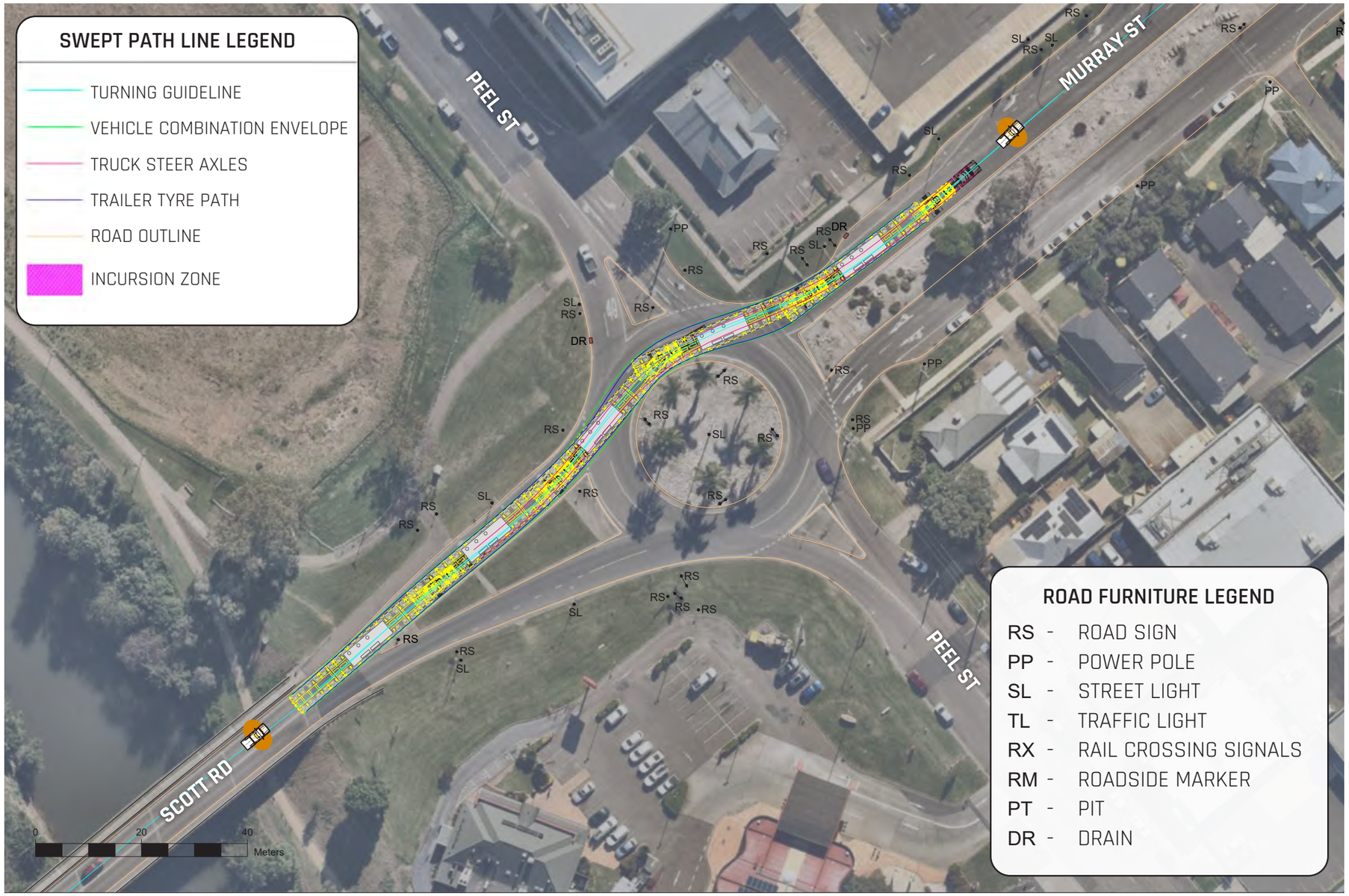
The roundabout at the intersection of New England Highway and Peel St in Tamworth is navigable and will not impact any infrastructure or existing roadside furniture.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- No modifications.
- No issues noted.

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		PROJECT: New England Solar	SCALE NTS
	DRAWN BY:	DRAWING TITLE: PINCH POINT	SHEET NO:
	DRAWN DATE:	DRAWING NAME: N40	REV
	CHECKED BY:		

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Pinch Point

N41

RIGHT TURN @ ROUNDABOUT
Murray St
& Marius St
TAMWORTH

ROUTE 1.2

The right turn on the roundabout at the intersection of Murray Street and Marius Street can be widened by crossing the median strip before the roundabout travelled in a contra-flow direction.

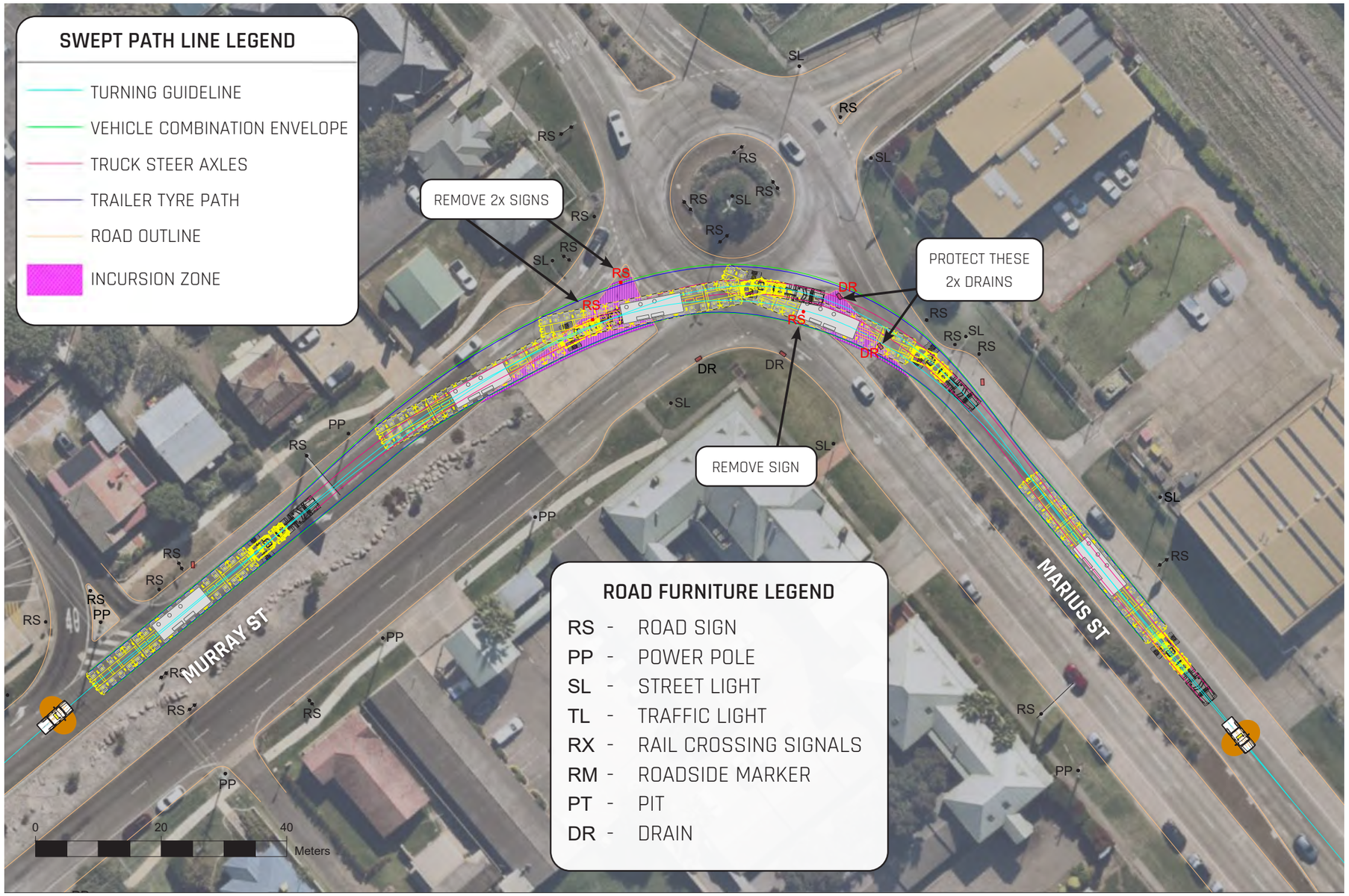
The turn will be completed with the load back in the correct lanes. Three signs (two in the approach area, 1 in the exit) will be removed. In the exit, there are two drains which will be protected.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2x Sign to be removed on the entry island.
- 1x Sign to be removed on the exit island.
- 2x Drains to be protected on exit island.
- Roundabout will be completed in a contra-flow direction.

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MOONBI RANGE CLIMB

A specific date for Moonbi Range travel is to be determined at time of this document being produced. Timing will be based on approvals, weather, permits and escort confirmation. Specific dates will all be contained in the external travel schedule document.

The Moonbi Range climb commences approximately 20Km after leaving Tamworth. This range climb must be held with special consideration as the journey will be slow going and therefore, special arrangements must be made to complete this section.

We WILL require closure of the road to allow us to utilize all lanes. To achieve this, we are required to install a VMS board at each end of the range a minimum of 7 days prior to the journey commencing.

A rest stop is located at each end of this section: Glen Ayr Truck Parking Bay Northbound is located prior to the climb commencing and Wildcroft Rest Area Northbound is located after the conclusion point of the range climb. These rest areas will be used as rally points. The load will wait for Police to close the range section of road.

Swept path analysis has been conducted for the entire range climb - refer to the following pages.

ALL TRAFFIC WILL BE EXCLUDED WHILST THE LOAD IS TRAVELLING THE MOONBI RANGE SECTION.



Pinch Point

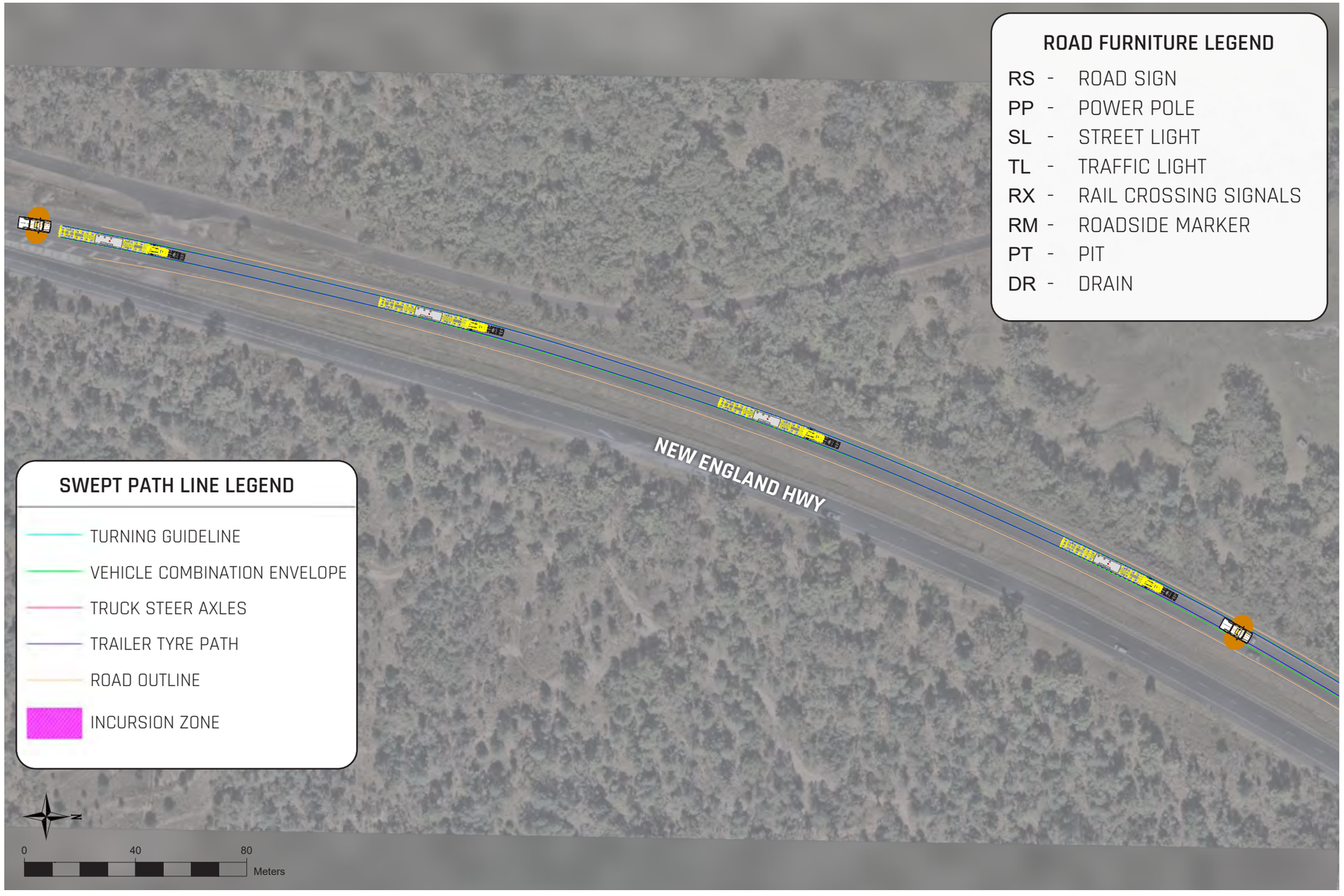
N42-01

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

This section of the Moonbi Range climb is a divided road with two lanes.

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Pinch Point

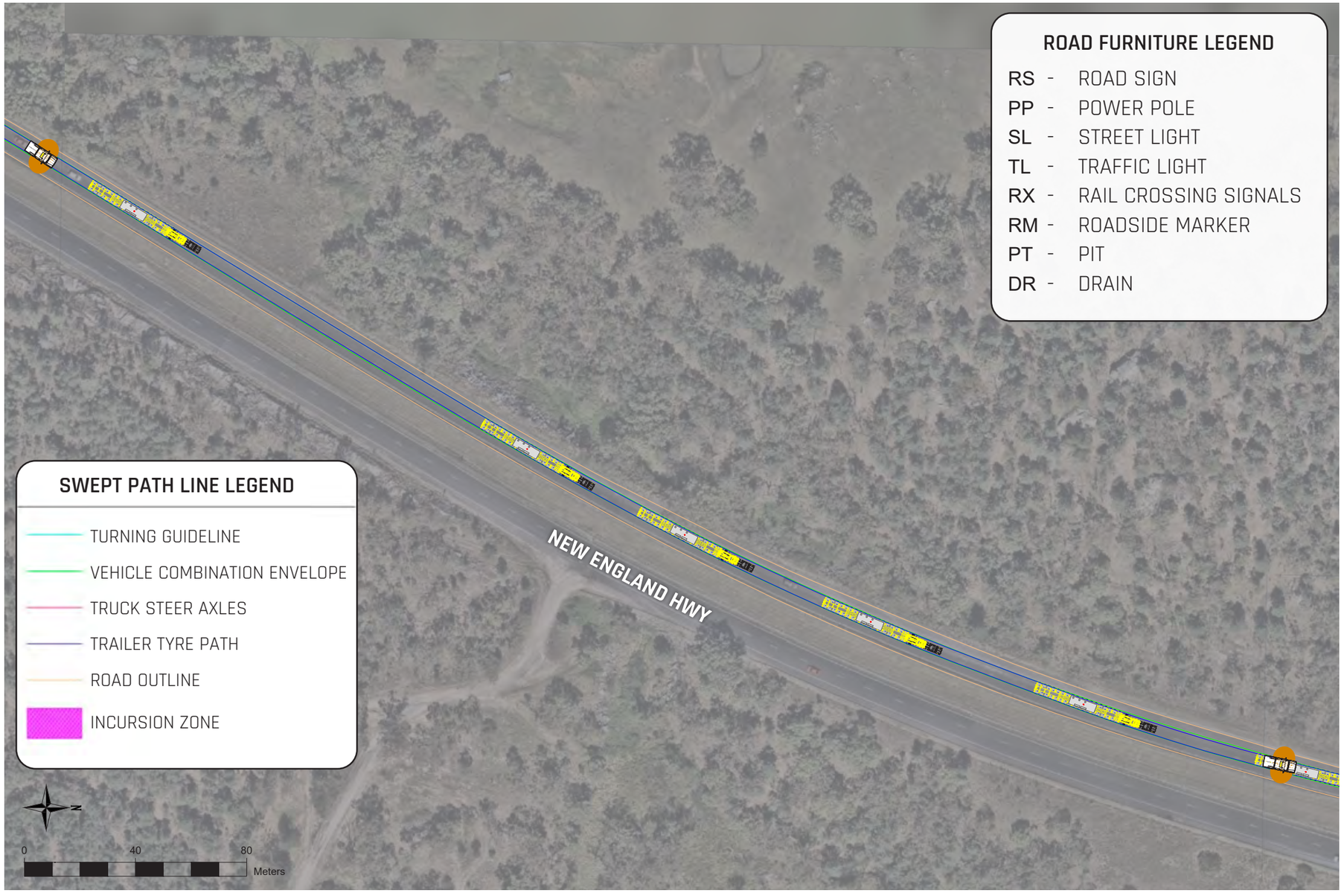
N42-02

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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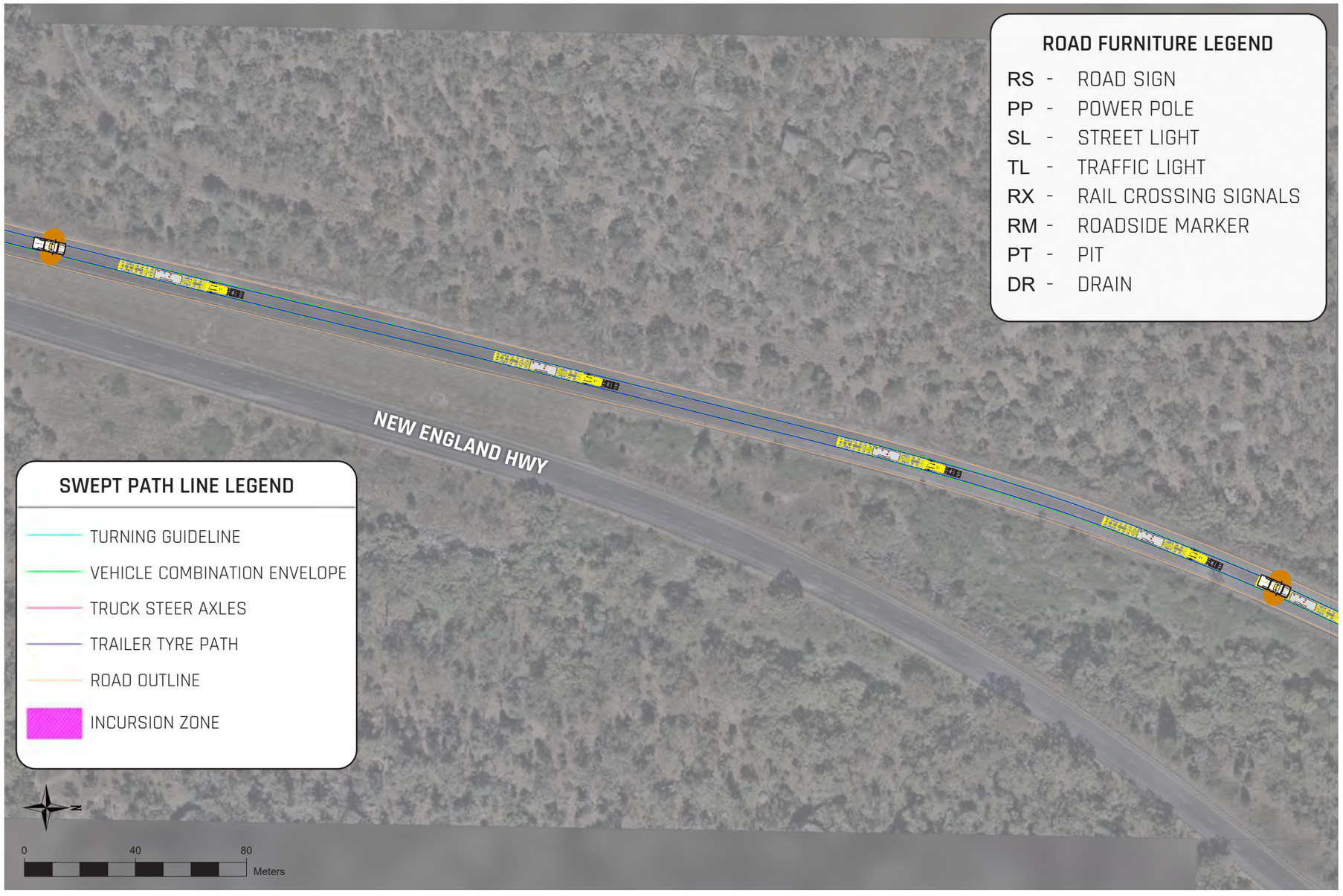
N42-03

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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DRAWING NAME:	N42-03	REV	

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Pinch Point

N42-04

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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Pinch Point

N42-05

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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DRAWING NAME:	N42-05	REV	

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Pinch Point

N42-06

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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Pinch Point

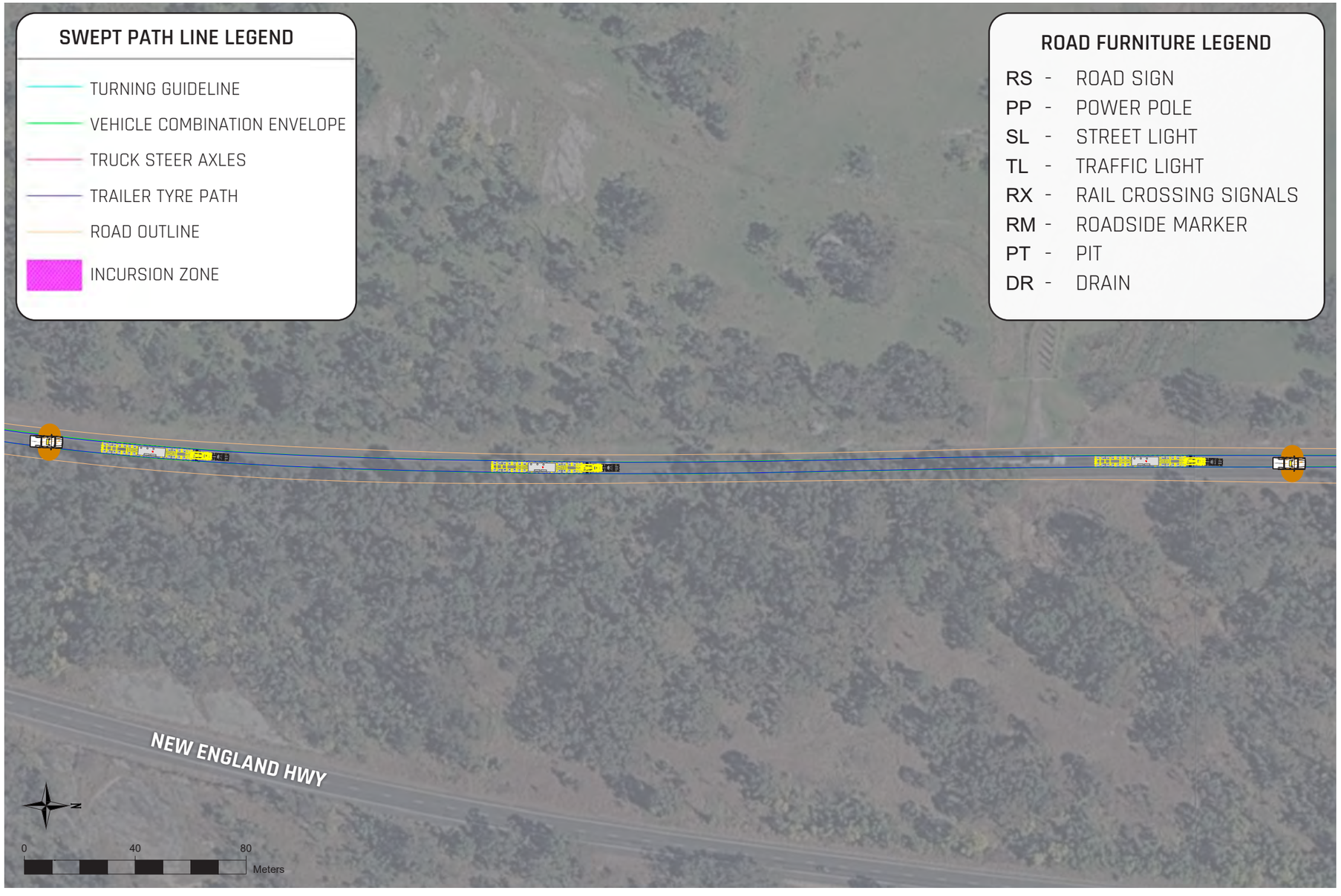
N42-07

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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Pinch Point

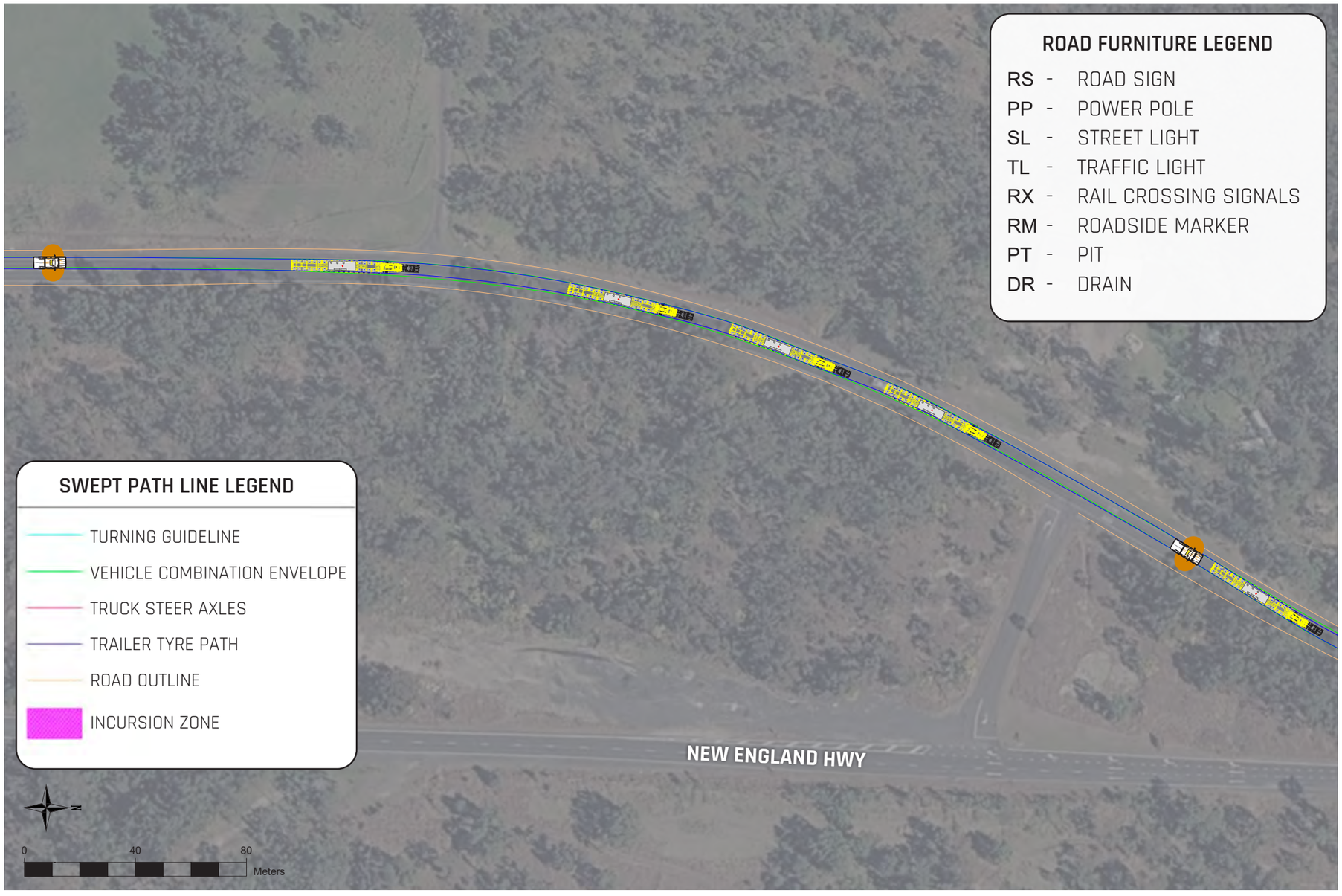
N42-08

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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Pinch Point

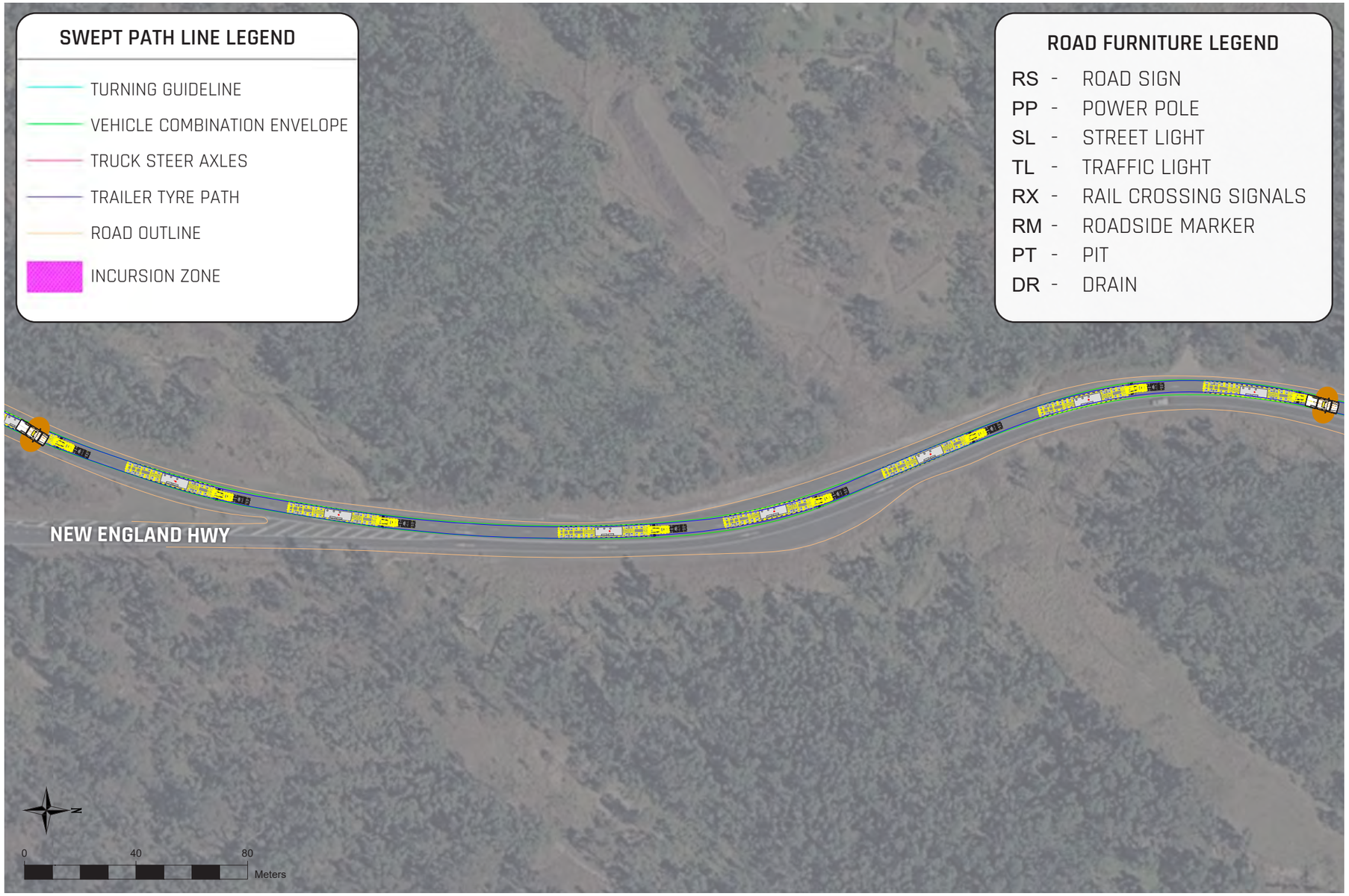
N42-09

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

From this point onwards, the highway merges back into an undivided road with two lanes northbound and one lane southbound.

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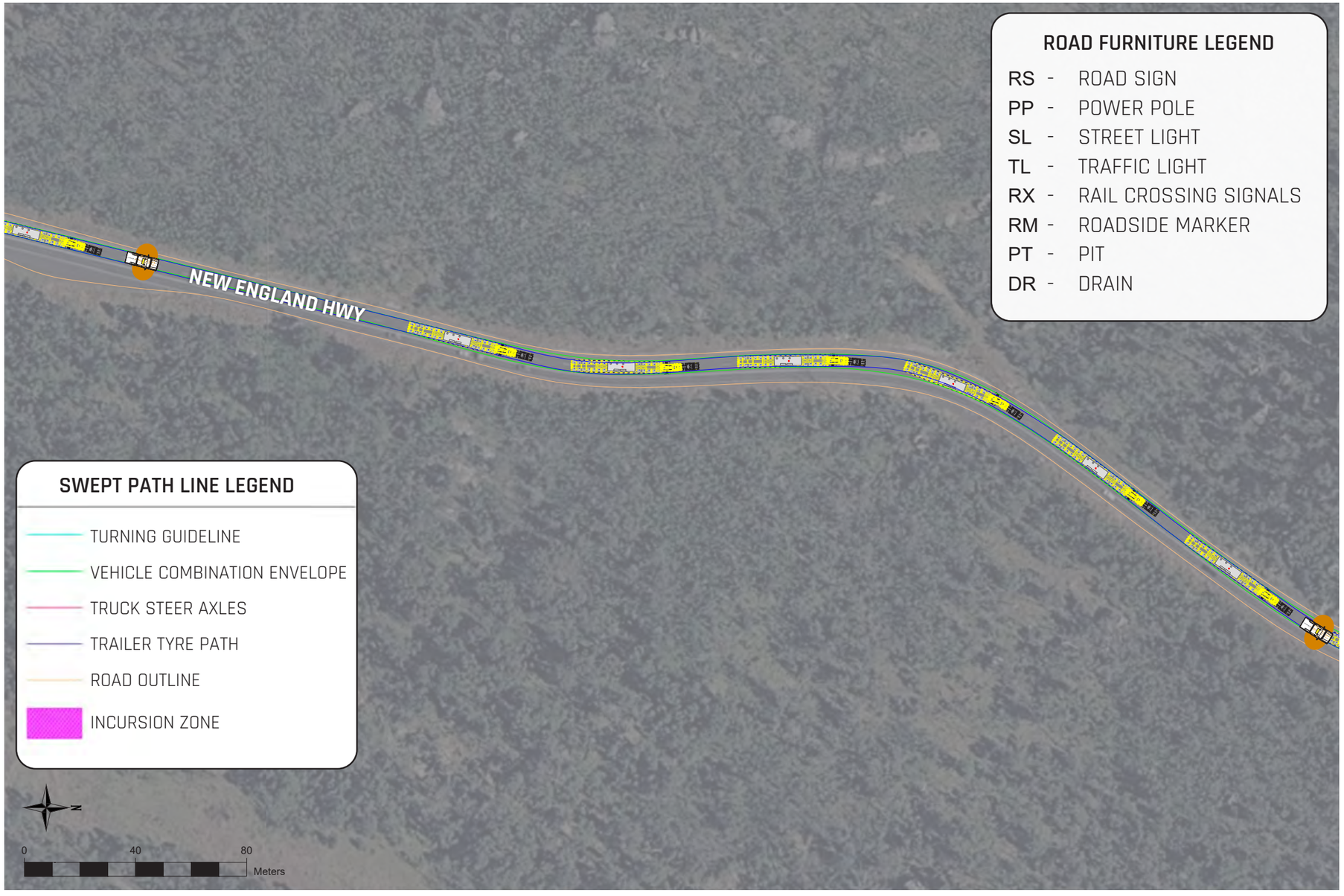
N42-10

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

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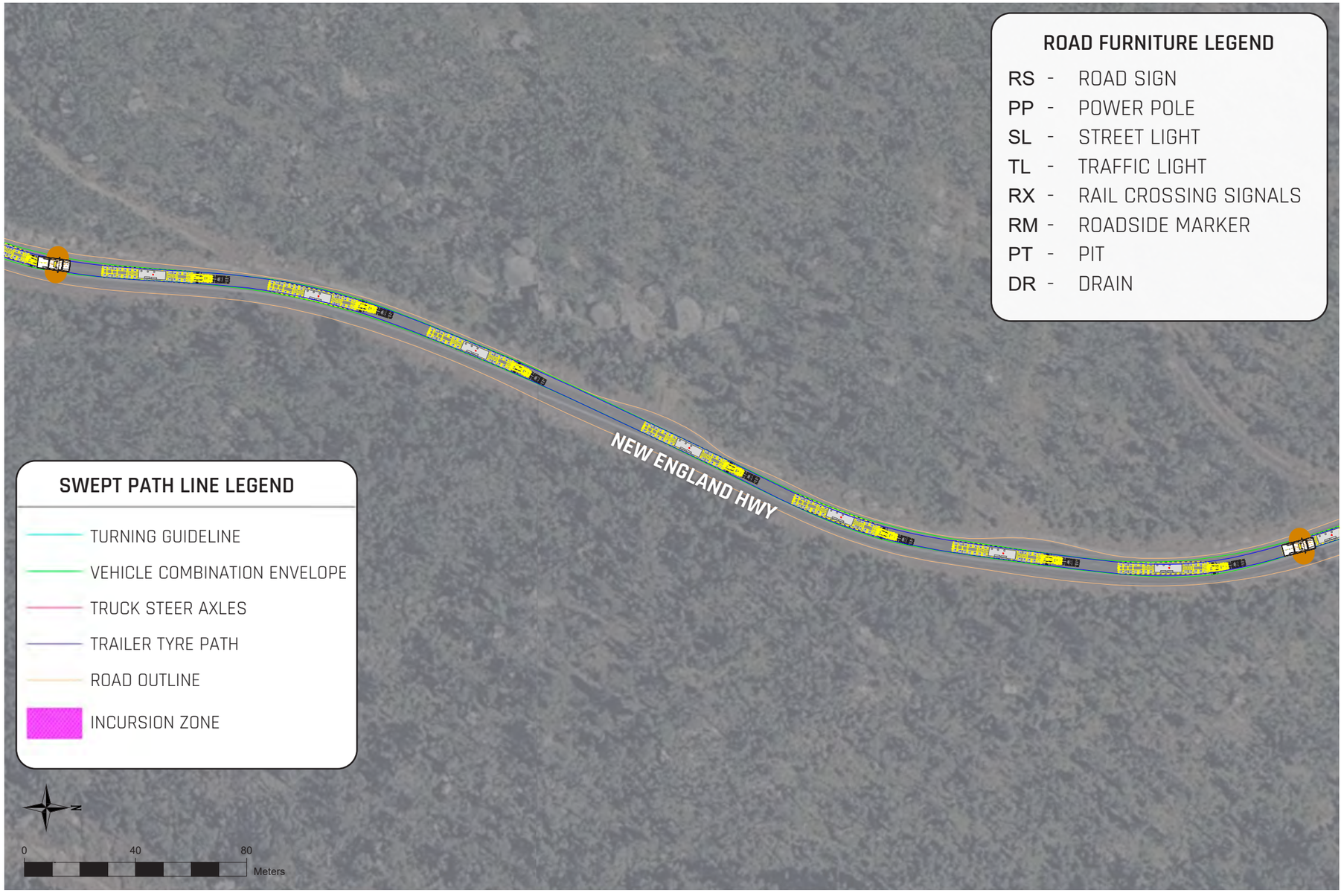
N42-11

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

From this point onwards, the highway merges back into an undivided road with two lanes northbound and one lane southbound.

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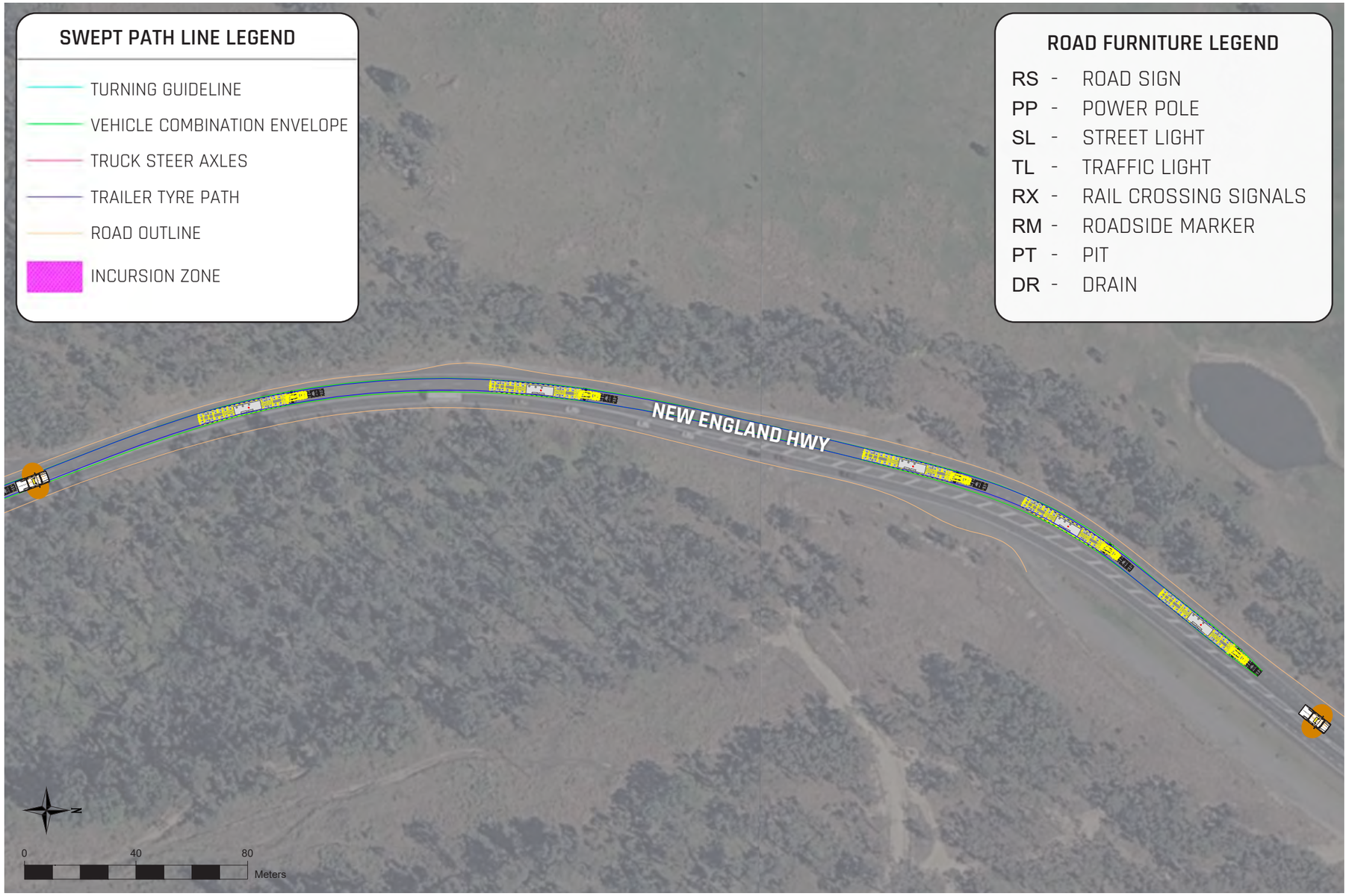
N42-12

STEEP CLIMB
Moonbi Range,
New England Hwy
MOONBI

ROUTE 1.2

From this point onwards, the highway merges back into an undivided road with two lanes northbound and one lane southbound.

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Pinch Point

N43

RIGHT TURN
New England Hwy
& Barleyfields Rd
URALLA

ROUTE 1.2

The right turn from New England Highway into Barleyfields Road is the location where the load leaves the national highway to make its way to site using local roads. This turn is sufficiently clear for the load to navigate with the exception of 2 road markers as marked in the diagram opposite.

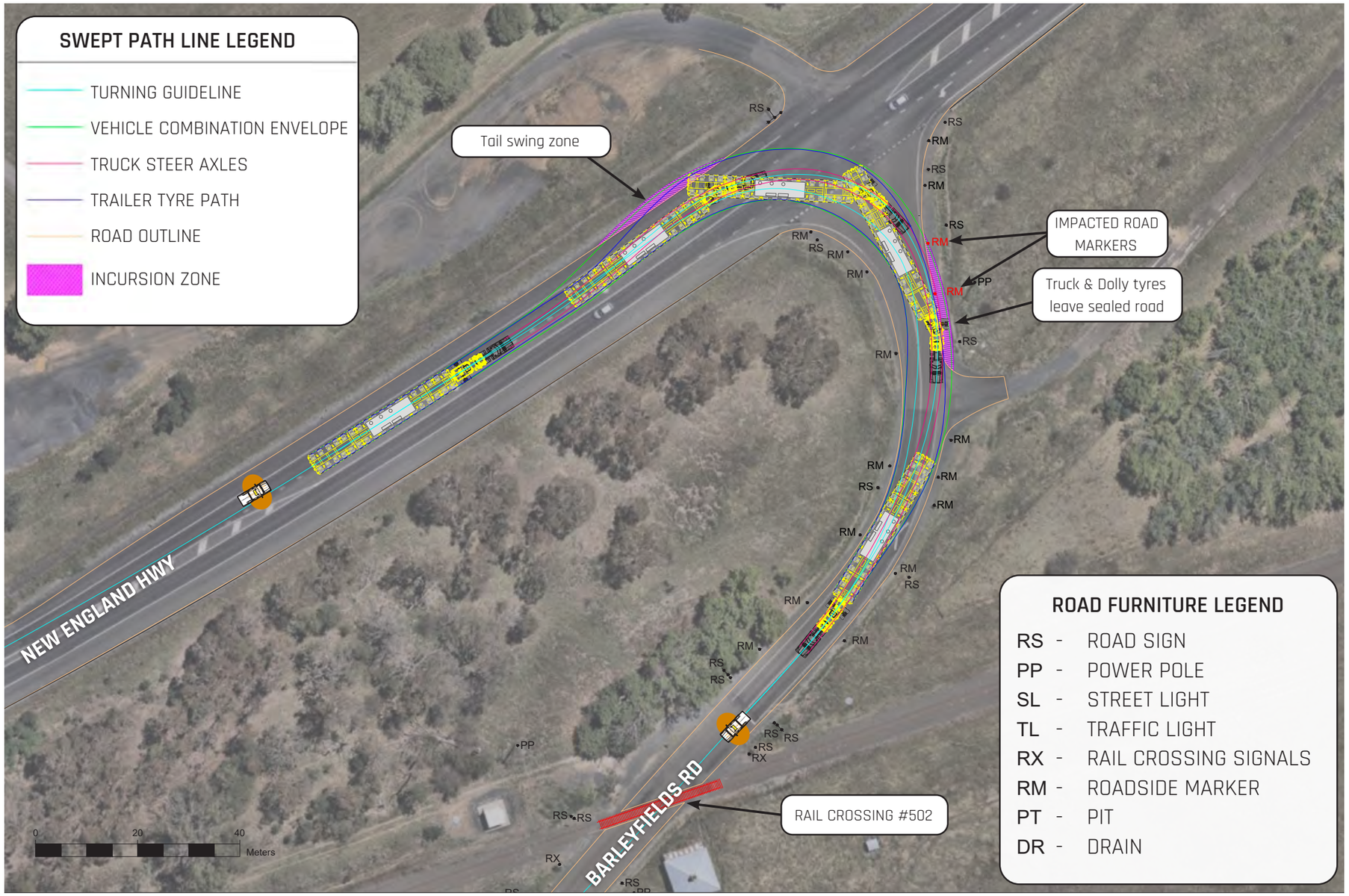
No further impact to furniture will occur.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 2 road markers will be impacted.
- Truck & Dolly tyres leave sealed road on east side of exit
- Tail will leave sealed road on north side of approach

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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ARES
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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:	
PROJECT:	New England Solar	SCALE	NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:	
DRAWING NAME:	N43	REV	

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N44

LEFT TURN
Barleyfields Rd
& Big Ridge Rd
URALLA

ROUTE 1.2

The left turn from Barleyfields Rd into Big Ridge Road is the final turn on public roads before site.

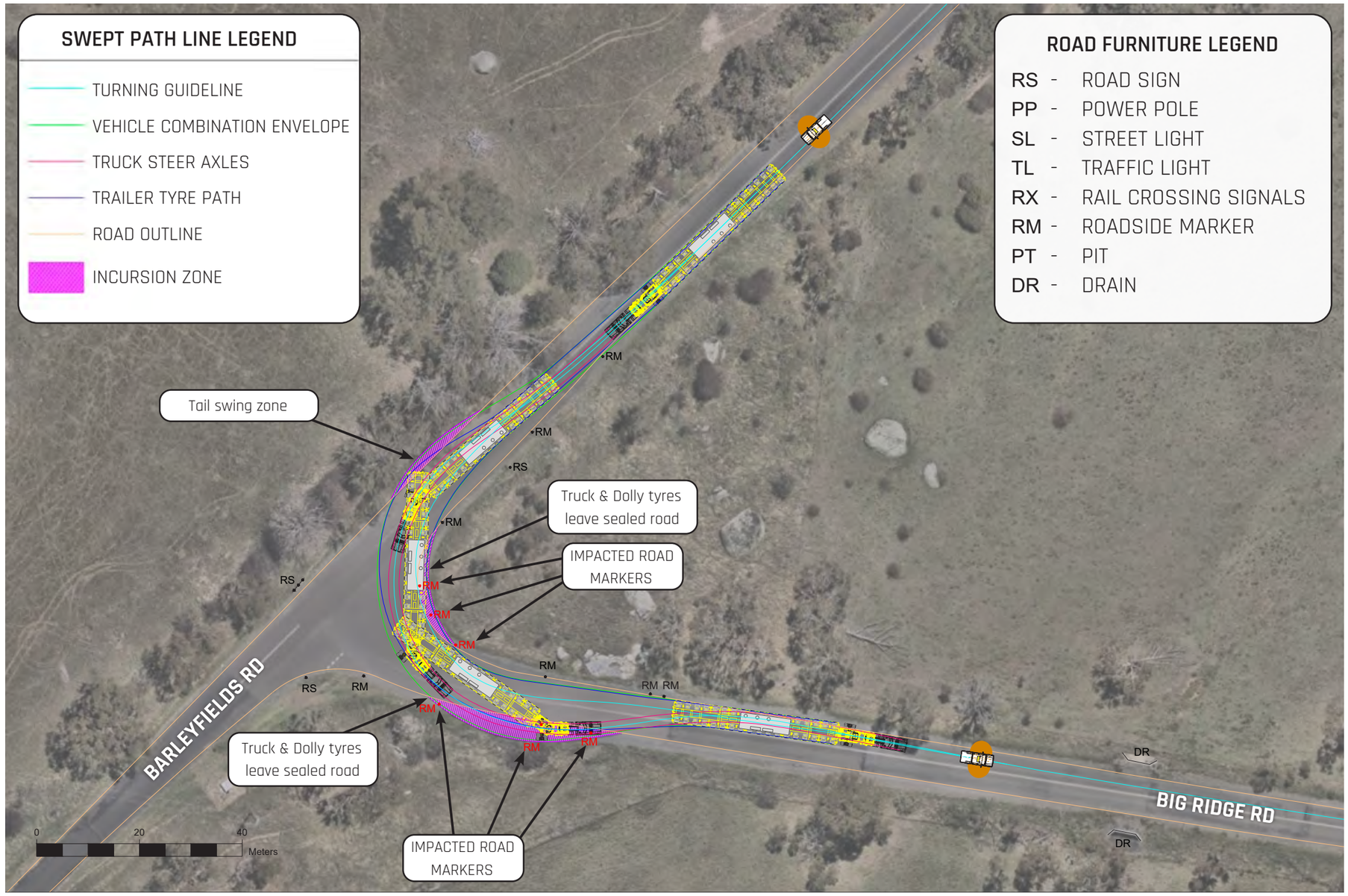
The turn is quite tight and to prevent excessive overrun or tail swing (impacting vegetation), the apex of the turn will be crossed. Six road markers will be impacted during this turn.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- 6 road markers will be impacted.
- Incursion will occur at all locations of the corner.

[CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS]



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DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N44	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Pinch Point

N45

SITE ENTRY
Big Ridge Rd
& New England BESS
URALLA

ROUTE 1.2

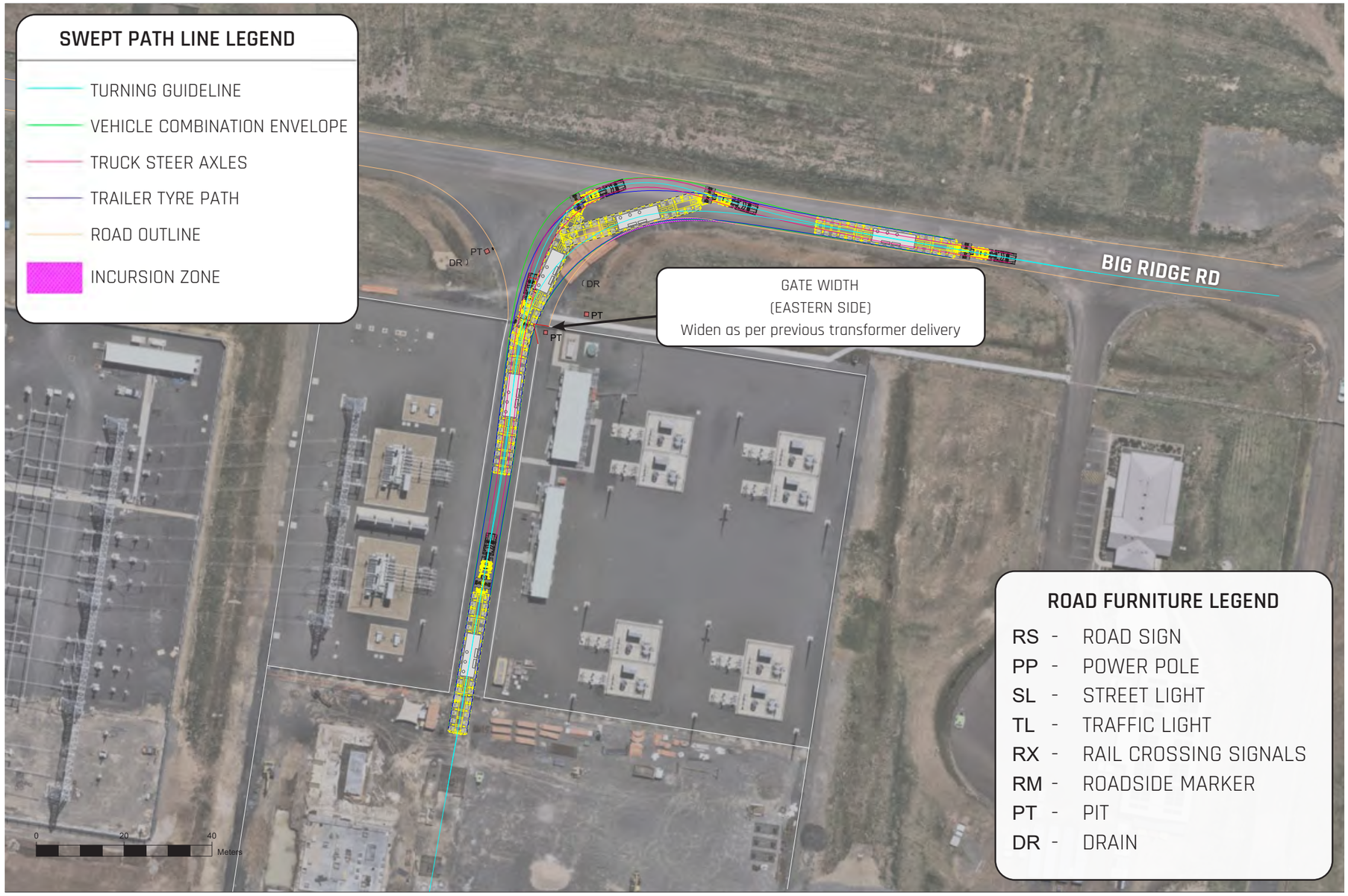
Entry to site will be in a reverse direction to assist with the unloading process. The dolly will need to be reduced to 3500mm before commencing the reversing manoeuvre. The gate opening is to be widened in the same way as the first transformer delivery. The truck must avoid leaving the sealed road on the north side of Big Ridge Rd as increased for the first transformer so should be able to allow entry to site without modification.

The pilot vehicles illustrated are positioned purely as escorting the load and are not intended to contribute any function of traffic control. All traffic control functions will be provided by NSW Police.

Summary of modifications/issues:

- Dolly narrowed to 3500mm
- Truck & dolly tyres leave sealed road north of entry gate

(CLICK TO VIEW THIS LOCATION IN GOOGLE MAPS)



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DRAWN BY:	
DRAWN DATE:	
CHECKED BY:	

CUSTOMER:	EPEC	SIZE:
PROJECT:	New England Solar	SCALE NTS
DRAWING TITLE:	PINCH POINT	SHEET NO:
DRAWING NAME:	N45	REV

ARES PROJECT SERVICES PTY LTD - ABN: 45 643 587 115

Route 1.2 Rest Stops



REST STOPS - ROUTE 1.2

No.	DISTANCE BETWEEN	KP	REST STOP NAME
		0.0	(SA/NSW BORDER)
01	121.2	121.2	Little Topar Roadhouse Rest Area
02	58.4	179.6	Dolo Hill Rest Area
03	115.0	294.6	MaCullochs Rest Area
04	203.9	498.5	Heavy Vehicle Inspection Rest Area
05	178.7	677.2	Girilambone Rest Area
06	193.7	874.5	Beemery Rest Area (opposite direction)
07	89.4	963.9	Yambie Lagoon Truck Parking Bay
08	66.1	1030.0	Unnamed Pullover Area - Walgett region
09	117.6	1147.6	West Burren Junction Rest Area
10	141	1288.6	Boggabri Rest Area
11	38.1	1326.7	Greenwood Grange Rest Area
12	46.2	1372.9	Breeza Truck Parking Bay
13	37.9	1410.8	Five Mile Truck Stop Bay S.B.
14	68.3	1479.1	Goonoo Goonoo Rest Area
15	24.2	1503.3	Almond Inn Truck Stop
16	20.9	1524.2	Glen Ayr Truck Parking Bay
17	9.8	1534.0	Wildcroft Rest Area N.B.
18	23.1	1557.1	Muswell Hill Rest Area
	52.9	**1610.0**	**SITE GATE**

01 Little Topar Roadhouse Rest Area
GPS: -31.780251, 142.227461



02 Dolo Hill Rest Area
GPS: -31.673391, 142.812925



03 MaCullochs Rest Area
GPS: -31.694717, 143.814567



04 Heavy Vehicle Inspection Rest Area
GPS: -31.497946, 145.819471



05 Girilambone Rest Area
GPS: -31.219919, 146.878904



06 Beemery Rest Area (opposite direction)
GPS: -30.004879, 146.359271



07 Yambie Lagoon Truck Parking Bay
GPS: -30.099562, 147.390587



08 West Burren Junction Rest Area
GPS: -30.103862, 148.954649



10 Boggabri Rest Area
GPS: -30.636304, 150.033251



12 Breeza Truck Parking Bay
GPS: -31.237898, 150.417024



13 Five Mile Truck Stopping Bay Southbound
GPS: -31.490042, 150.634825



14 Goonoo Goonoo Rest Area
GPS: -31.296909, 150.902072



15 Almond Inn Truck Stop
GPS: -31.100796, 150.944332



16 Glen Ayr Truck Parking Bay
GPS: -31.013275, 151.081796



17 Wildcroft Rest Area Northbound
GPS: -30.933386, 151.112618



18 Muswell Hill Rest Area
GPS: -30.805655, 151.255727




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KENWORTH

05

HSEQ

Health, Safety and Environment

Safety is always the highest priority for Ares.

Permits

Permits to complete this project will be required from the following parties:

- NHVR Oversize Overmass Permits
- QLD and NSW Police Approval
- Transport Authority (QLD Transport and TfNSW
- Local Council Approvals
- Rail Authority Approvals
- Utility Approval (electricity, telecommunications, etc.)

Verification of Competency

All ARES drivers will be in possession of a valid driver's license, which will be checked prior to commencement of transport operations. All drivers are to comply with fatigue management legislation and will be regularly audited by ARES management.

Personal Protective Equipment

It is ARES policy for all drivers to wear the required personal protective equipment (PPE) whenever it is required and to ensure it is of the appropriate type.

This includes but is not limited to:

- Protective Gloves – AS/NZS 2161.2:1998
- Safety Helmet - AS/NZS 1801:1997
- Lace up (Steel Cap) Safety Boots – AS/NZS 2210.1:2010
- Long Sleeve / Pants - Hi Vis safety work clothing – AS/NZS 4602.1:2011
- Safety Glasses – AS/NZS 1337.1:2010

Hazard Identification, Risk Assessment & Control

All drivers are trained in the use of the standard Hazard Reporting Form. Safe Work Method Statements (SWMS) are created for all activities to be undertaken and reviewed on a regular basis. Personnel undertaking an activity are required to sign onto the relevant SWMS.

ARES personnel are also encouraged to use their Take 5 booklets, which are available in each truck and also at site offices.

Incident reporting is overseen by the HSEQ representative and all details are recorded in an Online form on the ARES Portal. All hazards and incidents will be reported to the road authority, our client and management as required. Remedial and close out actions are reviewed on a regular basis by ARES management.

Communication

All selected radio channels will be documented in the SWMS and all Project personnel will be advised of the selected channels prior to the commencement of work, via the SWMS, Tool Box Meeting and/or the Operations Manager.

Communication between all parties in the Oversize vehicles and pilots will be on UHF Channel 40 and will be used to keep in positive contact at all times.



Quality

Ares is accredited to ISO 9001:2015 and maintains strict standards for quality.

Equipment Servicing & Maintenance

ARES' equipment maintenance program is accredited to the NHVAS and designed to keep our trucks and trailers in optimal running condition. Prime Movers are serviced every 3 months, and trailers are serviced every 12 months.

All service and maintenance records are kept online in the ARES Portal, and are available for review upon request.

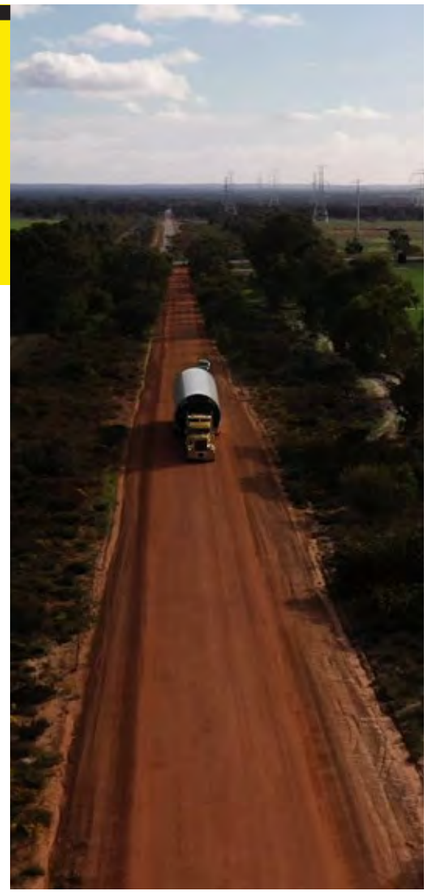
At the commencement of every shift, drivers will complete a daily checklist on all equipment before commencing, as per ARES policy

Non Conformances

Non conformances noted by ARES management or by external parties are recorded as Non Conformance Reports (NCRs) in the ARES Portal. Each NCR is treated in a similar fashion to an incident and is assigned an action-er to rectify and close out the non conformity.

Certified System Quality ISO 9001 SAI GLOBAL
Certified System Environment ISO 14001 SAI GLOBAL
Certified System OHS ISO 45001 SAI GLOBAL

Breakdown Contingency Plan



In the event of an emergency such as a breakdown or incident, ARES will notify the SA Traffic Management Centre (TMC) on 1800 018 313, or the NSW Transport Management Centre (TMC) on 131 700 immediately to provide information regarding any issues of the movement. The load will be moved to the next available pull over area or to the left lane and shoulder to ensure any traffic impact is minimal. Police will direct and manage traffic as appropriate with pilots accompanying the load to assist under the direction of police.

ARES will then consult and engage any one of the following service providers:

A Heavy Tow Truck will be engaged by ARES for the project to be on call to assist in the event of a breakdown and as a ballast/block truck where required. We will also have a number of other heavy rated prime movers available, one of which will travel with the load, acting as a backup vehicle should the need arise.



Contact	Operator	Phone No.
Standby Prime Mover	ARES Block Truck	TBC
Heavy Tow Truck (SA)	Aldinga Towing Southside Towing MGS Towing	0428 904 799 0426 958 956 0438 866 352
Heavy Tow Truck (NSW)	Yass Towing Service Hills Heavy Towing Svcs GRS Towing Alpha Towing	(02) 6226 2618 0408 123 302 1300 550 600 0460 025 742
Tyres	Beaurepaires Bridgestone	132 381 131 229
Mechanical	TBC	TBC
Fire/Police/Ambulance		000
Transport Management Centre (TMC)	South Australia TMC New South Wales TMC	1800 018 313 (SA) 131 700 (NSW)
ARES Project Manager	Jason Millar	0438 024 123

ARES will make contact with the relevant TMC again once the issue is resolved and the load is moving again. This will enable TMC to notify other road users who may be affected by the breakdown or incident.

All hazards and incidents will be reported to the relevant Road Authority, our client, and management, as required.

If specialist equipment and contractors are required such as cranes and traffic management, these will be engaged on an as-required basis.



Above:

Windfarm base section travelling down the Princes Motorway at night.

Opposite page, top:

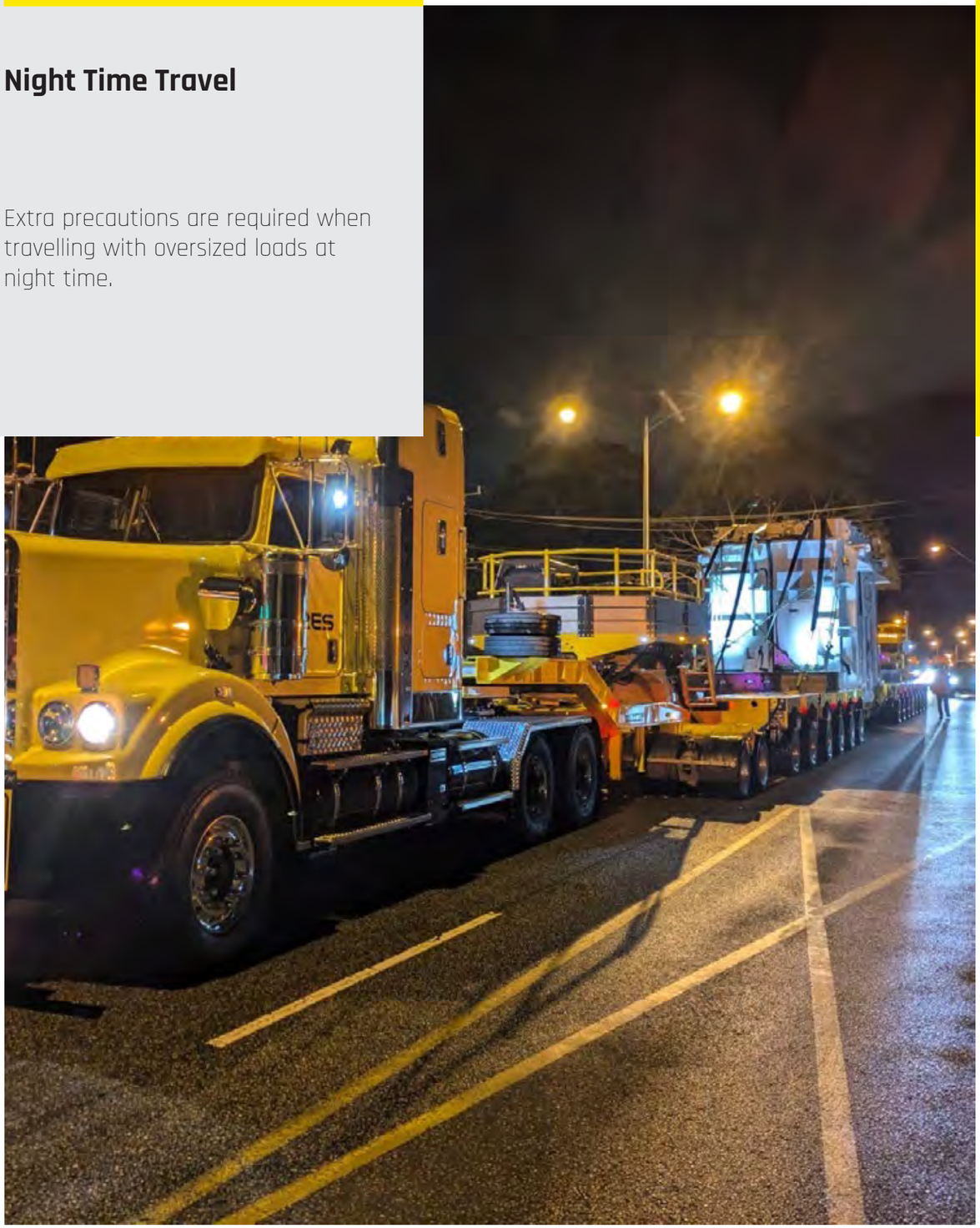
Base tower section being transported in remote Western Australia for the Yandin project.

Opposite page, bottom:

Block trucks assisting a transformer superload along the journey from Glen Waverley to Stanwell power station in Queensland. Multiple block trucks are available in the Ares Group fleet.

Night Time Travel

Extra precautions are required when travelling with oversized loads at night time.



ARES has extensive experience transporting components at night.

Approvals

An NHVR Permit will be required to be issued prior to travel. This will stipulate any special conditions, including curfew and time of day travel requirements.

The oversized load will Depart from the Port of Brisbane in the early hours in order to clear the Brisbane metropolitan area. The following sections outline how ARES plan to mitigate the risks of traveling down roads at night.

Pre-Departure Checks

Transport for NSW (TfNSW) must be contacted via email (roadmanager@transport.nsw.gov.au) a minimum 5 days prior to proposed travel date.

The NSW Transport Management Centre (TMC) must be contacted (Ph: 1800 679 782 or 131 700) prior to the commencement and at the conclusion of each stage of the movement.

Opposite Page:

A transformer travelling in the early hours through Melbourne, en route to Queensland.

Live Traffic NSW (https://www.livetraffic.com) must be checked prior to departure. If there is a disruption, the Project/Transport Manager shall make a Go/No Go decision based on consultation with relevant parties including TfNSW, TMC, client and site, the nature/duration of the disruption and the available time window for transport.

Lighting and Visibility

In addition to the standard lights and flashing beacons equipped as standard on ARES trucks, trailers and pilot vehicles, the extremities of the load shall be illuminated by suitable method (e.g. flood lights mounted on prime mover/dolly, or portable battery-operated magnetic lights). Care shall be taken to ensure the lighting is not directed in such a way as to dazzle other drivers.

Where appropriate, the load will be escorted front and rear by police cars with red/blue flashing lights for additional visibility.

Police Escorts and Pilots

The oversized load will be escorted by a complement of pilot vehicles and police escort vehicles at all times. Requirements may vary state by state - as shown in the table below:

State	Pilot Vehicles	Police / Escort Vehicles
South Australia	4 (TBC)	2 (TBC)
New South Wales	4 (TBC)	2 (TBC)

The length of this load is greater than 35 metres and so falls into the “Special Consideration” category for travel through both SA and NSW.

Police will provide all traffic management, with assistance from pilot vehicles where required and as directed by the Police.

Whilst on the road, typically the lead vehicle(s) will take a position at least 300m ahead of the load to establish

a buffer zone, and to allow for sufficient warning time to the truck driver in case of any unexpected obstructions or conditions, such as roadkill, traffic incidents, parked cars etc. The rear vehicle(s) will take up a protective position behind the load to observe and manage any traffic coming up from behind.

Clear communication between all pilot/police vehicles and truck driver shall be maintained by CB radio at all times.

The proposed arrangements for pilot and police vehicle positioning are provided on the following page. Please note that the exact arrangements may change based on road, traffic or weather conditions, vehicle speed, as well as directions given by Police.

Management of Traffic

The pilots, in close consultation with police where present, shall manage the build up of traffic behind the load by instructing the driver to pull off the road at suitably safe points to allow any queued traffic behind to pass. This is mainly applicable to single carriageway roads. Potential passing points shall be identified in advance and include:

- Overtaking lanes
- Pullover or parking bays
- Stretches of road with wider shoulders and clear line of sight ahead

The lead pilot / police is primarily responsible for monitoring oncoming traffic, identifying safe passing points ahead and communicating with the driver of the load and other escorts to slow and pull over. When oncoming traffic is encountered, the lead pilot will use light wands to alert the traffic to slow down, with the following pilot reinforcing. The load will also be instructed via radio to slow down and pull to one side to allow the oncoming traffic to pass safely.

The rear pilot / police is responsible for monitoring the amount of queued traffic behind the load and providing feedback to the lead pilot / police. At nominated passing points, the lead pilots will monitor for oncoming traffic whilst the load slows and pulls over to one side, allowing any queued traffic to safely pass. The rear pilot (if present) will position themselves at the rear of the load to mark the outer extremities of the load whilst vehicles pass.

Timing

Transport times will be purposely scheduled for night time in built up areas to minimize disruptions to local traffic. Loads will be clear of built up metropolitan areas before sunrise, and continue to site at times prescribed as the safest times.

Communication Plan

To further mitigate the risks associated with travel, the project will notify and inform local residents in advance of movements. These may include any of the following:

- DoT Media plan
- Radio advertisements
- Social media

The communications will contain information on the proposed times and locations of oversized transport on the route, as well as the nature of expected disruptions.

Travel Schedule

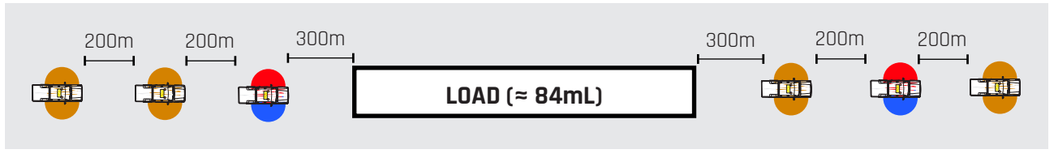
The travel schedule of this journey will be maintained as an external document to this report as specific factors such as dates and travel times are all still to be determined. There still remain some unknown factors - such as cargo availability date, authorization to travel from numerous authorities (transport, electrical, rail) and also the availability of escort vehicles.

To prevent changes in the travel schedule causing unnecessary revision changes to this document, a separate “Live” Travel schedule document will be created and maintained. The latest version of the travel schedule will be provided by request.

PROPOSED ESCORT LAYOUTS

SOUTH AUSTRALIA

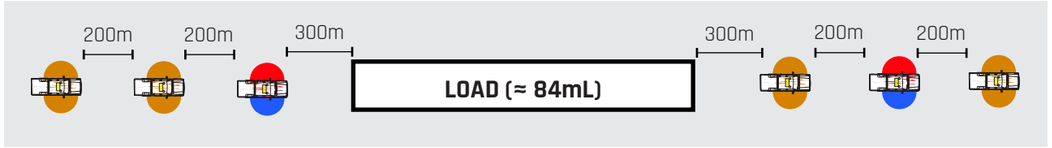
Length: Up to 84m, Width: 4.3m, Height: 5.58m, 4 Pilot Vehicles, 2 Police Escorts



Four Pilot vehicles will be present and positioned in front and behind the load as shown, two police escorts on hand will provide stoppage and direction of traffic at pinch points, as well as the management of any queued traffic behind. The load will position itself as far left as practicable. In a single carriageway, overtaking opportunities will be restricted except at nominated passing spots.

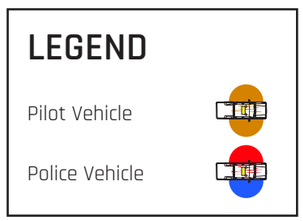
NEW SOUTH WALES

Length: up to 84m, Width: 4.3m, Height: 5.58m, 4 Pilot Vehicles, 2 Police Escorts



Four Pilot vehicles will be present and positioned in front and behind the load as shown, two police escorts on hand will provide stoppage and direction of traffic at pinch points, as well as the management of any queued traffic behind. The load will position itself as far left as practicable. In a single carriageway, overtaking opportunities will be restricted except at nominated passing spots.

DRAWINGS NOT TO SCALE





06

Conclusion

Conclusion

A brief outline of the report's major findings and any recommendations for actions.

> ...transport of this OSOM transformer from Port of Adelaide to New England Solar BESS is feasible.

Summary

Following our analysis, ARES believe that transport of this oversize over-mass (OSOM) transformer for the New England Solar BESS from the Port of Adelaide is feasible with the appropriate modifications made to the route as noted in this report.

One main transport route is proposed - broken up into individual state sections for manageable file size and revision convenience. Route 1.1 through South Australia to Cockburn - 555km. Route 1.2 through New South Wales from Cockburn to the New England Solar Bess site - 1610km. Both routes combined make up the entire journey, a total distance of 2165km.

The modifications required to the routes are minor, but reasonably expected due to the size, width and combined mass of this load. The following summary of Road Modifications are provided for quick reference. Any modifications on State roads will require the approval from the relevant state Department of Main Roads, Infrastructure & Transport.

In our swept path analysis, we have avoided incursions into existing infrastructure and private land wherever possible.

Next Steps

To progress the OSOM transport scope further from here, the following steps are recommended:

- Engagement with transport authorities and local councils to obtain feedback and approval of proposed routes and any special conditions.
- Communication with Transport Authorities regarding any current upgrades or repair works along the proposed route.
- Notification to relevant authorities of any requirements for any contraflow movements.
- Engagement of relevant power authorities to perform formal overhead asset surveys for all routes.
- Engagement of Traffic control teams required for any MoA requirements.

Summary of Road Modifications (Route 1.1)

The following table provides a quick summary of all Pinch Points located in South Australia.

Pinch Point	Road/Intersection	Modifications Required / Issues encountered	Risk
S01	Ocean Steamers Rd & Eastern Parade PORT ADELAIDE	· No modifications. · No issues.	Very Low
S02	Eastern Parade & Port River Expwy On-Ramp GILLMAN	· 1x Sign on Eastern Parade traffic island removed. · Minor traffic island incursion will occur.	Low
S03	Princes Hwy (Augusta Hwy) & Wilkins Hwy WARNERTOWN	· No modifications. · No issues.	Very Low
S04	Wilkins Hwy & Wilkins Hwy (Park Tce) GLADSTONE	· 1x sign to be removed.	Low
S05	Wilkins Hwy & Wilkins Hwy (Charles St) CALTOWIE	· No modifications. · No issues.	Very Low
S06	Wilkins Hwy (Ayr St) & Clyde St JAMESTOWN	· No modifications. · Load will leave sealed road in 2 places.	Low
S07	Apilla Rd & Boundary Rd JAMESTOWN	· 1x sign on left side of Apilla Rd to be removed. · 1x road marker on left side of Apilla Rd impacted. · Load will leave sealed road in 3 places.	Low
S08	Boundary Rd & Mannanarie Rd JAMESTOWN	· No modifications. · No issues.	Very Low
S09	RM Williams Way & Petersburg Rd BLACK ROCK	· No modifications. · No issues.	Very Low
S10	West Terrace & Main St PETERBOROUGH	· No modifications. · No issues.	Very Low
S11	Petersburg Rd & Barrier Hwy UCOLTA	· No modifications. · No issues.	Very Low

Summary of Road Modifications (Route 1.2)

The following table provides a quick summary of all Pinch Points located in New South Wales.

Pinch Point	Road/Intersection	Modifications Required	Risk
N01	Barrier Hwy & Creedon St BROKEN HILL	• No modifications. • No issues noted.	Very Low
N02	Creedon St & Gaffney St BROKEN HILL	• No modifications required. • No issues noted.	Very Low
N03	Through Roundabout Crystal St BROKEN HILL	• No modifications required. • Load will travel in a contra-flow direction.	Medium
N04	Crystal St & Iodide St BROKEN HILL	• No modifications required. • No issues noted.	Very Low
N05	Iodide St & Argent St BROKEN HILL	• No modifications required. • No issues noted.	Very Low
N06	Barrier Hwy & Mitchell Hwy NYNGAN	• No modifications required. • No issues noted.	Very Low
N07	Mitchell Hwy & Tarcoom St BOURKE	• No modifications required. • No issues.	Very Low
N08	Tarcoon St & Kamilaroi Hwy BOURKE	• No modifications required. • No issues.	Very Low
N09	Bathurst St & Bellmore St BREWARRINA	• 1x sign on the exit island to be removed. • No issues noted.	Low
N10	Kamilaroi Hwy BREWARINNA	• No modifications required. • Drain in exit must be avoided.	Very Low
N11	Kamilaroi Hwy WALGETT	• No modifications required. • No issues noted.	Very Low
N12	Wee Waa St & Peel St WALGETT	• No modifications required. • No issues noted.	Very Low
N13	Peel St & Montkeila St WALGETT	• No modifications required. • Check for clearance in Exit area.	Very Low
N14	Montkeila St & Castlereagh Hwy WALGETT	• 2x island signs removed as a precaution. • No issues noted.	Very Low
N15	Castlereagh Hwy & Kamilaroi Hwy WALGETT	• No modifications required. • No issues noted.	Very Low
N16	Kamilaroi Hwy CRYON	• No modifications required. • No issues noted.	Very Low
N17	Kamilaroi Hwy CRYON	• 1x Road sign to be removed. • Tail will leave sealed road on west side of approach.	Low
N18	Kamilaroi Hwy BURREN JUNCTION	• No modifications required. • No issues noted.	Very Low
N19	Boolcarrol Rd WEE WAA	• No modifications required. • Load uses both lanes during turn.	Very Low
N20	Boolcarrol Rd & Mitchell St WEE WAA	• No modifications required. • All lanes required for turn.	Very Low
N21	Mitchell St & Maitland St WEE WAA	• No modifications required. • All lanes required for turn.	Very Low
N22	Maitland St & Rose St WEE WAA	• No modifications required. • All lanes required for turn.	Very Low
N23	Wee Waa Rd & Barwan St NARRABRI	• No modifications required. • Load uses wrong-side lane during turn.	Very Low
N24	Barwon St & Killarney St NARRABRI	• 1x sign on Barwan Street centre island to be removed. • 2x signs on Killarney Street centre island to be removed. • All lanes will be used to make turn.	Low
N25	Killarney St & Tibbereena St NARRABRI	• 1x sign on Killarney Street to be temporarily removed. • Traversal of part of median strip required.	Low

Summary of Road Modifications (Route 1.2 - Cont'd)

Pinch Point	Road/Intersection	Modifications Required	Risk
N26	Tibbereena St & Dangar St NARRABRI	• No modifications. • Load will use all available lanes for turn.	Very Low
N27	Newell Hwy NARRABRI	• 2x Signs to be temporarily removed. • Load will travel in a contra-flow direction.	Low
N28	Newell Hwy & Kamilaroi Hwy NARRABRI	• 2x Signs to be removed on the approach island. • 1x Sign to be removed on the exit island. • Lane incursion will occur in entry and exit.	Low
N29	Wee Waa St & Grantham St Boggabri	• No modifications required. • Load will use all lanes in exit area of turn.	Very Low
N30	Conadilly St & Warrabungle St GUNNEDAH	• 2x Signs to be removed on the approach centre island. • 2x Signs to be removed on the exit centre island. • Load will use all lanes during exit of turn.	Low
N31	Warrabungle St & Bloomfield St GUNNEDAH	• No modifications. • No issues noted.	Very Low
N32	Boundary Rd & Kamilaroi Hwy GUNNEDAH	• No modifications. • No issues noted.	Very Low
N33	Kamilaroi Hwy GUNNEDAH	• No modifications. • No issues noted. • Roundabout will be in a contra-flow direction.	Very Low
N34	Lennox St & Loder St QUIRINDI	• No modifications. • No issues noted.	Very Low
N35	Kamilaroi Hwy & New England Hwy WILLOW TREE	• No modifications. • No issues noted.	Very Low
N36	New England Hwy @ Jack Smyth Dr TAMWORTH	• No modifications. • Avoid drain on left during exit.	Very Low
N37	New England Hwy @ Calala Lane TAMWORTH	• No modifications. • Avoid drain on left during exit.	Very Low
N38	New England Hwy @ Kurrawan St TAMWORTH	• No modifications. • No issues noted.	Very Low
N39	New England Hwy & Scott Rd TAMWORTH	• 1x Sign to be temporarily removed in the entry zone. • 1x Sign to be temporarily removed on the exit centre island. • Tail swing will occur over grass in approach area.	Low
N40	Scott Rd & Murray St TAMWORTH	• No modifications. • No issues noted.	Very Low
N41	Murray St & Marius St TAMWORTH	• 2x Sign to be removed on the entry island. • 1x Sign to be removed on the exit island. • 2x Drains to be protected on exit island. • Roundabout will be completed in a contra-flow direction.	Low
N42	Moonbi Range New England Hwy MOONBI	• No modifications. • Range to be closed to traffic by NSW Police during traverse.	Medium
N43	New England Hwy & Barleyfields Rd URALLA	• 2x Road markers will be impacted • Truck & Dolly tyres leave sealed road on east side of exit • Tail will leave sealed road on west side of approach	Low
N44	Barleyfields Rd & Big Ridge Rd URALLA	• 6 road markers will be impacted. • Incursion will occur at all points of the corner.	Medium
N45	Site Entry Big Ridge Rd URALLA	• Dolly narrowed to 3500mm • Truck & dolly tyres leave sealed road north of entry gate	Low

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