EPURON

APPENDIX K

Traffic and Transport

BOWMANS CREEK
WIND FARM

environmental impact statement

Traffic & Transport Impact Assessment

Bowmans Creek Windfarm
Environment Impact Statement

80020015

Prepared for

Hansen Bailey

25 February 2021

Cardno

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1 Introduction

Epuron Projects Pty Ltd (Epuron) is seeking approval for the construction, operation, maintenance and decommissioning of the Bowmans Creek Wind Farm (Project). The Project is located at Bowmans Creek, approximately 10 km east of Muswellbrook and 120 km from the Port of Newcastle in NSW. Epuron seeks State Significant Development (SSD) Development Consent approval under Division 4.7 of Part 4 of the *Environmental Planning & Assessment Act 1979* (EPA Act) for the Project (SSD 10315).

The Applications are supported by the *'Bowmans Creek Wind Farm Environmental Impact Statement'* (EIS) (Hansen Bailey, 2020). This Traffic & Transport Impact Assessment (TTIA) supports the EIS.

This TTIA will provide an assessment of the potential transport impacts during the construction, maintenance, operation and decommissioning phases of the Project. In addition to the proposed wind turbines, the TIA will also consider the associated operation and maintenance buildings, civil works and electrical infrastructure required to connect the wind farm to the existing transmission network. This assessment was undertaken in accordance with the Secretary's Environmental Assessment Requirements (SEARs)

This report will provide an assessment of the existing road network and its condition, identification of current and potential safety issues that may arise during construction and operation, intersection performance using SIDRA modelling and potential mitigation strategies to address any issues.

1.1 Planning Secretary's Environmental Assessment Requirements

Bowmans Creek Wind Farm is a State Significant Development (SSD) which is to be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*. In the planning SEARs, the key traffic and transport issues for the Project and the associated infrastructure are listed in **Appendix A** . **Appendix A** also indicates where each issue is addressed in this report.

1.2 Assessment Objectives

The key objectives of the TTIA are to address the SEARs' objectives and include but is not limited to:

- Review of any previous traffic impact assessments undertaken for the surrounding area;
- Review existing traffic count data and/or undertake traffic counts in areas where data is not available;
- Assess likely Project only and cumulative traffic impacts during the construction, operational and decommissioning phases of the Project (including intersection performance, capacity, safety and site access); and
- Identify necessary mitigation and management measures.

1.3 Project Description

The Project is located at Bowmans Creek, approximately 10 km east of Muswellbrook and 120 km from the Port of Newcastle in NSW. The Project extends predominantly across two Local Government Areas (LGAs), being the Muswellbrook and Singleton Council LGAs. A small number of turbines are additionally proposed in the Upper Hunter Shire LGA.

The Project will generally involve the construction, operation, maintenance and decommissioning comprised of:

- Up to 60 wind turbine sites consisting of:
  - A three-blade rotor mounted onto a tubular tower;
  - Crane hardstand area; and
  - Turbine laydown area;
- Electricity infrastructure:
  - Up to two substations;
  - A 330 kv transmission line to transmit the generated electricity into the existing Transgrid network;

  - Connections between the wind turbines and the substations, which will include a combination of underground reticulation cables and overhead powerlines;
- Ancillary infrastructure;
  - Operation and Maintenance Facility (O&M Facility);
  - Construction compound and storage facilities;
  - Unsealed access tracks within the Project Boundary;
  - Ongoing use of existing and additional monitoring masts and other monitoring;
  - Temporary construction facilities (including concrete batching plant, laydown areas and rock crushing facilities);
- Minor upgrades to the road network to facilitate delivery of oversized loads (such as wind turbine components) to the Project; and
- Administrative activities (including boundary adjustments and subdivisions).

The conceptual project layout is shown in **Figure 1-1**. This Assessment generally applies to the Project Boundary unless otherwise stipulated in this Assessment and the EIS Project Description.

Traffic impacts from the Project will be:

- Oversize overmass (OSOM), heavy, and light vehicles used to deliver construction materials and personnel during the construction phase; and
- Light vehicles used by onsite personnel and visitors during operation phase.

The haulage route for OSOM vehicles used to deliver construction materials is via Hebden Road (south) from New England Highway are shown on **Figure 1-1**and is split into two parts described as:

- Haulage Route 1 is the Hebden Road (south) between New England Highway and the intersection with Pictons Lane and section of Hebden Road (south) from the intersection with Pictons Lane to the proposed site;
- Haulage Route 3 is the section of Bowmans Creek Road connecting the north western to the south eastern areas of the proposed site.

The OSOM vehicles will originate from Port of Newcastle, travelling west via the Hunter Expressway to the New England Highway.

General access route via Hebden Road (north and south) from New England Highway will be used by all general construction vehicles (general light and heavy vehicles), operational traffic and decommissioning vehicles.

The study area is based on the transport route from Port of Newcastle to Hebden Road (south) and more closely at Hedben Road (north and south), Scrumlo Lane, Bowmans Creek Road and Albano Road.

1.4 Consultation

Consultation with Muswellbrook Shire Council and Singleton Council occurred on 2 July 2020 and 3 July 2020 respectively. Key items discussed were as follows:

- Project overview including boundaries and vehicular access
- Methodology for OSOM route assessment
- General findings within each respective Council LGA
- OSOM vehicle generation and projected timeframes

Consultation with Transport for NSW (TfNSW) occurred on 5 August 2020. Key items discussed were as follows:

- Project overview including boundaries and vehicular access
- Methodology for OSOM route assessment
- General finings along the state road network
- Specific options for access at Industrial Drive / Pacific Highway and John Renshaw Drive interchange onto the Hunter Expressway

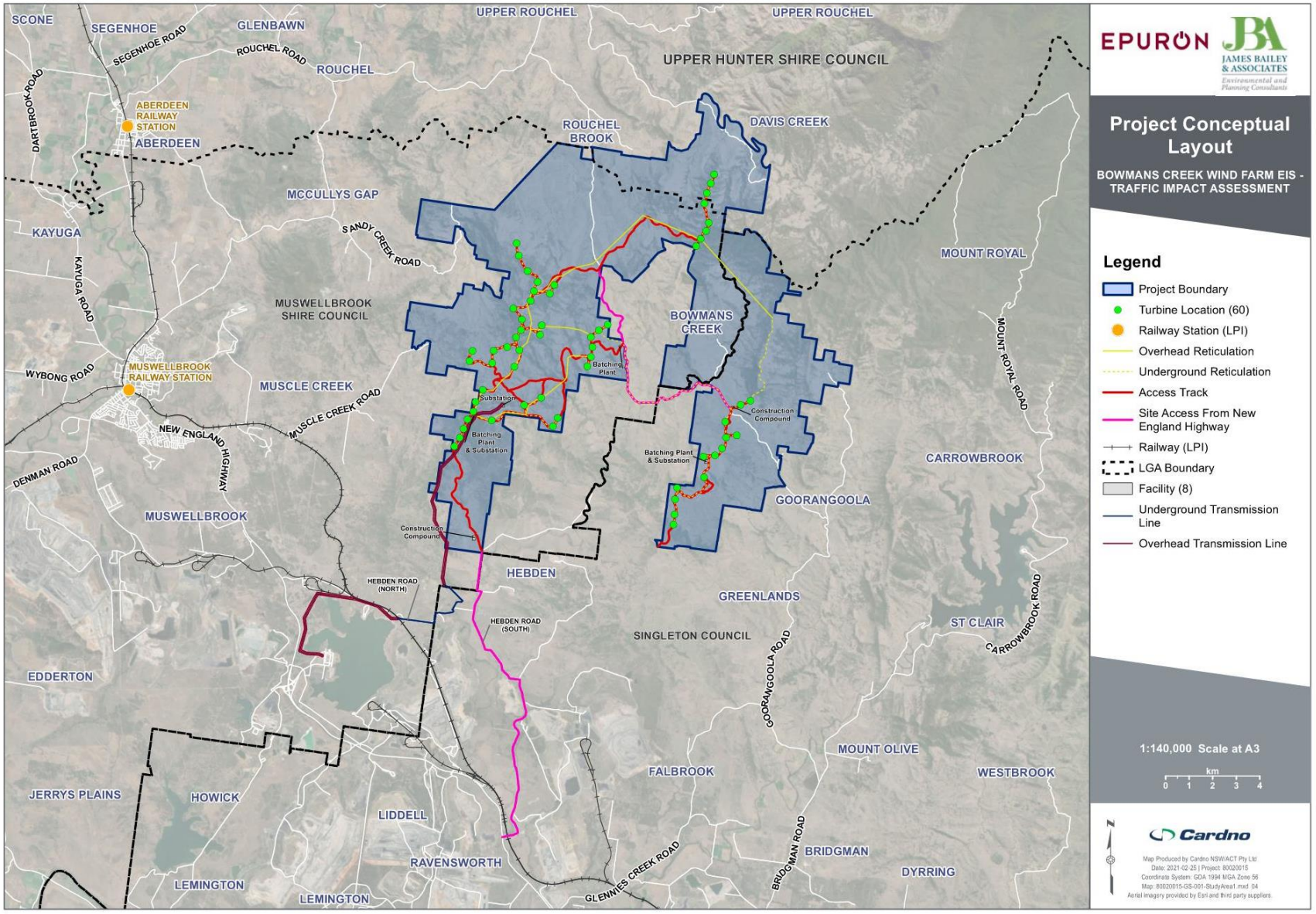
- OSOM route over Tarro Bridge
- Details of other wind farm OSOM routes and procedures previously approved by TfNSW
- Need for consideration of future projects within the network, such as M1 to Raymond Terrace and Hexham Road Straight projects which may have a similar project timeline to the OSOM route.

1.5 Reference Documents

In preparation of this report, the following documents were reviewed:

- Muswellbrook Mine Affected Roads Network Plan Review (Bitzios, May 2020)
- New England Highway Muswellbrook Bypass Options Report (Roads and Maritime, July 2018);
- Mount Owen Continued Operations Report Traffic Impact Assessment (Transport & Urban Planning, July 2014);
- Traffic and Transport Impact Assessment for Glendell Continued Operations Project (Puliyapang, 2019)
- Guide to Transport Impact Assessments (Transport for NSW, March 2018);
- Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads, 2007); and
- Guide to Traffic Generating Developments (RTA, October 2002).

Figure 1-1 Project Location



2 Existing Conditions

2.1 Location & Land Use

The Project is located at Bowmans Creek, the Project Boundary is approximately 10km east of Muswellbrook and 28km north of Singleton. The landscape is undulating with rural properties scattered throughout. Notable land uses nearby include agriculture, Mt Owen Coal Mine, Glendell Coal Mine and Liddell Coal Mine.

2.2 Road Hierarchy

All roads in NSW are categorised by TfNSW based on their role in the road network and for road management responsibilities:

- State Roads link urban and rural centres for the movement of people and freight across the state;
- Regional Roads are secondary roads that provide connectivity between towns or places of interest within a region; and
- Local Roads are low-capacity roads that provide local access to residences and businesses within a town or locality.

State Roads are managed and financed by TfNSW. Regional and local roads are managed and financed by councils, however TfNSW may provide financial assistance to councils for the management of Regional Roads due to their network significance.

Roads can also be classified functionally by the traffic volume they are expected to convey and their typical characteristics:

- Arterial Roads are major roads that connect one region to another;
- Sub-arterial Roads are secondary roads the connect different areas within a region;
- Collector Roads are minor roads that link local areas to sub-arterial and arterial roads; and
- Local Roads are minor roads that provide access to houses and carry low traffic volumes.

Table 2-1 provides the expected daily and peak hour traffic volumes, vehicle operating speed, heavy vehicle restrictions and pedestrian crossing requirements for each functional road classification.

Table 2-1 Road Function Description

Road characteristic	Arterial	Sub-arterial	Collector	Local
Daily traffic volume	> 15,000	5,000 – 20,000	2,000 – 10,000	< 2,000
Peak hour traffic volume	> 1,500	500 – 2,000	250 – 1,000	< 250
Vehicle operating speed	70 – 100 km/hr	60 – 80 km/hr	40 – 60 km/hr	≤ 40 km/hr
Heavy vehicles restrictions	None	Preferably none	Yes	Yes
Pedestrian crossings	Grade-separated or signals	Signals or refuge	Marked crossing or refuge	Marked crossing or refuge

Source: RTA Guide to Road Design, and modified

The existing road network conditions and issues have been identified using aerial imagery and observations made during a site visit undertaken on 10 October 2019. **Figure 2-1** illustrates the road network and some key features.

The location of OSOM routes from the New England Highway are also shown in **Table 2-1**.

Figure 2-1 Existing Road Network

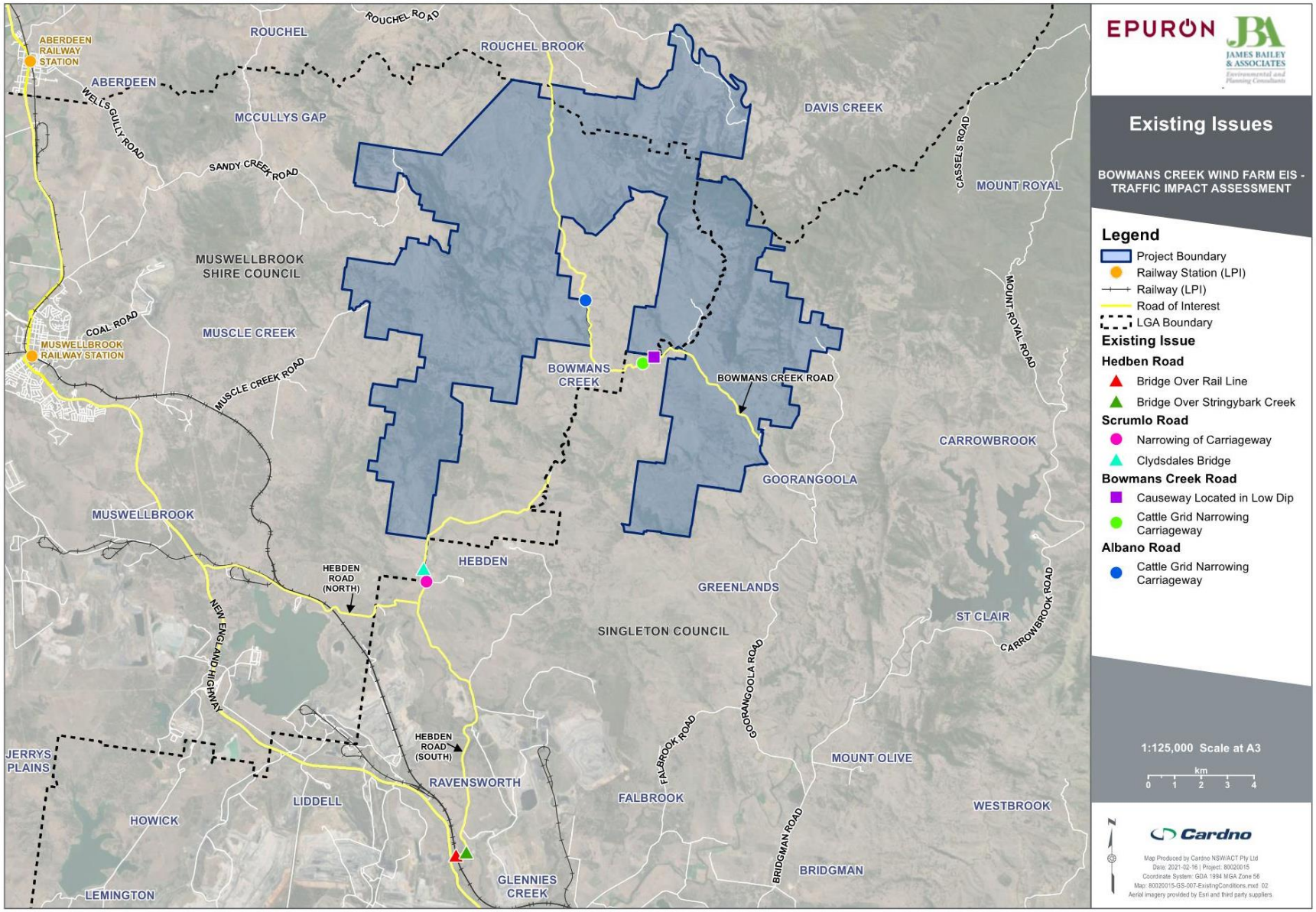
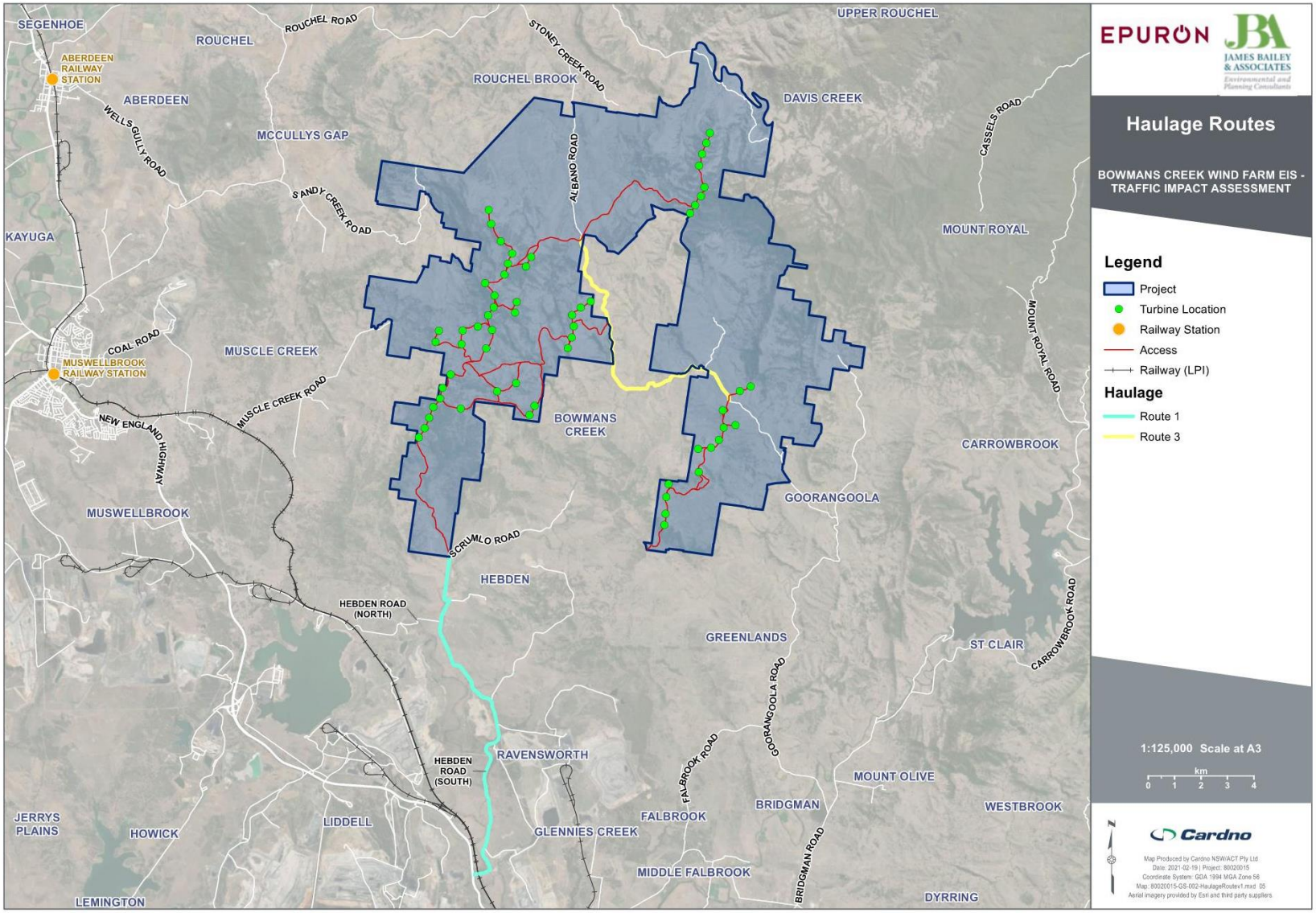


Figure 2-2 OSOM Haulage Routes



2.2.2 New England Highway

New England Highway is a state road (No.09) that varies between one to two lanes of traffic in each direction with segments of physical barrier separation. It is the main road that connects Muswellbrook and Singleton in a north-south direction. The posted speed limit is 100km/hour. This will be the main road used to access the haulage routes that will be located south of the Project.

2.2.3 Hebden Road

Hebden Road is approximately 21 km long and intersects with New England Highway twice, creating a circuit. The most southern intersection with New England Highway up to Hebden Road / Scrumlo Road intersection has been identified as part of the OSOM haulage route.

Hebden Road is a sealed road that allows for one lane of traffic in each direction but there are a few sections where only one lane of traffic is possible. The majority of the road has clear line markings but there are some sections that are unmarked or where the markings are difficult to see. The road surface is in a relatively good condition, and is particularly better between New England Highway and Pictons Lane. The posted speed limit is 80km/hour.

On the Hebden Road Haulage Route there is one bridge over the rail lines close to the southern intersection with New England Highway and a bridge over Stringybark Creek. On the site visit, there were signage stating that the road is subject to flooding.

2.2.4 Pictons Lane

Pictons Lane allows for one lane of traffic in each direction and does not have any road line markings. The road surface conditions vary between sealed and unsealed. Based on the site visit, the road is sealed from Hebden Road / Pictons Lane intersection for approximately 400 metres but then changes to a crushed road base surface for the remainder of the road. It was noted that signage on the route stated that heavy vehicles are permitted to operate between 7am to 6pm on Monday to Saturday.

2.2.5 Scrumlo Road

Scrumlo Road has been identified as Haulage Route 1 which will be used in the construction, operational and decommissioning phases. It will provide access to the south-western portion of the Project Boundary.

Scrumlo Road is a sealed road with no road line markings. The road surface conditions are in relatively good state. The carriageway width varies along the road where it is suitable for two lanes of traffic (one for each direction) or one lane. From Hebden Road / Scrumlo Road intersection to the access road to the East Quarry and Clydsdales Bridge to the end of Haulage Route 1, the carriageway is suitable for two lanes of traffic. However, between the access road to the East Quarry to the Clydsdales Bridge, the carriageway is only suitable for one lane of traffic.

2.2.6 Bowmans Creek Road

Bowmans Creek Road has been identified as Haulage Route 3 which will be used in the construction, operational and decommissioning phases. It will provide access to the eastern and western parts of the Project.

Bowmans Creek Road is approximately 8 km long and extends from Old Goorangoola Road to Albano Road. Approximately 6 km of the road is sealed with no road line markings and approximately 2 km is a gravel-like surface. The carriageway is suitable for one lane of traffic at any one time.

During the site visit it was noted that the gradient of the road varies significantly. This creates poor visibility especially around tight bends and on crests. There were also several causeways along the road and a few were located at low dips as seen in **Appendix B**. These areas will also be prone to flooding after heavy rainfall events. There are several cattle grids which narrow the clear width along the carriageway.

2.2.7 Albano Road

Albano Road is approximately 14 kilometres in length and will most likely be used to access the internal access tracks to the turbines. It connects to Bowmans Creek Road and Stoney Creek Road. Albano Road is currently an unsealed gravel road. The carriageway width accommodates one lane of traffic in one direction at any one time. Vehicle passing occurs within the grassed verge and shoulder area.

From the site visit, it was noted that the gradient varies significantly and there are a greater number of bends in the road. This will create visibility issues when manoeuvring around bends and travelling over crests. There are several cattle grids that narrowed the carriageway.

2.3 Heavy Vehicle Routes

Reference is made to TfNSW Restricted Access Vehicles (RAV) roads as well as Higher Mass Limits (HML) routes, both of which permit specific vehicle types for travel. Generally speaking, the RAV routes are for vehicles or vehicle combinations which exceed the overall dimensions of vehicles defined in the Heavy Vehicle National Law (HVNL) which is defined based on the width, height, length and internal dimensions. HML routes permit operators to utilise road freight transport vehicles achieving significant increase in productivity.

The heavy vehicle or vehicle combination that operate on approved RAV and HML routes generally include the following:

- B-Doubles;
- 4.6m High Vehicles; and
- Road Trains.

An OSOM vehicle is defined as a Class 1 vehicle under the HVNL and is considered to be OSOM if it exceeds any general access mass or dimension limits.

Figure 2-3 is an extract of the OSOM route proposed to be utilised by the Project's turbine componentry haulage (shown in red).

Figure 2-3 OSOM Route Restrictions

The following restrictions exist on the proposed haulage route:

- New England Highway, from Pacific Highway, Hexham to John Renshaw Drive, Tarro

  Vehicles or combinations exceeding 3.5 metres wide or 25.0 metres long are not permitted to travel between 8:00am and sunset on weekends or a state-wide public holiday.

> Hunter Expressway, from John Renshaw Drive, Buchanan to Magpie Street, Singleton

    Vehicles or combinations exceeding 3.2 metres wide are not permitted to travel from Monday to Friday from 7:30am to 9:30am and from Monday to Friday from 3:00pm to 6:00pm (except on state-wide public holidays).

2.4 Traffic Volumes

Singleton Council has provided historical weekly traffic data on Hebden Road and Bowmans Creek Road. The received data was collected in different months and years. The collection period for each road are as follows:

> Hebden Road (south) (540 m from New England Highway) – Monday 11 December to Sunday 17 December 2017

> Bowmans Creek Road (4 km from Goorangoola Road) – Monday 17 October to Sunday 22 October 2016

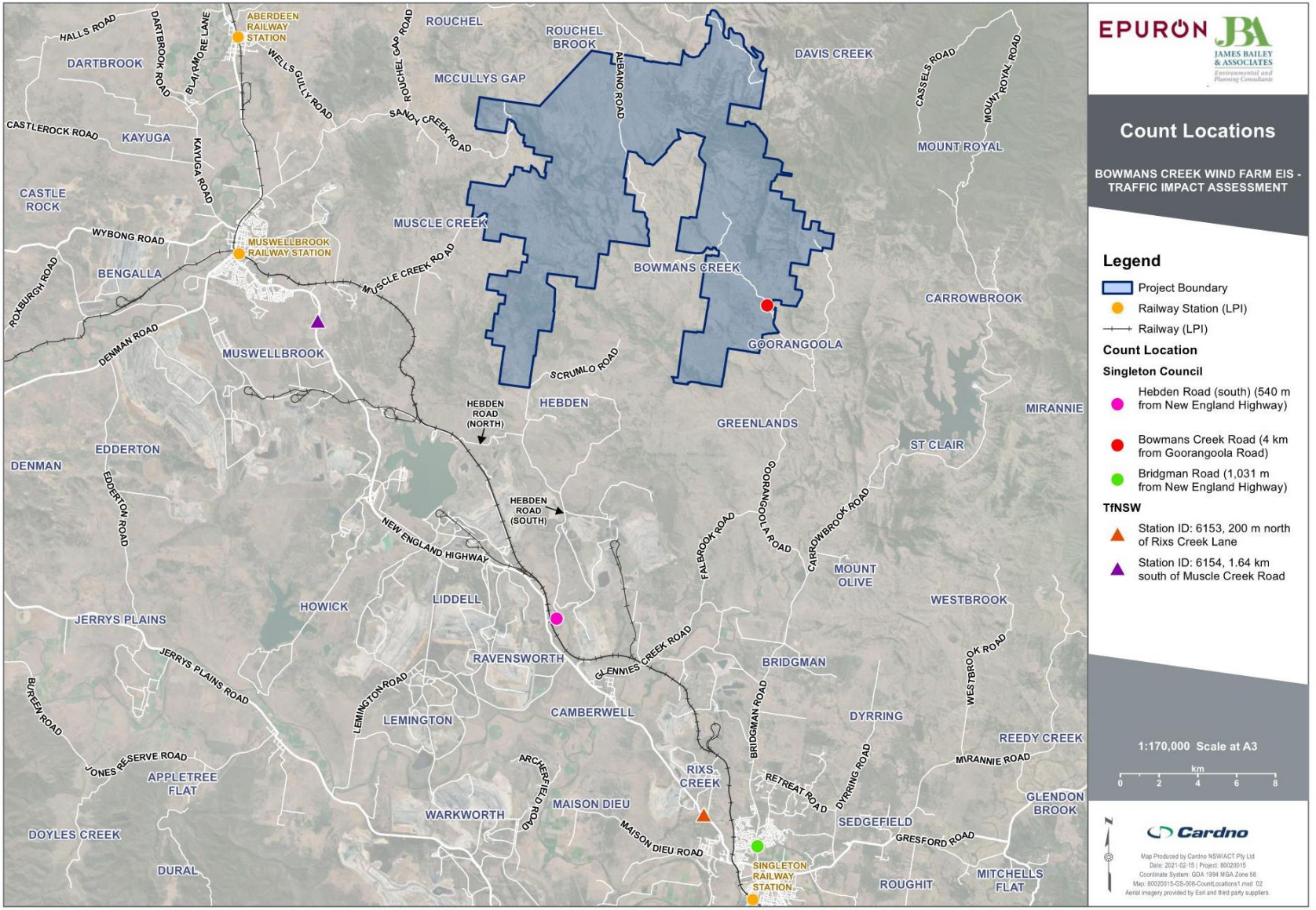
> Bridgman Road (1,031 m from New England Highway) – Wednesday 24 September to Tuesday 30 September 2014

This data is used to understand the daily variations across one week and determine the AM and PM peak hours based on the highest volume of traffic.

Additional traffic data has been sourced for the New England Highway from the TfNSW Traffic Classifier Station 6153 and 6154.

The relevant traffic data and locations are summarised in **Figure 1-1**.

Figure 2-4 Survey Count Locations



Other data sources have been obtained from the following documentation:

- Options Report for the New England Highway Muswellbrook Bypass (RMS July 2018); and
- Traffic and Transport Impact Assessment for Glendell Continued Operations Project (Puliyapang, 2019).

2.4.2 New England Highway

Project traffic will access the New England Highway (via Hebden Road) between the TfNSW Classifier Stations 6153 and 6154. Traffic data from the stations is summarised in **Table 2-2** and indicate the average weekday traffic volumes to be between about 9,800 to 16,200 vehicles a day. Traffic has grown between 2017 and 2019 by about 2.7% per year averaged over station 6153 and station 6154.

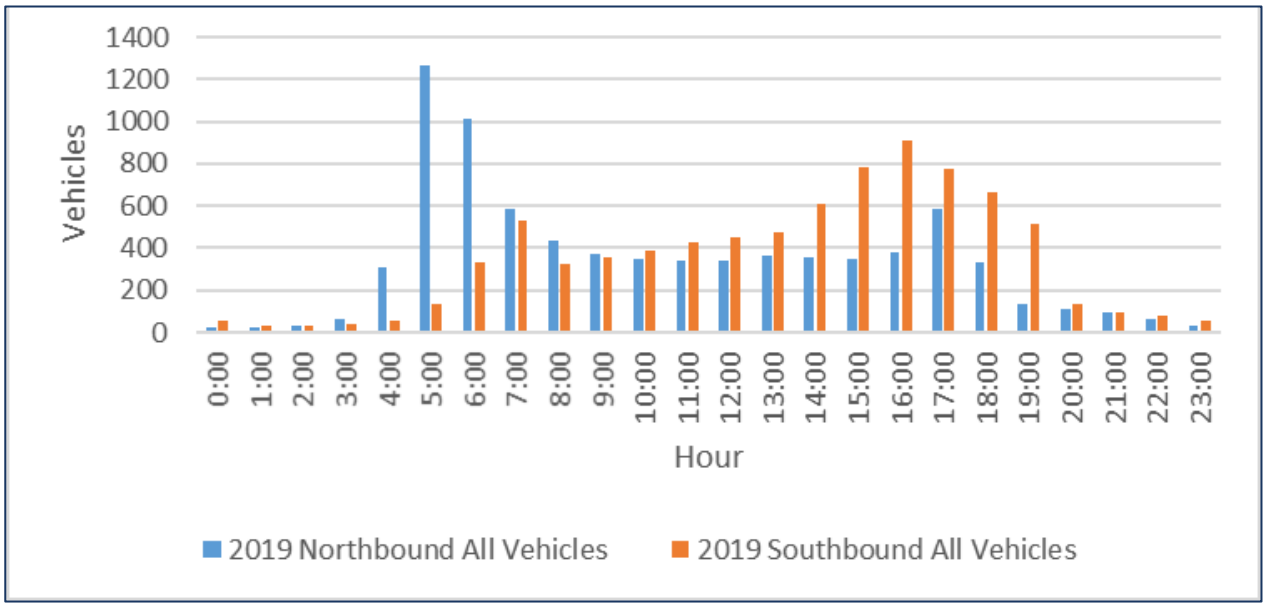
Table 2-2 New England Highway TfNSW Classifier Station Traffic Data

Station ID	Location on New England Highway	Average weekday traffic volumes			Traffic growth per year 2017 – 2019 (2 years)
		2017	2018	2019	
6153	200m north of Rixs Creek Lane	15,043	15,611	16,200	3.8%
6154	1.64km south of Muscle Creek Road	9,824	9,817	10,124	1.5%
Average for all locations		**12,434**	**12,714**	**13,162**	**2.7%**

Source: Traffic Volume Viewer (TfNSW)

Traffic profile shown in **Figure 2-5** was determined from the average weekday traffic counts for 2019 at station 6153. The traffic profile shows a peak northbound volume of over 1,200 vehicles between 5.00-6.00am, and peak southbound volume of over 800 vehicles between 4.00-5.00pm.

Figure 2-5 New England Highway Traffic Profile Average 2019



Source: Traffic Volume Viewer (TfNSW)

Traffic data for the New England Highway north of the site (and two Classifier Stations) was presented in Table 2 of the Options Report for the New England Highway Muswellbrook Bypass (RMS July 2018) and is shown below in **Figure 2-6**. The average weekday traffic volumes averaged over four locations on New England Highway have grown from 13,330 vehicles in 2007 to 14,880 vehicles in 2016, representing an average growth per year of 1.3%.

Figure 2-6 New England Highway all vehicle growth rates (2007 – 2016)

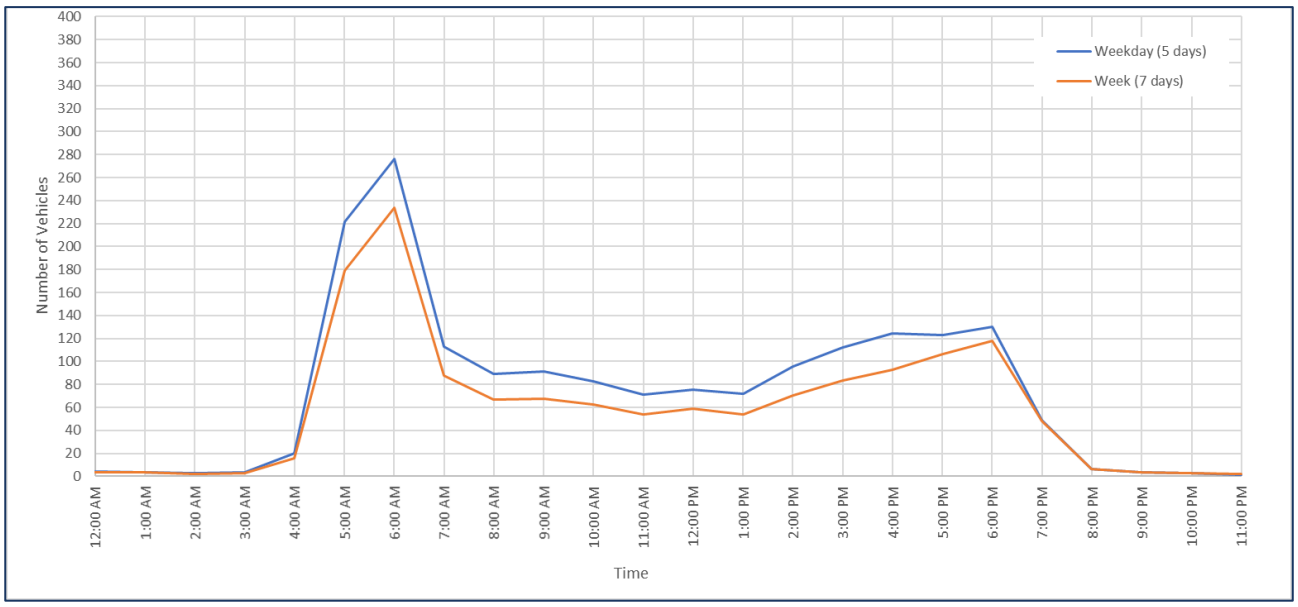
Site ID	Location on New England Highway	Average weekday traffic volumes			Traffic growth per year 2007 - 2016 (8.5 years)
		November 2007	June 2013	July 2016	
M-1	South of Muscle Creek Road	8900	9600	9560	0.8%
M-2	West of Rutherford Road	15,300	16,900	18,860	2.5%
M-3	South of Brook St	18,200	18,000	19,460	0.8%
M-4	South of Sandy Creek Road	10,900	12,100	11,630	0.8%
Average for all locations		**13,330**	**14,150**	**14,880**	**1.3%**

Source: Table 2 of the Options Report for the New England Highway Muswellbrook Bypass (RMS July 2018)

2.4.3 Hebden Road (south)

The weekly traffic profile of Hebden Road (south) (540 m from New England Highway) is relatively consistent across all days of the week. The AM peak occurred on Tuesday 12 December 2017 at 6am – 7am (total of 371 vehicles) and the PM peak occurred on Wednesday 13 December 2017 at 4pm – 5pm (total of 156 vehicles). The traffic volume profile of Hebden Road (south) is presented in **Figure 2-7**.

Figure 2-7 Hebden Road (south) Traffic Volume Profile

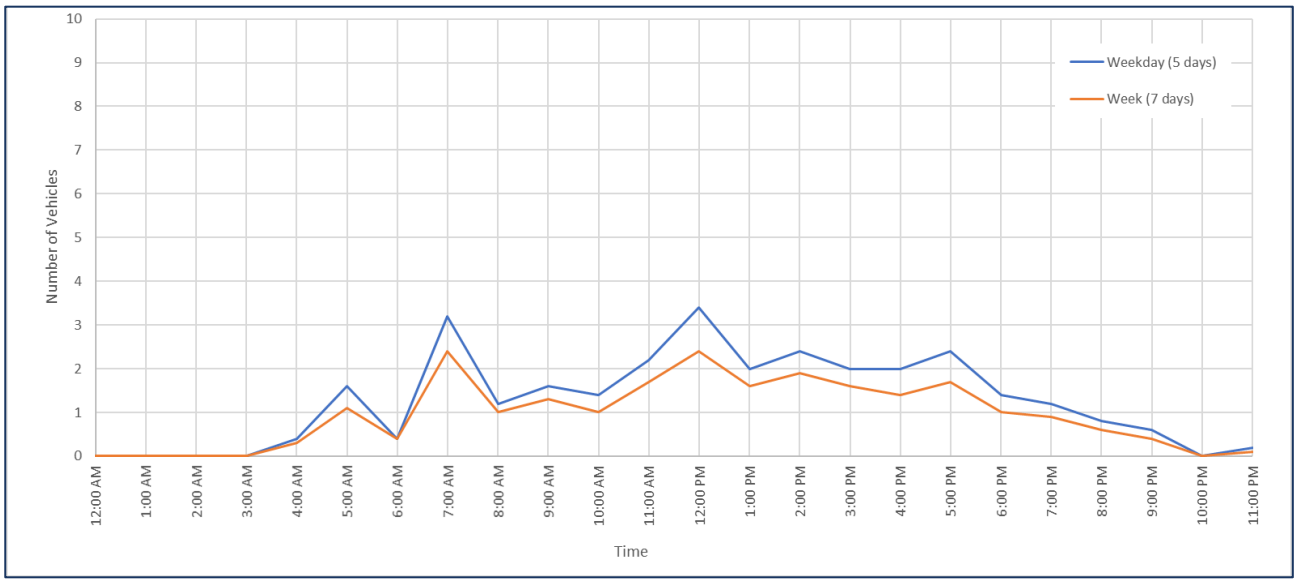


Source: Singleton Council

2.4.4 Bowmans Creek Road

There is very low traffic volume on Bowmans Creek Road and therefore there is no discernible traffic profile. Based on the profiles, the AM peak occurs on Tuesday 18 October 2016 at 7am – 8am (total of 8 vehicles) and the PM peak occurs on Tuesday 18 October 2016 at 12pm – 1pm (total of 7 vehicles). The traffic volume profile of Bowmans Creek Road is presented in **Figure 2-8**.

Figure 2-8 Bowmans Creek Road Traffic Volume Profile



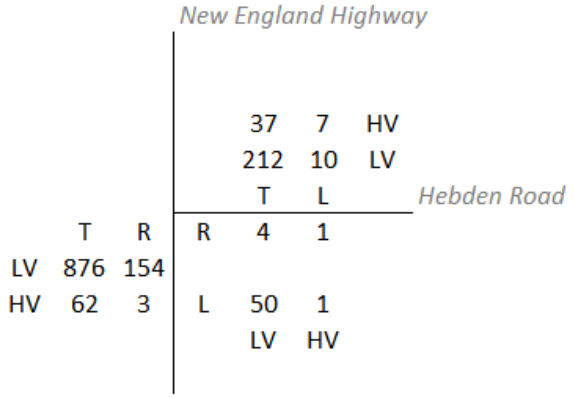
Source: Singleton Council

2.4.5 New England Highway / Hebden Road (south) intersection

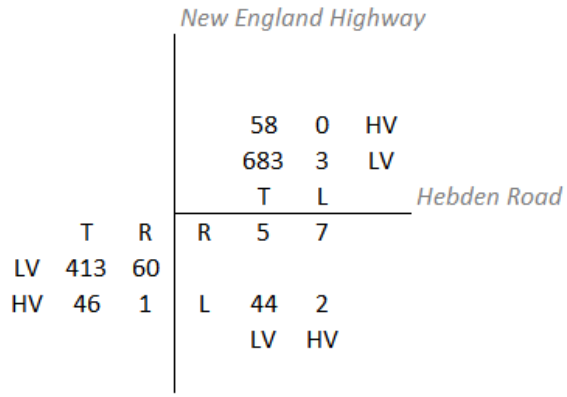
The New England Highway / Hebden Road (south) intersection was assessed in the Traffic and Transport Impact Assessment for Glendell Continued Operations Project (Puliyapang, 2019) report. Within the cited report, intersection turning count data was collected on Tuesday 21 August 2018 and the report indicated the AM and PM peak hours of the intersection to be 5.45-6.45am and 5.00-6.00pm respectively. The peak hour turning volumes are shown in **Figure 2-9**.

Figure 2-9 New England Highway / Hebden Road intersection count data

AM Peak 5.45 am - 6.45 am



PM Peak 5.00 pm - 6.00 pm



Source: Traffic and Transport Impact Assessment for Glendell Continued Operations Project (Puliyapang, 2019)

2.5 Crash History

TfNSW provided reported crash data for key roads that will be used during the construction, operational (and maintenance when replacement blades need to come in) and decommissioning phases.

Figure 1-1 represents the severity of reported crash incidents along the OSOM haulage and general traffic access routes.

In total, 8 incidents were reported between 1 April 2014 and 31 March 2019 which included:

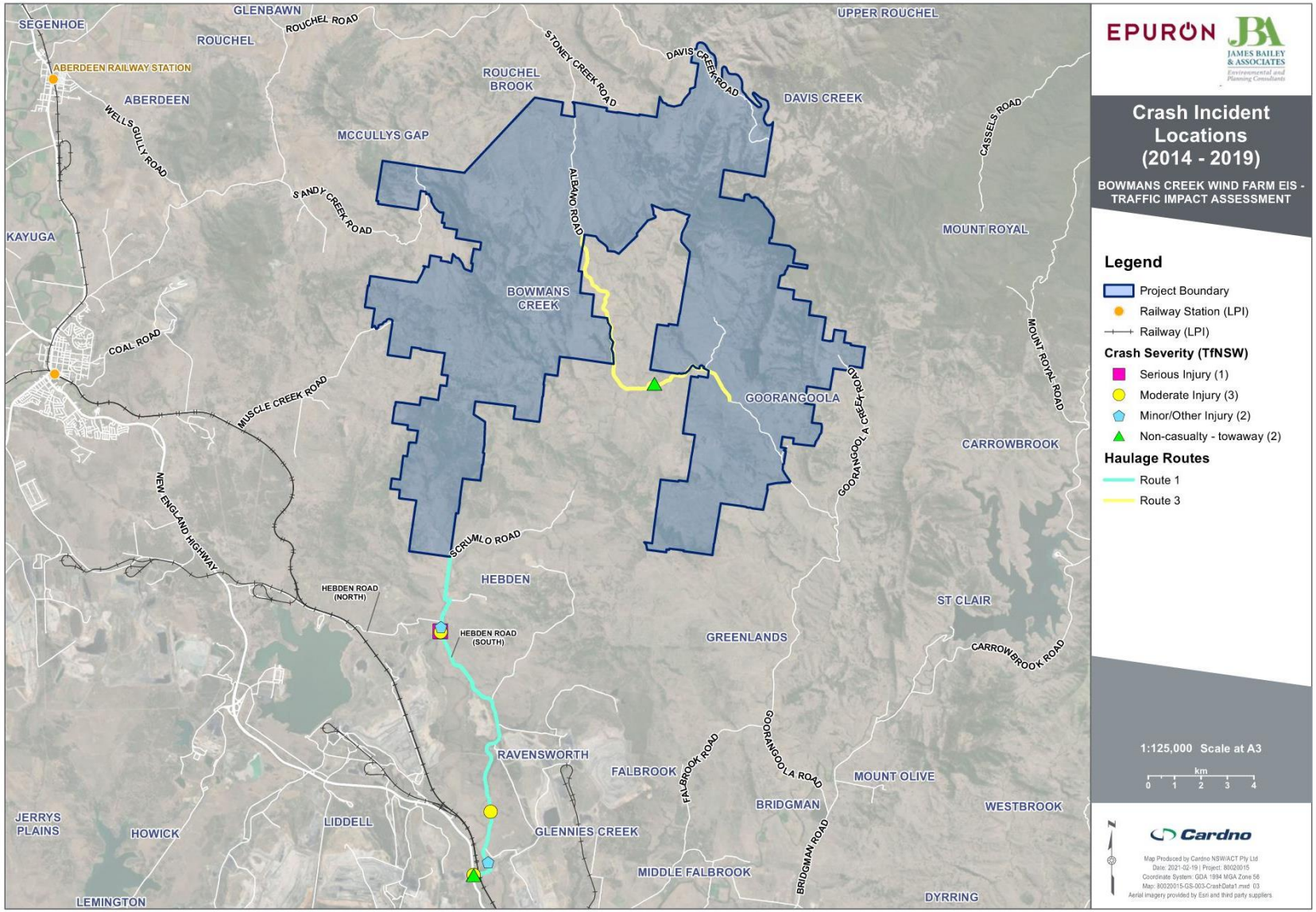
- One (1) incident that resulted in a serious injury;
- Three (3) incidents that resulted in moderate injury;
- Two (2) incidents that resulted in a minor injury or other; and
- Two (2) incidents that results in the vehicle being towed away (non-casualty).

Each incident is classified under the Road User Movement (RUM) Codes to determine the type of crash. The most common crash type is when vehicles from the opposing direction collide while making a right through (RUM 21) and vehicles driving off the carriageway while making a right bend and colliding into objects or parked vehicles (RUM 81).

Crashes mostly occurred in close proximity to the New England Highway / Hebden Road and Hebden Road / Scrumlo Road intersections. There was only one reported case of a serious injury. There was an approximately even split in crashes that resulted in serious / moderate injuries and minor/other injuries or towaways (non-casualties).

The serious injury involved a motorcycle that drove off the carriageway whilst making a right bend (RUM 80), which occurred near Hebden Road / Scrumlo Road intersection. It was reported that speeding was a factor in the cause of the incident.

Figure 2-10 Crash Locations



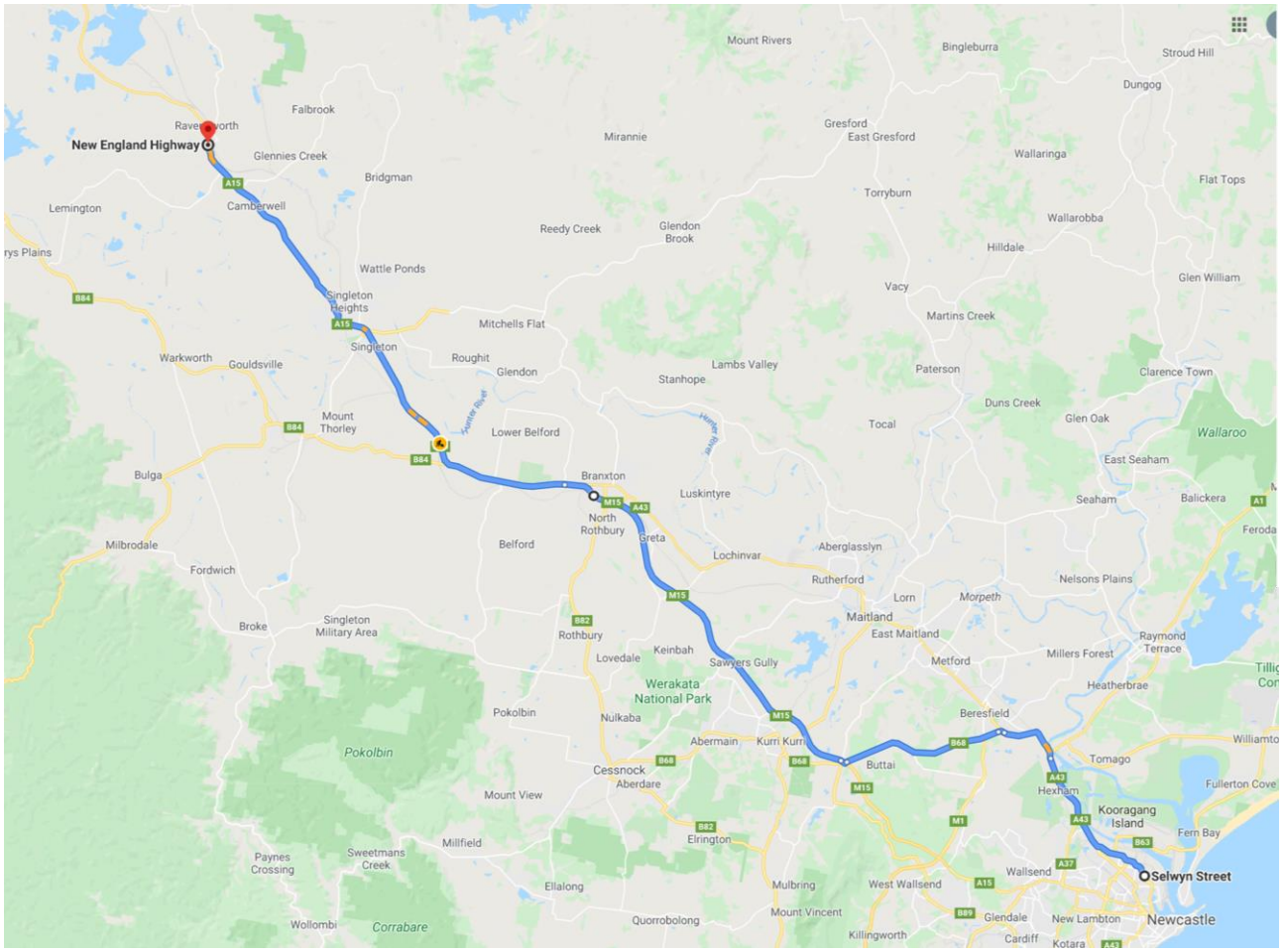
3 OSOM Transport Route Assessment

3.1 Overview of haulage route

The delivery of wind turbines and wind turbine components will be from the Port of Newcastle, approximately 100km south east of the Project site. The use of the Port is not uncommon, with other windfarms utilising Mayfield Berth 4 for the purpose of turbine and blade storage before transporting to the regional location.

Figure 3-1 is an extract of the proposed OSOM travel route from the Port, whilst **Figure 1-1** are the proposed OSOM routes around the project from New England Highway..

Figure 3-1 OSOM Journey Route

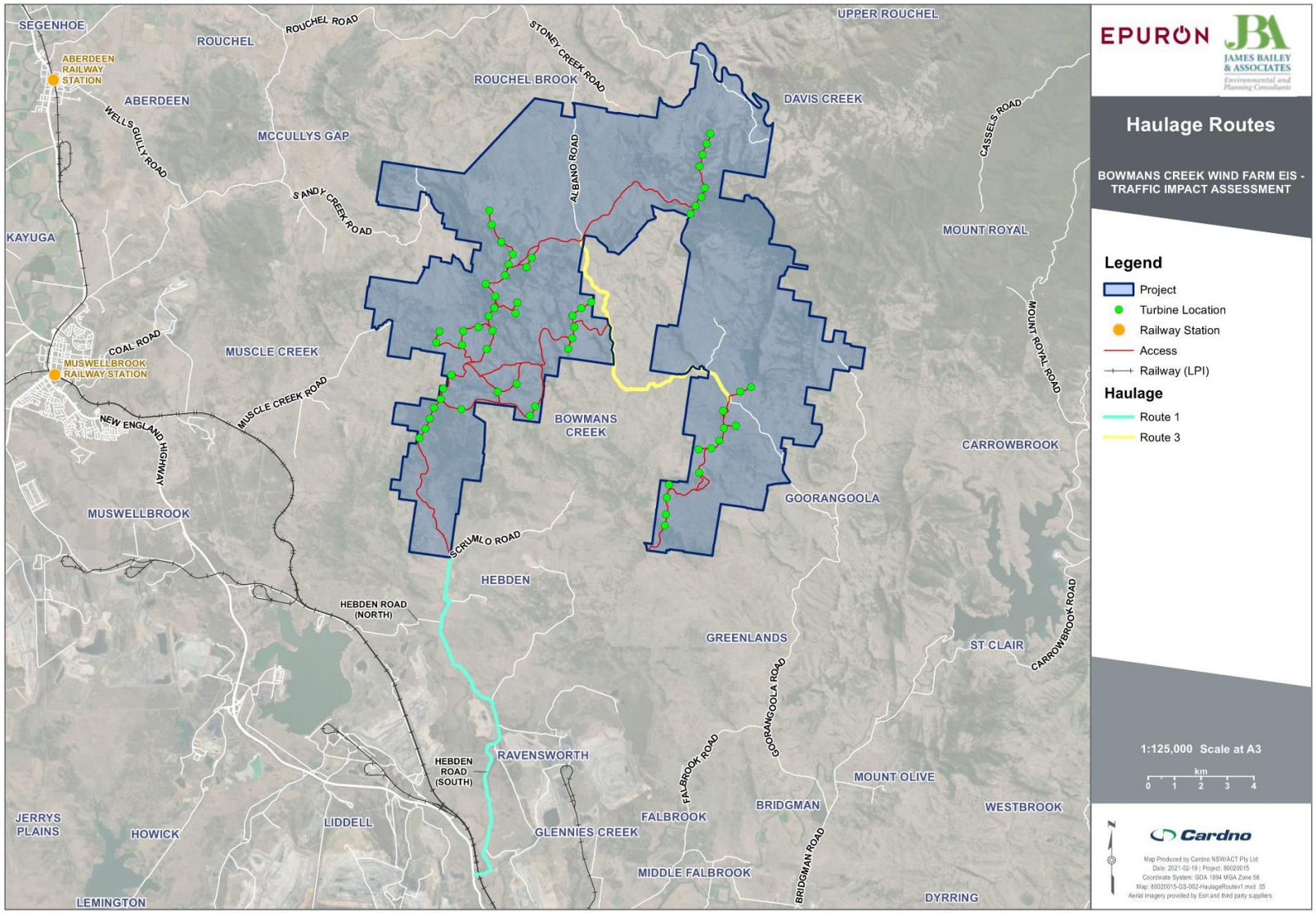


Source: Google Maps

Once at the intersection of Hebden Road / New England Highway, OSOM vehicles will access the site via the identified site access locations and roads on Hebden Road and Bowmans Creek Road as follows:

- Haulage Route 1 is the section of Hebden Road (south) between New England Highway and the intersection with Pictons Lane and Hebden Road (south) from the intersection with Pictons Lane to the proposed site;
- Haulage Route 3 is the section of Bowmans Creek Road connecting the north western to the south eastern areas of the proposed site.

Figure 3-2 OSOM Routes



3.2 Vehicle Specifications

The proposed OSOM vehicle transporter will be supplied by a nominated contractor. The vehicle and procedures will be as per requirements stipulated within their operating manuals.

3.3 Swept Path Route Assessment

Cardno reviewed the OSOM haulage route using AutoCAD 2019 Vehicle Tracking software. The Vehicle Tracking program has a template wind turbine / blade transporter which has been modified to suit the custom vehicle length proposed to be used by Epuron.

Swept paths for the turbine delivery from the Hebden Road via New England Highway to the site entry was also reviewed as is attached in **Appendix C**.

Swept paths for the turbine delivery from the Newcastle Port to Hebden Road via New England Highway was also reviewed as is attached in **Appendix C**.

Key parameters within the vehicle profile are outlined in **Table 3-1**.

Table 3-1 Vehicle profile parameters

Vehicle parameter	Setting
Vehicle Length	85.8m
Load Length (turbine)	80m
Load Width (turbine)	3.9m
Rear Track Angle Limit	30 Degrees
Turning Radius	9.8m
Vehicle Speed At Turns and Constraints	10km/h

The notable conflict points to be addressed as part of the post EIS Traffic Management Plan (TMP) and detailed design are also provided in **Appendix C**.

The key items for the movement of OSOM vehicles are summarised below:

- Port of Newcastle to Hebden Road
  - Minor works required on Selwyn Street upon exit from the Port. Access to Pacific Highway and Hunter Expressway will require traffic management measures and likely short term road closures. This appears to be consistent with movements of other similar turbine deliveries by OSOM vehicles likely to operate under traffic control.
  - Two alternate paths are identified for movement from Industrial Drive onto the Pacific Highway. Minor works likely to be required to enable cross over of the central median, operating under traffic control.
  - Two alternate paths are identified for movement from John Renshaw Drive onto the Hunter Expressway. Navigating the roundabout interchange under normal road conditions may require modification to verge areas and the over pass safety screens to allow the OSOM vehicle to turn. The alternate path identified involves closure of the westbound carriageway and off-ramp from the Expressway with minor works required to enable cross over on John Renshaw Drive.
  - No impact identified at Tarrow Bridge for the OSOM vehicle
- Route 1
  - Initial segment of the route near the New England Highway requires intersection works, bridge capacity assessment and road widening before the transport vehicle travels north on Hebden Road. The potential works on New England Highway are based on the tail of the OSOM vehicle potentially encroaching into the cutting on the western side of the Highway.
- Route 3
  - The vertical geometry along Bowmans Creek Road / Albano Road is undulating and may require road improvements in accordance with Council and the OSOM vehicle specification requirements. This can be addressed as part of the detailed design.

There was no identified Crown Land that is impacted by the movement of the OSOM vehicle.

3.4 Visual Road Condition & Safety Review

An on-site review of the road condition and safety features of the OSOM route from on Hebden Road, Scrumlo Road, Bowmans Creek Road and Albano Road. The site review was informed by the desktop swept path assessment and documentation prepared as part of **Section 3.3**.

The OSOM route from New England Highway onto Hebden Road to Scrumlo Road (Route 1) is generally considered to be satisfactory. As identified in **Appendix C**, there is anticipated to be road works and vegetation removal / trimming however this is considered to be achievable and can be addressed as part of the detailed design for the works.

The box culverts / causeways and bridges along Hebden Road and Scumlo Road appear adequate and can be addressed at the detailed design of the TMP and a recommended dilapidation assessment to capture any changes in conditions during OSOM movements.

The OSOM route on Bowmans Creek Road and Albano Road (Route 3) is generally undulating and consisting of crushed road base surface. The topography of Route 3 in select locations is generally exceeding the maximum 20-25% gradient considered suitable for the OSOM vehicle. Where the gradient is considered to be high, the road will need to be modified in consultation with Council to satisfy Council and the OSOM vehicle requirements.

4 Traffic Impact Assessment

4.1 Traffic Generation

For the majority of the time, the Project will operate with limited staff and generate minimal traffic movement during the operation phase. Accordingly, apart from the initial construction phase, the Project is anticipated to have a negligible impact upon traffic on the local road network.

4.1.1 Construction Phase

The various construction work phases will overlap with each other. The duration of the Project construction phase is expected to be approximately 18 months. An indicative Project construction schedule is presented in **Figure 4-1.**

Around 50% of material for road base would be sourced from the site (mainly from turbine foundation excavation). There are a number of suitable quarries in the area that could potentially supply the remaining imported material (excluding water).

Potable water will be sourced from the municipal water supply and transported to the site using road registered water trucks. Water that does not need to be of potable quality will be sourced from water storages in the region and transported to the site using road registered water trucks.

As such, the bulk of the materials for roads, hardstands and foundations would be sourced locally.

Traffic generated by the Project during the construction phase will be split across two broad categories:

- OSOM vehicles used to turbines is via Hebden Road (south) from New England Highway. These vehicles will only use the Haulage Route (Route 1 and Route 3); and
- General traffic generated by construction personnel travelling to / from the site (i.e. utes, vans and private cars) and other heavy vehicles which are used for the delivery of smaller wind turbine components and externally sourced construction materials such as aggregate and cement for concrete production. These vehicles are anticipated to use the general access route via Hebden Road (north and south) from New England Highway.

Figure 4-2 provides details on vehicle types and traffic generation expected for the life of the construction program. The values provided are based on traffic generated from external sources and are based one one-way movements only. The overall traffic generation to be assessed is twice the values shown.

The estimated daily vehicle movements in construction months are summarised in **Figure 4-3**.

Construction worker parking will be provided on site.

Figure 4-1 Indicative Construction Program

Access Route	Category	Purpose	Construction Month																		
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
All	Construction Operations	General	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18
	Preliminary Transport	Management	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	18
		Employee		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		16
	Wiind Farm Construction	Site Set Up	x	x																	2
		Establish Site Access	x	x	x	x															4
		Roads and Hard Standings			x	x	x	x	x	x											6
		Foundation Construction						x	x	x	x	x	x								6
		Cables and Reticulation									x	x	x	x	x	x					6
		Turbine Components											x	x	x	x	x	x			6
		Cranage											x	x	x	x	x	x			6
	Sub-Station Construction	Sub Station Civils					x	x	x	x	x	x									6
		Sub Station Electrical						x	x	x	x	x	x								6
		Sub Station Misc										x									1
		Transmission Lines							x	x	x	x	x	x							6
	Operational Infastructure	General														x	x	x	x		4
		Decommission of Temprary Structures																	x	x	2

Figure 4-2 Indicative Construction Traffic Demands

Operation	Purpose	tonnes / load	total tonnage	Delivery Vehicle	Trips: as per all construction materials sourced externally
General					
Construction	Water delivery	15	na	Truck Tanker	4,680
Operations	Fuel delivery	15	na	Truck Tanker	156
	Skip delivery	3	na	SM Flat Bed	117
	Portaloo Deliveries	12	na	L Low Loader	195
Wind Farm Construction					
Site Set-Up	Miscelaneous Establishment Deliveries	5	na	L Low Loader	40
	Earthworks equipment delivery	30	na	H Low Loader	30
Road & Hard standings	Imported material for site roads capping (200mm)	30	31,020	Truck and Dog	3,337
	Imported material for crane hardstands (300mm)	30	27,372	Truck and Dog	1,026
	Imported material for construction site compound (350mm)	30	2,331	Truck and Dog	85
	Imported material for batching plant (350mm)	30	9,713	Truck and Dog	356
	Lime / Cement Stabilisation	60	3,931	Cement Delivery	66
	Subgrade improvement material / fill	30		Truck and Dog	-
Foundation	Heavy equipment delivery	30	na	H Low Loader	10
Construction	Misc works	5	na	SM Flat Bed	10
	Aggregate delivery to batching plant	30	75,600	Truck and Dog	2,520
	Concrete binder for batching	60	13,118	Cement Delivery	219
	Water delivery to batching plant	15	5,593	Truck Tanker	373
	Reinforcing steel delivery	30	3,816	HT Flat bed	127
	Foundation bolts or steel insert delivery	12	na	L Low Loader	72
	Concrete delivery to site [=3]	17	TBC	Redimix Concrete Truck	-
Turbine Components	Tool container delivery	15	na	L Low Loader	15
	WTG container delivery	25	na	SM Flat bed	90
	Tower container delivery	25	na	SM Flat bed	90
	Top section delivery	50	na	Low loader - Towers	72
	Middle Top Section	50	na	Low loader - Towers	72
	Middle Bottom Section	50	na	Low loader - Towers	72
	Bottom Section Delivery	50	na	Low loader - Towers	72
	Blades delivery - single blade transport	10	na	Low loader - Blade	216
	Nacelle and Transformer	80	na	Low loader - Nacelle	72
	Drive Train	80	na	Low loader - Drive Train	72
	Hubs + Spinner	15	na	L Low Loader	72
	Power module	24	na	H Low Loader	72
	Return Containers	25	na	HT Flat bed	360
	Escort Vehicles	na	na	4WD and commercial	1,584
Cable Installation	Cable delivery	15	na	L Low Loader	72
	Excavator delivery	30	na	H Low loader	8
	Cable laying equipment	15	na	L Low loader	2
	Cable Bedding Sand	30	7,305	Truck and Dog	264
Cranage	Terrain crane [150t]	130	na	H Low Loader	3
	Terrain crane [220t]	220	na	H Low Loader	4
	Terrain crane [500t]	500	na	H Low Loader	13
	Main Crane	30	na	H Low Loader	24
Overhead Transmission Line	Pole delivery	2	na	Semi trailer	138
	Associated work OHTL vehicles	5	na	Semi trailer	
	Associated work OHTL vehicles	60	na	Medium rigid	
	Associated work OHTL vehicles	3	na	Medium rigid	
Internal Sub Station Construction					
Sub Station Civils	Lime / Cement Stabilisation	17	83	Redimix Concrete Truck	2
		30	2,775	Truck and Dog	62
	Imported Stone for substation compound	30	8,325	Truck and Dog	62
Sub Station Electrical	Transformer delivery - substation	130	130	H Low loader - Trans	1
	Switchgear etc.	15	na	L Low Loader	2
	Misc electrical equipment	5	na	SM Flat Bed	1
	Switchgear cable and pylon delivery	24	450	H Low Loader	2
	Operations building	15	12	L Low Loader	3
Operational Infastructure					
Operational Structures			na	Six axle articulated	16
			na	L Low Loader	8
			na	4WD and commercial	44
Decommission of Temprary Structures			na	Six Axle Articulated	16
			na	L Low Loader	8
			n/a	4WD and commercial	44
Misc Small Vehicles	Workers and Visitors	na	na	Vans, cars	35,100
	Misc small tools etc.	na	na	Light goods van	200
	Total estimated OD Traffic (one-way)				732
	Total estimated HV Traffic (one-way)				14,685
	Total estimated traffic for project (one way delivery)				52,449

Notes: (1) OSOM based on 72 turbines

(2) One-way trips shown. Total trips will be double.

Figure 4-3 Monthly & Daily Construction Traffic Demand

Access Route	Vehicle Type	Access per month (Trips)																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
All	Truck Tanker	263	263	263	263	263	331	331	331	331	331	331	263	263	263	263	263	263	263	**5209**
	SM Flat Bed	7	7	7	7	7	8	8	8	8	9	38	37	37	37	37	37	7	7	**308**
	HT Flat Bed	0	0	0	0	0	21	21	21	21	21	81	60	60	60	60	60	0	0	**487**
	L Low Loader	13	13	13	13	13	26	26	26	38	38	53	40	40	42	30	30	19	17	**489**
	H Low Loader	15	15	0	0	7	9	9	9	11	12	15	13	13	13	12	12	0	0	**167**
	Truck and Dog	0	0	801	801	801	1241	1241	1241	485	485	485	44	44	44	0	0	0	0	**7712**
	Low Loader Towers	0	0	0	0	0	0	0	0	0	0	48	48	48	48	48	48	0	0	**288**
	Low Loader Blade	0	0	0	0	0	0	0	0	0	0	36	36	36	36	36	36	0	0	**216**
	Low Loader Nacelle	0	0	0	0	0	0	0	0	0	0	12	12	12	12	12	12	0	0	**72**
	Low Loader Drive Train	0	0	0	0	0	0	0	0	0	0	12	12	12	12	12	12	0	0	**72**
	Cement Delivery	0	0	11	11	11	47	47	47	36	36	36	0	0	0	0	0	0	0	**284**
	Redimix Concrete Truck					2														**2**
	4WD and Commercial	1350	1363	1363	1363	1363	1363	1363	1363	1363	1363	2227	2227	2227	2249	2249	2249	1385	1350	**36972**
	Semi Trailer	0	0	0	0	0	0	23	23	23	23	23	23	0	0	0	0	0	0	**138**
	Medium Rigid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Six axle articulated	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	4	12	8	**32**
	Daily Total (Assuming 26 operating days per m	87	87	118	118	118	140	141	141	112	112	131	108	108	109	106	106	88	87	
	Monthly Total	**2253**	**2266**	**3062**	**3062**	**3072**	**3647**	**3670**	**3670**	**2916**	**2918**	**3397**	**2820**	**2797**	**2825**	**2767**	**2767**	**2291**	**2250**	**52443**

Notes: (1) One-way trips shown. Total trips will be double.

The Project is expected to generate about 141 daily one way traffic movements during the peak construction period (Months 7 – 8), of which about 47%, or 66, of these trips will be delivery related heavy vehicles.

Over-dimensioned vehicles will most likely be generated during month 11-16, during which time a peak of 106 to 131 one-way daily vehicles is generated. The delivery of turbines is likely to be grouped to minimise the impact on the road network along its journey and occur outside of peak times during periods accepted by TfNSW and the local Council.

4.1.2 Operation Phase

During the operation of the Project, routine maintenance is likely to be carried out by up to 15 people per day, based on the site compound off Hebden Road. Assuming each person drives themselves to and from the compound, the daily traffic generation would equate to 30 trips.

4.1.3 Maintenance and Decommissioning Phase

The Project will be in perpetuity, maintenance may be required in 25 years when turbines may need to be replaced. Notwithstanding, maintenance work and Project decommissioning would conceptually generate a similar or less number of trips than the construction stage.

The decommissioning of the Project would result in similar traffic movements when compared to the construction phase, however with a significantly reduced workforce and removal of certain material deliveries (e.g. there will be no need for concrete trucks / pours).

Traffic management controls will need to be considered at the decommissioning stage to mitigate any traffic and transport impacts. This may include the timing of inbound / outbound trips at the Hebden Road intersections with New England Highway, or preferred routes to local roads via Singleton or Scone for light vehicle access.

4.2 Traffic Distribution

It is assumed delivery related heavy vehicle trips will be evenly distributed through the day (12 hour working day) due to material arrivals required at different times of the day. Staff are expected to arrive at an assumed 80% / 20% in / out distribution in the AM peak and 20% / 80% in / out distribution in the PM peak.

As shown in **Figure 4-3**, the peak number of one-way movements is during month 7-8 (141 one-way movements, or 282 total trips in and out of the Project site).

Table 4-1 details the peak hour traffic generation whereby a total of 86 trips are assessed in both the AM and PM peak.

Table 4-1 Trip Generation and Distribution AM and PM Peak

Vehicle Type	Daily Two-Way trips	Peak Hour Factor	Peak Hour Total Movements	AM Peak IN / OUT	PM Peak IN / OUT
Light vehicles	150	50%(1)	75	60 / 15	15 / 60
Heavy vehicles	132	8.3%(2)	11	6 / 5	5 / 6
Total	**282**		**86**	**66 / 20**	**20 / 66**

Notes: (1) this assumes all one-way trips occur during the peak hour

(2) this is based on heavy vehicle movements being evenly distributed across the 12 hour work day.

All vehicles will access the site from New England Highway via Hebden Road north or south. The workforce (reflected by light vehicles) is anticipated to be split between Singleton 50% (including south of Singleton), Muswellbrook 45% and Scone 5%. The workforce from Singleton is assumed to access the site via Hebden Road (south). The workforce from Muswellbrook and Scone is assumed to access the site via Hebden Road (north).

It is assumed that heavy vehicles will follow the same assumed origin / destination, whilst the OSOM delivery of the turbines will originate from Port of Newcastle.

4.3 Traffic Assignment

The route by vehicle type and phase is shown in **Figure 4-4** Considering the assumptions detailed above, the resulting traffic assignment of the worst case scenario (peak construction period) during the AM and PM peak for the Project is presented in **Figure 4-4.**

Figure 4-4 Traffic Routes

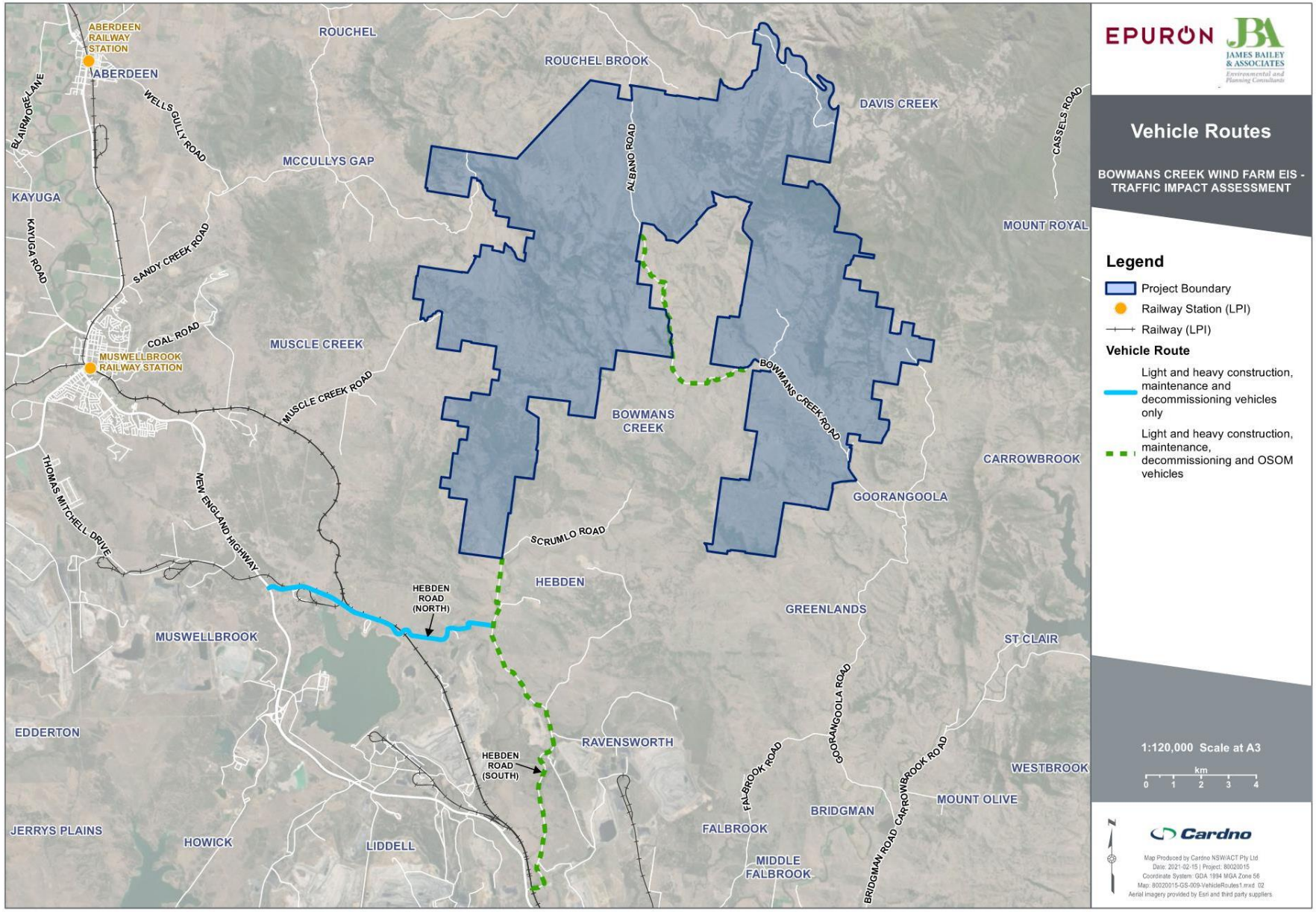
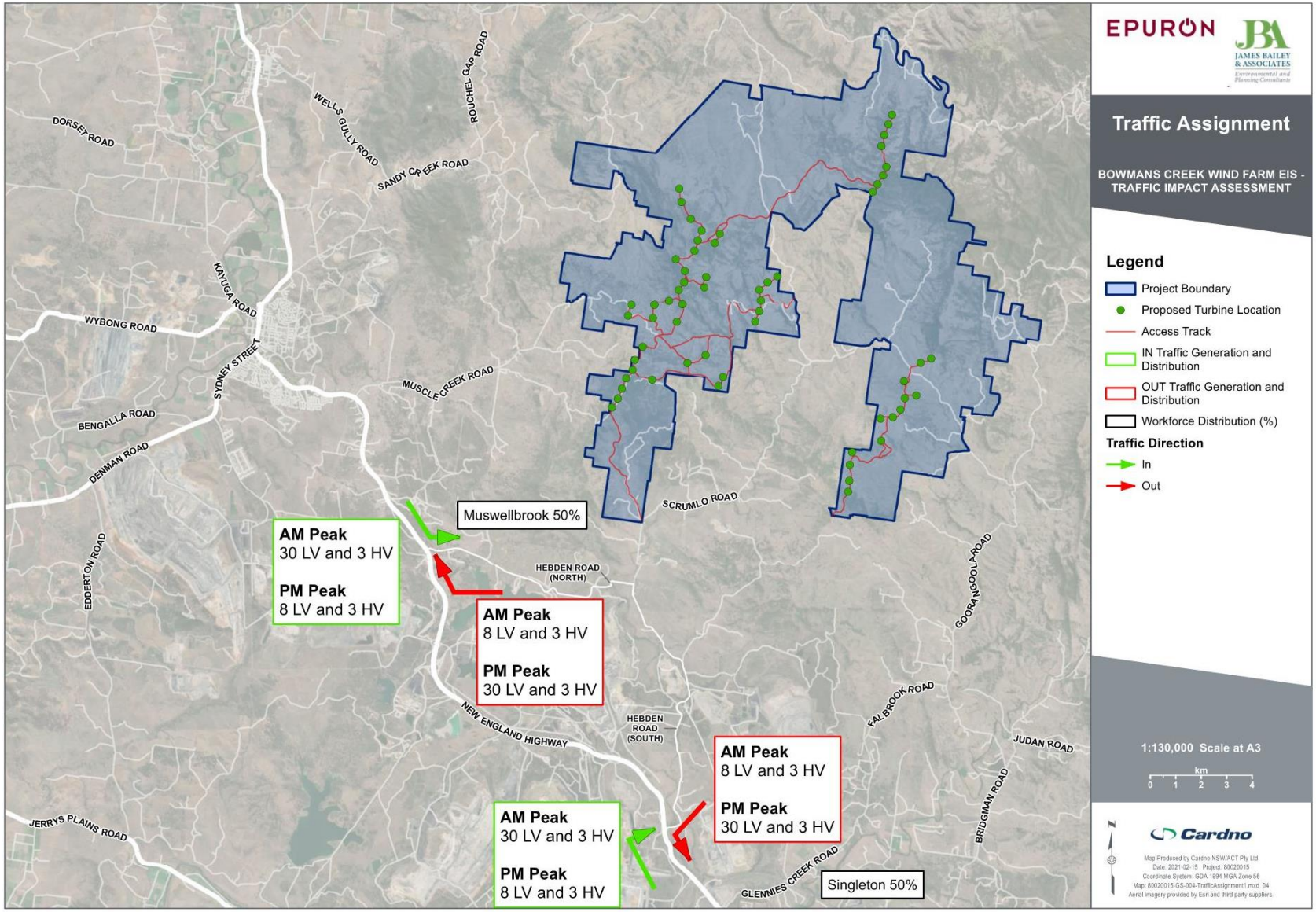


Figure 4-5 Traffic Assignment

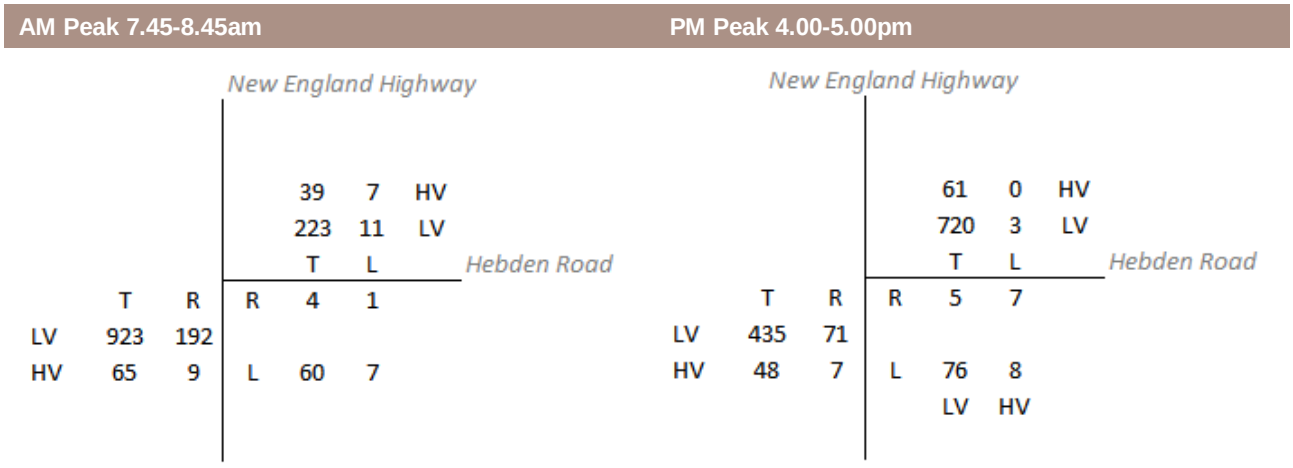


To estimate year 2020 turning volumes for an assessment of the New England Highway / Hebden Road (south) intersection, the following assumptions were made:

- Adopt the turning volumes from the Traffic and Transport Impact Assessment for Glendell Continued Operations Project (Puliyapang, 2019) report;
- Apply a growth rate of 2.7% per annum for seven years (as determined in **Section 2.4.2**) to the through traffic on New England Highway; and
- No change in traffic in/out of Hebden Road is assumed for continued operations of Mount Owen and Glendell Mines which are the primary users of Hebden Road.

The resulting estimated year 2020 turning volumes for the New England Highway / Hebden Road intersection is shown in **Figure 4-6**.

Figure 4-6 Forecast New England Highway / Hebden Road Intersection Turning Volume



Once general construction traffic has entered Hebden Road from the New England Highway, it will access the O&M Facility off Scumlo Road before dispersing across the site.

4.4 Intersection Performance

The key intersections were modelled and assessed using the classified intersection counts using SIDRA 8 intersection modelling software. SIDRA is a micro-analytical tool for evaluation of intersection performance mainly in terms of capacity, level of service and a wide range of other performance measures such as delay, queue length and stops for vehicles and pedestrians, as well as fuel consumption, pollutant emissions and operating cost. The SIDRA software can be used as an aid for design and evaluation of fixed-times /pre-timed and actuated signalised intersections, signalised pedestrian crossings, signalised single point interchanges, roundabouts, roundabout meters, two-way stop sign control, all-way stop sign control, and give-way/yield sign-control. The benefits of the SIDRA model is the relatively faster model development and processing when compared to more complex microsimulation tools and the simplistic outputs provided by the program that summarises intersection performances.

The *'RMS Guide to Traffic Generating Developments' (version 2.2, 2002)* provides a guide in assessing the level of service (LoS) for various intersection controls. **Table 4-2** shows an extract of the guide and highlights the key indicators in evaluating performance.

Table 4-2 Intersection performance guidelines

Level of Service	Average Delay per Vehicle (seconds)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	>70	Unsatisfactory and requires additional capacity	Unsatisfactory and requires additional capacity

Source: RMS Guide to Traffic Generating Developments (version 2.2, 2002)

TfNSW guidelines state that for roundabouts and priority control intersections a Level of Service (LoS) assessment should be reported based on the worst performing movement of the intersection. For traffic signals, the average movement delay and corresponding Level of Service over all movements should be determined and reported. However, it is important to review the worst performing movement for a sign controlled intersection in the context of all traffic movements as relatively small traffic volumes may not be reflective of the overall intersection performance.

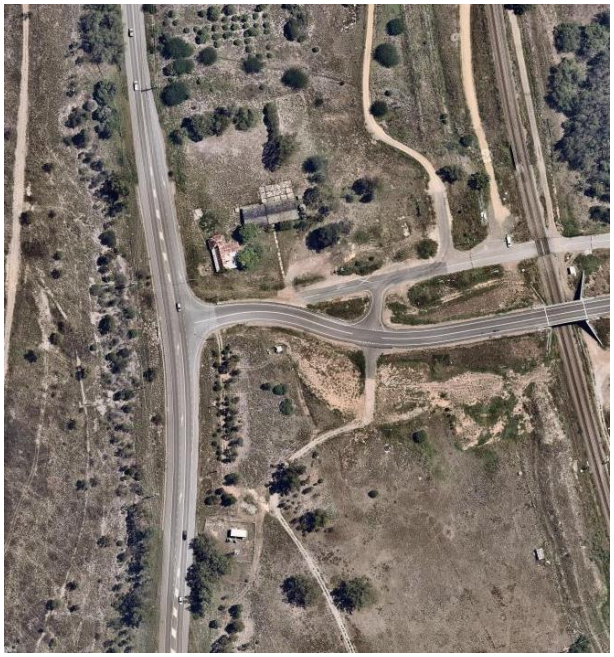
Another form of operational measurement is to assess the Degree of Saturation (DoS) of individual intersections. An ideal DoS is less than 0.9 and up to 0.8 is considered satisfactory. As the DoS approaches 1.0, the intersection will be close to capacity, with queue lengths increasing.

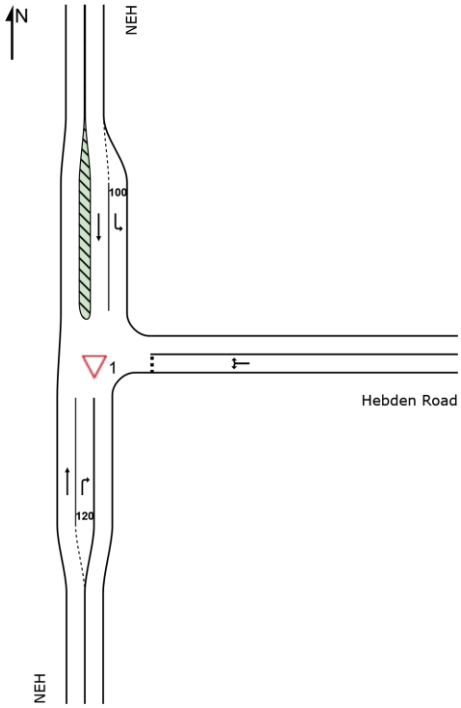
The layout of the New England Highway / Hebden Road (south) intersection modelled in SIDRA is shown in **Figure 4-7**. Although the Hebden Road approach is wide enough to provide storage for more than one vehicle, the approaches were modelled conservatively by using a single lane approach.

The intersection performance results presented in **Table 4-3** indicate the intersection performs well with a DoS less than 0.8 the AM and PM peak. The intersection is priority controlled so the highest movement delay is used to understand the performance of the intersection. The highest movement delay of the intersection is the Hebden Road right turn, which is a LoS F in the AM and PM peak. However, this movement impacts less than 13vph and was therefore not considered to reasonably reflect the performance of the intersection. Instead, the next highest movement delay was used to assess intersection performance. This was the south approach right turn in the AM peak and the Hebden Road left turn in the PM peak, which results in a LoS A and LoS C in the AM and PM peak respectively.

Figure 4-7 New England Highway / Hebden Road (south) Intersection Model Layout

Aerial photo of intersection	SIDRA model layout





Source: Background image from Nearmap (accessed 2020)

Table 4-3 New England Highway / Hebden Road (south)– Without Project Construction Traffic

Period	Degree of Saturation	Highest Movement Delay (s)	Level of Service
2020 AM Peak	0.560	9.0	LOS A
2020 PM Peak	0.556	32.3	LOS C

The intersection performance results presented in **Table 4-4** indicate the New England Highway / Hebden Road intersection with the addition of project construction traffic, performs well with a DoS less than 0.8 in the AM and PM peak. The intersection is priority controlled so the highest movement delay is used to understand the performance of the intersection. The highest movement delay of the intersection is the Hebden Road right turn, which is a LoS F in the AM and PM peak.

Similar to the intersection assessment without project construction traffic, this movement impacts less than 13vph and was therefore not considered to reasonably reflect the performance of the intersection. Instead, the next highest movement delay was used to assess intersection performance. This was the south approach right turn in the AM peak, and the Hebden Road left turn out in the PM peak, which results in a LoS A and LoS C in the AM and PM peak respectively.

Table 4-4 New England Highway / Hebden Road (south)– With Project Construction Traffic

Period	Degree of Saturation	Highest Movement Delay (s)*	Level of Service
2020 AM Peak	0.561	9.1	LOS A
2020 PM Peak	0.660	34.2	LOS C

Comparing the SIDRA analysis results in **Table 4-3** and **Table 4-4** indicates the intersection is not detrimentally impacted by the addition of project construction traffic (same LoS) and therefore would not require any upgrades. The SIDRA movement summaries are presented in **Appendix D**.

4.4.2 Impact to other nearby intersections

Data is limited for the other nearby intersections including the other access via Hebden Road (north), however the intersection performance of New England Highway / Hebden Road (south) intersection is considered to reflect the worst case impact of the Project. Impacts on the performance of the other nearby intersections is expected to be less based on the lack of other traffic generating land uses nearby and generally low vehicular traffic in the road network.

The highest delay movement of the Hebden Road (south) and the other access at Hebden Road (north) would be the right turn out of the minor side road onto New England Highway. If delays on this turning movement deteriorates, it is recommended project construction related traffic avoid travelling between the hours of 5.00-6.00am and 4.00-5.00pm when traffic peaks on the New England Highway.

4.4.3 Other Considerations

4.4.3.1 Local School Buses

Local school buses operate on the northern side of the New England Highway. The relevant school routes are Singleton Primary & High School Route 6310 & 6339. These two routes are the same, and apply in the AM and PM respectively. They travel from Scrumlo Road to Hebden Road onto the New England Highway and vice versa. Route 6310 operates at 7:55am from Scrumlo Road and Route 6339 at 3:42pm from Singleton once a day.

The interaction of construction general traffic and OSOM vehicles can be coordinated with the Primary & High School and be addressed as part of the TMP. It is anticipated that based on the low frequency (once in the morning and once in the afternoon), the exposure to construction traffic is also similarly low and therefore would be a minor conflict.

5 Traffic Management

In order to mitigate the impact the Project has on the local road network, a high level traffic management strategy has been developed for the Project's critical areas/activities. This strategy is outlined below.

5.1 Traffic Management Plan

A TMP should be prepared to address the life of the project (construction, maintenance, operation and decommissioning). The TMP is to be prepared in accordance with the consent conditions, which may include the following:

- minimise the traffic safety impacts of the development and disruptions to local road users during the construction and decommissioning of the development, including:
  - temporary traffic controls, including detours and signage;
  - notifying the local community about development-related traffic impacts;
  - minimising potential conflict between development-related traffic and:
    - stock movements;
    - domestic animals;
    - school buses, in consultation with local schools; and
    - mining related traffic
  - implementing measures to minimise development-related traffic on the public road network outside of standard construction hours;
  - ensuring development-related traffic does not track dirt onto the public road network;
  - ensuring loaded vehicles entering or leaving the site have their loads covered or contained;
  - providing sufficient parking on site for all development-related traffic;
  - responding to any emergency repair requirements or maintenance during construction and/or decommissioning;
  - a traffic management system for managing over-dimensional vehicles; and
  - fatigue management;
- include a drivers code of conduct that addresses:
  - travelling speeds;
  - procedures to ensure that drivers to and from the development adhere to the designated over dimensional and heavy vehicle routes; and
  - procedures to ensure that drivers to and from the development implement safe driving practices; and
- include a detailed program to monitor and report on the effectiveness of these measures and the code of conduct.

As part of the consultation process, TfNSW indicated the need to consider future projects in the region such as M1 to Raymond Terrace and the Hexham Road Straight projects which are proposed in a similar timeframe to the Project. As such, the Proponent will consult with TfNSW and relevant stakeholders in the development of the applicable TMP at the time to reduce impacts from the turbine delivery program should the projects occur in parallel.

5.2 Stakeholder Management Plan

A Stakeholder Management Plan, inclusive of a Communications Plan is to be developed to provide relevant information to the public, general stakeholders, mining and extractive companies which utilise Hebden Road (whilst in operation) and affected landowners which will include, but not be limited to the following:

- Issues that have been raised, inclusive of method of resolution and achievement of resolution;

- A communications matrix that clearly defines responsibility of each party including individuals and companies; and
- A product delivery campaign which will include truck volumes and durations.

Communications to key stakeholders informing of heavy vehicle haulage routes and project progress includes but may not be limited to:

- Notifications in local newspapers;
- Notifications in online news outlets and local news social media pages; and
- Notifications via local radio stations.

Key stakeholder communications will detail that in the event of any complaints, a contact phone number (or other communication method technologically relevant at the time) be made available.

5.3 Internal Management

An internal management strategy will be established within the Project Boundary. This strategy will form part of the site's induction that will be undertaken by all personnel on-site.

The following key items are to be implemented:

- 40 km/h speed limit on internal access roads;
- Radio communication between construction vehicles available at all times;
- All loads to be correctly restrained; and
- Warning signage to be provided at critical areas and intersection points.

The on-site parking within the construction compound is required to provide a dedicated safe area where personnel can access their vehicles.

Once a transport contractor has been nominated, they will be required to produce a Job Safety Assessment (or similar) specific to the Project.

5.4 Working Hours

The nominal standard working hours for the proposed construction of the Project will be generally 7 am to 6 pm (weekdays) and 8:00am to 1:00pm (Saturday) for standard construction work (additional activities may be subject to an 'Out of Hours Protocol'). Code of Conduct

During construction of the site and ongoing operation, a code of conduct should be issued to all contractors to ensure impacts to surrounding residents and general road users is minimised.

5.4.1 Driver Induction

Prior to commencing construction activities, regular and returning drivers of semi-trailers, rigid vehicles and/or B-Double and OD vehicles that will access and egress the site for pick-up and delivery of material will be required to undertake a driver induction. The induction course will need to be developed early to ensure that it is ready prior to construction activity (including any site preparation works) commencing. Irregular and one off drivers of pick-ups and deliveries would be considered exempt to this induction requirement. The induction course would cover:

- Suitable routes to and from the site;
- Suitable times of travel (i.e. outside of school bus times);
- Applicable traffic management procedures that will need to be in place prior to approaching or departing the site (if required);
- Communications and notification procedures;
- Speed restrictions (on the road network and the site);
- Environmental procedures; and
- Safety procedures (during transportation and in the evident of an incident / emergency).

5.4.2 Contractor Liaison

A nominated contractor will be responsible for liaising with appropriate contractor(s) responsible for delivery of materials to/from the site to ensure that they comply with the TMP, including adherence to specified construction traffic routes. It will be the contractor's responsibility to ensure routes are satisfactory and that appropriate measures (traffic management or other mitigation measures as well as liaison with relevant local authorities) are in place to ensure safe movement of vehicles to/from the site.

5.4.3 Vehicle Access

Construction Vehicle Access

All vehicle access during the construction phase will be via the identified site access locations and haulage routes described in **Section 1.3**.

Vehicle Height Specifications

Generally, all vehicles accessing the Project site (with exception of OSOM vehicles and OD vehicles) will operate within the permitted height requirements. If necessary, the applicable approvals will be sought in instances where vehicle height exceeds that which is permitted on the public road network.

Oversized Vehicles

OSOM vehicles will access the site via the identified site access locations and roads on Hebden Road and Bowmans Creek Road/Albano Road. The OSOM routes are subject to the separate permit and approval processes which will be undertaken by accredited transport providers.

Local residents would be informed of such activities via letter drop or by electronic communications at least 1 week in advance.

Emergency Services

Emergency service vehicles will be permitted unrestricted access to the site.

Construction Staging / Parking

All car parking will be provided within the confines of the site and will therefore not encroach on the local road network. There will be sufficient area within the site during differing phases of construction to accommodate vehicle parking, including construction traffic deliveries and on-site manoeuvring as and when required.

A nominated contractor will continually monitor parking provisions within the Project Boundary, as well as the staging of construction vehicles into and out of the Project site, to ensure no impact on the local road network occurs. If required the day-to-day vehicle parking demands could be reduced via the promotion and consideration of car sharing and mini-bus services.

Signage

Construction vehicle signage is to be considered and implemented prior to any works being undertaken. There may potentially be the need to further reduce speed limits on some roads to facilitate safe vehicle access around sites. Appropriate signage will be required in these instances to inform road users. This is to be developed following nominated contractor commission and agreed with key stakeholders.

6 Conclusions

This report has presented and detailed the Bowmans Creek Wind Farm project on behalf of Epuron, and assessed the impact to the existing road network during construction, operation and decommission phases. The Project is a SSD to be assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*. This report has addressed the SEARs, assessing key traffic and transport issues as summarised in **Appendix A**.

The OSOM vehicle manoeuvring from the Port of Newcastle to the Project has been undertaken based on AutoCAD swept path and a site inspection. The key items for the movement of OSOM vehicles are summarised below, with detailed plans and mitigation locations provided in **Appendix C**:

- Port of Newcastle to Hebden Road – minor works required on Selwyn Street upon exit from the Port. Access to Pacific Highway and Hunter Expressway will require traffic management measures and likely short-term road closures.
- Route 1 - initial segment of the route near the New England Highway requires intersection works, bridge capacity assessment and road widening before the transport vehicle travels on Hebden Road. This is based on the tail of the OSOM vehicle encroaching into the cutting on the western side of the Highway.
- Route 3 - the vertical geometry is undulating and may require road improvements in accordance with Council and the OSOM vehicle specification requirements. This can be addressed as part of the detailed design.

The construction phase of the Project is likely to generate the highest levels of vehicle movements. The peak period of the Project has been identified as Month 7-8, consisting of 141 one-way daily trips of which approximately 66 one-way trips are heavy vehicles. The work force is expected to be distributed by 50% Singleton, 45% Muswellbrook and 5% Scone. The key roads accessing the project site were assumed to be Hebden Road (north and south) via New England Highway.

The peak hour intersection analysis has been undertaken at the Hebden Road (south) / New England Highway intersection. The highest delay movement of the Hebden Road (south) and the other access at Hebden Road (north) would be the right turn out of the minor side road onto New England Highway. If delays on this turning movement deteriorates, it is recommended project construction related traffic avoid travelling between the hours of 5.00-6.00am and 4.00-5.00pm when traffic on New England Highway is at its peak.

During operational phase, there is expected to 15 personnel on-site. The level of traffic generated during the operation of the Project is considerably lower than that assessed as part of the construction phase. It is unlikely to result in adverse road conditions during the operation.

Decommissioning of the project will see traffic generation levels lower than the construction phase due to a number of services not being required (e.g. concrete mixers, delivery of construction material etc).

A high level traffic management strategy has been developed for the Project's critical areas/activities. This strategy includes a Traffic Management Plan, Stakeholder Management Plan and Driver Code of Conduct, identifying hours of construction activities and internal site management.

APPENDIX A

SEARS

BOWMANS CREEK WINDFARM SEARS

SEARS	Section of this report where item is addressed in further detail
▪ Assess the construction, operational and decommissioning traffic impacts of the development.	▪ Section 4
▪ Provide details of traffic volumes (both light and heavy vehicles) and transport and haulage routes during construction, operation and decommissioning, including traffic associated with sourcing raw materials (water, sand and gravel).	▪ Section 4
▪ Assess the potential traffic impacts of the project on road network function including intersection performance, site access arrangements, site access and haulage routes and road safety, including school bus routes and school zones.	▪ Section 4
▪ Assess the capacity of the existing road network to accommodate the type and volume of traffic generated by the project (including over-mass / over-dimensional traffic haulage routes from port) during construction, operation and decommissioning.	▪ Section 4
▪ An assessment of the likely transport impacts to the site access and haulage routes, site access point, any rail safety issues, any Crown land, particularly in relation to the capacity and conditions of the roads.	▪ Section 3 ▪ Appendix C
▪ Provide details of measures to mitigate and / or manage potential impacts including a schedule of all required road upgrades (including resulting from over mass / over dimensional traffic haulage routes), road maintenance contributions, and any other traffic control measures, developed in consultation with the relevant road authority.	▪ Section 3 ▪ Section 5 ▪ Appendix C

STAKEHOLDER REQUIREMENTS		Section of this report where item is addressed in further detail
Muswellbrook Shire Council	▪ Consultation in relation to over dimensional traffic, additional to road authority	▪ Section 4
Singleton Shire Council	▪ Clarify whether construction and maintenance traffic will utilise local roads in Singleton Shire Council LGA. Also consider the likely impacts on existing road infrastructure along Bridgman Road, Goorangoola Road and Old Goorangoola Road	▪ Section 3 ▪ Section 4
Transport for NSW	▪ Traffic study in accordance with Guide to Traffic Generating Development 2002	Section 4
	▪ Construction management plan	▪ Section 5
	▪ Impacts on regional and state road network including pedestrian, cyclist and public transport facilities and provision for service vehicles	▪ Section 4

APPENDIX B

PHOTO INVENTORY

Photo 1 – looking west on Hebden Road to New England Highway intersection

Photo 2 – Looking east on Hebden Road at bridge over ARTC line

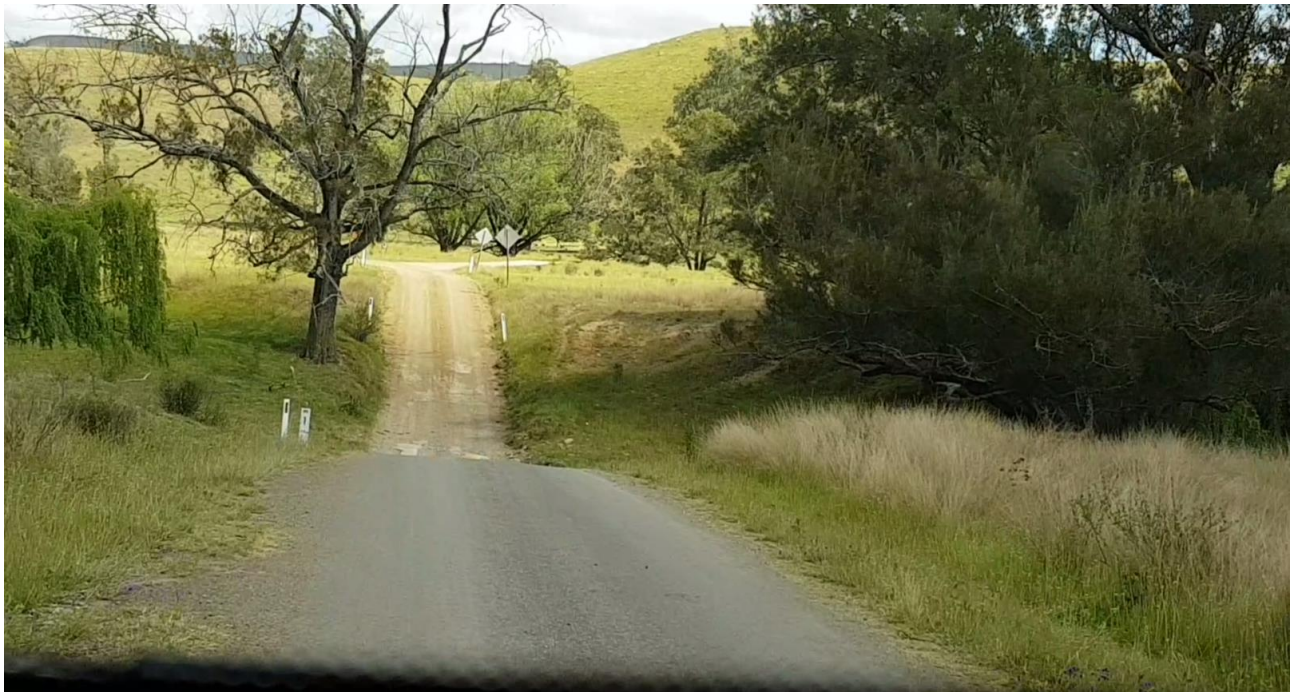


Photo 5 – Looking west on Bowmans Creek Road / Albano Road at causeway example

APPENDIX

C

OSOM ROUTE ASSESSMENT

Table C1: Hebden Road & Haulage Routes 1 to 3

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
1	Hebden 1	Furniture	Guardrail removed or relocated during turbine delivery		
1	Hebden 1	Overhang	Load path clearance required, embankment may need to modified	Y	
2	Hebden 1	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
2	Hebden 1	Property	Vehicle and load path near property, may require landowner notification		
2	Hebden 1	Overhang	Load path clearance required, trees require trimming		Y
3	Hebden 1	Driver Instructions	For wheel path to stick to pavement and avoid bridge abutment, truck will need to turn later.		
3	Hebden 1	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
4	Hebden 1	Property	Property boundary unclear		
4	Hebden 1	Pavement Widening	If 3 "Driver Instructions" occur, pavement widening will need to occur	Y	
5	Hebden 1	Furniture	Guardrail removed or relocated during turbine delivery		
6	Hebden 1	Property	Vehicle and load path near property, may require landowner notification		
7	Hebden 1	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
8	Hebden 1	Furniture	Machinery above OSOM height. Guardrail either side and close to edge of pavement and would require relocation or removal		
9	Hebden 1	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
10	Route 1 (Hebden)	Furniture	A tension line supporting the power pole is potentially within the OSOM height, this will require a survey to confirm		
11	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
11	Route 1 (Hebden)	Property	Vehicle and load path on property, landowner notification required. Vehicle could turn later to avoid property; however, this would require widening on the righthand side of the road		

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
12	Route 1 (Hebden)	Furniture	Potential impacts to guardrail. Guardrail (on both sides of the bridge) removal or relocation required		
12	Route 1 (Hebden)	Overhang	Load path clearance required		
13	Route 1 (Hebden)	Stuctural Design	The structural capacity of the bridge in terms of weight is required.		
14	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
14.5	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
15	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
16	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
17	Route 1 (Hebden)	Property	Vehicle and load path near property, may require landowner notification		
17	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
18	Route 1 (Hebden)	Overhang	Trees require trimming for load path		Y
19	Route 1 (Hebden)	Overhang	load path clearance required. Land slopes upward and fence is higher than road surface. Possible earthworks required.	Y	
20	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
20	Route 1 (Hebden)	Property	Vehicle and load path on property, landowner notification required		
21	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
21	Route 1 (Hebden)	Overhang	Trees require trimming for load path		Y
21	Route 1 (Hebden)	Property	Vehicle and load path on property, landowner notification required		
22	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
22	Route 1 (Hebden)	Overhang	Trees require clearing.	Y	

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
23	Route 1 (Hebden)	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
23	Route 1 (Hebden)	Property	Vehicle and load path near 2 x properties, will require landowner notification on at least one		
30	Albano	Overhang	Trees require trimming for load path		Y
30	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
31	Albano	Overhang	Load path clearance required		
31	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
32	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
33	Albano	Overhang	Trees require trimming for load path		Y
33	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
34	Albano	Property	Vehicle and load path near 2 x properties, will require landowner notification		
34	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
34	Albano	Overhang	Trees require trimming for load path		Y
35	Albano	Overhang	Trees require trimming for load path		Y
35	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
36	Albano	Overhang	Trees require trimming for load path		Y
37	Albano	Cattle Grid	Cattle grid will need to be widened and associated fences moved.	Y	
37	Albano	Overhang	Trees require trimming for load path		Y
37	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
38	Albano	Overhang	Trees require trimming for load path		Y

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
39	Albano	Overhang	Trees require trimming for load path		Y
40	Albano	Causeway	Steep road grade. OSOM vertical grade max 10%. Slope profile of causeway approx 30%. Would require vertical assessment and upgrades to causeway to create flatter profile.	Y	
40	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
42	Albano	Overhang	Trees require trimming for load path		Y
42	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
43	Albano	Overhang	Trees require trimming for load path		Y
43	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
44	Albano	Causeway	Steep road grade. OSOM vertical grade max 10%. Slope profile of causeway approx 30%. Would require vertical assessment and upgrades to causeway to create flatter profile.	Y	
44	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
44	Albano	Overhang	Trees require trimming for load path		Y
45	Albano	Overhang	Load path clearance required		
45	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
46	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
46	Albano	Property	Vehicle and load path on property, landowner notification required		
46	Albano	Overhang	Load path clearance required		
47	Albano	Property	Vehicle and load path on property, landowner notification required		
47	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
48	Albano	Causeway	Steep road grade. OSOM vertical grade max 10%. Slope profile of causeway approx 30%. Would require vertical assessment and upgrades to causeway to create flatter profile.	Y	
48	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
49	Albano	Cattle Grid	Cattle grid will need to be widened and associated fences moved.		
50	Albano	Property	Vehicle and load path potentially on property, landowner may require notification		
50	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
51	Albano	Property	Vehicle and load path potentially on property, landowner may require notification		
52	Albano	Cattle Grid	Cattle grid will need to be widened and associated fences moved.		
53	Albano	Property	Vehicle and load path on property, landowner notification required		
54	Albano	Property	Vehicle and load path on property, landowner notification required		
55	Albano	Property	Vehicle and load path potentially on property, landowner may require notification		
55.5	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
56	Albano	Overhang	Trees require trimming for load path		Y
56	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
57	Albano	Overhang	Trees require trimming for load path		Y
57	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
58	Albano	Overhang	Trees require trimming for load path		Y
58	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
59	Albano	Overhang	Trees require trimming for load path		Y

Figure Point	Route	Impact Type	Impact Description	Land Disturbance	Vegetation Trimming
59	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
60	Albano	Property	Vehicle and load path potentially on property, landowner may require notification		
60	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
61	Albano	Overhang	Trees require trimming for load path		Y
61	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	
62	Albano	Property	Vehicle and load path on property, landowner notification required		
62	Albano	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel), temporary road.	Y	

Table C2: Route 3 Additional

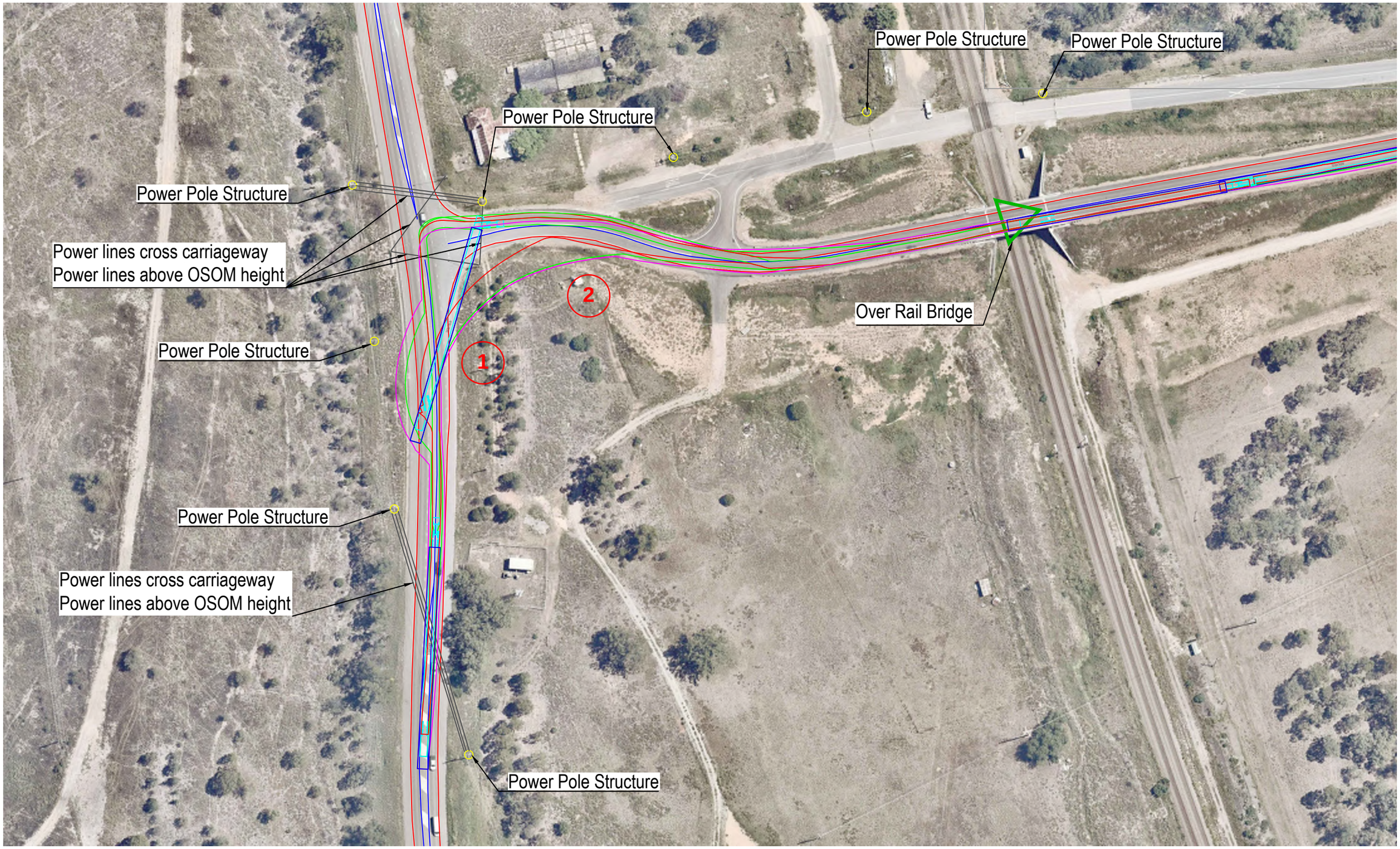
Figure Point Number	Route Section	Impact Type	Impact Description
63	Albano Road	Cattle Grid	Cattle grid will need to be modified and associated fences moved.
64	Albano Road	Tree Branch Trimming	Tree Branch Trimming Required
65	Albano Road	Road Widening	Minor widening and stabilising road surface needed
66	Albano Road	Road Widening	Minor widening and stabilising road surface needed
67	Albano Road	Tree Branch Trimming	Tree Branch Trimming Required
68	Albano Road	Road Widening	Minor widening and stabilising road surface needed
69	Albano Road	Road Widening	Minor widening and stabilising road surface needed
70	Albano Road	Embankment	Embankment may impact rear of load. Clearance to be reviewed
71	Albano Road	Property Overhang	Load path overhangs corner of property
72	Albano Road	Cattle Grid	Cattle grid will need to be modified and associated fences moved.

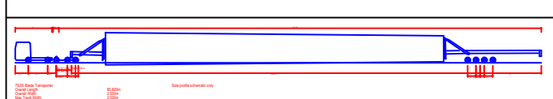
73	Albano Road	Tree Branch Trimming	Tree Branch Trimming Required
74	Albano Road	Tree Branch Trimming	Tree Branch Trimming Required
75	Albano Road	Cattle Grid	Cattle grid will need to be modified and associated fences moved.

Table C3: Port of Newcastle to Hebden Road

Figure Point Number	Route Section	Impact Type	Impact Description
1	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Fencing may need to be temporarily removed, however the rear overhang should clear the fencing. Wheel path stays within bitumen
2	Newcastle Port to Pacific Hwy/New England Hwy	Swept Path Overhang	Fencing may need to be temporarily removed, however the rear overhang should clear the fencing. Wheel path stays within bitumen
3	Newcastle Port to Pacific Hwy/New England Hwy	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required
4	Newcastle Port to Pacific Hwy/New England Hwy	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel)
4	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Traffic Light required to be relocated or removed during turbine delivery
4	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Power Poles appear to be clear of OSOM load
5	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	OSOM overhangs median however should be clear (vertically) of the barrier.
6	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Traffic lights appear close to the OSOM vehicle but should be clear. Wheel path stays within bitumen.
7	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	OSOM overhangs median however should be clear (vertically) of the barrier.
8	Newcastle Port to Pacific Hwy/New England Hwy	Pavement Widening	Wheel path exits pavement. Suitable sub base as per OSOM Standard required (e.g gravel)
8	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Power Poles required to be relocated or removed during turbine delivery
8	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Traffic Lights required to be relocated or removed during turbine delivery

Figure Point Number	Route Section	Impact Type	Impact Description
8	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Median barrier encroached by OSOM body and load and required to be removed during turbine delivery
8	Newcastle Port to Pacific Hwy/New England Hwy	Road Furniture	Alternate path for OSOM vehicle to utilise opposite side of the carriageway. Traffic lights appear close to the OSOM vehicle but should be clear. Wheel path stays within bitumen.
-	Pacific Hw/New England to John Renshar Dr/ Black Hill Rd	-	
9	John Reshaw Drive/ Black Hill Rd to John ReshawDr /Hart Rd	Road Furniture	OSOM vehicle to utilise opposite side of the carriageway. Traffic lights appear close to the OSOM vehicle but should be clear. Wheel path stays within bitumen.
10	John Reshaw Drive/ Black Hill Rd to John ReshawDr /Hart Rd	Swept Path Overhang	OSOM overhangs median however should be clear (vertically) of the barrier.
-	John Reshaw/Hart Rd to Hunter Exy/Wine Country Dr	-	
-	Hunter Exy/Wine Country Dr to New England/ Golden Hwy	-	
11	New England Hwy/Golden Hwy to New England Hwy/Rixs Creek	Swept Path Overhang	OSOM overhangs median however should be clear (vertically) of the barrier.
12	New England/ Riks Creek to New England/ Hebden Rd	Swept Path Overhang	OSOM overhangs median however should be clear (vertically) of the barrier.





VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

Preliminary Plan

FOR DISCUSSION PURPOSES ONLY
SUBJECT TO CHANGE
WITHOUT NOTIFICATION

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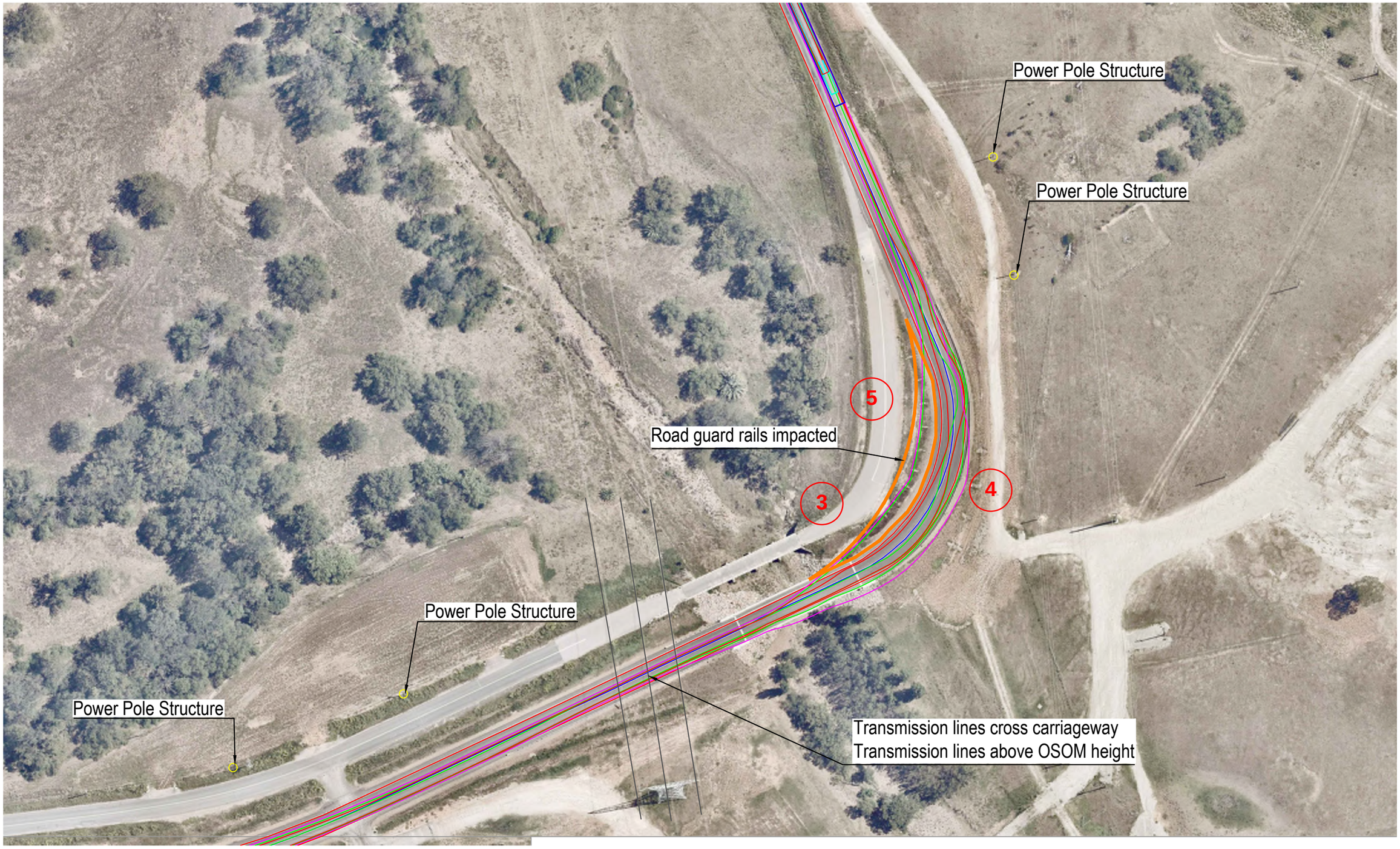
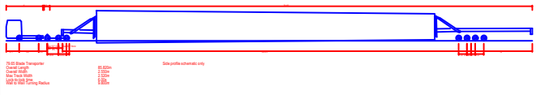
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Hebden Road Sheet 2 of 8 17 October 2-10





VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

Preliminary Plan

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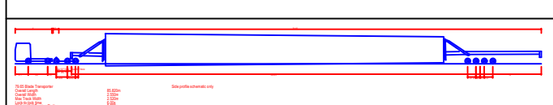
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Hebden Road Sheet 3 of 8 17 October 2-10

Transmission lines cross carriageway
Transmission lines above OSOM height

Potential property boundary impacts

6



VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

Preliminary Plan

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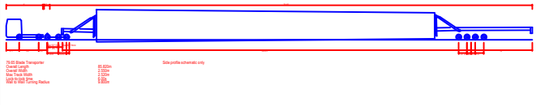
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Hebden Road Sheet 4 of 8 17 October 2-10



VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

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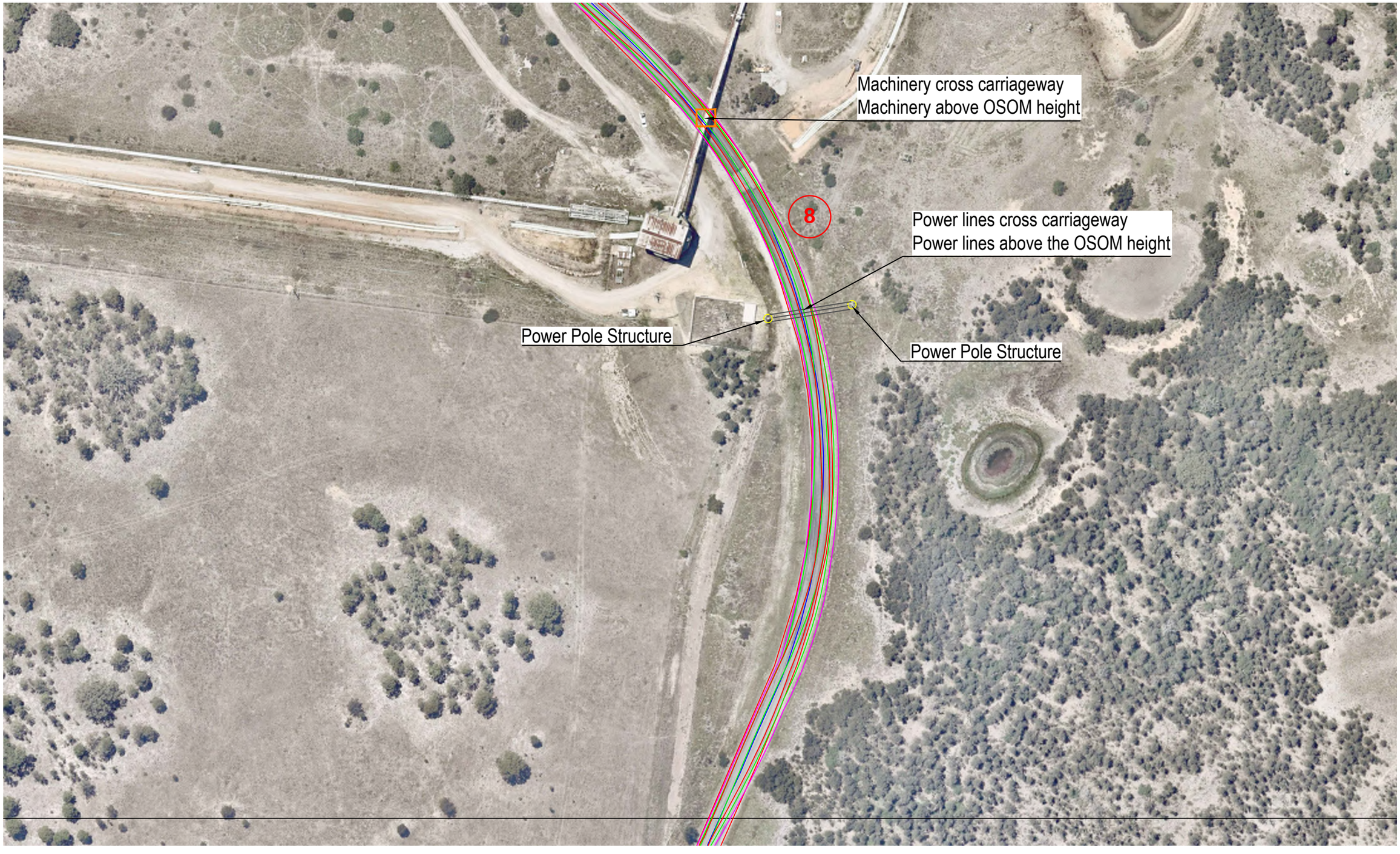

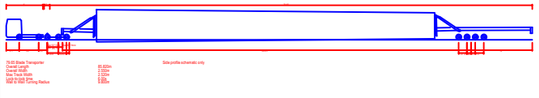

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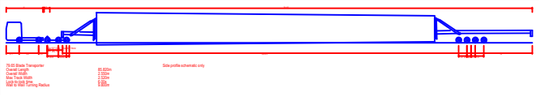

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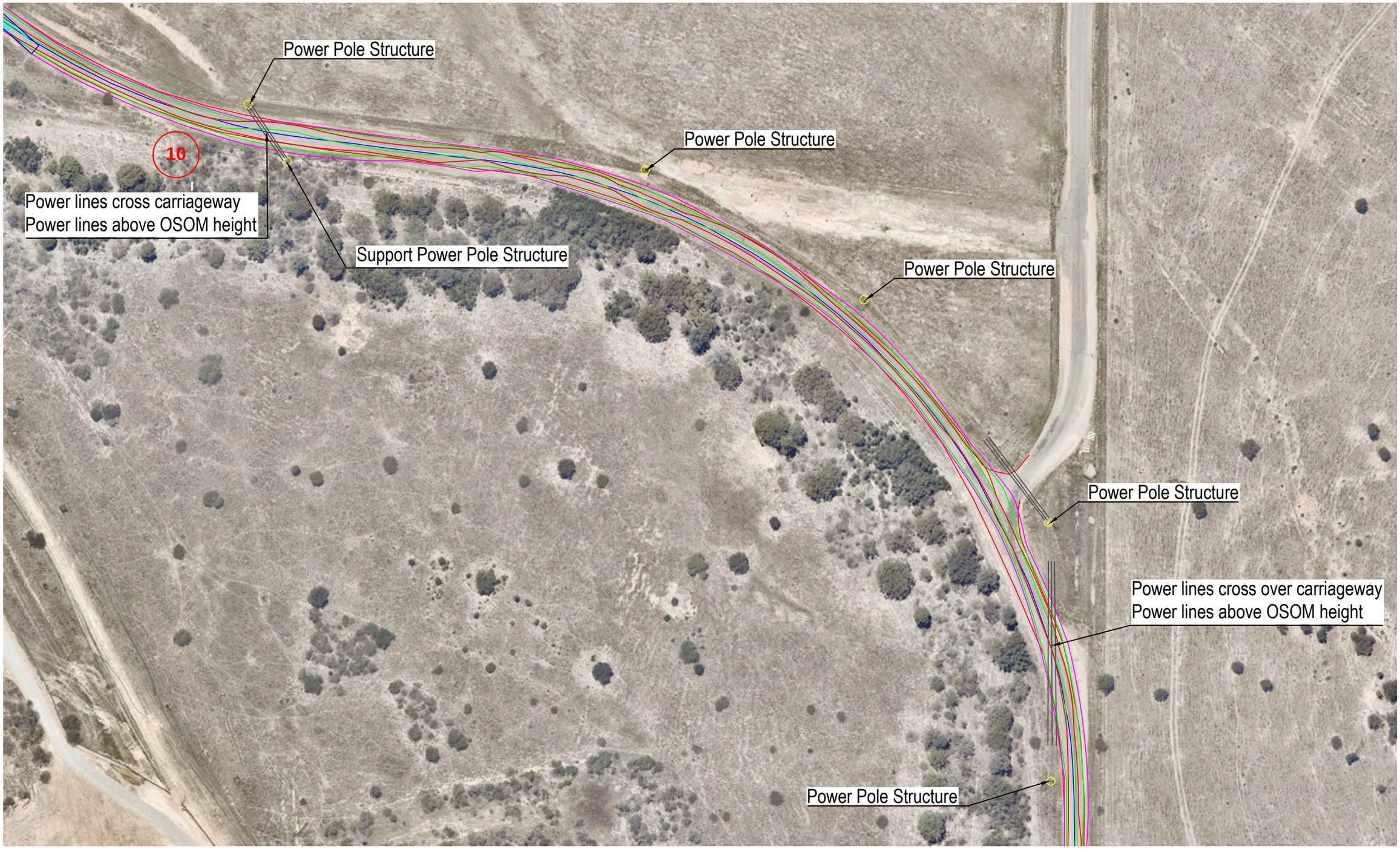

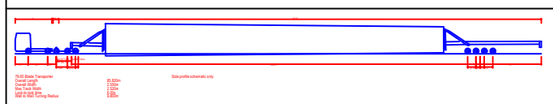

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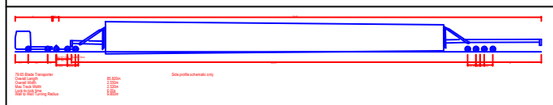

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Title	Route 1 Sheet 3 of 7 17 October 2-10

14

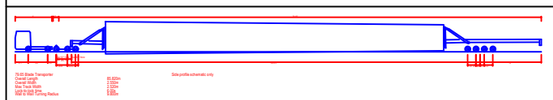
Potential imapcts to the guard railings

Bridge

13

Potential impacts to the guard railings

12



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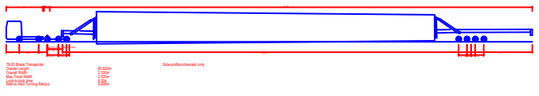

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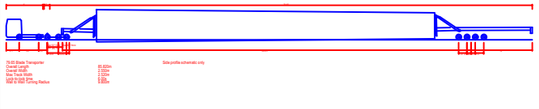
Title	Route 1 Sheet 5 of 7 17 October 2-10

18

Possible property boundary impacts

17

16



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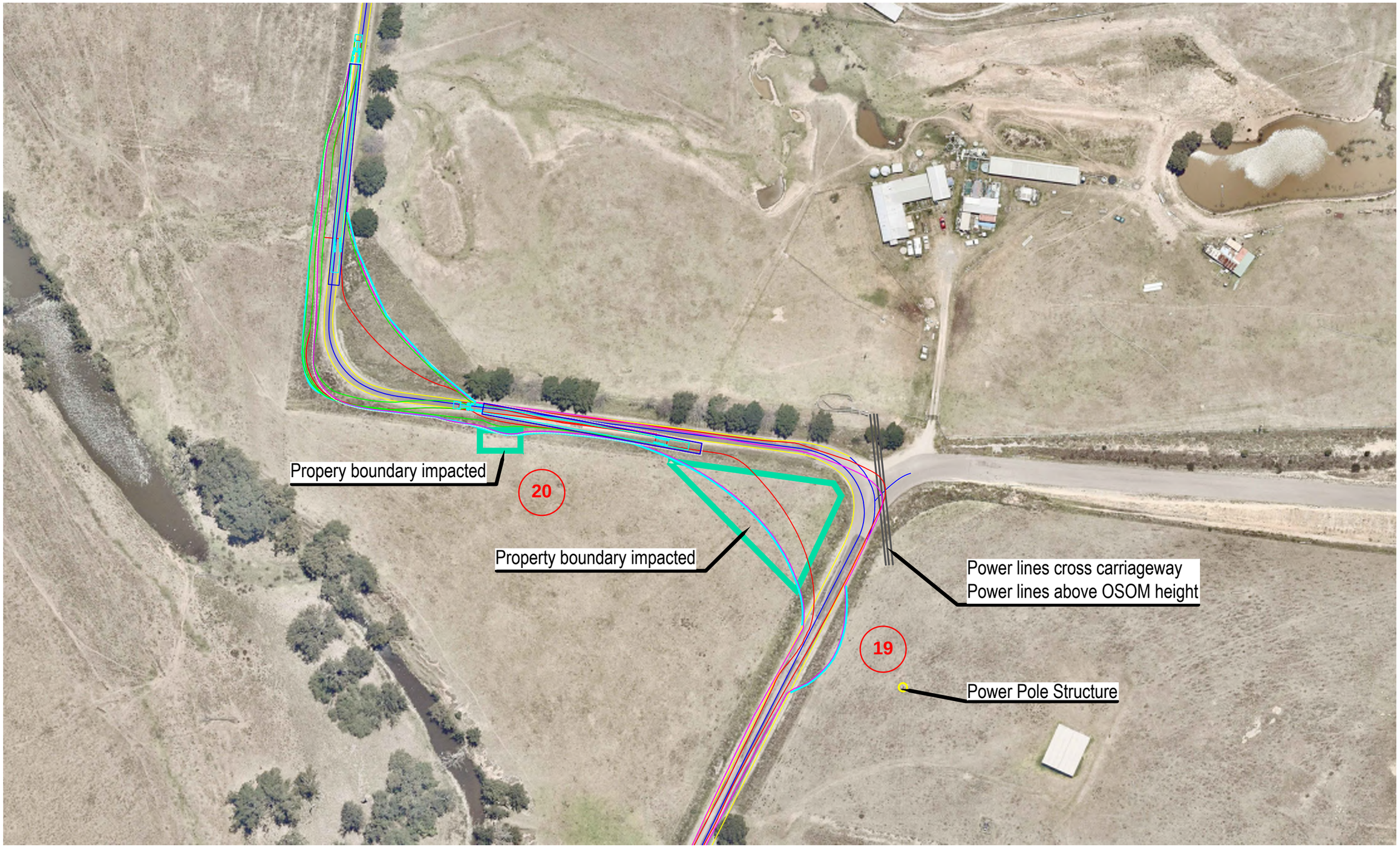

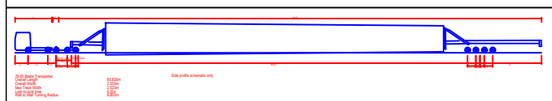

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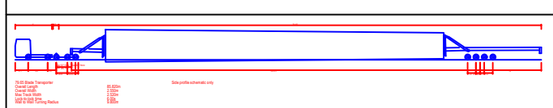

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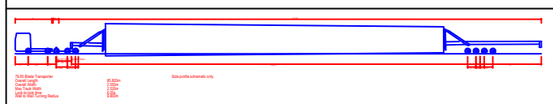
Title	Route 3 Sheet 3 of 16 17 October 2019



VEHICLE LEGEND

- VEHICLE BODY PATH
- LOAD PATH
- WHEEL PATH

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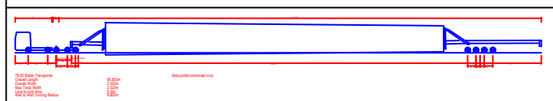

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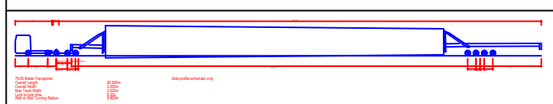

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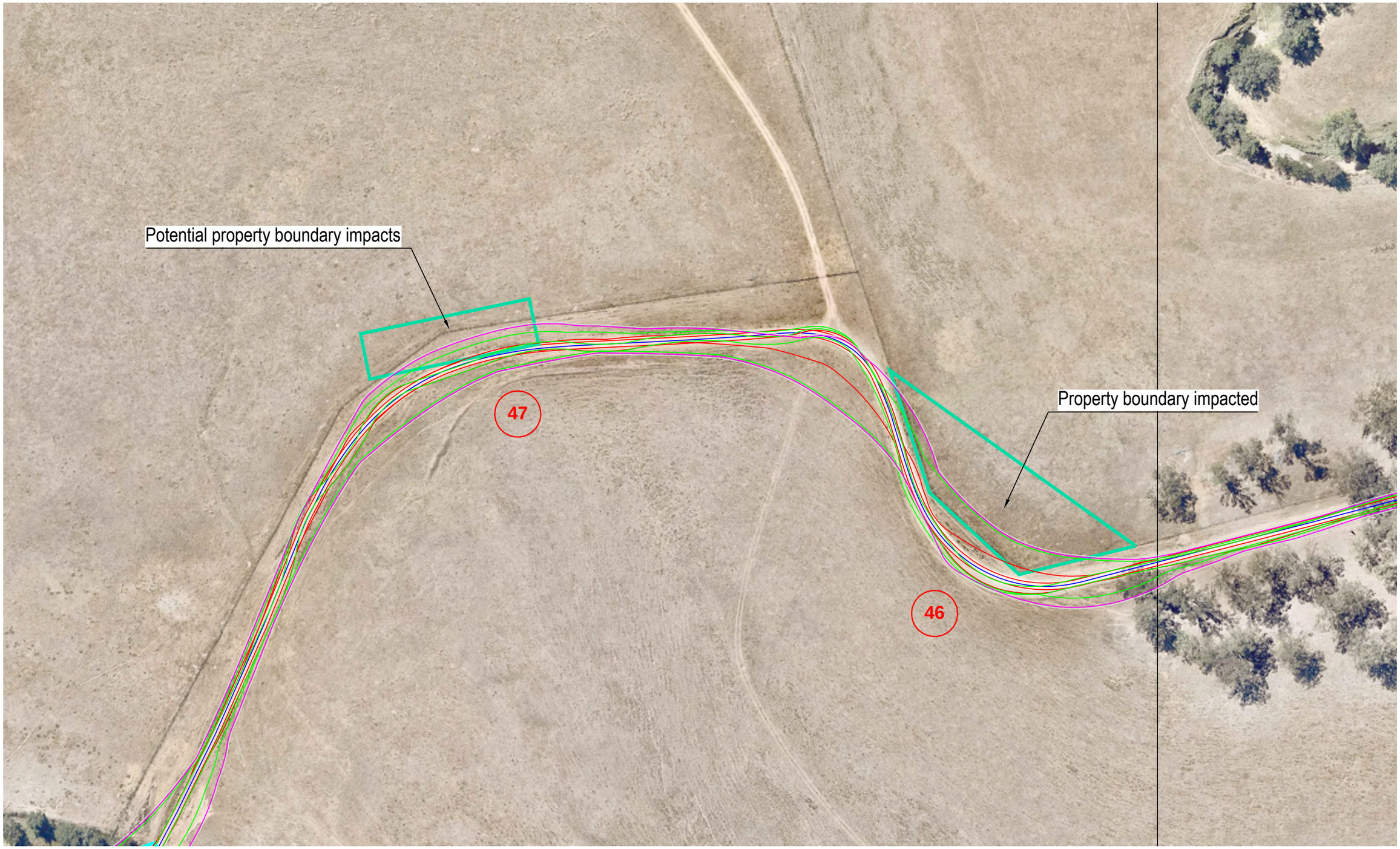

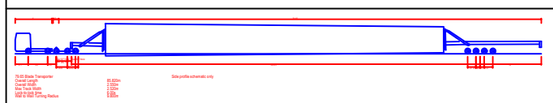

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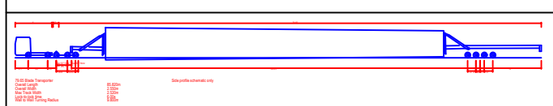

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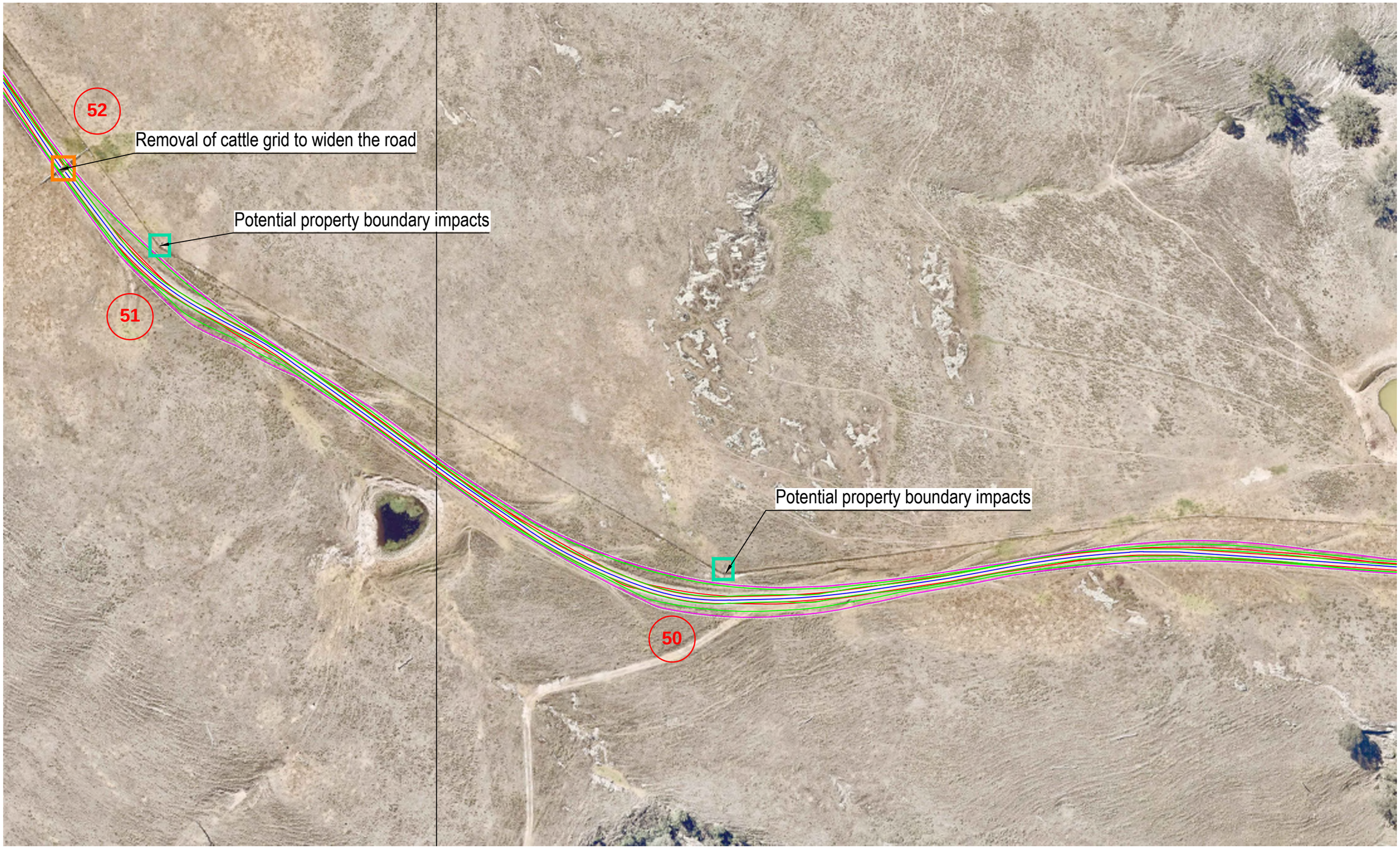

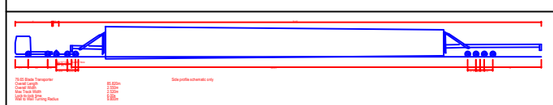

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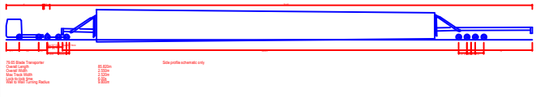

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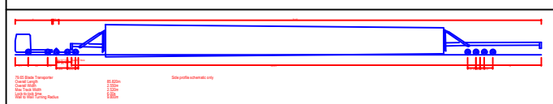

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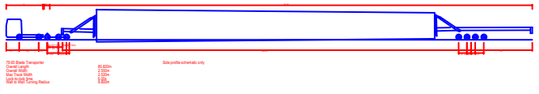
Title	Route 3 Sheet 11 of 16 17 October 2019



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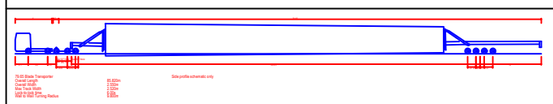

VEHICLE LEGEND

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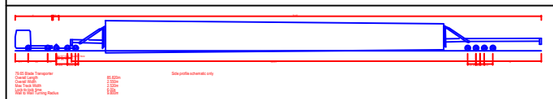

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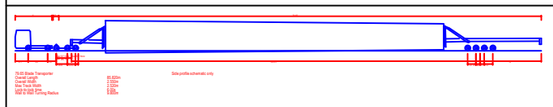
Title	Route 3 Sheet 14 of 16 17 October 2019



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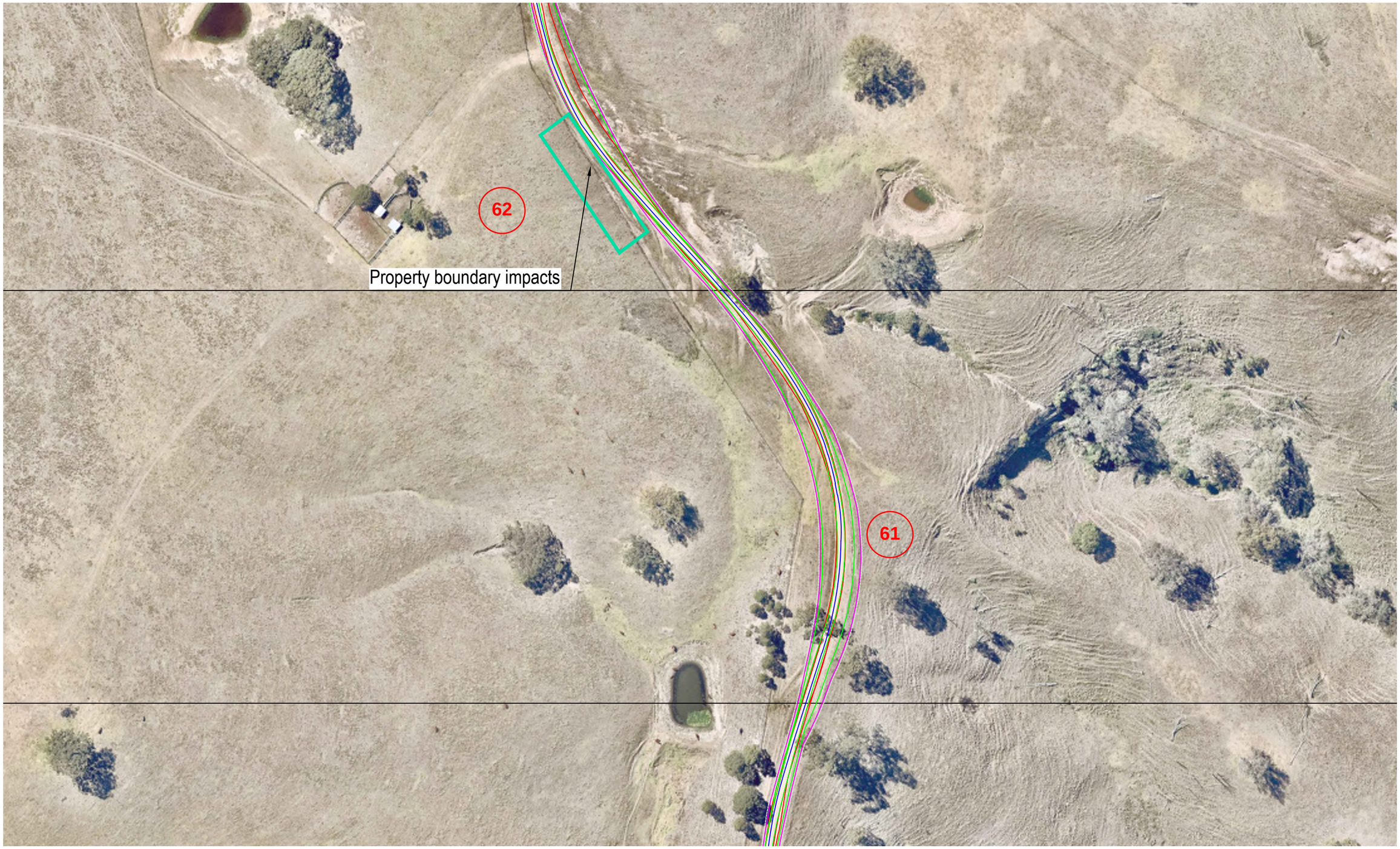

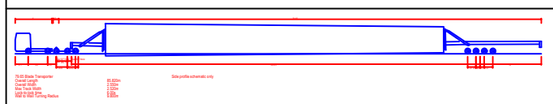

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Web: www.cardno.com.au

Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 16 of 16 17 October 2019

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

Preliminary Plan

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 1 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 2 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 3 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 4 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

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ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 5 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 6 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

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Web: www.cardno.com.au

Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 7 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

Preliminary Plan

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Web: www.cardno.com.au

Client: Hansen Bailey

Project: Bowmans Creek Wind Farm
80020015
Turbine Haulage Route

Title: Route 3
Sheet 8 of 11
19 February 2021

VEHICLE LEGEND

WHEEL PATH

LOAD PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 9 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

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ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 10 of 11 19 February 2021

VEHICLE LEGEND

WHEEL PATH

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ASSUMED SPEED 5km/h

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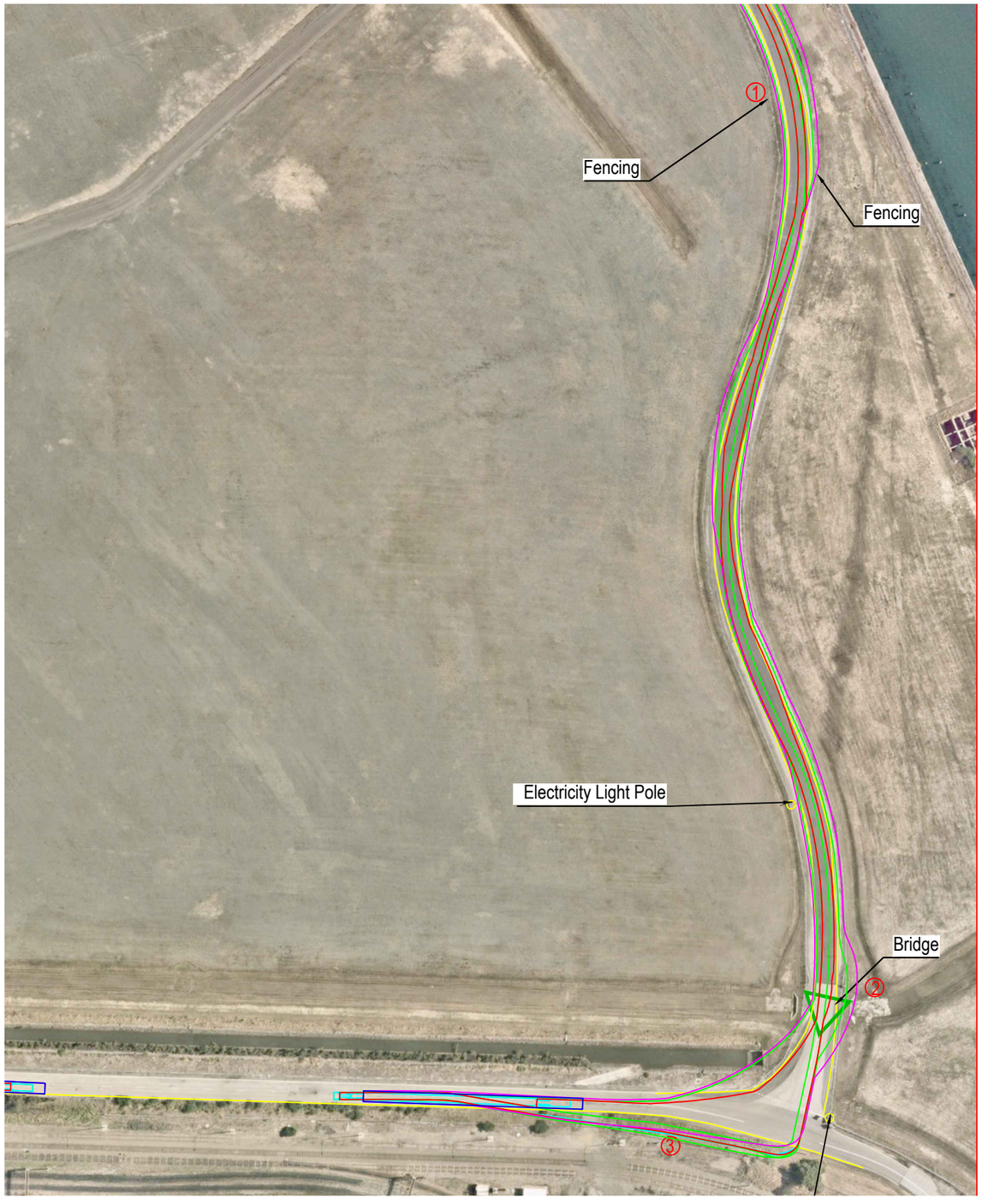
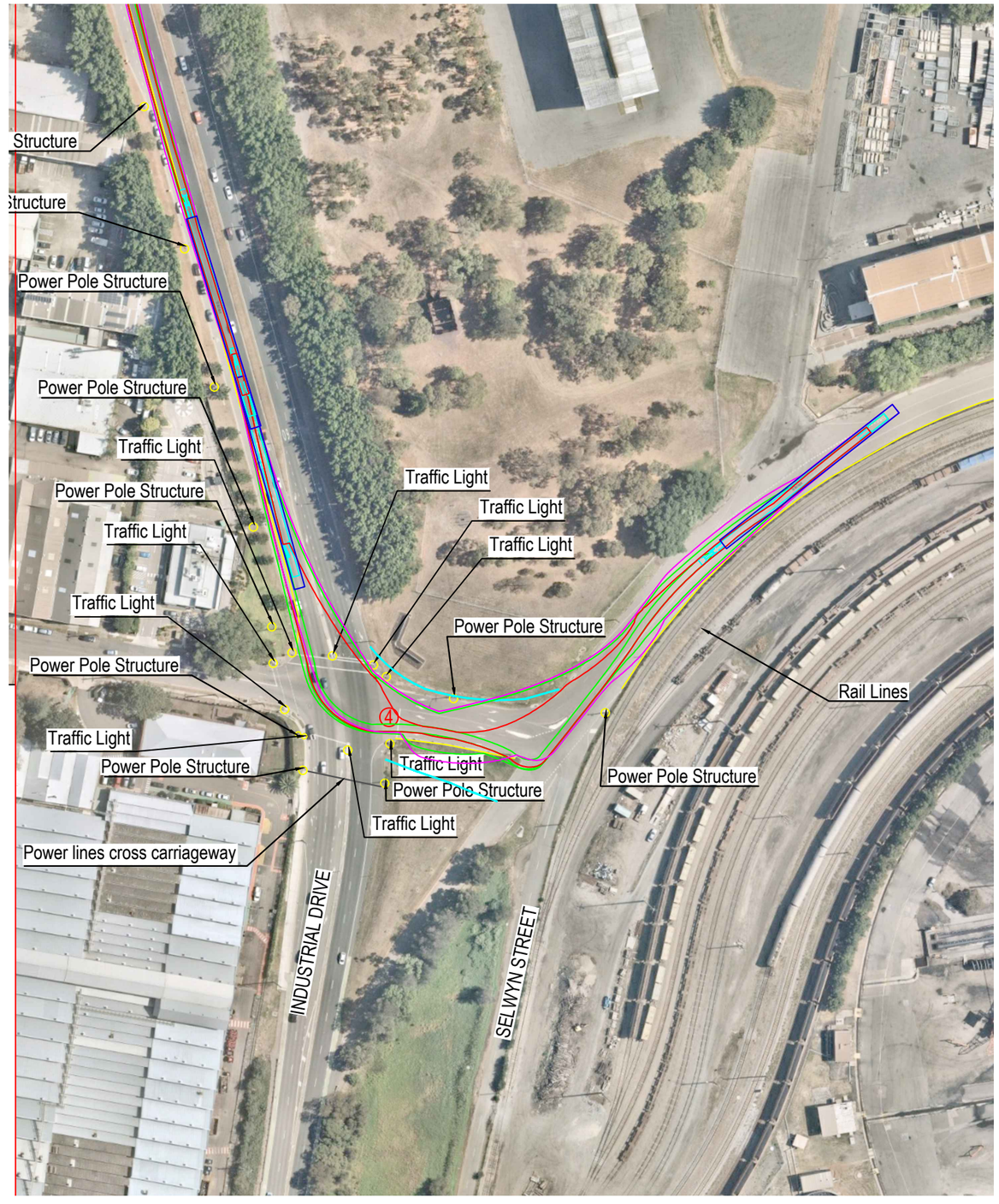
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Route 3 Sheet 11 of 11 19 February 2021





VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

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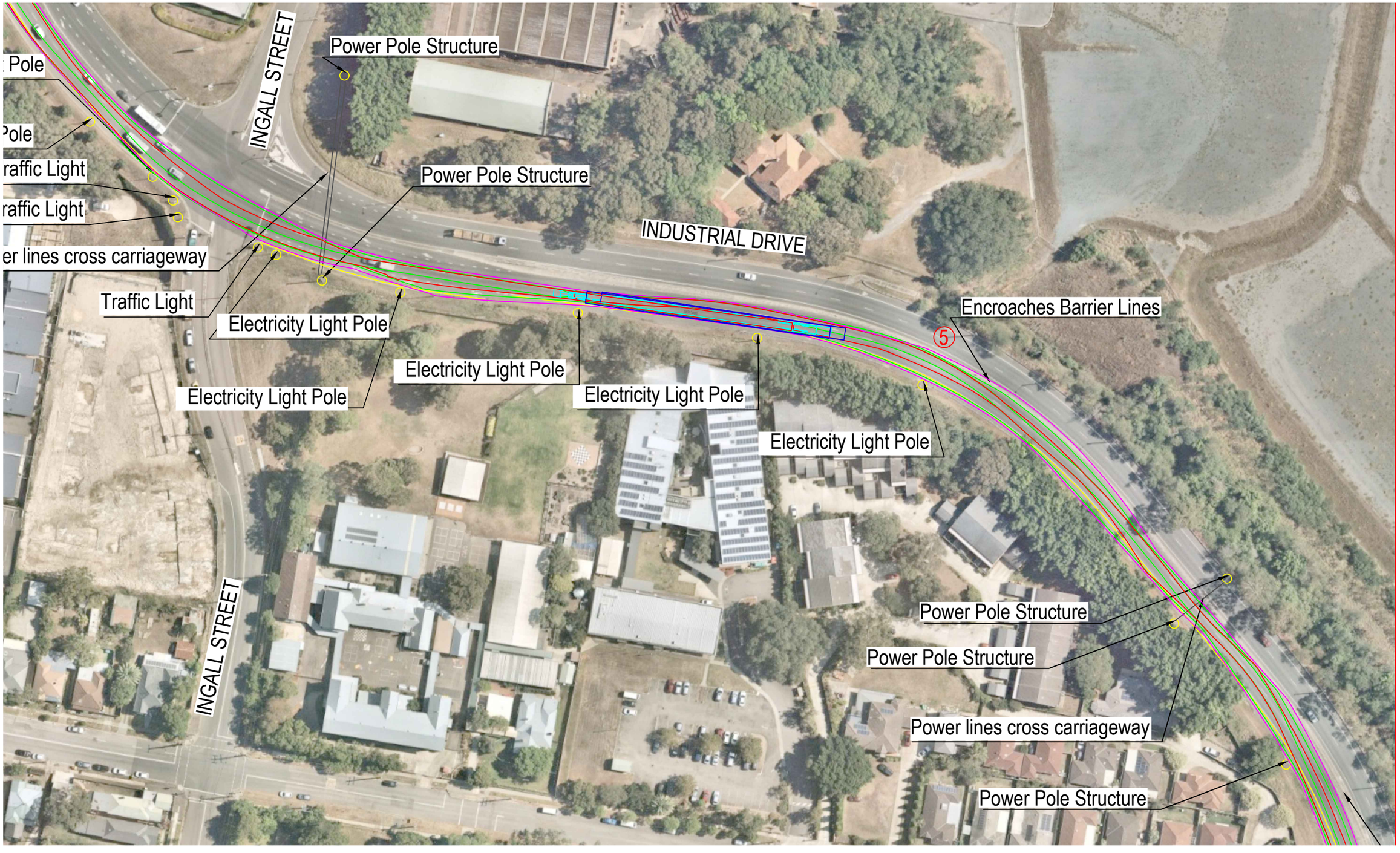
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020



VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

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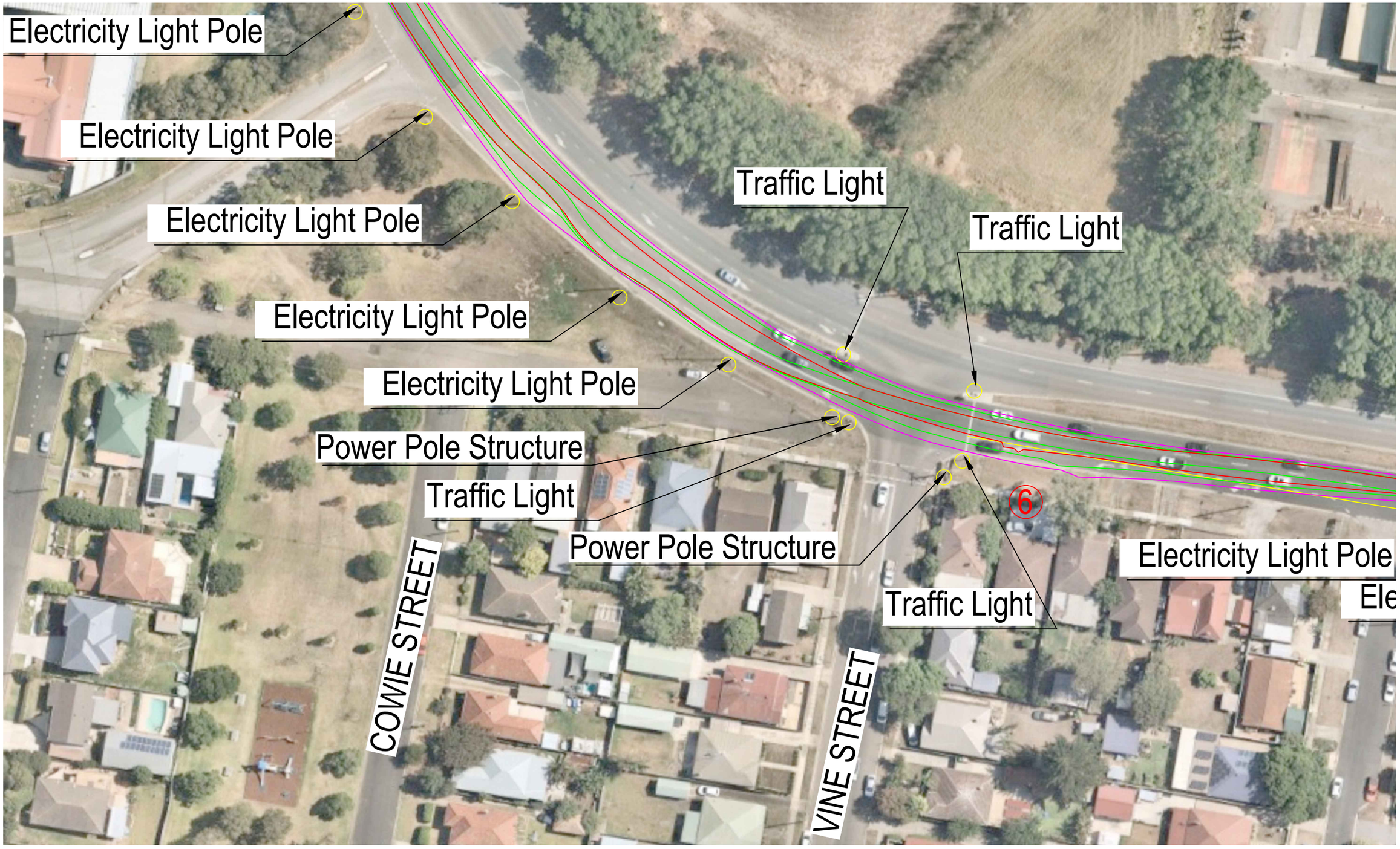
Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020



VEHICLE LEGEND

- VEHICLE BODY PATH
- LOAD PATH
- WHEEL PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020

VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

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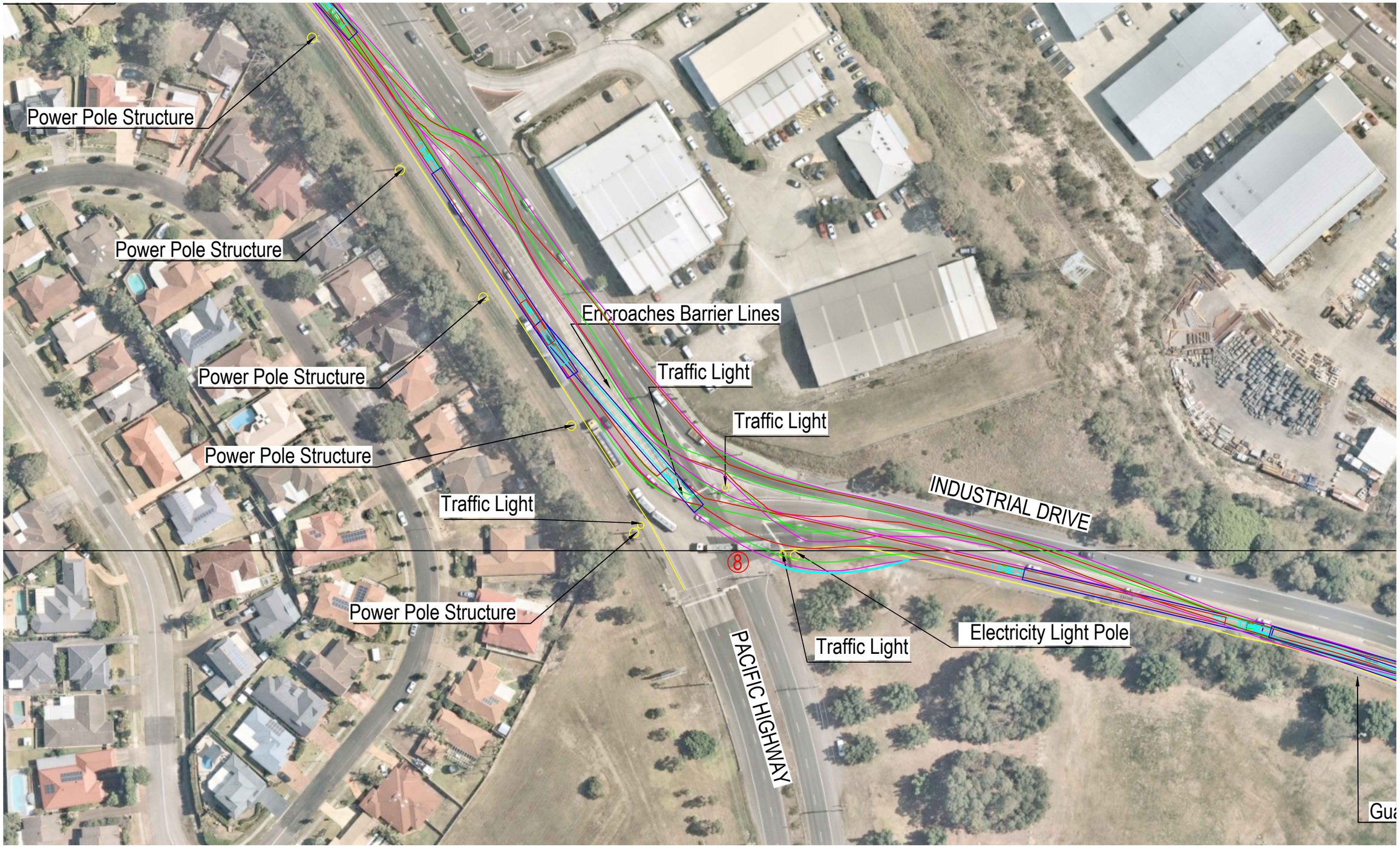
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020



VEHICLE LEGEND

VEHICLE BODY PATH

LOAD PATH

WHEEL PATH

ASSUMED SPEED 5km/h

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020

VEHICLE LEGEND

- VEHICLE BODY PATH
- LOAD PATH
- WHEEL PATH

Preliminary Plan

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 11 May 2020

VEHICLE LEGEND

- VEHICLE BODY PATH
- LOAD PATH
- WHEEL PATH

Preliminary Plan

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 4 May 2020

VEHICLE LEGEND

- VEHICLE BODY PATH
- LOAD PATH
- WHEEL PATH

Preliminary Plan

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Client	Hansen Bailey
Project	Bowmans Creek Wind Farm 80020015 Turbine Haulage Route
Title	Newcastle Port to Hebden Road 11 May 2020

APPENDIX D

SIDRA MOVEMENT SUMMARY

MOVEMENT SUMMARY

Site: 1 [NEH / Hebden Rd Base AM]

Site Category: Estimated 2020
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: NEH												
2	T1	1040	6.6	0.560	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.4
3	R2	174	1.8	0.169	9.0	LOS A	0.7	5.0	0.43	0.71	0.43	67.3
Approach		1214	5.9	0.560	1.4	NA	0.7	5.0	0.06	0.10	0.06	93.0
East: Hebden Road												
4	L2	57	1.9	0.196	8.3	LOS A	0.6	4.2	0.62	0.73	0.62	58.3
6	R2	5	20.0	0.196	104.7	LOS F	0.6	4.2	0.62	0.73	0.62	54.1
Approach		62	3.4	0.196	16.5	LOS B	0.6	4.2	0.62	0.73	0.62	57.9
North: NEH												
7	L2	19	38.9	0.013	8.8	LOS A	0.0	0.0	0.00	0.66	0.00	62.2
8	T1	276	14.9	0.155	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		295	16.4	0.155	0.6	NA	0.0	0.0	0.00	0.04	0.00	96.1
All Vehicles		1571	7.8	0.560	1.8	NA	0.7	5.0	0.07	0.12	0.07	91.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [NEH / Hebden Rd Base PM]

Site Category: Estimated 2020
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: NEH												
2	T1	508	9.9	0.279	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
3	R2	67	1.6	0.149	14.5	LOS B	0.5	3.7	0.72	0.91	0.72	61.1
Approach		576	9.0	0.279	1.7	NA	0.5	3.7	0.08	0.11	0.08	92.9
East: Hebden Road												
4	L2	51	4.2	0.556	32.3	LOS C	2.0	15.8	0.93	1.07	1.35	35.4
6	R2	13	58.3	0.556	154.2	LOS F	2.0	15.8	0.93	1.07	1.35	31.1
Approach		63	15.0	0.556	56.7	LOS E	2.0	15.8	0.93	1.07	1.35	34.4
North: NEH												
7	L2	3	0.0	0.002	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	75.3
8	T1	822	7.8	0.443	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.6
Approach		825	7.8	0.443	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.5
All Vehicles		1464	8.6	0.556	3.2	NA	2.0	15.8	0.07	0.09	0.09	89.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [NEH / Hebden Rd Base AM - with construction traffic]

with construction traffic
Site Category: Estimated 2020
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: NEH												
2	T1	1040	6.6	0.561	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.4
3	R2	208	3.0	0.204	9.1	LOS A	0.9	6.3	0.44	0.72	0.44	66.7
Approach		1248	6.0	0.561	1.6	NA	0.9	6.3	0.07	0.12	0.07	91.9
East: Hebden Road												
4	L2	67	6.3	0.220	8.5	LOS A	0.7	5.0	0.62	0.74	0.62	57.7
6	R2	5	20.0	0.220	114.1	LOS F	0.7	5.0	0.62	0.74	0.62	54.5
Approach		73	7.2	0.220	16.1	LOS B	0.7	5.0	0.62	0.74	0.62	57.4
North: NEH												
7	L2	19	38.9	0.013	8.8	LOS A	0.0	0.0	0.00	0.66	0.00	62.2
8	T1	276	14.9	0.155	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
Approach		295	16.4	0.155	0.6	NA	0.0	0.0	0.00	0.04	0.00	96.1
All Vehicles		1616	7.9	0.561	2.1	NA	0.9	6.3	0.08	0.13	0.08	90.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [NEH / Hebden Rd Base PM - with construction traffic]

with construction traffic
Site Category: Estimated 2020
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: NEH												
2	T1	508	9.9	0.280	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.8
3	R2	79	5.3	0.182	15.1	LOS B	0.6	4.7	0.73	0.91	0.73	59.5
Approach		587	9.3	0.280	2.1	NA	0.6	4.7	0.10	0.12	0.10	91.5
East: Hebden Road												
4	L2	85	6.2	0.660	34.2	LOS C	2.8	21.5	0.92	1.12	1.59	37.2
6	R2	13	58.3	0.660	164.9	LOS F	2.8	21.5	0.92	1.12	1.59	32.7
Approach		98	12.9	0.660	51.1	LOS D	2.8	21.5	0.92	1.12	1.59	36.6
North: NEH												
7	L2	3	0.0	0.002	7.8	LOS A	0.0	0.0	0.00	0.66	0.00	75.3
8	T1	822	7.8	0.443	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	99.6
Approach		825	7.8	0.443	0.1	NA	0.0	0.0	0.00	0.00	0.00	99.5
All Vehicles		1511	8.7	0.660	4.2	NA	2.8	21.5	0.10	0.12	0.14	86.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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