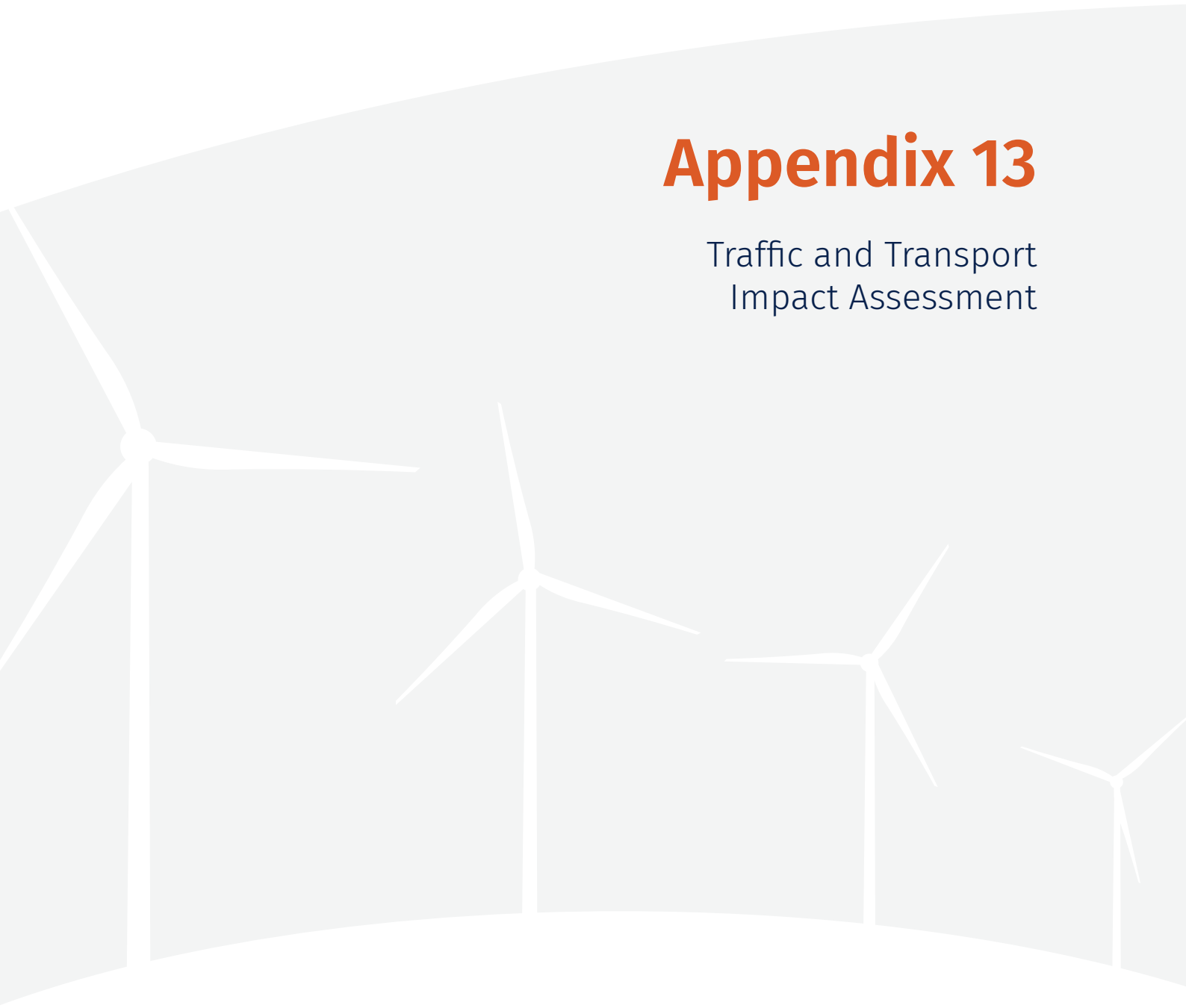
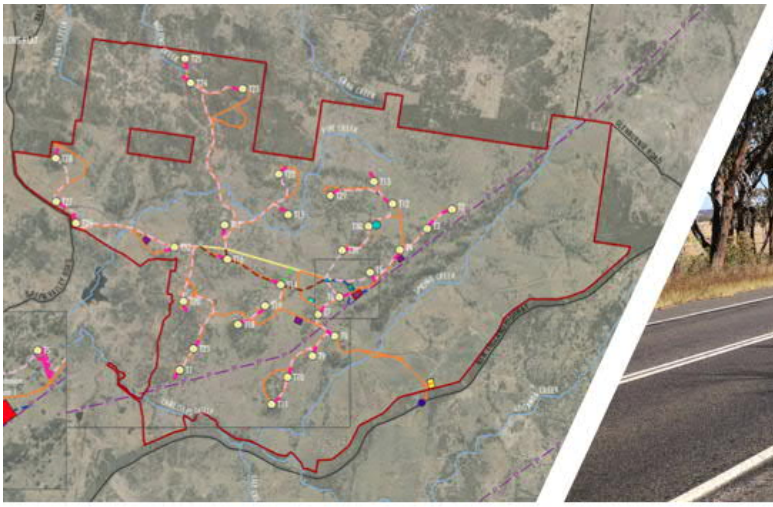
Appendix 13

Traffic and Transport
Impact Assessment



ACCESS TRAFFIC
CONSULTING



Thunderbolt Energy Hub (Stage 1)

EIS Traffic and Transport Assessment

November 2021

Prepared for Umwelt Australia Pty Ltd

Quality Information

Document	EIS Traffic Impact Assessment
Client	Umwelt Australia Pty Ltd
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			Name / Position	Signature
0	30/11/2021	Draft for Client Comment	Andrew Barrie Principal Traffic Engineer	Original Signed
A	20/12/2021	Final	Andrew Barrie Principal Traffic Engineer CPEng NPER	

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Executive Summary

Access Traffic Consulting was commissioned by Umwelt Australia Pty Ltd (Umwelt) on behalf of Neoen Australia Pty Ltd (Neoen) to undertake a traffic and transport assessment for the proposed Thunderbolt Energy Hub – Stage 1 (the Project), which is to be located approximately 47km north-east of Tamworth and 18km to the south-west of the Uralla township, on land straddling both the Tamworth Regional Council (TRC) and Uralla Shire Council (USC) Local Government Areas (LGAs).

This traffic and transport assessment was carried out to determine the level of potential impacts of the construction, operations and decommissioning phases of the Project on the operation of the surrounding road network. The outcomes of this assessment will be used in support of the Environmental Impact Statement (EIS) for the Project, with TRC, USC and Transport for New South Wales (TfNSW) expected to be advice agencies. Further to this, the purpose of this report is also to assess the Project's compliance with the requirements of Schedule 2 of the Environmental and Planning Regulation (2000), as outlined in the traffic and transport section of the Secretary's Environmental Assessment Requirements (SEARs) provided for the Project.

Based on the increase in traffic numbers anticipated as a result of the construction, operations and decommissioning phases of the Project , it is anticipated that the Project will have a minor impact on the traffic operation of the surrounding road network. The technical assessment identified the following upgrade works and mitigation treatments were required as part of the Project to maximise the safety and operational performance of the external road network:

- Completion of works along the identified transport route to accommodate the swept paths of the Over Size Over Mass (OSOM) turbine component transport vehicles, including the relocation of signage and road lighting infrastructure and construction of required temporary hardstand pavement areas as identified in the Preliminary Transport Route Assessment for the Project. It is noted that the exact extents and scope of these works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.
- Construction of the proposed upgraded works to the site access intersection with the New England Highway to provide basic left (BAL) and short channelised right (CHRs) turn treatments on the New England Highway approaches, as per Austroads standards.
- Installation of advisory "truck turning" signage be installed on the approaches to the site access intersection with the New England Highway, to highlight to motorists the presence of the Project access and the potential for turning heavy vehicles to/from the side road.
- Preparation of traffic management plan for Project outlining proposed management measures and processes to minimise the impact of Project traffic (including OSOM turbine component transport vehicles) on the external road network.

In addition to the traffic assessments completed, a high level pavement impact assessment of the relevant road network was also undertaken for the construction, operations and decommissioning phases of the Project. The results of this assessment identified:

- That the heavy vehicle movements associated with the construction phase of the Project were expected to lead to a minor increase in pavement loadings of 10% on the key section of the New England Highway, between Tamworth and Armidale, which when considered over the proposed overall construction period of 18 months, was not considered to lead to a significant impact or reduction to the design life of the existing road pavement on this section of the New England Highway.
- That the proponent enters into an infrastructure or maintenance agreement with both the City of Newcastle (CoN) and Muswellbrook Shire Council (MSC) regarding the required mitigation works to offset the expected pavement impacts of the Project on the lower order, local government controlled road links of Selwyn Street and George Street (CoN - both routes) and Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street and Dartbrook Mine Access Road (MSC - Route 2 only). It is also recommended that this infrastructure agreement include reference to the requirement for pre and post dilapidation inspections to be undertaken on the sections of the local government roads used by Project traffic, with these inspections to be completed by representatives of the proponent and the appropriate Council. These inspections are required to identify and document the current

condition of the roads (pre construction) and establish the required maintenance and/or rehabilitation works (to be completed by the proponent at no cost to Council) deemed necessary to reinstate the roads to their documented condition prior to the introduction of Project traffic at the completion of their use.

- That the operations phase of the Project will only generate relatively low traffic volumes on the network (approx. 10 vehicles per day (vpd)) with negligible heavy vehicle movements (approximately 1 heavy vehicle (HV) per week), which will have a negligible impact to the operation (and pavement loadings) of all relevant road links on the external road network.
- Similarly, the decommissioning phase of the Project (which has conservatively been assumed to generate approximately 70% of the peak construction phase traffic) will have a minimal impact to the existing road pavements on the relevant sections of the external road network.

If the mitigation measures and works listed above are carried out, then the Project will have minimal traffic impact on the relevant sections of the local government and state controlled road networks.

Taking the above into consideration, this report (in combination with the Preliminary Route Assessment) demonstrates the compliance of the Project with Schedule 2 of the Environmental and Planning Regulation (2000), as outlined in the traffic and transport items of the Secretary's Environmental Assessment Requirements (SEARs) provided.

Access Traffic Consulting therefore recommends that the Project be approved from a traffic engineering and traffic impact viewpoint.

1.0 Introduction

1.1 Project Background

Neoen Australia Pty Ltd (Neoen) is the proponent of Thunderbolt Energy Hub – Stage 1 (the Project), located approximately 47km north-east of Tamworth, in north-eastern New South Wales, located in both the Tamworth Regional Council and Uralla Shire Council Local Government Areas (LGA). The Project is proposed to consist of up to 32 wind turbines and supporting infrastructure, with an estimated generation capacity of up to 192 megawatts (MW).

1.2 Scope and Study Area

Access Traffic Consulting was subsequently commissioned by Umwelt Australia Pty Ltd (Umwelt) on behalf of Neoen to undertake a traffic and transport impact assessment (TIA) as part of the Environmental Impact Statement (EIS) for the Project.

This TIA was carried out to determine the level of potential impacts of the construction, operations and decommissioning phases of the Project on the operation of the surrounding road network. The outcomes of this assessment will be used in support of the Environmental Impact Statement (EIS) for the Project, with Tamworth Regional Council, Uralla Shire Council and Transport for New South Wales (TfNSW) expected to be advice agencies.

Further to this, the purpose of this report is also to assess the Project's compliance with the requirements of Schedule 2 of the Environmental and Planning Regulation (2000), as outlined in the traffic and transport items of the Secretary's Environmental Assessment Requirements (SEARs) provided for the Project.

The following methodology was adopted to undertake the required assessments as part of the TIA, as summarised in the key tasks listed below.

- Broadly identify the existing transport infrastructure which is of relevance to the Project.
- Estimate traffic generation associated with the construction, operations and decommissioning phases of the Project and the distribution of this Project traffic on the identified road network, including the movement of materials, plant, equipment and turbine components in addition to the construction, operations and decommissioning phase workforces.
- Assess the potential impact of the Project on the surrounding transport infrastructure during the construction, operations and decommissioning phases.
- Identify potential mitigation and management strategies to be implemented during the construction, operations and decommissioning phases to offset the impact of the proposed Project (if required).

The adopted methodology centres on establishing a background, "without Project" traffic scenario for the identified transport routes and comparing this with a scenario including the additional Project-generated traffic, i.e. the "with Project" scenarios.

The process allows for the assessment of the traffic impacts of the Project in terms of road safety, access requirements, intersection operations, road link capacity, road pavements and other transport infrastructure. Following this, if required, potential mitigation and/or management measures would be formulated to address the potential traffic impacts of the Project.

1.2.1 Study Area

As noted above, the Project Area is located approximately 47km north east of Tamworth and adjacent to the New England Highway. This assessment relates to Stage 1 of the Thunderbolt Energy Hub only, with the relevant Project Area approximately 5,918 hectares (ha) in area and located to the north of the New England Highway, as shown on **Figure 1** overpage.

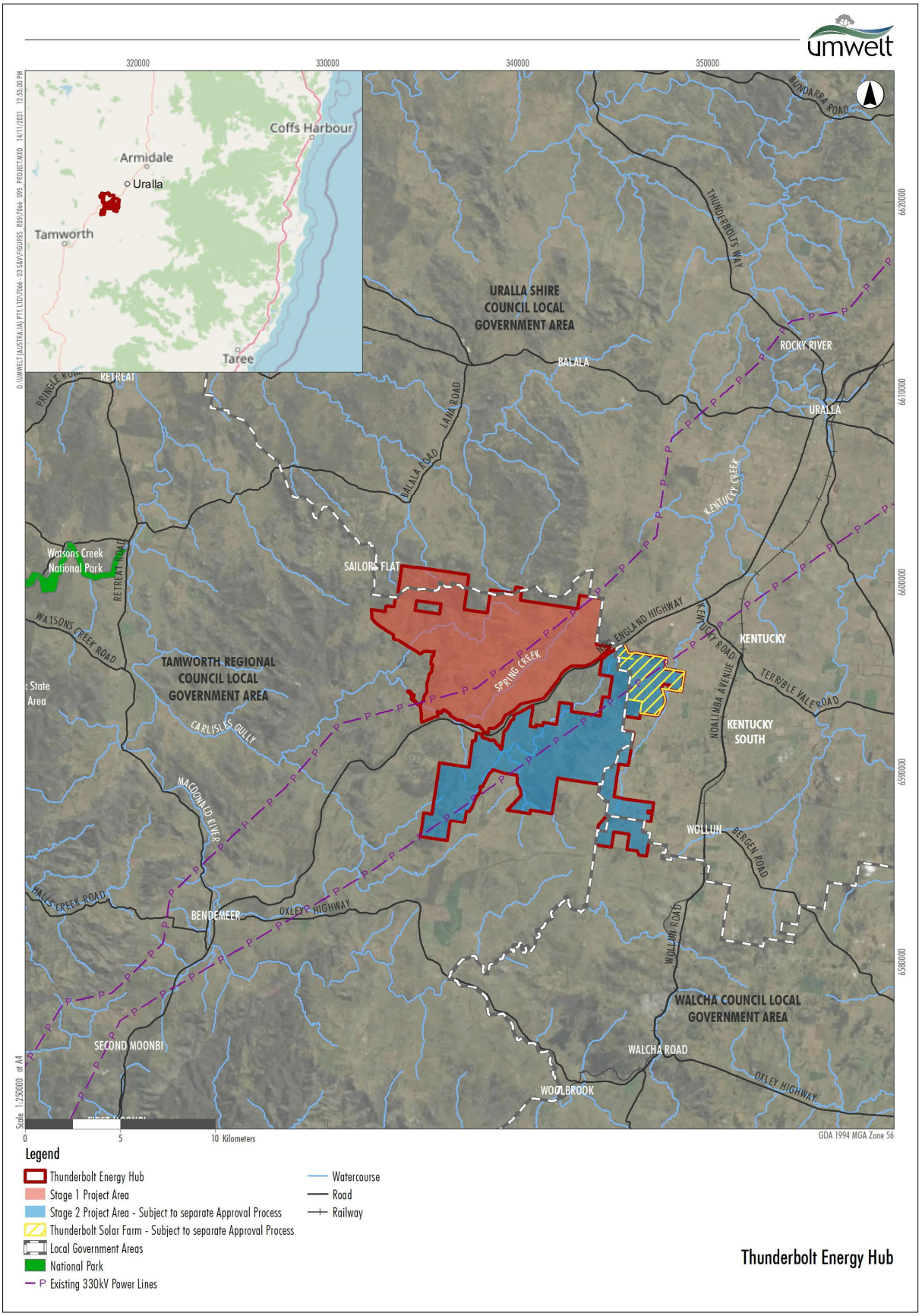


Figure 1 Thunderbolt Energy Hub Stage 1 **[Source: Umwelt]**

1.3 Approval Agency Advice

1.3.1 State Environmental Assessment Requirements

The SEARs are a set of technical considerations that the EIS must address. Details of the SEARs for the Project were received on 16 November 2020, with a summary of the specific requirements relating to traffic and transport provided in **Table 1** below.

It is noted that the SEARs received were provided during an earlier stage, when the Project was covering a larger area and incorporated what is now described as the Stage 2 area (see **Figure 1** above). As such it is noted that some of the requirements outlined in **Table 1** may not be applicable to Stage 1 of the Project.

Table 1 Traffic and Transport SEARs Items

SEARS Items		Reference / Response
i)	Assess the construction, operational and decommissioning traffic impacts of the development on the local and state road network (including New England Highway, Kentucky Road, Noalimba Avenue, Oxley Highway, Wollun Woolbrook Road, Old Wollun Road, Traceys Road, Reeves Road, Westvale Road, Gunnalong Road, Pine Creek Road, Walcha Stock Route Road, Borgers Road, Rimbanda Road and any other roads proposed to be used).	The assessment contained within this report includes an evaluation of the traffic impacts of the construction, operations and decommissioning phases of the Project on the relevant sections of the external road network expected to be utilised by traffic generated by the Project. As such the assessment is primarily focussed on the main construction transport route which includes the section of the New England Highway between Tamworth and Armidale and the road links identified to form part of the turbine transport routes from the port facilities in Newcastle to the Project Area. Furthermore, it is noted that the Project is not anticipated to lead to any increases in traffic on Kentucky Road, Noalimba Avenue, Oxley Highway, Wollun Woolbrook Road, Old Wollun Road, Traceys Road, Reeves Road, Westvale Road, Gunnalong Road, Pine Creek Road, Walcha Stock Route Road, Borgers Road and Rimbanda Road.
ii)	Provide details of the peak and average traffic volumes (including light, heavy and over-mass / over-dimensional vehicles) and transport and haulage routes during construction, operation and decommissioning, including traffic associated with sourcing raw materials (water, sand and gravel).	Estimates of the Project traffic volumes have been provided in **Section 4.0** of this report, with additional Project traffic calculations also provided for reference in **Appendix E**.
iii)	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.	A summary of the results of the assessment of the impacts of the Project can be seen in Section 5.0 of this report, and are noted to include assessments of the construction, operations and decommissioning phases of the Project as requested.
iv)	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.	An assessment of the potential impact of the Project (construction, operations and decommissioning phase) on the road link capacity is provided in **Section 5.4** of this report. Further to this, it is noted that further traffic management measures and processes are proposed to be provided in the Traffic Management Plan for the Project, expected to be developed as part of subsequent detailed design phases of the Project.
v)	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 and use of rail level crossings (and rail safety assessment if required) and impacts to rail underbridges and overbridges.	An assessment of the transport impacts to the Project Area access and haulage routes is provided in Section 5.0 of this report, noting further details of haulage route assessment completed for Project are provided in the Preliminary Transport route assessment by Rex J Andrews, included for reference as **Appendix A**.

		No specific assessment has been completed of existing rail infrastructure as impact of the Project is expected to be limited to the requirement for the OSOM turbine component transport vehicles traversing a number of rail overbridges and crossings on the transport routes, as identified in the preliminary transport route assessment prepared by Rex J Andrews (refer **Appendix A**). As such it has been identified that further negotiation and approval from the relevant rail authority will be required before loads can access the routes, with these discussions proposed to be undertaken in subsequent phases of the Project, once exact turbine component and transport vehicle configurations are confirmed.
vi)	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 and / or rail authority.	Schedule of measures to mitigate and manage the identified impacts of Project are provided in **Section 6.0** of this report.
vii)	An assessment of the likely impacts of all stages of the development (including the cumulative impacts of the development with existing and proposed developments in the New England region, including the Thunderbolt Energy Hub more broadly, New England Solar Farm and the proposed Salisbury Solar Farm and Winterbourne Wind Farm), taking into consideration any relevant State and Commonwealth legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice and including the NSW Wind Energy Guideline for State Significant Wind Energy Development (2016).	A summary of the results of the assessment of the impacts of the Project is provided in Section 5.0 of this report, and are noted to include assessments of the construction, operations and decommissioning phases of the Project. Further to this, **Section 4.5** of the report identifies the review undertaken to establish the other renewable energy projects in the vicinity of the Project Area that are likely to be constructed concurrently with the Project. The identified impacts associated with the Project are then addressed in **Section 5.2**.

This TIA has been prepared in response to a number of the items identified above and aims to provide additional information and clarification to the traffic assessment undertaken, in particular regarding the expected traffic and transport impacts of the Project on the state and local government-controlled road networks.

Further information regarding the turbine component transport movements and routes for the Project is provided in the Preliminary Transport Route Assessment report (refer **Appendix A**) prepared by Rex J Andrews Transport, which should be read in conjunction with this TIA.

In addition, the preparation of a detailed traffic management plan (TMP) is proposed to be undertaken as part of the detailed design phases of the Project once the detailed project design and configuration of the turbine components and associated transport vehicles, is confirmed.

1.4 Data Sources

The following sources of data have been used for the purpose of this assessment:

- TfNSW traffic count data (2019 year and hourly summaries) for Site Station ID T0257, located 140m south of Caroline Street in Bendemeer.
- Interactive crash statistic data from the TfNSW Centre for Road Safety database (2016-2021).
- Preliminary Transport Route Assessment report, prepared by Rex J Andrews Transport, included for reference in **Appendix A**.

1.5 Limitations

Whilst the assessment undertaken is deemed appropriate to assess the anticipated traffic impacts of the Project on the surrounding road network, the following limitations should be noted:

- No assessment has been undertaken to determine the acceptability of the use of the existing culvert and bridge infrastructure along the identified turbine component transport route from a structure load limits / restrictions perspective. This is due to the fact that the vehicle and load configurations for the turbine component transport operations adopted in this assessment are indicative only, with the exact vehicle and load configurations to be confirmed by a suitable transport contractor. It is therefore expected that the assessment of these structures will be completed by the relevant transport contractor as part of the preparation of a detailed route assessment / traffic management plan to be prepared during the detailed design phase of the Project.
- The assessment of the traffic impacts associated with the Project does not consider the works anticipated to be required as part of the route preparation works for the turbine component transport operation, as identified in the associated Preliminary Transport Route Assessment completed for the Project (dated November 2021). It is expected that these works will be subject to further consultation, detailed design and approval (as required).

2.0 Existing Conditions

2.1 Land Use and Zoning

The Project Area is generally used for agricultural purposes, mainly grazing. The majority of the land within the Project Area is identified as a "RU1 – Primary Production" under the Tamworth Regional Local Environmental Plan (2010), with small areas on the northern Project Area boundary of zoned as "RU2 – Rural Landscape" under the Uralla local Environmental Plan (2012), as shown in **Figure 2**.

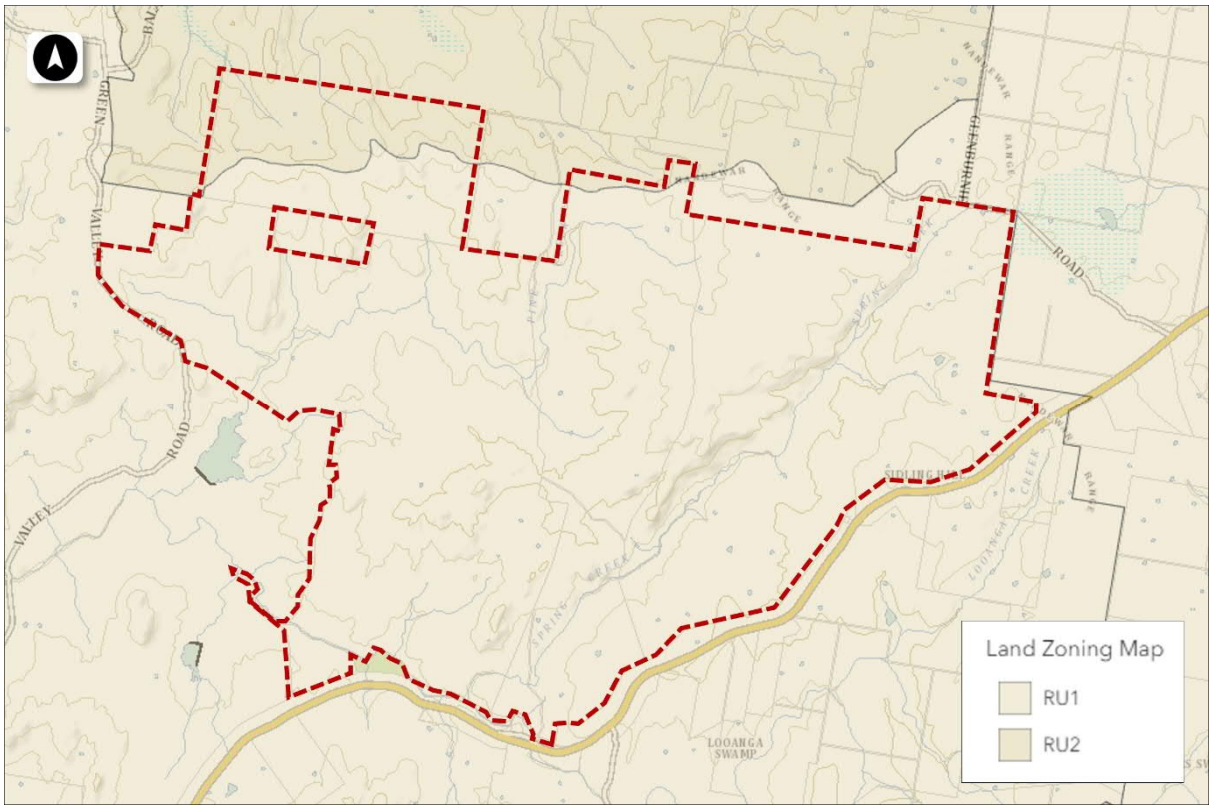


Figure 2 Project Area Land Use Zoning **[Source: NSW Planning Portal ePlanning Spatial Viewer]**

2.2 Adjacent Land Use / Approvals

As shown in **Figure 2** above, the adjacent land parcels to the west, south and east of the Project Area are currently zoned as "RU1 – Primary Production", while the land to the north is zoned as "RU2 - Rural Landscape". Further to this, no active or planned development approvals which could influence this TIA are understood to be currently held over the adjacent properties.

It is however noted that as part of the SEARs for the Project further assessment has been requested regarding the potential cumulative impacts of similar renewable energy projects in the areas surrounding the regional centres of Tamworth and Armidale, including those within the identified Renewable Energy Zone (REZ). Further detail regarding the cumulative impact assessment is provided in **Section 4.5** of this report.

2.3 Surrounding Road Network Details

2.3.1 Project Transport Routes

2.3.1.1 Construction Phase

Based on the expected construction works for the Project the following transport routes have been identified, as indicatively shown in **Figure 3**:

- The construction workforce is assumed to commute daily to/from the Project Area from either Tamworth or Armidale via the New England Highway (50/50 split travelling from north and south).
- Construction equipment (bulk earthworks plant, prefabricated buildings) and materials (such as cement, concrete aggregates, reinforcing steels, diesel fuel, explosives and road gravels) will primarily be sourced locally (as far as reasonably practical) from the regional centres of Tamworth or Armidale or regional quarry operations via the New England Highway.
- Significant turbine components and specialist equipment will be imported from overseas and shipped to the Port of Newcastle, before being transported by road to the Project Area utilising both state and local government controlled roads (within the local government areas of City of Newcastle, Muswellbrook Shire Council and Tamworth Regional Council.

  A preliminary transport route assessment for the proposed routes has been undertaken (refer **Appendix A**), with the following routes to the Project Area for the transportation of turbine components from the Port of Newcastle identified as outlined in **Table 2** below.

Table 2 Preliminary Turbine Component Transport Routes

From Port of Newcastle	
Route 1: Blades & Loads Under 5.2m Height	**Route 2: Towers & Loads Over 5.2m Height**
Selwyn Street (CoN) George Street (CoN) Industrial Drive (A43) Maitland Road (A43) New England Highway (A1) John Renshaw Drive (A1/B68) Hunter Expressway (M15) New England Highway (A15) Golden Highway (B84) Denman Road New England Highway (A15) Scott Road (A15) Murray Street (A15) Marius Street (A15) New England Highway (A15)	Selwyn Street (CoN) George Street (CoN) Industrial Drive (A43) Maitland Road (A43) New England Highway (A1) John Renshaw Drive (A1/B68) Hunter Expressway (M15) New England Highway (A15) Golden Highway (B84) Denman Road Bengalla Road (MSC) Wybong Road (MSC) Kayuga Road (MSC) Ivermein Street (MSC) Stair Street (MSC) Dartbrook Mine Access Rd (MSC) New England Highway (A15) Scott Road (A15) Murray Street (A15) Marius Street (A15) New England Highway (A15)

2.3.1.2 Operations Phase

The following transport routes relevant to the operations phase of the Project have been identified:

- The workforce during operation will consist of a small number of local workers (i.e. approx. 9 staff) who are expected to reside locally to the Project Area (likely in Tamworth or Armidale).
- Heavy vehicle movements during the operations stage of the Project are anticipated to be extremely low, with only occasional movements to/from the Project Area (in the order of 1 vehicle per week) associated with maintenance activities, routine removal of waste and delivery of consumables to the Project operations facility. These heavy vehicle movements are expected to originate from either Tamworth or Armidale and travel to the Project Area via the New England Highway.

2.3.1.3 Decommissioning Phase

While the details regarding the expected vehicle movements during the decommissioning phase of the Project are difficult to confirm at this stage, it is understood that they are likely to be similar to the

construction phase in relation to the movements of staff and materials, equipment and site components. Based on this the following assumptions have been made regarding the transport routes for the Project during site decommissioning:

- The workforce during decommissioning is assumed to commute daily to/from the Project Area from either Tamworth or Armidale via the New England Highway.
- Construction equipment (bulk earthworks plant) and materials (such as gravels and soils for rehabilitation works) will primarily be sourced locally (as far as reasonably practical) from the regional centres of Tamworth or Armidale and transported to the Project Area via the New England Highway.
- Associated infrastructure (site buildings) are expected to be removed from the Project Area and transported to either Tamworth or Armidale, via the New England Highway.
- The turbines are expected to be dismantled, removed and transported to nearby metal recycling facilities, which are expected to be located in either Tamworth or Armidale.

2.3.2 Road Links

Based on the transport routes for the construction, operations and decommissioning phases outlined above, the critical road links in terms of the potential impacts of the Project were determined to be the section of the New England Highway between Tamworth and Armidale, which is expected to accommodate the majority of the staff and heavy vehicle movements generated by the Project.

All of the other road links identified were noted to only be utilised by turbine component transport vehicles. As these movements are only temporary (during a 6 month period during construction) and are expected to travel out of hours and under full escort, the Project is not anticipated to have a significant, ongoing impact on the operation of the road links forming the OSOM transport routes.

2.3.2.1 New England Highway (A15)

As noted above, the section of the New England Highway critical to the Project is the approximately 105km length of the link between Tamworth and Armidale, with the majority of this section currently operating as a high speed (100km/hr) two-way, two lane rural highway. In the vicinity of the Project Area, the New England Highway provides one lane of travel in each direction as well as sealed road shoulders varying in width up to 1.5m, with the existing configuration and condition of the road shown in **Figure 4** and **Figure 5**.

Figure 4 New England Highway – Looking NE along Project site frontage

Figure 5 New England Highway – Looking SW along Project site frontage

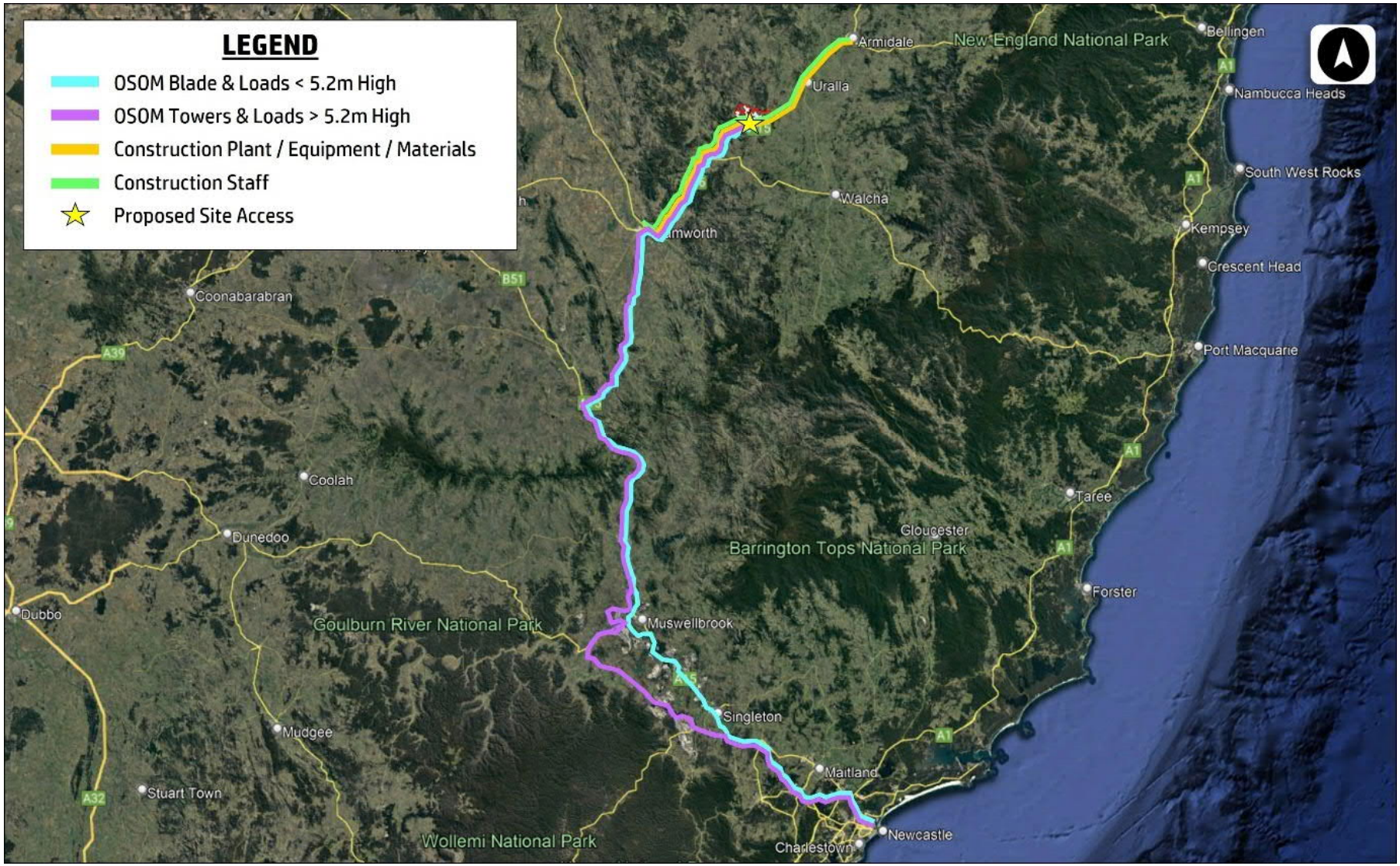


Figure 3 Project Construction Phase Transport Routes **[Source: Google Earth Pro]**

2.3.3 Intersections

In terms of the traffic impact assessment for the Project, the critical intersection on the external road network was identified to be the proposed Project Area access intersection with the New England Highway, which is located at one of the existing site access points for Kyabra Station and is proposed to be upgraded as part of the Project to cater for project related traffic travelling to/from the Project Area. Further details of this intersection are provided in **Section 2.6** (existing configuration), **Section 2.5.2** (existing operation), **Section 3.3** (proposed configuration) and **Section 5.2** (proposed operation) below.

All other intersections on the external road network were noted to primarily only be utilised by turbine component transport vehicles. The movements of these Project related vehicles are only temporary and as they are expected to travel out of hours and under full escort, they are not anticipated to have a significant impact on the operation of any relevant intersections. As such no further assessment of these intersections was deemed warranted.

2.4 Existing Traffic Volumes

2.4.1 Road Link Volumes

The road link volumes for the relevant section of the New England Highway have been estimated from the available count data from TfNSW, with the data from Station ID T0257, located 140m south of Caroline Street in Bendemeer utilised (refer **Figure 6**). It is noted that this site is located south of the intersection of the New England Highway with the Oxley Highway (at Bendemeer) and as such is likely to have recorded slightly higher volumes than those expected on the section of highway adjacent to the Project Area. Notwithstanding this, the site is expected to provide an appropriate representation of the current background volumes on the rural portions of the New England Highway relevant to the Project.

At the request of TfNSW, the historical data for 2019 has been adopted as the base volumes for the assessment, in lieu of the recently recorded count data for 2020 and 2021 which indicate reduced vehicle movements on the network due to the recent restrictions on travel due to the COVID-19 pandemic.

A summary of the recorded 2019 traffic movements for the relevant section of the New England Highway is provided in **Figure 7**, with a background growth rate of 1% per annum (compound) applied to these base volumes to establish forecasts of the current (2021) volumes on the link (refer **Table 3**), as well as the expected background volumes at future design horizons for the project (up to 2056).

The use of the 1% p.a. (compound) growth rate is considered appropriate due to the minimal growth recorded at this site for the available period between 2015 to 2019 (approx. 0.65%), the fact that the data site used has historically had higher volumes than those adjacent to the relevant section of the Highway adjacent to the Project Area, and the significant length of time volumes are required to be forecasted to (up to 2056 for decommissioning works).

Table 3 Current (2021) AADT Traffic Volumes

Road ID	Road Segment		Base Data Year	Base Year AADT				10 Yr. GR %	Background AADT (2021)			
	Start (km)	End (km)		Gaz	% HV	A-Gaz	% HV		Gaz		A-Gaz	
									Total	HV	Total	HV
A15 New England Highway (Tamworth to Armidale)												
A15	0.000	**63.700**	2019	2,149	23.36%	2,179	23.59%	1.00%	2,192	512	2,223	524
	63.700	105.000		2,149	23.36%	2,179	23.59%	1.00%	2,192	512	2,223	524

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage) / HV (Heavy vehicles)
* New England Highway chainage assumed to run from Tamworth to Armidale
** Ch. 63.700km New England Highway/Site Access intersection.

Figure 6 Traffic Count Station T0257 Location **[Source: TfNSW Traffic Volume Viewer]**

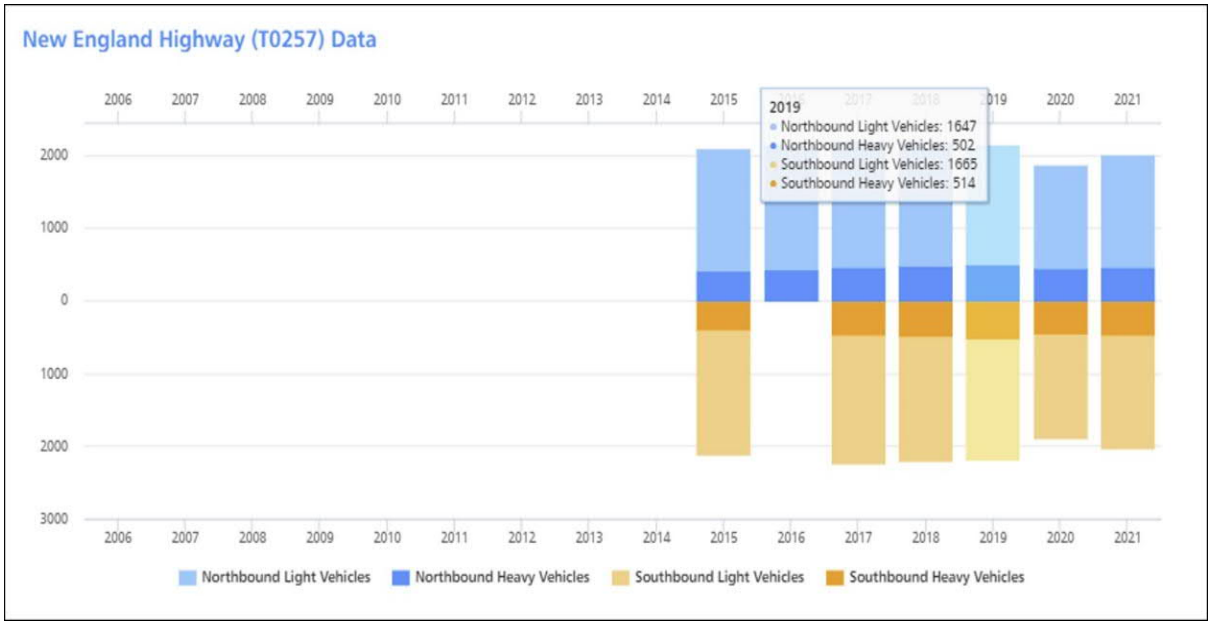


Figure 7 Traffic Count Station T0257 2019 Daily Traffic Volumes [Source: TfNSW Traffic Volume Viewer]

2.4.2 Intersection Volumes

Similarly, an estimate of the current (2021) traffic volumes on the New England Highway at the existing Project Area access intersection was established from the 2019 hourly profile data for TfNSW traffic count station ID T0257. Based on a review of the available data two distinct peaks during both the AM and PM periods were identified, including the expected period of peak traffic generation for the Project (6-7am & 5-6pm to coincide with staff movements) and the periods for peak traffic volumes on the adjacent section of the New England Highway (10-11am & 3-4pm). A summary of the recorded 2019 volumes for these identified peak periods is shown in **Figure 8** to **Figure 11**.

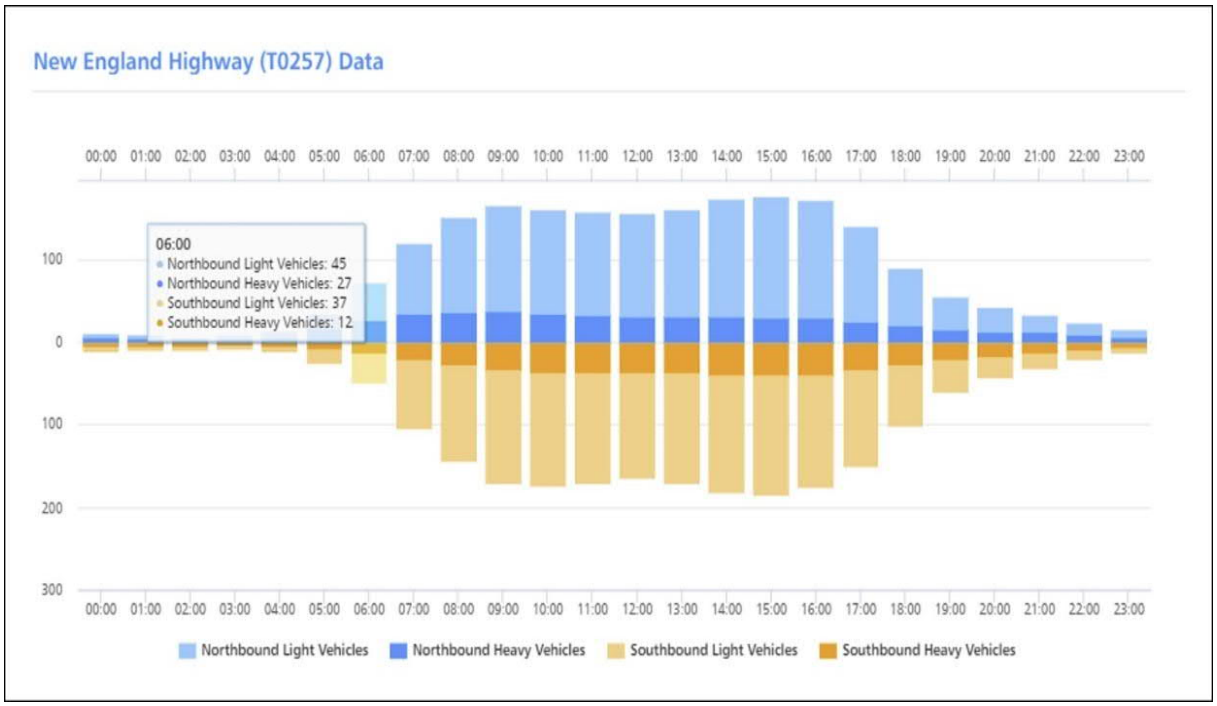


Figure 8 Traffic Count Station T0257 2019 6-7am Traffic Volumes **[Source: TfNSW Traffic Volume Viewer]**

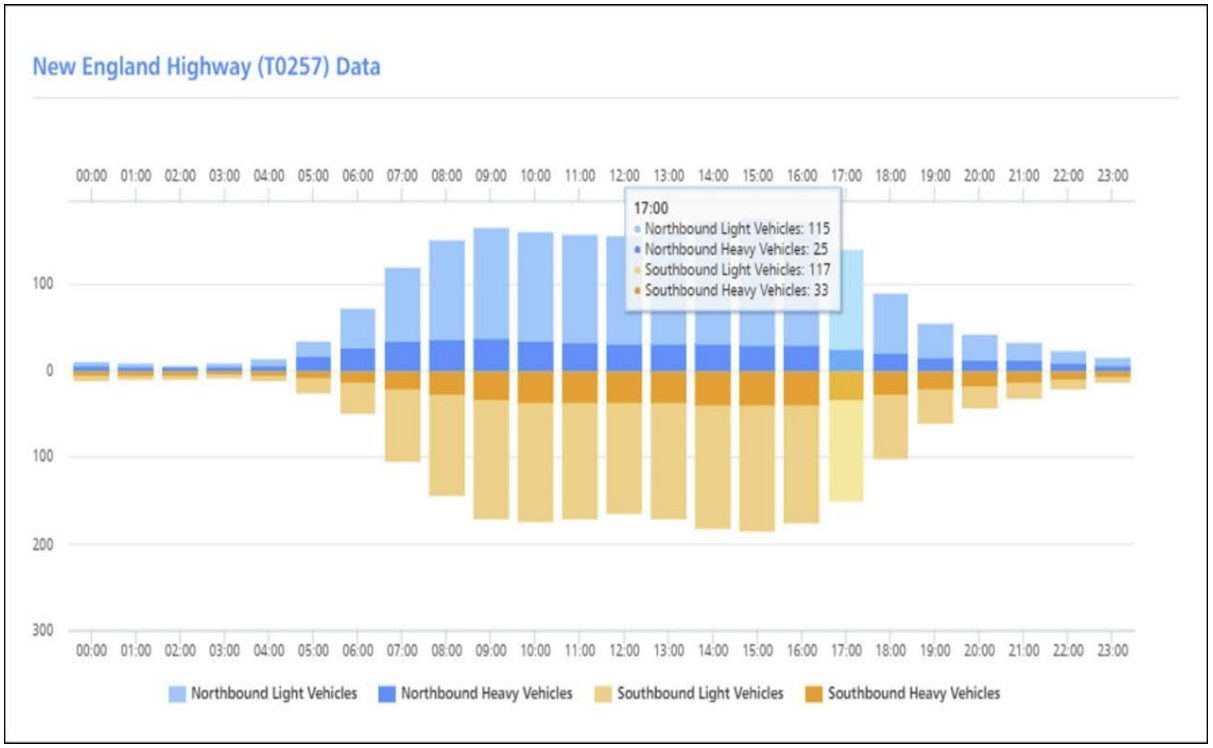


Figure 9 Traffic Count Station T0257 2019 5-6pm Traffic Volumes **[Source: TfNSW Traffic Volume Viewer]**

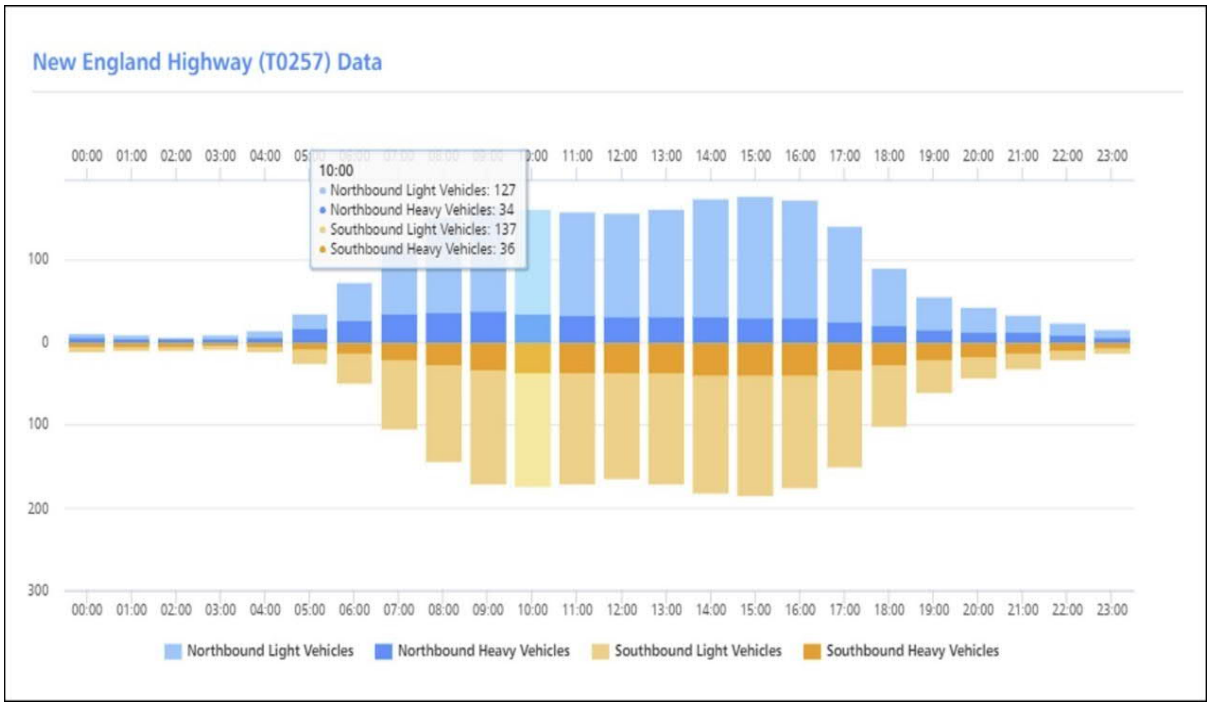


Figure 10 Traffic Count Station T0257 2019 10-11am Traffic Volumes [Source: TfNSW Traffic Volume Viewer]

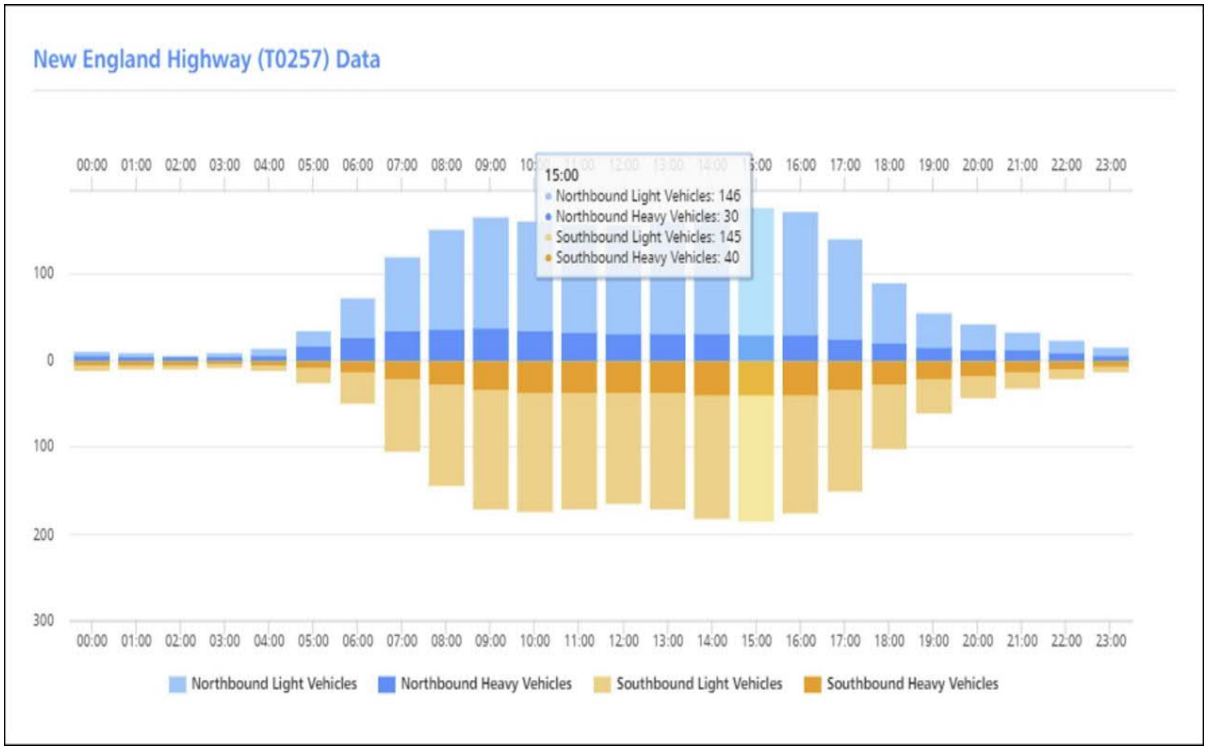


Figure 11 Traffic Count Station T0257 2019 3-4pm Traffic Volumes [Source: TfNSW Traffic Volume Viewer]

Similarly, a 1% per annum (compound) growth rate has been applied to the New England Highway volumes at the Project Area access intersection to establish the current (2021) and future year forecast volumes, with the movements into and out of the access each conservatively assumed to be 1 light vehicle and 1 heavy vehicle per hour in each direction during all peak periods assessed. A summary of the resultant 2021 AM and PM peak hour volume forecasts are provided in **Table 4** below.

Table 4 Peak Hour (Project Traffic) Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2021 AM Peak (Project Peak)	1	1	46	28	1	1	1	1	38	12	1	1
2021 PM Peak (Project Peak)	1	1	117	26	1	1	1	1	119	34	1	1
2021 AM Peak (NE Hwy Peak)	1	1	130	35	1	1	1	1	140	37	1	1
2021 PM Peak (NE Hwy Peak)	1	1	149	31	1	1	1	1	148	41	1	1

2.5 Existing Intersection and Network Performance

2.5.1 Road Links

Based on the road link volumes forecasts in **Table 4** above, it can be seen that the existing two lane rural highway configuration of the relevant section of the New England Highway can be considered to have adequate capacity (approx. 12,000vpd) to cater for the current 2021 volumes on the link (approx. 4,330vpd).

In addition, it is noted that no assessment has been made on the current operation of the additional road links identified to form part of the proposed OSOM turbine component transport routes. As these movements are expected to be temporary in nature, undertaken out of hours and under escort and be of relatively low volume (max 18vpd including 6 OSOM vehicles) it is not anticipated that they will have a significant ongoing impact to the operation or capacity of the road links forming the turbine transport routes.

2.5.2 Intersections

An assessment of the current operational performance of the existing Project Area access intersection with the New England Highway has been undertaken, based upon the forecast current (2021) background AM peak and PM peak periods identified in **Table 4** above.

The results of these analyses are summarised in **Table 5** below, with the detailed results provided for reference in **Appendix B**. These results revealed that the current configuration of site access intersection is expected to operate satisfactorily for the forecast current (2021) background or pre Project traffic conditions, with all calculated values of Degree of Saturation (DOS), Level of Service (LOS), average delay and vehicle queue lengths for both intersections well within acceptable limits of operation for a priority-controlled intersection for all traffic scenarios assessed.

Table 5 SIDRA Results – New England Highway / Project Area Access Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
New England Highway / Project Area Access Intersection				
2021 AM Peak (Project Peak)	0.051	LOS A	0.5	0.2
2021 PM Peak (Project Peak)	0.096	LOS A	0.2	0.2
2021 AM Peak (NE Hwy Peak)	0.110	LOS A	0.2	0.2
2021 PM Peak (NE Hwy Peak)	0.117	LOS A	0.2	0.2

** LOS value identified is for worst movement at the intersection, not the overall intersection.

2.6 Existing Site Access

The current vehicular access to the subject site is provided via the existing Kyabra Station (Lot 1 DP263410) property access from the New England Highway, located on the northern side of the highway approximately 64km to the north-east of Tamworth (approx. co-ordinates Latitude 30°46'51.09"S / Longitude 151°20'7.78"E).

The existing access is understood to currently cater for a limited number of vehicle movements, including heavy vehicles. The approach of the access to the highway is currently unsealed (refer **Figure 12**), with no designated turn lane or property access treatments provided on either New England Highway approach to the access. Based on site observations, suitable sight distances were noted to be available in both directions to/from the existing access (refer **Figure 13** and **Figure 14**), noting that while the crest on the north-east bound New England Highway approach to the access does somewhat restrict sightlines, the elevated access approach to the highway enables required safe intersection sight distances to be achieved.

Figure 12 Existing Project Area Access Location and Configuration **[Source: Google Earth Pro]**

Figure 13 South-west from Existing Project Area Access

Figure 14 North-east from Existing Project Area Access

2.7 Road Crash History Review

A review of the road crash history on the relevant section of the New England Highway in the vicinity of the Project Area was undertaken using the interactive crash statistic data available from the TfNSW Centre for Road Safety database for the period between 2016-2021.

The results of this search identified 3 recorded crashes within the relevant section of the New England Highway within 1km of the Project Area access in either direction, as shown in **Figure 15**. A summary of the details of the recorded crash data is provided for reference in **Table 6**.

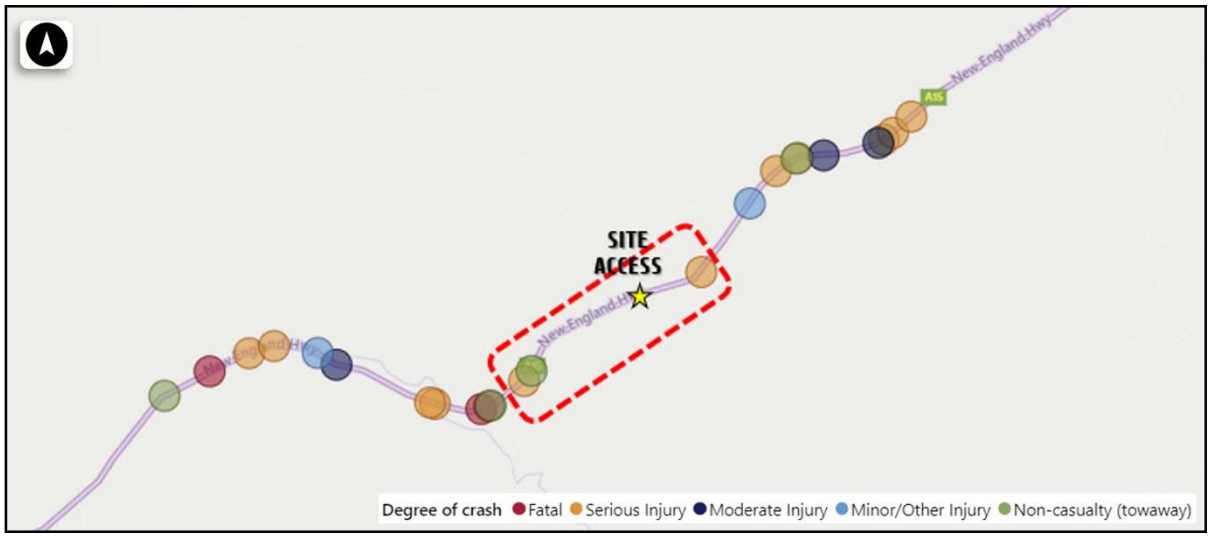


Figure 15 Road Crash Locations **[Source: TfNSW Crash & Casualty Statistics]**

Table 6 Summary of Road Crash History

Crash Reference Number	Crash Year	Degree of Crash	Crash Type	RUM Code	RUM Description
1116484	2016	Serious Injury	Single Vehicle	83	Off Carriageway Right / Right Bend into Object
1152149	2017	Serious Injury	Single Vehicle	88	Out of Control on Carriageway (Bend)
1160865	2018	Non Casualty (Towaway)	Single Vehicle	87	Off Carriageway Left / Left Bend into Object

Based on the low number (3) of crashes recorded, and the spread of the locations along the section link, it can be concluded that there is not any particular existing road feature or design deficiency which is likely to be contributing to crashes in the vicinity of the Project Area. Further to this, it can be seen that no crashes were recorded at the existing Project Area access location.

3.0 Project Details

3.1 Conceptual Project Layout

As shown in **Figure 16**, the Project includes up to 32 turbines and associated infrastructure. One vehicular access point to the site from the adjacent New England Highway is proposed to service all Project traffic from the construction, operations and decommissioning phases of the Project.

The conceptual site layout also identifies a number of internal construction site facilities, including the construction compound, site laydown areas, batching plant areas and substations. A copy of the conceptual layout for the Project has been included for reference in **Appendix C.**

3.2 Project Details

Information regarding the proposed construction activities, day to day operations and decommissioning of the Project has been provided by the proponent (Neoen), with a summary of the key site elements of the Project provided in **Table 7**.

Table 7 Key Elements of Thunderbolt Energy Hub (Stage 1 – Wind Farm)

Element	Site Quantity
Turbines	32
Site Accesses	1
Length of Internal Access Roads	45,860 m
Substations	1
Switching Stations	1
Turbine Construction Hardstand Areas	32
Site Construction Compounds	1
Satellite Site Construction Compound / Laydown Areas	5
Site Batch Plant Areas	3
Site Operational and Maintenance Facility Areas	1
Meteorological Masts	6

3.2.1 Construction Phase

The construction of the Project is anticipated to be completed over a 18-24-month period which is expected to commence in Q1 2024 (pending approval). For the purpose of this assessment, it has conservatively been assumed that the overall construction duration of the Project will be 18 months, which is considered to be the worst case for daily and peak hour traffic generation. Based on this assumed 18 month overall construction it is expected that all construction works on site will be completed by the end of Q2 2025 (June 2025), with the peak period of construction expected to occur within Q2 and Q3 2024.

The proposed hours of the construction operations for the Project will typically be 12 hours per day Monday to Saturday, approximately equating to 24 working days per month, noting that there may be minor exceptions to these timings as required throughout the construction process. Preliminary details of the proposed construction phase activities have been provided by Neoen, with a high level summary of the key construction tasks, the likely order of completion and anticipated timeframes provided in **Table 8.**

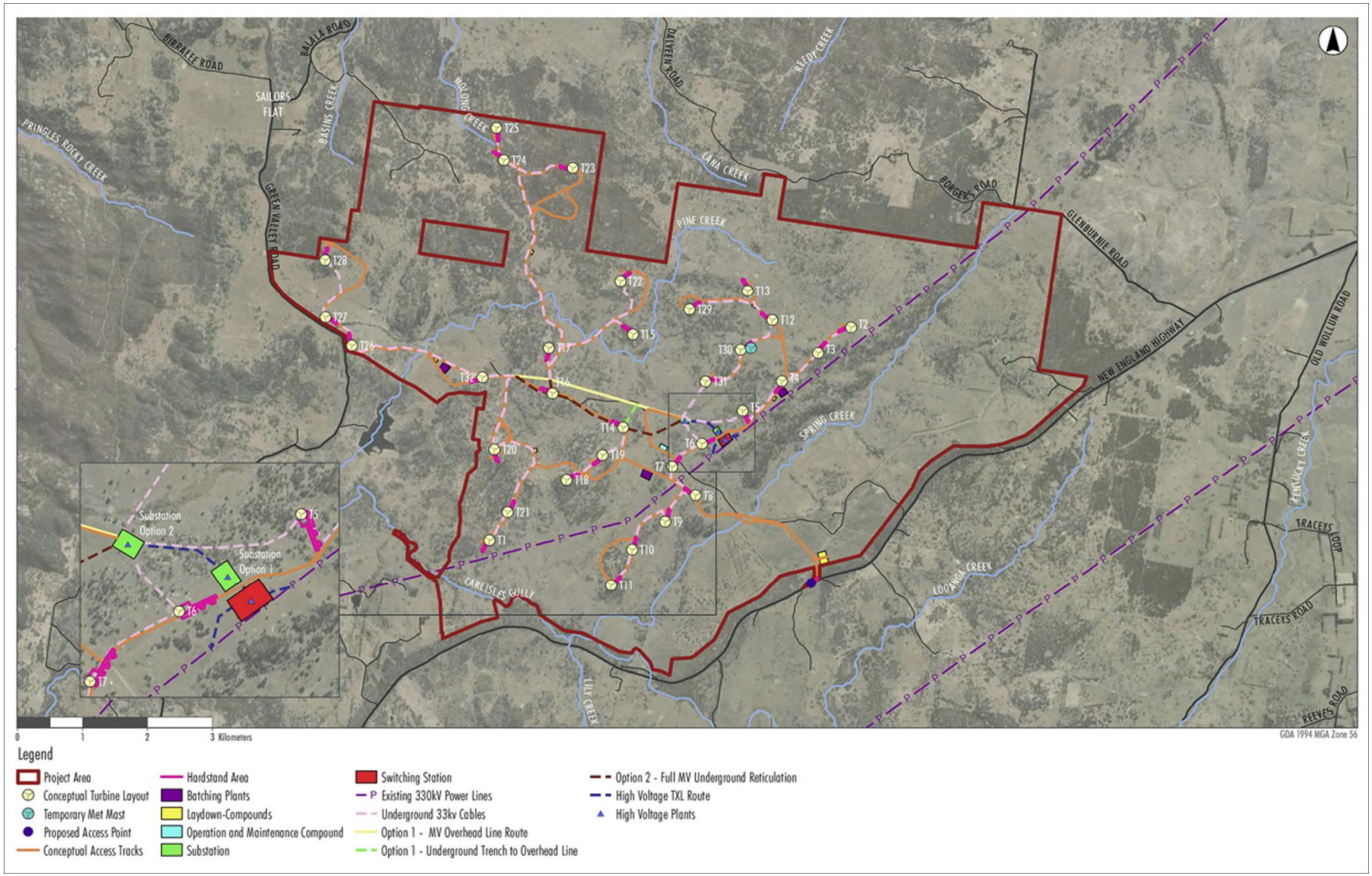


Figure 16 Thunderbolt Energy Hub (Stage 1 - Wind Farm) – Conceptual Project Layout **[Source: Umwelt]**

Table 8 Proposed Construction Schedule – Thunderbolt Energy Hub (Stage 1 - Wind Farm) [Source: Neoen]

ID	TASK	DURATION	MONTH																	
			Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			Q1 2024			Q2 2024			Q3 2024			Q4 2024			Q1 2025			Q2 2025		
A	Mobilisation & Site Establishment	1 M																		
B	Internal Access & Road Upgrades	8 M																		
C	Site Infrastructure Areas	8 M																		
D	Cabling (Underground & Overhead)	7 M																		
E	Turbine Foundations	5 M																		
F	Turbine Transportation	6 M																		
G	Turbine Erection	9 M																		
H	Finalisation / Commissioning / Demobilisation	6 M																		

3.2.2 Operations Phase

The operations phase of the Project will commence upon completion of the construction works, with the wind farm to be operated by a relatively small number of staff (approximately 9). In addition, it is expected that limited numbers of heavy vehicles will access the Project Area during operations, with only periodic maintenance (monthly) and routine service/refuse collection vehicles (1 per week) anticipated to travel to/from the Project Area.

Further to this, based on information provided by Neoen, it is understood that the proposed period of operation / life expectancy of the Project is approximately 25-30 years.

3.2.3 Decommissioning Phase

Finally, at the end of the operational life of the Project infrastructure (approx. 25-30 years) it is proposed that decommissioning works will be undertaken to remove wind turbine structures and site building infrastructure, as well as complete rehabilitation works to the access roads and hardstand areas throughout the Project Area (as required). As part of the removal of the wind turbines it is understood that the components will be removed from site and recycled.

Based on information provided by Neoen it is understood that at this stage the decommissioning phase works are anticipated to be completed over a 12 month period, with the peak traffic movements to/from the site during decommissioning conservatively estimated to be approximately 70% of the identified peak construction movements (both material/equipment delivery and peak staff movements).

3.3 Site Access

As shown in **Figure 16** above, the main access for Project traffic from the state controlled road network (New England Highway) will be via an upgraded configuration of the existing Kyabra Station property access intersection on the northern side of the highway carriageway located approximately 64km to the north-east of Tamworth (approx. Latitude 30°46'51.09"S / Longitude 151°20'7.78"E). As identified in **Section 2.3.4** above, it is expected that suitable safe intersection sight distances on the New England Highway are deemed to be achievable from the current access location.

In terms of the proposed configuration of the site access intersection with the New England Highway, the turn warrants assessment completed for the intersection (refer **Section 5.2**) indicate that the proposed upgrade works to the current intersection would require the provision of a basic left turn (BAL) and short channelised right (CHRs) turn treatments. Further to this, it is recommended that these upgrade works be provided generally in accordance with Figure 8.2 of Part 4A (rural BAL) and Figure A7 of Part 4 (rural CHRs) of Austroads Guide to Road Design, adopting a design speed of 110km/h, turning lane width of 3.5m and a 26m B-Double design vehicle. An indicative layout of the proposed Project Area access intersection is shown in **Figure 17** below, with additional details of the preliminary access works included in **Appendix D**.

Figure17 Proposed Site Access Arrangements (New England Highway)

Vehicle manoeuvring to/from the Project Area via this access has also been assessed, with swept path analysis undertaken for the largest vehicle expected from each direction to the site (26m B Double). Results of the swept path analysis at the Project Area access intersection are provided in the vehicle turn path diagrams included for reference as **Appendix E**. From these diagrams it can clearly be seen that the largest general (not including turbine component transport vehicles) construction vehicle (26m B Double) can safely manoeuvre both into and out of the Project Area utilising the proposed Project Area access intersection configuration.

In addition, the route assessment undertaken for the turbine component transport movements identified that additional works, including the provision of additional temporary hardstand area to the west of the proposed Project Area access, is required to accommodate the swept paths of the oversize blade transport vehicle movements (approx. 65m in length). The extents of these additional access works are shown in **Figure 18** below, noting that the exact configuration of the works will be confirmed in subsequent detailed design phases of the Project once the final configuration of the turbine components and associated transport vehicles are confirmed.

Figure 18 Additional OSOM Turbine Component Access Works **[Source: Rex J Andrews]**

Finally, it is noted that the Project Area access intersection configuration should be considered preliminary only, noting that further works and discussions with TfNSW are expected to be required during the detailed design phase of the Project, in response to the conditions of approval for the Project. Notwithstanding this, it is considered that suitable Project Area access arrangements to cater for the anticipated Project traffic volumes can be provided at this location.

3.4 Internal Site Facilities

As previously identified, the conceptual project layout (refer **Appendix C**) includes a series of internal access tracks throughout the Project Area which provide vehicular access between the external road network and the turbine locations and associated internal infrastructure. The access track layout has been designed to utilise the existing topography of the land, avoiding steep areas where possible, and to avoid areas of sensitive native vegetation.

The Project will comprise a total of approximately 50 km of access roads, with a summary of the intended design criteria for the internal tracks provided below:

- The internal access tracks will typically between 6-9m in width.
- Regular passing places and turning areas will be provided.
- The access tracks will only link to the identified Project Area access point, with no other connections to adjacent external roads proposed.
- Tracks will not be sealed but will be constructed from aggregate which expected to be locally sourced from quarries in both the Tamworth and Armidale areas.
- The number of water course crossings have been minimised as far as practicable.
- Track margins will be managed to reduce potential sediment-laden run-off.

The conceptual layout also identifies that a number of site facilities, including the proposed substation, switching station, construction compound, Operations and Maintenance Compound, laydown areas and onsite concrete batch plant areas, as shown in **Figure 16** above.

Further to this, whilst not currently shown on the conceptual layout it is understood that the suitable parking facilities will be provided for the Project in accordance with the requirements of all relevant standards, guidelines and policies. In addition, due to the large area of land available within the Project Area for the required internal facilities (including the construction site office and parking facilities), and the current setback from the external road network, it is not anticipated that any of the construction, operations or decommissioning phases of the Project will lead to an overspill of parking or vehicle queuing at the Project Area access that would lead to negative impacts to the operation of the surrounding road network.

3.5 Turbine Component Transport Route Upgrades

As previously identified, a transport route assessment has been separately undertaken for the Project by Rex J Andrews Transport to assess the impact of the movements of the various turbine component transport vehicle configurations on the sections of the external road network proposed to form part of the proposed transport routes for these oversize, over-mass (OSOM) vehicles between the port facilities in Newcastle and the Project site.

The transport route assessment completed (refer **Appendix A**) has identified two separate routes to the Project site from the Port of Newcastle, including one for transport vehicles with loads over 5.2m in height. A summary of the identified transport routes is provided in **Table 9** below:

Table 9 Identified OSOM Turbine Component Transport Routes

Route Survey 1 – Newcastle to Thunderbolt Energy Hub Stage 1	
Components:	Blades and loads under 5.2m in height
Distance:	350.0km
Route:	Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, New England Highway, (Tamworth bypass via Scott Road, Murray St, Marius St), New England

	Highway.
Route Survey 2 – Newcastle to Thunderbolt Energy Hub Stage 1	
Components:	Towers and loads over 5.2m in height (up to 5.8m)
Distance:	388.0km
Route:	Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, (Muswellbrook bypass via Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street, Dartbrook mine access Road), New England Highway, (Tamworth bypass via Scott Street, Marius Street), New England Highway.

In addition to identifying the proposed transport routes, the assessment also highlighted a number of specific locations or pinch points along the transport routes where additional works are expected to be required to accommodate the swept paths and vehicle clearance envelopes of the proposed turbine component transport vehicle configurations.

Further details of the route pinch points, and the currently proposed works are outlined in the transport route assessment included for reference in **Appendix A**. It is noted that the majority of the route pinch points identified will only require traffic management measures or minimal works (signage relocation works) to accommodate the expected OSOM vehicle movements, while a summary of the pinch points requiring modification works is provided in **Table 10** and **Table 11** for identified turbine transport routes 1 and 2 respectively.

It is anticipated that these works will form part of additional approvals for the Project, with the extent and scope of the additional works to be clarified through a subsequent route assessment to be undertaken in subsequent stages of the Project, once the exact configurations of both the turbine components and associated transport vehicles proposed to be utilised for Stage 1 (wind farm) of the Thunderbolt Energy Hub are confirmed by Neoen.

Table 10 Turbine Transport Route 1 – Modification Works Pinch Point Summary **[Source: Rex J Andrews]**

KM Index	Location	Section of Road	Current Clearance	Procedure	Comments
0.0	Mayfield	Mayfield #4 berth onto Selwyn Street	Length: 70.0 m Width: 8.0 m	Moderate right hand turn	Hardstand will need to be added to the left side exit of the corner. The existing culvert will be okay. Some signs will need to be relocated and or made removable and a section of fence will need to be relocated.
1.3	Mayfield	Selwyn Street onto Industrial Drive via George Street	Length: 70.0 m Width: 8.0 m	Right hand turn	The first right hand turn through George Street will need a sign made removable and a disused pole on the overhang removed.
126.0	Muswellbrook	Thomas Mitchell Drive onto Denman Road	Length: 60.0 m Width: 7.0 m	Right hand turn	Blades to travel around this corner on the correct side of the road. Some hardstand is required on the left side exit of the corner. Some signs will need to be made removable.
129.5	Muswellbrook	New England Highway railway underpass	Length: 65.0 m Width: 4.0 m Height: 5.0m	Travel directly ahead	Modelling indicates the GE 158 split blade would not have adequate clearance to the rail bridge (by approximately 100mm). This is not due to the size of the blade but due to the current approach to packaging this particular model for transport. With a minor adjustment to the packaging the required clearance could be achieved.

KM Index	Location	Section of Road	Current Clearance	Procedure	Comments
					Once the turbine model is confirmed further detailed analysis and consultation with the manufacturer would be required to ensure appropriate clearances which may include consideration of packaging for haulage. Note: all other loads over 4.0 metres in width and 5.0 metres in height are required to use either Route 2 or the Muswellbrook OSOM bypass via Bell Street.
284.0	Tamworth	New England Highway onto the heavy vehicle bypass at Scott Road.	Length: 66.0 m	Loads to cut across the wrong side of the roundabout from correct side to correct side	A tree will need to be removed from within the road reserve on the blade overhang and some signs will need to be made removable.
286.0	Tamworth	Murray Street onto New England Highway	Length: 66.0 m	Loads to cut across the wrong side of the roundabout from correct side to correct side. But travel through the incorrect side of the roundabout.	Signs to be made removable and no parking areas to be put in place.
350.0	Kentucky	New England Highway	Length: 40.0 m Width: 8.0 m	Left hand turn into Project Area	The corner will need to be redesigned to be suitable for the blades. Hard stand crosses the road reserve, through Crown Land and into the Project Area. Numerous trees will need to be removed and large area of hardstand added.

Table 11 Turbine Transport Route 2 – Modification Works Pinch Point Summary **[Source: Rex J Andrews]**

KM Index	Location	Section of Road	Current Clearance	Procedure	Comments
350.0	Kentucky	New England Highway	Length: 40.0 m Width: 8.0 m	Left hand turn into Project Area	The corner will need to be redesigned to be suitable for the blades. Hard stand crosses the road reserve, through Crown Land and into the Project Area. Numerous trees will need to be removed and large area of hardstand added. These works are located within the Road Reserve and extend across Crown Land and in the Project Area

4.0 Development Traffic

As required by the SEARs for the Project, this assessment considers three distinct periods of traffic generation for the Project, including the construction, operations and decommissioning phases. The expected traffic generation and distribution during all three of these phases of the Project is discussed in the sections below.

4.1 Construction Phase

As identified above, the construction phase of the Project is proposed to commence in Q1 2024 (pending approvals) with an overall construction period of 18-24 months. For the purpose of this assessment, it has conservatively been assumed that the overall duration of the Project will be the 18 months, which is considered to be the worst case as it will lead to the generation of higher daily and peak hour traffic volumes from the construction works. Adopting an assumed 18 month overall construction period, it is expected that all construction works on site will be completed by the end of Q2 2025 (June 2025), with the peak period of construction expected to occur between Q2 2022 and Q1 2023 (refer **Table 8** above).

The main traffic generating activities occurring within the construction phase of the Project are the transport of the various construction materials / equipment to the Project Area and the daily construction staff movements. Further details of these activities, including the Project traffic generation and its expected distribution on the surrounding road network, are provided in the following sections.

4.1.1 Turbine Component Transport Movements

As previously identified the turbine components will be imported from overseas, shipped to port facilities in Newcastle, before being transported by road to the Project Area. Based on information provided by Neoen, it is understood that each of the turbines on site will likely consist of 13-16 individual components depending on the configuration adopted, including 3-6 blade pieces (6 two-piece blades), hub, nacelle and drivetrain components, and up to 6 tower sections.

In addition, on average, two light escort vehicles will accompany each over dimension turbine component. Based on these numbers, a summary of the proposed turbine transport traffic volumes for the Project was established, as shown below:

- 1,266-1,554 vehicles total from Port of Newcastle, including:
  - 844-1,036 light vehicle escorts.
  - 416-512 turbine component transport vehicles.
  - 6 meteorological mast transport vehicles.

Based on a proposed turbine component haulage rate of approximately 2 full turbines per week, and an assumed 6 day a week haulage operation, this would equate to up to 32 turbine components per week or a maximum of 6 components per day. Combined with the assumed 2 light escort vehicles per component, the maximum daily vehicles on the network from the turbine transport operations would be 18 vehicles. Further to this, it is noted that as various routes have been identified for the different turbine components, a number of the identified road sections (particularly those forming over dimension bypasses) would be utilised less frequently and see lower daily traffic volumes from the haulage operations.

4.1.2 Materials and Equipment Delivery Movements

Neoen has provided preliminary information and assumptions regarding the expected construction phase of the Project based on their experience in developing similar wind farm developments. This information has been used to calculate the expected material and equipment quantities for the Project and the associated vehicle movements for the delivery of these items, based on the following general assumptions regarding the expected Project traffic numbers.

- The required gravel materials for the internal access roads, infrastructure areas and concrete aggregates have conservatively been assumed to be 100% imported from external quarry sources in both Tamworth and Armidale, with no internal sources currently identified within the Project Area.
- Similarly, it has been conservatively assumed 100% of the construction water requirements will be imported from external sources in both Tamworth and Armidale.

- Concrete is to be sourced from the on-site batch plant facility, with the associated materials (cement / aggregates etc.) proposed to be 100% imported to the Project Area.
- Other miscellaneous site equipment (site buildings, fencing etc.) and materials, including diesel fuel and the explosives utilised for blasting during the turbine foundation works, are expected to be imported from external sources in both Tamworth and Armidale.

A calculated breakdown of the Project generated traffic movements by construction task, is summarised in **Table 12**, while the detailed calculations completed in order to convert operational / construction information into vehicle movements are included for reference in **Appendix E**.

Table 12 Summary of Total Project Material / Equipment Delivery Movement Volumes

Task	Duration	Total Vehicles	Type of Vehicles	Max Vehicles per Day (Avg)
Task A – Mobilisation and Site Establishment	1 month	1,534 vehicles (external) 42 internal concrete truck movements	Semi-Trailers Truck and Dog Combinations Concrete Trucks	64 vehicles / day (external)
Task B – Internal Access and Road Upgrades	8 months	9,674 vehicles (external)	Truck and Dog Combinations	54 vehicles / day (external)
Task C – Site Infrastructure Areas	8 months	1,300 vehicles (external) 317 internal concrete truck movements	Semi-Trailers Truck and Dog Combinations Concrete Trucks	18 vehicles / day (external)
Task D – Cabling (Underground & Overhead)	7 months	314 vehicles (external)	Semi-Trailers Truck and Dog Combinations	4 vehicles / day (external)
Task E – Turbine Foundations	5 months	1,946 vehicles (external) 5,333 internal concrete truck movements	Semi-Trailers Truck and Dog Combinations Concrete Trucks	18 vehicles / day (external)
Task F – Turbine Transportation	6 months	1,266-1,554 vehicles total (including 844-1,036 light vehicle escorts)	Special Transport Vehicles (Permit) Escorts (light vehicle)	18 vehicles / day (including 6 OSOM vehicles)
Task G – Turbine Erection	9 months	10 vehicles required for crane delivery.	B-Doubles / Low Loaders	5 vehicles / day (external)
Task H – Finalisation / Commissioning / Demobilisation	6 months	580 vehicles (external)	Semi-Trailers	14 vehicles / day (external)
Other – Site Water (Does not include internal water truck movements)	18 months	3,774 vehicles	Water Trucks	10 vehicles / day (external)

4.1.3 Construction Staff Movements

The proponent has also provided the following information and assumptions regarding the proposed staff movements for the construction phase of the Project:

- Maximum (peak) construction workforce will comprise approximately 190 staff, of which 100% are assumed to travel from either Tamworth or Armidale.
- Outside of the peak construction period, the daily staff numbers associated with the Project are expected to be significantly less (i.e. in the order of 115 staff).
- Construction staff are expected to commute to the site daily from either Tamworth (50%) or Armidale (50%).

- Construction staff are expected to commute to the Project Area using a mix of private vehicles (light vehicles and 4WDs) and minibuses, with an average capacity of 2 staff per vehicle and 15 staff members per bus.
- The split of private vehicles and minibus usage by staff is anticipated to be approximately 50% / 50%.

Based on these general staff assumptions, the expected staff numbers and associated vehicle movements were established, with **Table 13** summarising the expected number of staff by construction task and by month, and **Table 14** converting the estimated staff numbers to anticipated vehicle movement numbers.

4.2 Operations Phase

The estimated workforce during the proposed 25-30 year operations phase of the Project (i.e. following the completion of the construction stages) is anticipated to only consist of a small number of local workers (i.e. approximately 5-10 staff) who are expected to reside locally to the Project Area and commute daily (most likely to/from Tamworth and/or Armidale). Further to this, the heavy vehicle movements during the operations phase of the Project are also likely to be extremely low (approx. 1 HV per week) and are considered to be negligible from a traffic engineering or transport planning perspective.

4.3 Decommissioning Phase

As previously identified, based on information provided by Neoen it is understood the decommissioning phase works associated with the Project are anticipated to be completed over a 12 month period, with the peak traffic movements to/from the Project Area during decommissioning conservatively estimated to be approximately 70% of the peak construction movements to/from the Project Area (both daily and during AM and PM peak periods).

However, as these works are likely to occur in more than 30 years the exact nature of the works and associated traffic movements are difficult to confirm at this stage. As such it is proposed that when more accurate information is available closer to the start of the decommissioning works, an updated traffic impact assessment be completed as part of the required decommissioning and rehabilitation strategy, to clearly outline the proposed decommissioning works, the associated traffic movements, their anticipated impact on the surrounding road network and any management and mitigation required.

4.4 Project Traffic Volumes on the Network

The calculated Project traffic volumes for the construction, operations and decommissioning phases of the Project outlined above have been distributed onto the public road network based upon assumed trip origins and destinations based on known equipment / materials sources and other Project operational information provided by the proponent. Further details of the expected Project traffic volumes on the key road links and intersections of the relevant sections of the external road network are provided in the following sections.

4.4.1 Road Links

As previously identified, the use of the external road network by general Project traffic during each stage of the Project is anticipated to be generally limited to the section of the New England Highway in close proximity to the Project Area, namely the length between the regional centres of Tamworth and Armidale. Detailed calculations were undertaken to establish the peak daily Project traffic volumes for each phase of the Project works on this key section of the road network, with a copy included for reference as **Appendix E**. A summary of the calculated construction, operations and decommissioning Project traffic volumes for the identified road links is provided in **Table 15**, noting:

- The peak construction phase Project volumes are experienced during the construction period where Tasks B, C, D, F and G (refer **Table 13**) are being completed simultaneously with typical site water and peak construction staff movements on the network.
- The operations phase Project volumes are based on the potential maximum volumes for staff movements on each section of the link (5-10 staff), noting and assumed 50% / 50% split of staff between Tamworth and Armidale.
- The decommissioning phase Project volumes are conservatively assumed to be 70% of the calculated construction phase volumes.

Table 13 Forecast Staff Numbers during Construction

ID	Duration (Days)	Work Activity	Max Staff	MONTH																	
				Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Sep-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Q1 2024			Q2 2024			Q3 2024			Q42024			Q1 2025			Q2 2025		
A	24	Mobilisation & Site Establishment	25	25																	
B	192	Internal Access & Road Upgrades	50		25	50	50	50	50	50	50	25									
C	192	Site Infrastructure Areas	25			15	25	25	25	25	25	25	15								
D	168	Cabling (Underground & Overhead)	25				15	25	25	25	25	25	15								
E	120	Turbine Foundations	50			50	50	50	50	50											
F	144	Turbine Transportation	20								20	20	20	20	20	20					
G	216	Turbine Erection	75									75	75	75	75	75	75	75	75	75	
H	144	Finalisation / Commissioning / Demobilisation	20													20	20	20	20	20	20
M	432	Management	20	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	10

Table 14 Forecast Daily Staff Vehicle Volumes

				MONTH																	
				Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Sep-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Q1 2024			Q2 2024			Q3 2024			Q42024			Q1 2025			Q2 2025		
Total Staff Numbers				35	35	135	160	170	170	170	140	190	145	115	115	135	115	115	115	115	30
Staff	**Vehicle**	100% **Capacity**	**Utilisation by Staff**	*35*	*35*	*135*	*160*	*170*	*170*	*170*	*140*	*190*	*145*	*115*	*115*	*135*	*115*	*115*	*115*	*115*	*30*
Required Staff Vehicle Movements	LV	2	50%	9	9	34	40	43	43	43	35	48	37	29	29	34	29	29	29	29	8
	Mini Bus	15	50%	2	2	5	6	6	6	6	5	7	5	4	4	5	4	4	4	4	1
			Total	**11**	**11**	**39**	**46**	**49**	**49**	**49**	**40**	**55**	**42**	**33**	**33**	**39**	**33**	**33**	**33**	**33**	**9**

Table 15 Project Traffic Volumes on External Road Network Links

Road Description	AADT Segment		Maximum Daily Project Traffic Volumes								
			Construction			Operations			Decommissioning		
	Start (km)	End (km)	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Bi-Dir
New England Highway (Tamworth-Armidale)	0.000	**63.700**	94	94	188	6	6	12	66	66	132
	63.700	105.00	76	76	152	6	6	12	53	53	106

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)
* New England Highway chainage assumed to run from Tamworth to Armidale
** Ch. 63.700km New England Highway/Site Access intersection.

Notwithstanding this, a number of other state and local government controlled roads were also identified in the preliminary transport route assessment (refer **Appendix A**) to be utilised as part of the turbine component transport operations from the Port of Newcastle to the Project Area during construction.

However, these turbine transport movements will typically be completed in off peak (or night) periods and under permit utilising escort vehicles. Further to this, based on the proposed transport schedule the maximum number of Project vehicles per day on the road links forming the turbine transport routes is 18vpd (including 6 OSOM transport vehicles and 12 light escort vehicles), with several road sections forming part of the alternate routes for the over dimension components likely to see even lower Project traffic volumes.

4.4.2 Intersections

Based on the information provided by Neoen and the subsequent traffic calculations undertaken, the peak hour traffic volumes from the construction, operations and decommissioning phases of the Project were also established at the key intersection of the New England Highway / Project Area Access.

As noted above, to ensure that the critical period at the intersection has been assessed, volumes for two different AM and PM peak hour periods have been established, including the period of peak Project traffic generation (6-7am and 5-6pm) and the periods of peak traffic flow on the adjacent section of the New England Highway identified from the historic traffic data for the link (10-11am & 3-4pm). The volumes at these periods have been established by combining the expected staff / visitor movements to the Project Area with the calculated hourly heavy vehicle movements for each Project phase.

A summary of the identified construction, operations and decommissioning phase Project traffic volumes at the access intersection is outlined in **Table 16** and **Table 17** for the project traffic and the relevant section of the New England Highway peaks respectively, with further details of the calculations undertaken to establish these volumes are provided for reference in **Appendix E**.

Table 16 Peak Hour (Project Peak) Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction Phase												
AM Peak (Project Peak)	26	9	0	0	0	4	2	5	0	0	24	8
PM Peak (Project Peak)	2	5	0	0	24	8	26	9	0	0	0	4
Operations Phase												
AM Peak (Project Peak)	5	1	0	0	1	1	0	1	0	0	5	1
PM Peak (Project Peak)	1	1	0	0	5	1	5	1	0	0	1	1
Decommissioning Phase												
AM Peak (Project Peak)	18	6	0	0	0	3	1	4	0	0	17	6
PM Peak (Project Peak)	1	4	0	0	17	6	18	6	0	0	0	3

Table 17 Peak Hour (Highway Peak) Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction Phase												
AM Peak (NE Highway Peak)	7	5	0	0	5	4	7	5	0	0	5	4
PM Peak (NE Highway Peak)	7	5	0	0	5	4	7	5	0	0	5	4
Operations Phase												
AM Peak (NE Highway Peak)	1	1	0	0	1	1	1	1	0	0	1	1
PM Peak (NE Highway Peak)	1	1	0	0	1	1	1	1	0	0	1	1
Decommissioning Phase												
AM Peak (NE Highway Peak)	5	4	0	0	4	3	5	4	0	0	4	3
PM Peak (NE Highway Peak)	5	4	0	0	4	3	5	4	0	0	4	3

4.5 Cumulative Project Traffic Volumes

As identified in the SEARs for this Project, an assessment of the potential cumulative traffic impact of the Project in conjunction with other projects in the area was requested to be undertaken. As such a review of the known projects in the vicinity of the Project Area (as shown in **Figure 18)** was undertaken to determine which were expected to lead to an increase in traffic volumes on the relevant sections of the road network concurrently with anticipated increases from the Project.

A summary of this review, including commentary regarding the requirements to consider each identified Project in the area are provided for reference in **Table 19**.

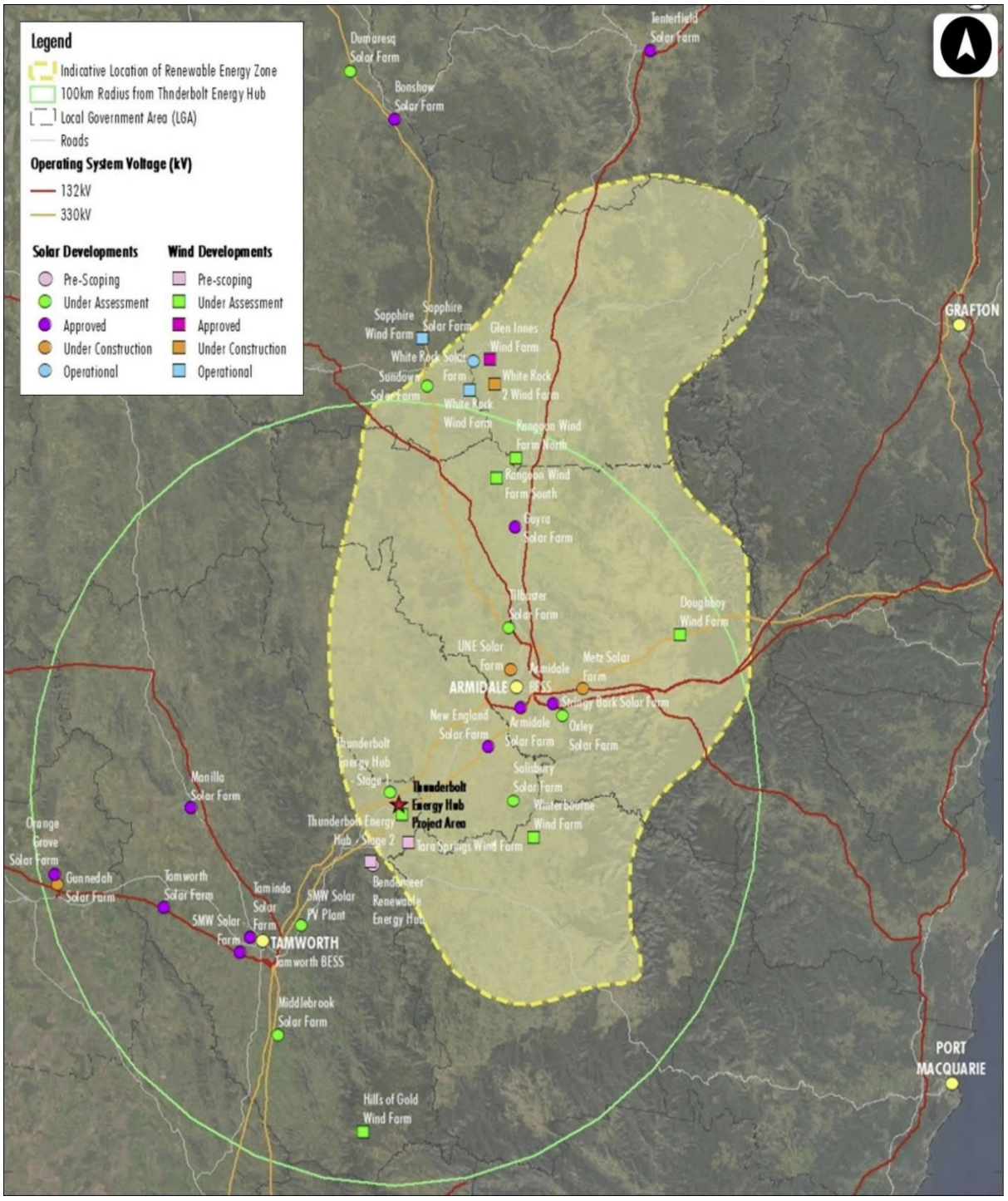


Figure 19 Identified Renewable Energy Projects in Vicinity of Subject Site **[Source: Umwelt]**

Table 18 Cumulative Project Traffic Review Summary

Project	Dev. Type	Dev. Stage	Review Comments	Req. for Cumulative Traffic
Sapphire Wind Farm (93km north of Armidale)	Wind	Operational	Operations traffic for Sapphire Wind Farm expected to be limited to between SWF site and Inverell or Glen Innes, i.e. not past Project Area.	No
White Rock Wind Farm (115km Northeast of Project)	Wind	Operational	Operations traffic for White Rock Wind Farm expected to be limited to between SWF site and Inverell or Glen Innes, i.e. not past Project Area.	No
White Rock Solar Farm (115km northeast of Project)	Solar	Operational	Operations traffic for White Rock Solar Farm expected to be limited to between SWF site and Inverell or Glen Innes, i.e. not past Project Area.	No
White Rock 2 Wind Farm (110km north of Project)	Wind	Under Construction	As White Rock 2 Wind Farm is currently under construction it is expected to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the White Rock 2 Wind Farm site and Inverell or Glen Innes, i.e. not past Project Area.	No
Gunnedah Solar Farm (58km west of Tamworth)	Solar	Under Construction	As Gunnedah Solar Farm is currently under construction it is expected to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Gunnedah Solar Farm site and Tamworth, i.e. not past Project Area.	No
Metz Solar Farm (58km northeast of Project)	Solar	Under Construction	As Metz Solar Farm is currently under construction it is expected to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Metz Solar Farm site and Armidale, i.e. not past Project Area.	No
UNE Solar Farm (46km northeast of Project)	Solar	Under Construction	As UNE Solar Farm is currently under construction it is expected to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the UNE Solar Farm site and Armidale, i.e. not past Project Area.	No
Glen Innes Wind Farm (115km north of Project)	Wind	Approved	As Glenn Innes Wind Farm is already approved (although the construction timeframe is unknown) there is sufficient time for the construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Glenn Innes Wind Farm site and Inverell or Glen Innes, i.e. not past Project Area.	No
Bonshaw Solar Farm (150km north of Armidale)	Solar	Approved	As Bonshaw Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for the construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Bonshaw Solar Farm site and Inverell or Texas (QLD), i.e. not past Project Area.	No
Sapphire Solar Farm (93km north of Armidale)	Solar	Approved (Construction 2022)	As Sapphire Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for the construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Sapphire Solar Farm site and Armidale, Inverell or Glen Innes, i.e. not past Project Area.	No

Project	Dev. Type	Dev. Stage	Review Comments	Req. for Cumulative Traffic
Tenterfield Solar Farm (160km north of Armidale)	Solar	Approved (Construction 2022)	As Tenterfield Solar Farm is already approved and construction is expected to commence in 2022, its construction be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Tenterfield Solar Farm site and Tenterfield, i.e. not past Project Area.	No
Orange Grove Solar Farm (60km west of Tamworth)	Solar	Approved	As Orange Grove Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Orange Grove Solar Farm site and Tamworth, i.e. not past Project Area.	No
Stringy Bark Solar Farm (50km northeast of Project)	Solar	Approved	As Stringy Bark Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for the construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Stringy Bark Solar Farm site and Armidale, i.e. not past Project Area.	No
Taminda Solar Farm (4km north of Tamworth)	Solar	Approved	As Taminda Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for the construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Taminda Solar Farm site and Tamworth, i.e. not past Project Area.	No
Tamworth Solar Farm (28km west of Tamworth)	Solar	Approved	As Tamworth Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Tamworth Solar Farm site and Tamworth, i.e. not past Project Area.	No
New England Solar Farm (28 km northeast of Project)	Solar	Approved	As New England Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the New England Solar Farm site and Armidale, i.e. not past Project Area.	No
Guyra Solar Farm (76km northeast of Project)	Solar	Approved	As Guyra Solar Farm is already approved(although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Guyra Solar Farm site and Armidale, i.e. not past Project Area.	No
5MW Solar Farm (58km southwest of Project)	Solar	Approved	As 5MW Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the 5MW Solar Farm site and Tamworth, i.e. not past Project Area.	No
Armidale Solar Farm (41.5km northeast of Project)	Solar	Approved	As Armidale Solar Farm is already approved (although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Armidale Solar Farm site and Armidale, i.e. not past Project site.	No
Manilla Solar Farm (40km north of Tamworth)	Solar	Approved	As Manilla Solar Farm is already approved(although the construction timeframe is unknown) there is sufficient time for construction to be completed prior to the commencement of the Project. Also the operations traffic is expected to be limited to between the Manilla Solar Farm site and Tamworth, i.e. not past Project site.	No

Project	Dev. Type	Dev. Stage	Review Comments	Req. for Cumulative Traffic
Hills of Gold Wind Farm (57km southeast of Tamworth)	Wind	Under Assessment EIS Exhibited	Potential for construction to be completed concurrently with Project, however the construction traffic from the Hills of Gold Wind Farm is expected to be limited to between the Hills of Gold Wind Farm site and either Tamworth or Newcastle (for turbine components), i.e. not past Project Area. Similarly the operations phase traffic from the Hills of Gold Wind Farm is expected to be limited to between the Hills of Gold site and Tamworth, i.e. not past Project Area.	No
Doughboy Wind Farm (89km northeast of Project)	**Wind**	**Under Assessment Prepare EIS**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Doughboy Wind Farm site and Armidale i.e. not past Project Area. There is however potential for the turbine component transport movements from the Doughboy Wind Farm to utilise the section of the New England Highway past the Project Area on route to Doughboy site from Newcastle.**	**Yes**
Rangoon Wind Farm (N & S) (94km North of Project)	**Wind**	**Under Assessment Prepare EIS**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Rangoon Wind Farm site and Armidale i.e. not past Project Area. There is however potential for the turbine component transport movements to utilise the section of the New England Highway past the Project Area on route to Rangoon Wind Farm site from Newcastle.**	**Yes**
Winterbourne Wind Farm (38km east of Project Area)	Wind	Under Assessment Prepare EIS	Potential for construction / operations to be completed concurrently with Project, however the construction traffic is expected to be limited to between the Winterbourne Wind Farm site and either Tamworth or Newcastle (for turbine components) via the Oxley Highway, i.e. not past Project Area. Similarly the operations phase traffic is expected to be limited to between the Winterbourne Wind Farm site and Tamworth via the Oxley Highway, i.e. not past Project Area.	No
Oxley Solar Farm (50km northeast of Project)	**Solar**	**Under Assessment EIS Exhibited**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Oxley Solar Farm site and Armidale i.e. not past Project Area. There is however potential for the solar component transport movements to utilise the section of the New England Highway past the Project Area on route to the Oxley Solar Farm Site from Newcastle.**	**Yes**
Tilbuster Solar Farm (55km northeast of Project)	**Solar**	**Under Assessment EIS Exhibited**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Tilbuster Solar Farm site and Armidale i.e. not past Project Area. There is however potential for the solar component transport movements to utilise the section of the New England Highway past the Project site on route to the Tilbuster Solar Farm Site from Newcastle.**	**Yes**
Middlebrook Solar Farm (25 km south of Tamworth)	Solar	Under Assessment Prepare EIS	Potential for construction / operations to be completed concurrently with Project, however the construction traffic is expected to be limited to between the Middlebrook Solar Farm site and either Tamworth or Newcastle (for solar components), i.e. not past Project Area. Similarly the operations phase traffic is expected to be limited to between the Middlebrook Solar Farm site and Tamworth, i.e. not past Project Area.	No
Salisbury Solar Farm (32km northeast of Project)	**Solar**	**Under Assessment Prepare EIS**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Salisbury Solar Farm site and Armidale i.e. not past Project Area. There is however potential for the solar component transport movements to utilise the section of the New England Highway past the Project Area on route to the Salisbury Solar Farm Site from Newcastle.**	**Yes**

Project	Dev. Type	Dev. Stage	Review Comments	Req. for Cumulative Traffic
Thunderbolt Energy Hub – Solar Farm (adjacent to the Project Area)	Solar	Under Assessment Prepare EIS	Construction of the Thunderbolt Energy Hub Solar Farm is anticipated to occur after the construction phase of Project, however it is noted that construction and operations phase traffic is likely to use section of New England Highway past the Project Area. Notwithstanding this, the operations phase volumes from the Project are expected to be minor and not significantly impacted by passing traffic from the construction or operations phases of other Projects.	No
5MW Solar Plant (40km southwest of Project)	Solar	Under Assessment Prepare EIS	Potential for construction / operations to be completed concurrently with Project, however the construction traffic is expected to be limited to between the 5MW Solar Farm site and either Tamworth or Newcastle (for solar components), i.e. not past Project Area. Similarly the operations phase traffic is expected to be limited to between the 5MW Solar Farm site and Tamworth, i.e. not past Project Area.	No
Sundown Solar Farm (108km north of Project)	**Solar**	**Under Assessment Prepare EIS**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Sundown Solar Farm site and Armidale i.e. not past Project Area. There is however potential for the solar component transport movements to utilise the section of the New England Highway past the Project Area on route to the Sundown Solar Farm Site from Newcastle.**	**Yes**
Dumaresq Solar Farm (164km northwest of Armidale)	Solar	Under Assessment Prepare EIS	Potential for construction / operations to be completed concurrently with Project, however the construction and operations phase traffic is expected to be limited to between the Dameresq Solar Farm site and either Inverell or Texas (QLD), i.e. not past Project Area. Similarly the solar components are expected to be transported to the Dameresq Solar Farm site via Brisbane, i.e. not past Project Area.	No
Tamworth Battery Energy Storage System (8km south of Tamworth)	Other	Under Assessment Prepare EIS	Potential for construction / operations to be completed concurrently with Project, however the construction traffic is expected to be limited to between the Tamworth Battery Energy System site and either Tamworth or Newcastle (for battery components), i.e. not past Project Area. Similarly the operations phase traffic is expected to be limited to between the Tamworth Battery Energy System site and Tamworth, i.e. not past Project Area.	No
Armidale Battery Energy Storage System (45km northeast of Project)	**Other**	**Under Assessment Prepare EIS**	**Potential for construction / operations to be completed concurrently with Project, however main construction and operations traffic expected to be limited to between Armidale Battery Energy Storage System site and Armidale i.e. not past Project Area. There is however potential for the battery component transport movements to utilise the section of the New England Highway past the Project Area on route to the Armidale Battery Energy Storage System from Newcastle.**	**Yes**
Thunderbolt Energy Hub – Stage 2 (South of the Project Area)	Wind	In Planning	Construction timeframe associated with Stage 2 of the Thunderbolt Energy Hub Wind Farm is yet to be confirmed however it is anticipated to occur after the construction phase of the Project, however it is noted that construction and operations phase traffic for Stage 2 is likely to use section of New England Highway past the Project Area. Notwithstanding this, the operations phase volumes from the Project (Thunderbolt Energy Hub Wind Farm Stage 1) are expected to be minor and not significantly impacted by passing traffic from the construction or operations phases of other Projects.	No

Project	Dev. Type	Dev. Stage	Review Comments	Req. for Cumulative Traffic
Bendemeer Renewable Energy Hub (30km southwest of Project)	Wind & Solar	In Planning	Construction anticipated to occur after the construction phase of Project. Notwithstanding this, it is expected that construction and operations phase traffic would be restricted to between the Bendemeer Renewable Energy Hub site and either Tamworth or Newcastle (transport of turbine and solar components), i.e. not past Project Area.	No
Tara Springs Wind Farm (10km south of Project)	Wind	In Planning	Construction anticipated to occur after the construction phase of Project. Notwithstanding this, it is expected that construction and operations phase traffic would be restricted to between the Tara Springs Wind Farm site and either Tamworth or Newcastle (transport of turbine components) via the Oxley Highway, i.e. not past Project Area.	No

As shown by this review, the majority of the other projects in the region are not anticipated to be required to be considered as part of a cumulative impact assessment for the Project as they are either located in areas which would not lead to increases in traffic volumes on the relevant section of the New England Highway relevant to the Project or the timing of their construction phase is expected to be prior to or following that of the Project, meaning that the significant construction volumes from these other Projects will not align with the construction volumes from the Project. The review did however identify a eight projects located north of the Project Area where either the turbine component (wind farm), solar component (solar farm) or battery component (battery storage facility) transport movements have the potential to align with the construction phase of the Project.

In regard to the haulage of the large OSOM turbine components associated with the other identified projects, it is expected that all movements will originate from the Port of Newcastle and follow a similar route to that identified for the Project, via the New England Highway. As all of these OSOM movements will be required to be undertaken under permit, it is expected that restrictions and management measures will be implemented to ensure that movements from one site only will occur at any time, to minimise the impacts on the operation of the road links forming part of the identified transport routes. As such the additional traffic past the Project Area from the identified projects to the north of the Project Area is anticipated to be limited to turbine transport volumes from one wind farm only at any one time (approx. 20 vpd).

To account for the expected increase in traffic volumes on the relevant section of the New England Highway adjacent to the Project Area from the identified projects to the north of the Project Area, an additional sensitivity analysis has been completed as part of the assessment of the road link and intersection impacts associated with the Project assuming a 20% increase in the background traffic volumes on the relevant section of the New England Highway. This increase is considered conservative and sufficient to account for any likely increase in traffic due to potential concurrent transport movements of turbine, solar and battery components from the other renewable energy projects in the region. Further details of the cumulative impact assessment undertaken are provided in **Section 5.2** and **Section 5.3** below.

5.0 Impact Assessment and Mitigation

Based on the information provided above, it was determined that the critical elements of the surrounding road network in terms of the potential impact of the Project were the identified road links forming the proposed transport routes for the Project, in particular the section of the New England Highway between Tamworth and Armidale, and the key site access intersection with the New England Highway.

Further assessment of the impact of the Project on these elements is provided in the following sections.

5.1 With and Without Project Traffic Volumes

5.1.1 Road Link Volumes

As identified above, the peak traffic generation associated with the Project is expected to occur during the peak construction period, with the expected maximum traffic volumes from the Project for the construction and subsequent operations and decommissioning phases identified in **Table 15** above.

Based on these volumes and the adopted distribution of Project traffic identified in **Section 4.0** above, the forecast traffic volumes on the relevant sections of the road network were established for both the with and without Project scenarios. These volumes were developed at the relevant design horizons for each phase of the Project, with summaries for the construction, operations and decommissioning phases outlined in **Table 19** to **Table 21** below.

Table 19 Road Link Daily Traffic Volumes (Construction Phase)

Road ID	Road Segment		Background Daily Volumes		Project Operations Traffic (Daily)		Operations Daily Traffic Volume	
	Start (km)	End (km)	2024		2024		2024	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)								
A15	0.000	**63.700**	2,259	2,290	94	94	2,353	2,384
	63.700	105.000	2,259	2,290	76	76	2,335	2,366

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

Table 20 Road Link Daily Traffic Volumes (Operations Phase)

Road ID	Road Segment		Background Daily Volumes		Project Operations Traffic (Daily)		Operations Daily Traffic Volume	
	Start (km)	End (km)	2025		2025		2025	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)								
A15	0.000	**63.700**	2,281	2,313	6	6	2,287	2,319
	63.700	105.000	2,281	2,313	6	6	2,287	2,319

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

Table 21 Road Link Daily Traffic Volumes (Decommissioning Phase)

Road ID	Road Segment		Background Daily Volumes		Project Operations Traffic (Daily)		Operations Daily Traffic Volume	
	Start (km)	End (km)	2056		2056		2056	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)								
A15	0.000	**63.700**	3,105	3,149	66	66	3,171	3,215
	63.700	105.000	3,105	3,149	53	53	3,159	3,202

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

5.1.2 Intersection Volumes

In addition to road link volumes, traffic volumes at the key site access intersection with the New England Highway were established for the peak construction, operations and decommissioning phases of the Project. To establish these volumes, the Project volumes as identified in **Section 4.4.2** above were added to the forecast background traffic volumes at the relevant design horizons for each phase of the Project.

The resulting turning volumes at the New England Highway / Project Area Access intersection for the peak construction, operations and decommissioning phases of the Project are summarised in **Table 22** to **Table 24** below.

Table 22 Construction Phase Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Peak Construction Phase (2024)												
2024 AM Peak (Project Peak)	27	10	47	28	1	5	3	6	39	13	25	9
2024 PM Peak (Project Peak)	3	6	121	26	25	9	27	10	123	35	1	5
2024 AM Peak (NE H'way Peak)	8	6	133	36	6	5	8	6	144	38	6	5
2024 PM Peak (NE H'way Peak)	8	6	153	32	6	5	8	6	152	42	6	5
Cumulative Construction Phase (2024)												
2024 AM Peak (Project Peak)	27	10	57	34	1	5	3	6	47	15	25	9
2024 PM Peak (Project Peak)	3	6	145	32	25	9	27	10	148	42	1	5
2024 AM Peak (NE H'way Peak)	8	6	160	43	6	5	8	6	173	45	6	5
2024 PM Peak (NE H'way Peak)	8	6	184	38	6	5	8	6	183	50	6	5

Table 23 Operations Phase Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Operations Phase (2055)												
2055 AM Peak (Project Peak)	6	2	64	39	2	2	2	2	53	17	6	2
2055 PM Peak (Project Peak)	2	2	165	36	6	2	6	2	167	47	2	2
2055 AM Peak (NE H'way Peak)	2	2	182	49	2	2	2	2	196	52	2	2
2055 PM Peak (NE H'way Peak)	2	2	209	43	2	2	2	2	207	57	2	2

Table 24 Decommissioning Phase Traffic Volumes, New England Highway / Project Area Access Intersection

Year	New England Highway SW				Project Area Access NW				New England Highway NE			
	Left		Through		Left		Right		Through		Right	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Decommissioning Phase (2056)												
2056 AM Peak (Project Peak)	19	8	65	39	1	4	3	5	53	17	18	7
2056 PM Peak (Project Peak)	3	5	166	36	18	7	19	8	169	48	1	4
2056 AM Peak (NE H'way Peak)	6	5	184	49	5	4	6	5	198	52	5	4
2056 PM Peak (NE H'way Peak)	6	5	211	43	5	4	6	5	210	58	5	4

5.2 Access and Frontage Impact Assessment and Mitigation

An assessment has been undertaken to establish the appropriate turn treatments at the Project Area access intersection with the New England Highway. This assessment is based on the turn treatment warrants graph as per Figure 2.26(a) of Austroads Guide to Traffic Management - Part 6: Intersections, Interchanges and Crossings to reflect the high speed rural highway traffic environment.

The forecast turning movement volumes at the Project Area access intersection during the peak periods of the construction, operations and decommissioning phase of the Project, as identified in **Table 22** to **Table 24** above have been used as the basis of this assessment, with a summary of the resultant turn warrants from the assessment shown in **Table 25** below. Further details of the turn warrant calculations (including graphs) for each of the identified traffic scenarios is also included for reference as **Appendix F.**

Table 25 Intersection Turn Warrants Assessment - New England Highway / Project Area Access Intersection

Project Traffic Scenario	Recommended Turn Warrants	
	Left Turn Treatment	Right Turn Treatment
Project Construction Phase		
Peak Construction – 2024 AM Peak (Project Peak)	BAL	CHRs
Peak Construction – 2024 PM Peak (Project Peak)	BAL	BAR
Peak Construction – 2024 AM Peak (New England Highway Peak)	BAL	CHRs
Peak Construction – 2024 PM Peak (New England Highway Peak)	BAL	CHRs
Cumulative Construction – 2024 AM Peak (Project Peak)	BAL	CHRs
Cumulative Construction – 2024 PM Peak (Project Peak)	BAL	CHRs
Cumulative Construction – 2024 AM Peak (New England Highway Peak)	BAL	CHRs
Cumulative Construction – 2024 PM Peak (New England Highway Peak)	BAL	CHRs
Project Operations Phase		
Operations – 2055 AM Peak (Project Peak)	BAL	BAL
Operations – 2055 PM Peak (Project Peak)	BAL	CHRs
Operations – 2055 AM Peak (New England Highway Peak)	BAL	CHRs
Operations – 2055 PM Peak (New England Highway Peak)	BAL	CHRs
Project Decommissioning Phase		
Peak Decommissioning – 2056 AM Peak (Project Peak)	BAL	CHRs
Peak Decommissioning – 2056 PM Peak (Project Peak)	BAL	CHRs
Peak Decommissioning – 2056 AM Peak (New England Highway Peak)	BAL	CHRs
Peak Decommissioning – 2056 PM Peak (New England Highway Peak)	BAL	CHRs
Proposed Site Access Turn Treatments	**BAL**	**CHRs**

As shown in **Table 25** above, based on the expected peak hour traffic volumes at the access intersection during the critical periods of the construction, operations and decommissioning phases of the Project, it was shown that the required intersection treatments at the New England Highway / Project Area Access intersection were a basic left (BAL) and short channelised right (CHRs) treatments.

Based on this, the proposed configuration of the Project Area access intersection with the New England Highway (refer **Section 3.3** above), which includes the provision of BAL and CHRs treatments at the intersection, can therefore be considered appropriate to cater for the expected Project traffic volumes. Furthermore, it is recommended that the required turn treatments at the site access intersection be designed in accordance with Figure 8.2 of Austroads Guide to Road Design Part 4A and Figure A7 of Austroads Guide to Road Design Part 4 respectively.

In addition to the identified turn treatments at the site access intersection, it is also recommended that traffic management measures including advisory “truck turning” signage be installed on the New England

Highway approaches to the access during the peak construction phase of the Project, to highlight to motorists the presence of the Project access intersections and the potential for turning heavy vehicles to/from the side roads.

Finally, it is noted that temporary pavement works are expected to be required to provide additional hardstand areas to extend the trafficable surface at the site access intersection with the New England Highway to accommodate the swept paths of the identified turbine component transport vehicle movements for the Project. The exact extents of these temporary works at the access intersection will be confirmed as the turbine component and transport vehicle configurations are finalised in subsequent stages of the Project, however preliminary details can be seen in the Preliminary Transport Route Assessment report completed for the Project (refer **Appendix A**) and **Figure 18** above.

5.3 Intersection Impact Assessment and Mitigation

SIDRA analysis was undertaken to establish the operational performance of the proposed upgraded configuration of the Project Area access intersection with the New England Highway. This analysis was completed for the relevant traffic scenarios for the construction, operations and decommissioning phases of the Project, considering the AM and PM peak periods at the critical design horizons for each phase as outlined in **Section 4.0** above.

A summary of the results of the completed analysis of the proposed New England Highway / Project Area Access intersection is provided in **Table 26**, **Table 27** and **Table 28** for the construction, operations and decommissioning phase respectively, with detailed SIDRA output summaries included for reference in **Appendix G**.

Table 26 Construction Phase SIDRA Results – New England Highway / Project Area Access Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Peak Construction (2024) – Proposed Project Area Access Intersection Configuration				
2024 AM Peak (Project Peak)	0.075	LOS A	3.4	1.0
2024 PM Peak (Project Peak)	0.097	LOS B	1.8	3.0
2024 AM Peak (NE H'way Peak)	0.113	LOS B	1.1	1.4
2024 PM Peak (NE H'way Peak)	0.120	LOS B	1.1	1.4
Cumulative Peak Construction (2024) – Proposed Project Area Access Intersection Configuration				
2024 AM Peak (Project Peak)	0.085	LOS A	3.1	1.0
2024 PM Peak (Project Peak)	0.116	LOS B	1.6	3.2
2024 AM Peak (NE H'way Peak)	0.134	LOS B	1.0	1.5
2024 PM Peak (NE H'way Peak)	0.142	LOS B	1.0	1.6

** LOS value identified is for worst movement at the intersection, not the overall intersection.

Table 27 Operations Phase SIDRA Results – New England Highway / Project Area Access Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Operations (2055) – Proposed Project Area Access Intersection Configuration				
2055 AM Peak (Project Peak)	0.074	LOS A	1.0	0.4
2055 PM Peak (Project Peak)	0.131	LOS A	0.5	0.7
2055 AM Peak (NE H'way Peak)	0.151	LOS B	0.3	0.5
2055 PM Peak (NE H'way Peak)	0.161	LOS B	0.3	0.6

** LOS value identified is for worst movement at the intersection, not the overall intersection.

Table 28 Decommissioning Phase SIDRA Results – New England Highway / Project Area Access Intersection

Analysis Scenario	Intersection Degree of Saturation	Level of Service**	Intersection Average Delay (sec)	Maximum 95% Back of Queue Length (m)
Peak Decommissioning (2056) – Proposed Project Area Access Intersection Configuration				
2056 AM Peak (Project Peak)	0.087	LOS A	2.3	0.8
2056 PM Peak (Project Peak)	0.133	LOS B	1.2	2.6
2056 AM Peak (NE H'way Peak)	0.152	LOS B	0.8	1.3
2056 PM Peak (NE H'way Peak)	0.163	LOS B	0.7	1.4

** LOS value identified is for worst movement at the intersection, not the overall intersection.

The results above indicate that the proposed upgraded configuration (BAL / CHRs) of the site access intersection with the New England Highway is expected to operate satisfactorily during the peak construction phase traffic scenarios identified for the Project, with all values for intersection DOS, LOS, average delay and vehicle queue lengths being within acceptable limits of operation for a priority-controlled (give-way) intersection.

Further to this, it is noted that the results of the additional cumulative impact assessment undertaken for the construction phase of the Project (refer **Table 26**) indicated that the proposed configuration of the site access intersection is also expected to operate satisfactorily considering the potential increase in traffic volumes on the New England Highway as a result of the concurrent construction of other renewable Projects in the region.

Based on these results, it can therefore be seen that the proposed configuration of the New England Highway / Project Area Access intersection, incorporating BAL and CHRs turn treatments, can be considered appropriate to cater for the additional traffic volumes generated by the peak construction, operations and decommissioning phases of the Project.

5.4 Road Link Capacity Assessment and Mitigation

In addition to the analysis of the proposed Project Area access intersection, an assessment of the impact of the additional traffic generated by the various phases of the Project on the operation of the road links utilised has also been completed. This assessment identifies the expected increase in daily traffic volumes on the road network during the key construction, operations and decommissioning phases of the Project, and comments on the level of impact the increase in traffic is anticipated to have on the operation of the road links.

The assessment is primarily focussed on the section of the New England Highway between the regional centres of Tamworth and Armidale, as this link is proposed to be utilised by the majority of the additional traffic generated by the Project. A summary of the assessment of the percentage increase in daily traffic volumes on the relevant section of the New England Highway as a result of the construction, operations and decommissioning phase traffic from the Project is shown in **Table 29** to **Table 31** below, with further details of the calculations undertaken provided in **Appendix E**.

Table 29 Road Link Daily Traffic Volume Comparison (Construction Phase)

Road ID	Road Segment		Background Daily Volumes		Project Construction Traffic (Daily)		% Increase in Daily Traffic Volume		Peak Construction Daily Traffic Volume	
	Start (km)	End (km)	2024		2024		2024		2024	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)										
A15	0.000	**63.700**	2,259	2,290	94	94	4.16%	4.10%	2,353	2,384
	63.700	105.000	2,259	2,290	76	76	3.32%	3.32%	2,335	2,366

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

Table 30 Road Link Daily Traffic Volume Comparison (Operations Phase)

Road ID	Road Segment		Background Daily Volumes		Project Operations Traffic (Daily)		% Increase in Daily Traffic Volume		Operations Daily Traffic Volume	
	Start (km)	End (km)	2025		2025		2025		2025	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)										
A15	0.000	**63.700**	2,281	2,313	6	6	0.26%	0.26%	2,287	2,319
	63.700	105.000	2,281	2,313	6	6	0.26%	0.26%	2,287	2,319

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

Table 31 Road Link Daily Traffic Volume Comparison (Decommissioning Phase)

Road ID	Road Segment		Background Daily Volumes		Project Decommissioning Traffic (Daily)		% Increase in Daily Traffic Volume		Decommissioning Daily Traffic Volume	
	Start (km)	End (km)	2056		2056		2056		2056	
			Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)										
A15	0.000	**63.700**	3,105	3,149	66	66	2.12%	2.09%	3,171	3,215
	63.700	105.000	3,105	3,149	53	53	1.71%	1.69%	3,159	3,202

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

As can be seen by the results in above, the addition of the expected construction, operations and decommission phase traffic volumes from the Project is shown to have a minimal impact on the identified section of the New England Highway, with all increases in daily traffic volumes forecast to be less than 5% and all road link volumes with Project traffic shown to be well within operating capacity for a two lane rural highway (generally 12,000-15,000vpd).

Based on this, it is expected that the existing configuration of the relevant section of the New England Highway is adequate to cater for the additional traffic volumes generated by the Project.

5.4.1 Turbine Component Transport Routes

It is also noted that additional sections of the external road network have been identified to be temporarily (approx. 6 months) utilised by the Project as part of the turbine component transport routes during construction. However, as the movement of these OSOM vehicles is required to be undertaken under permit (with escort vehicles) and likely out of hours, it is not anticipated that the relatively small increase in daily traffic volumes (up to18vpd, including 6 OSOM vehicles) will have a significant ongoing impact on the operation or capacity of the roads forming the proposed turbine transport routes.

Notwithstanding this, it is noted that a detailed Traffic Management Plan (TMP) is proposed to be prepared as part of subsequent stages of the Project to identify the proposed measures and processes to be implemented to manage the Project traffic movements and reduce their impact traffic on the operation of external road network, in particular the OSOM turbine transport movements. The TMP will be developed in consultation with TfNSW.

5.5 Pavement Impact Assessment and Mitigation

In addition to the assessment of the potential traffic impacts of the increased traffic movements associated with the Project, a high level review of the potential increases in pavement loading as a result of the Project has also been undertaken. Further details of the assessment of the expected pavement impacts of the construction, operations and decommissioning phase of the Project are provided below.

5.5.1 Construction Phase

5.5.1.1 Construction Transport Routes

As previously identified, the main transport route for the Project during construction is anticipated to be the section of the New England Highway, between Tamworth and Armidale. As such the assessment of the potential pavement impact of the construction traffic was also limited to this section of the external road network, with the assessment consisting of the comparison of the overall pavement loading (in Equivalent Standard Axles) from the background traffic volumes on the link during the construction period to the pavement loading estimated to be generated by the Project traffic, in particular the heavy vehicle movements.

The pavement loading (ESAs) for the background traffic on the network was calculated based on the identified heavy vehicle percentages for the relevant section of the New England Highway, with the following assumptions also applied to this calculation.

- The percentage of heavy vehicles identified for the link in the 2019 traffic data (TfNSW Station ID T0257) utilised for the assessment will be maintained for future years, with the overall background traffic numbers assumed to increase at approximately 1% (compound) per year
- The impact of light vehicles can be ignored as the contribution to pavement loading (ESAs) is negligible in comparison to heavy vehicles.
- The adopted value for the Equivalent Standard Axles per Heavy Vehicle (ESAs/HV) was adopted from WIM site data (2017) for the New England Highway at Armidale (1.97 ESAs/HV), as specified in Table E1 of Austroads Guide to Pavement Technology Part 2: Pavement Structural Design.
- The background period of the assessment is the proposed duration of construction i.e. 18 months which equates to approximately 548 days.

The pavement loading generated by the Project construction traffic was then calculated based on the estimated number of heavy vehicle movements during construction and the average loaded and unloaded ESAs/HV values for each vehicle configuration. It is noted that the values for the OSOM turbine component transport movements have been adopted from information provided from a previously assessed wind farm development and provide indicative component loading information which will need to be reassessed in subsequent stages of the Project when the turbine component and transport vehicle configurations have been confirmed.

A summary of the comparison of the background and Project generated pavement loadings is provided in **Table 32**, with further details of the Project pavement loading calculations undertaken included for reference in **Appendix H**.

Table 32 Pavement Loading Comparison – Project Construction Phase

Road ID	Road Segment		Background ESA		Project-Generated ESA		% Increase in ESAs	
	Start (km)	End (km)	Gaz	A-Gaz	Gaz	A-Gaz	Gaz	A-Gaz
New England Highway (Tamworth – Armidale)								
A15	0.000	**63.700**	569,064	582,667	63,584	17,585	**11.17%**	3.02%
	63.700	105.000	569,064	582,667	15,654	56,816	2.75%	**9.75%**

Gaz (Gazettal direction of travel or with chainage) / A-Gaz (Against Gazettal direction of travel or against chainage)

The results in **Table 32** above indicate that the heavy vehicle movements associated with the construction phase of the Project are expected to only lead to a minor increase in pavement loadings on the relevant section of the New England Highway, with calculated values in the order of 10%. This calculated increase of 10%, when considered over the proposed overall construction period of 18 months, is not considered to lead to a significant impact or reduction to the design life (typically 20 years) of the existing road pavements on the relevant section of the New England Highway.

5.5.2 Turbine Component Transport Routes

In terms of the expected pavement impact on the identified road sections forming the proposed turbine transport routes, it is noted that the vast majority of the routes are comprised of higher order (and volume), state controlled roads. As such it is expected that the existing road pavements on these links would be more than adequate to cater for the increase in pavement loadings from the proposed OSOM turbine transport vehicle movements during construction.

Notwithstanding this, it is noted that both of the identified turbine component transport routes propose the use of lower order, local government controlled road links. These include the City of Newcastle (CoN) controlled Selwyn Street and George Street (both routes) and the Muswellbrook Shire Council (MSC) controlled links of Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street and Dartbrook Mine Access Road (Route 2 only).

As it is expected that these lower order roads were not designed to cater for larger heavy vehicles like the OSOM turbine transport vehicles, it is recommended that further consultation be undertaken with the City of Newcastle and Muswellbrook Shire Council regarding the required mitigation works on the identified links to offset any potential pavement impacts of the Project. It is also recommended that pre and post dilapidation inspections to be undertaken on the sections of the local government roads used by Project traffic prior to the commencement of construction, with these inspections to be completed by representatives of the proponent and the appropriate Council. These inspections are required to identify and document the current condition of the roads (pre construction) and establish the required maintenance and/or rehabilitation works relevant to the Project.

5.5.3 Operations Phase

As identified above, it is understood that the operations phase of the Project will only generate relatively low traffic volumes on the network (approx. 10vpd) with negligible heavy vehicle movements (approximately 1 HV per week). As such it can be considered that this phase of the Project will have a negligible impact to the operation (and pavement loadings) of all relevant road links.

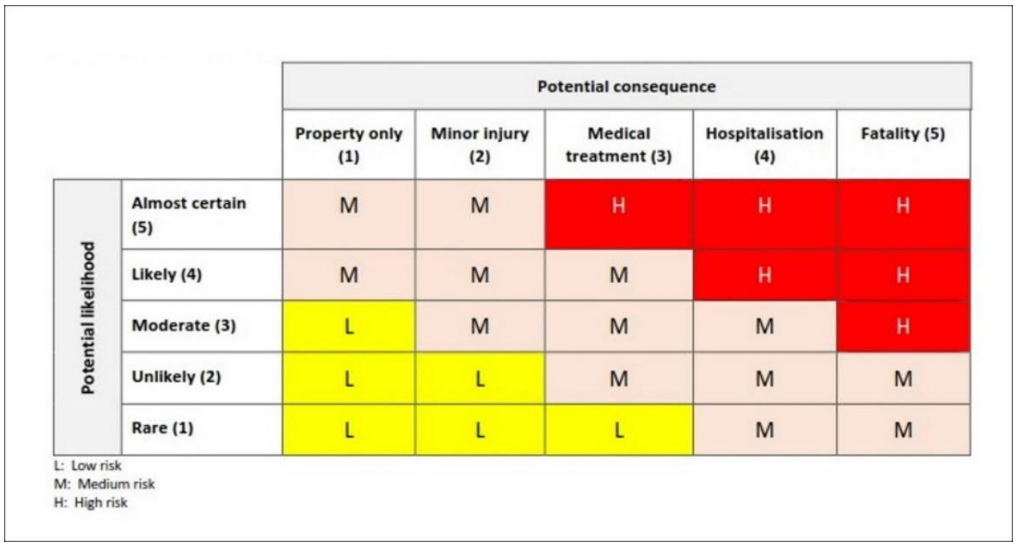
5.5.4 Decommissioning Phase

As identified above, the decommissioning phase of the Project has conservatively been assumed to generate approximately 70% of the peak construction phase traffic on the external road network, over an assumed 12 month period.

As the construction phase of the Project was shown to have a minor impact on the road pavements of the relevant section of the New England Highway, and the decommissioning phase is forecast to generate lower traffic volumes (and therefore pavement loading) for a shorter period, it can therefore be concluded that the decommissioning phase of the Project will have a minimal impact to the existing road pavements on the relevant section of the New England Highway.

5.6 Road Safety Assessment

A high level road safety assessment has also been undertaken to establish the existing and post development road safety risks relevant to the Project. To establish the level of risk regarding the existing and expected post development road safety considerations identified, a safety risk score matrix as shown in **Figure 20** was utilised, with the results of the road safety risk assessment summarised in **Table 33**.



Potential likelihood	Potential consequence: Property only (1)	Minor injury (2)	Medical treatment (3)	Hospitalisation (4)	Fatality (5)
Almost certain (5)	M	M	H	H	H
Likely (4)	M	M	M	H	H
Moderate (3)	L	M	M	M	H
Unlikely (2)	L	L	M	M	M
Rare (1)	L	L	L	M	M

L: Low risk
M: Medium risk
H: High risk

Figure 20 Adopted Risk Score Matrix

Table 33 Project Road Safety Assessment – Stage 1 (Wind Farm) Thunderbolt Energy Hub

		Existing / Pre-Development			With Project				With Project & Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
1	The Project is expected to lead to an increase in turning vehicle movements at the proposed Project Area access intersection, which currently provides low volume access from the New England Highway. This increase in turning vehicles has the potential to lead to an increase in vehicle conflicts at the access intersection.	Unlikely	Hospitalisation / Fatality	**Medium**	Moderate	Hospitalisation / Fatality	**Medium / High**	**Project Area access intersection to be upgraded as part of the Project to provide required rural BAL / CHRs turn treatments in accordance with the turn warrants assessment undertaken and the requirements of Austroads Guide to Road Design.** These upgrade works are expected to provide safer turn facilities at the access, reducing the potential of vehicle conflicts associated with the increase in Project traffic at the access.	Unlikely	Hospitalisation / Fatality	**Medium**

		Existing / Pre-Development			With Project				With Project & Mitigation		
Risk Item		Likelihood	Consequence	Risk Score	Likelihood	Consequence	Risk Score	Mitigation Measure	Likelihood	Consequence	Risk Score
2	The Project is also expected to lead to an increase in vehicle movements on the relevant section of the New England Highway (Tamworth to Armidale). This increase in vehicle movements on this section of the New England Highway has the potential to lead to an increase in vehicle conflicts along the link.	Unlikely	Hospitalisation / Fatality	**Medium**	Unlikely	Hospitalisation / Fatality	**Medium**	As identified above, the expected increase in traffic volumes along the relevant section of the link is relatively minor (up to 188vpd – between Tamworth & site access) during peak construction. Further to this, the assessment of the road link operation undertaken identified that even with the addition of the Project traffic (construction, operations and decommissioning) the "with Project" road link volumes were still well within the capacity of the link (2 lane rural highway – approx. 12,000vpd). **No physical mitigation works are therefore expected to be required, however it is noted that a Traffic Management Plan will be developed and implemented as part of subsequent detailed design phases of the Project, with this TMP to outline the proposed measures to reduce the impact of Project traffic on the adjacent road network.**	Unlikely	Hospitalisation / Fatality	**Medium**
3	The Project is also expected to lead to an increase in vehicle movements on the road sections proposed to form part of the identified OSOM turbine component transport routes. This increase in vehicle movements on the roads forming the turbine transport routes, in particular the OSOM vehicles has the potential to impact the operation of these links and lead to increased vehicle conflicts along the link.	Unlikely	Medical Treatment / Hospitalisation	**Medium**	Moderate	Medical Treatment / Hospitalisation	**Medium**	**Additional minor works are proposed to be undertaken at locations along the identified transport routes to enable the OSOM vehicle movements to traverse the network.** **In addition to the physical works, a Traffic Management Plan will be prepared and implemented as part of subsequent detailed design phase of the Project outlining the proposed measures and processes to reduce the impact of the OSOM vehicle movements on the external road network.**	Unlikely	Medical Treatment / Hospitalisation	**Medium**

6.0 Conclusions and Recommendations

6.1 Summary of Impacts and Mitigation Measures Proposed

Based on the outcomes of this assessment and the increase in traffic numbers anticipated as a result of the construction, operations and decommissioning phases of the Project, it is anticipated that the Project will have a minimal impact on the traffic operation of the surrounding road network.

Notwithstanding this, the following mitigation treatments are recommended:

- Completion of minor works along the identified transport route to accommodate the swept paths of the OSOM turbine component transport vehicles, including the relocation of signage and road lighting infrastructure and construction of required temporary hardstand pavement areas as identified in the Preliminary Transport Route Assessment for the Project (refer **Appendix A**). It is noted that the exact extents and scope of these works will be determined in subsequent detailed design phases of the Project once the turbine component and transport vehicle configurations are confirmed.
- Construction of the proposed upgraded works to the Project Area access intersection with the New England Highway to provide basic left (BAL) and short channelised right (CHRs) turn treatments on the New England Highway approaches, as per Austroads standards.
- Installation of advisory "truck turning" signage be installed on the approaches to the Project Area access intersection with the New England Highway, to highlight to motorists the presence of the Project Area access and the potential for turning heavy vehicles to/from the side road.
- Preparation of traffic management plan for Project outlining proposed management measures and processes to minimise the impact of Project traffic (including OSOM turbine component transport vehicles) on the external road network.

In addition to the traffic assessments completed, a high level pavement impact assessment of the relevant road network was also undertaken for the construction, operations and decommissioning phases of the Project. The results of this assessment identified:

- That the heavy vehicle movements associated with the construction phase of the Project were expected to lead to a minor increase in pavement loadings of 10% on the key section of the New England Highway, which in consideration of the overall construction period of 18 months, was not considered to lead to a significant impact or reduction to the design life of the existing road pavement on the relevant section of the New England Highway.
- Neoen will undertake further consultation with the City of Newcastle and Muswellbrook Shire Council regarding an infrastructure or maintenance agreement to cover any required mitigation works to offset the expected pavement impacts of the Project on the lower order, local government controlled road links of Selwyn Street and George Street (CoN - both routes) and Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street and Dartbrook Mine Access Road (MSC - Route 2 only). This would also include pre and post dilapidation inspections to be undertaken on the sections of the local government roads used by Project traffic, with these inspections to be completed by representatives of the Neoen and the appropriate Council. These inspections are required to identify and document the current condition of the roads (pre-construction) and establish the required maintenance and/or rehabilitation works deemed necessary to reinstate the roads to their documented condition prior to the introduction of Project traffic at the completion of their use.
- That the operations phase of the Project will only generate relatively low traffic volumes on the network (approx. 10vpd) with negligible heavy vehicle movements (approximately 1 HV per week), which will have a negligible impact to the operation (and pavement loadings) of all relevant road links on the external road network.
- Similarly, the decommissioning phase of the Project (which has conservatively been assumed to generate approximately 70% of the peak construction phase traffic) will have a minimal impact to the existing road pavements on the relevant sections of the external road network.

6.2 Conclusion

Based on the information provided above, it can be seen that if the identified mitigation measures and works are provided as part of the Project, the potential impacts of the Project will have been appropriately managed, with minimal traffic impacts anticipated on the relevant sections of the local government and state controlled road networks.

As such it can be concluded that this report, in combination with the Preliminary Route Assessment demonstrates the compliance of the Project with Schedule 2 of the Environmental and Planning Regulation (2000), as outlined in the traffic and transport items of the Secretary's Environmental Assessment Requirements (SEARs) provided.

Access Traffic Consulting therefore recommends that the Project be approved from a traffic engineering and traffic impact viewpoint.

Appendix A – Preliminary Transport Route Assessment

REX J ANDREWS
ENGINEERED TRANSPORTATION

ROUTE STUDY: NEOEN

PROJECT: THUNDERBOLT ENERGY HUB

EX PORT OF NEWCASTLE

BLADE SIZE: SPLIT BLADE

09/12/2021 REV 02

Rev.	Date	Change	Responsible	Checked
00	19/05/20	Route Assessed	W Andrews	✓
00	24/11/21	Report Compiled	W Andrews	✓
00	25/11/21	Report Completed	W Andrews	✓
01	25/11/21	Several edits	W Andrews	✓
02	09/12/21	Several edits	W Andrews	✓

Index:

1.0 Introduction

Neoen Australia Pty Ltd (Neoen) has engaged Umwelt (Australia) Pty Limited (Umwelt) to prepare and EIS for the proposed Thunderbolt Energy Hub - Stage 1 (the Project), located in the New England Tablelands in NSW.

This study is to understand the transport route constraints for the components listed in this report and support the EIS for the Project.

This document describes observations and previous experience on route and explains the Transport of Wind turbine equipment from Newcastle to the Thunderbolt Energy Hub Project Area.

This study is based on a split blade with a hub height of up to 165 metres.

This Route survey took place on the 19/05/2021.

2.0 Evaluation

1	No Cost
2	Some Work
3	Moderate Amount of Work
4	Extreme Amount of Work

(Mark below boxes with an X)

		1	2	3	4
A	Harbour		**X**		
B	Road Modification		**X**		
C	Road Furnishings		**X**		
D	Trees		**X**		
E	Site Entrance			**X**	
F	Bridge Calculations		**X**		
G	Traffic Control		**X**		

3.0 Project data

Date of latest Route Assessment: 18/05/2021

Survey undertaken by: (Rex J Andrews P/L)

Project name: Thunderbolt energy hub

Location: Newcastle Port (NSW) to Uralla (NSW)

Turbine types:

GE 158 split blade (Case study) – note turbine model is yet to be confirmed – GE 158 split blade used as example only.

4.0 Transport combinations (Examples)

TURBINE CASE STUDY:

Machine Head (12l x 4.8w x 4.2h x 97T)
Configuration. Prime mover with 10x8 Platform trailer + Backup truck
Overall dimensions: 36.0l x 5.0w x 5.2h x 174.5T + Backup truck

Drivetrains (7.4l x 3.3w x 3.2h x 82.0T)
Configuration. Prime mover with 8x8 platform trailer.
Overall dimensions: 30.0l x 4.3w x 4.3h x 136.0T.

Hubs (4.0l x 3.5w x 3.8h x 50T)
Configuration. Prime mover with 5x8 Low loader.
Overall dimensions: 26.0l x 3.5w x 4.9h x 82.0T.

GE 158 Split Blades (Root) (65.4l x 4.0w x 3.3h x 28T)
Possible transport. Prime mover with 1x4 dolly and 4x4 Extending trailer.
Overall dimensions: 75.0l x 4.5w x 5.0h x 68.5T.

GE 158 Split Blades (Tip) (15.1l x 2.4w x 2.4h x 2.5T)
Configuration. Prime mover with 3x4 Extending trailer.
Overall dimensions: 22.0l x 2.5w x 4.0h x 32.5T.

128 METRE TOWER EXAMPLE:

Base Towers (15.6l x 5.4 x 4.95 x 85T)
Configuration. Prime mover with 3x8 4x8 Bookend
Overall dimension: 39.0l x 5.5w x 5.5h x 164.5T (+ Push truck)

Section 2 Towers (19.9l x 4.95 x 4.95 x 87T)
Configuration. Prime mover with 3x8 4x8 Bookend
Overall dimension: 44.0l x 5.0w x 5.3h x 164.5T (+ Push truck)

Section 3 Towers (26.9l x 4.95 x 4.65 x 98T)
Configuration. Prime mover with 5x8 5x8 Bookend
Overall dimension: 46.0l x 5.0w x 5.3h x 164.5T (+ Push truck)

Section 4 Towers (28.9l x 4.65 x 4.4 x 84T)
Configuration. Prime mover with 5x8 5x8 Bookend
Overall dimension: 35.0l x 5.0w x 5.3h x 154.5T (+ Push truck)

Top Towers (36.9l x 4.4w x 3.97h x 78T)
Configuration. Prime mover with 4x4 Dolly and 3x8 Jinker trailer
Overall dimension: 54.0l x 5.1w x 4.9h x 152.5T

149 METRE TOWER EXAMPLE:

Base Towers (10.1l x 5.85 x 5.5 x 91T)
Configuration. Prime mover with 5x8-5x8 Bookend.
Overall dimension: 42.0l x 5.85w x 5.9h x 164.5T (+ Push truck)

Section 2 Towers (14.1l x 5.5 x 5.5 x 89T)
Configuration. Prime mover with 5x8-5x8 Bookend.
Overall dimension: 44.0l x 5.5w x 5.7h x 164.5T (+ Push truck)

Section 3 Towers (16.5l x 5.5 x 4.95 x 89T)
Configuration. Prime mover with 5x8-5x8 Bookend.
Overall dimension: 46.0l x 5.5w x 5.7h x 164.5T (+ Push truck)

Section 4 Towers (17.2l x 4.95 x 4.65 x 86T)
Configuration. Prime mover with 8x8 low platform.
Overall dimension: 35.0l x 5.0w x 5.9h x 154.5T (+ Push truck)

Section 5 Towers (20.5l x 4.65 x 4.65 x 84T)
Configuration. Prime mover with 10x8 platform trailer.
Overall dimension: 38.0l x 4.7w x 5.7h x 164.5T (+ Push truck)

Section 6 Towers (29.9l x 4.65w x 4.65 x 87T)
Configuration. Prime mover with 5x8-5x8 Extending platform trailer.
Overall dimension: 45.0l x 4.7w x 5.7h x 164.5T (+ Push truck)

Top Towers (35.5l x 4.65w x 3.97h x 74T)
Configuration. Prime mover with 4x8-4x8 Extending platform trailer.
Overall dimension: 54.0l x 5.1w x 5.7h x 152.5T (+ Push truck)

ERECTION CRANES:

LG1750 carrier (19.2l x 3.0 x 4.0 x 96T)
Configuration. Prime mover with 10x8 Platform trailer + Backup truck
Overall dimensions: 36.0l x 4.2w x 5.2h x 174.5T + Backup truck

LTM1500 carrier (21.0l x 3.0 x 4.0 x 96T)
Configuration. Prime mover with 10x8 Platform trailer + Backup truck
Overall dimensions: 36.0l x 5.0w x 5.2h x 174.5T + Backup truck

TRANSFORMER:

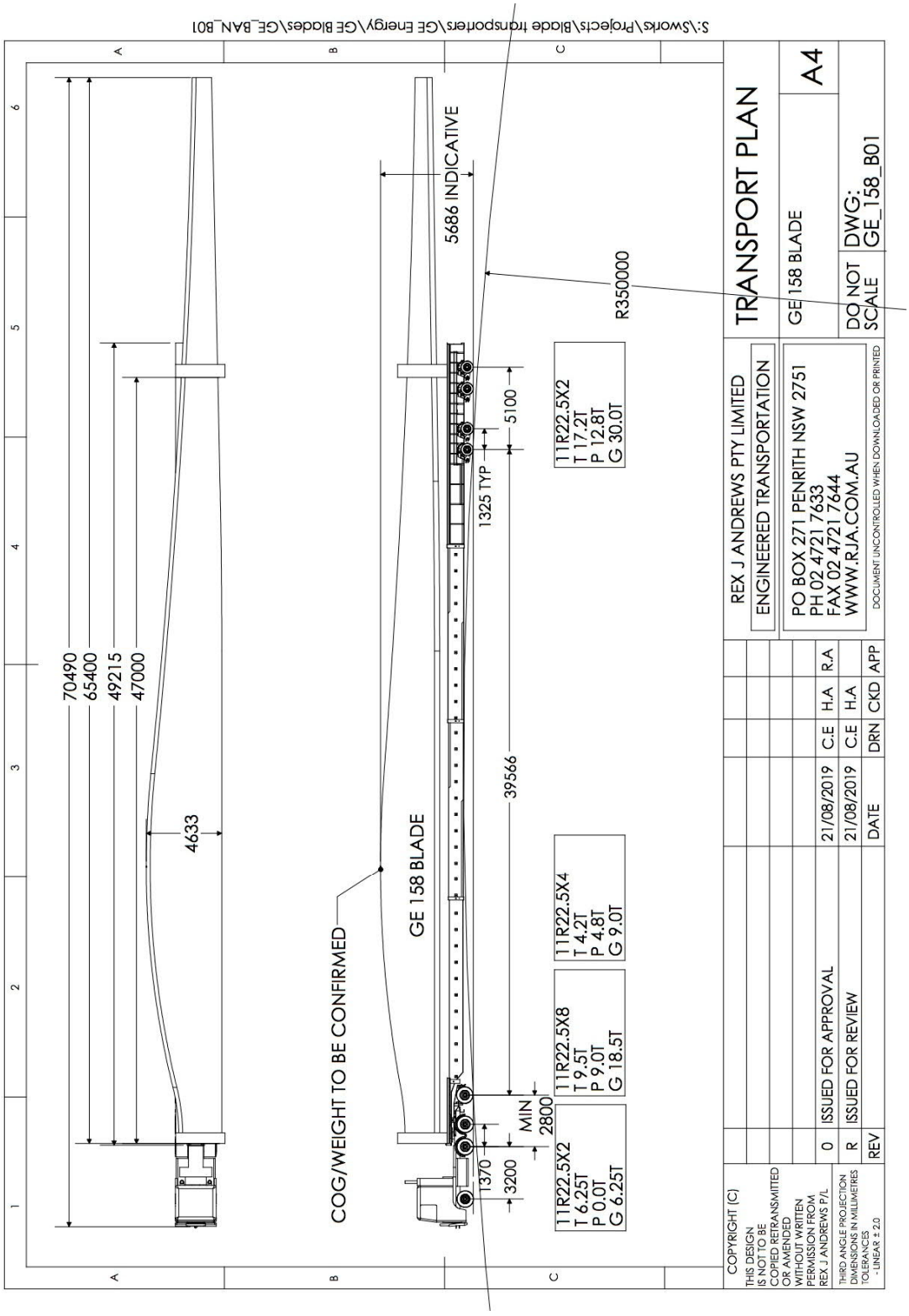
Possible Transformer size (9.2l x 4.0 x 4.35 x 167T)
Configuration. Prime mover with 10x8-10x8 Beamset + 4 x Backup trucks
Overall dimensions: 45.0l x 4.3w x 5.4h x 324.5T + 4 x Backup trucks
Or
Configuration. Prime mover with 16x8 Platform trailer + 3 x Backup trucks
Overall dimensions: 45.0l x 4.3w x 5.4h x 256.5T + 3 x Backup trucks

SWITCHROOM:

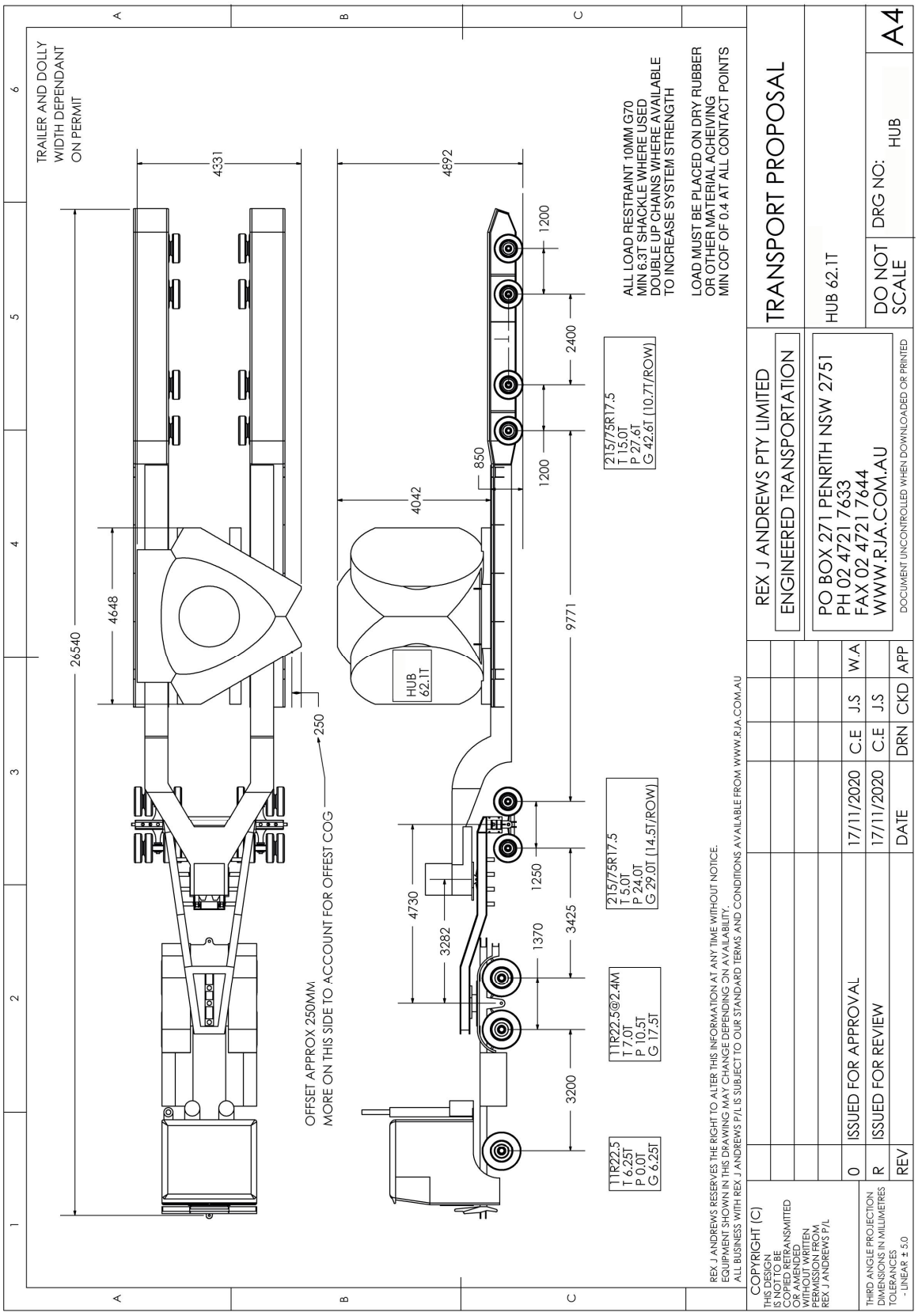
The largest Switchroom size that is recommended for this site would be as follows.
Switchroom dimensions: 30.0l x 6.0w x 4.4h x 90.0T

5.0 Transport drawings (Examples)

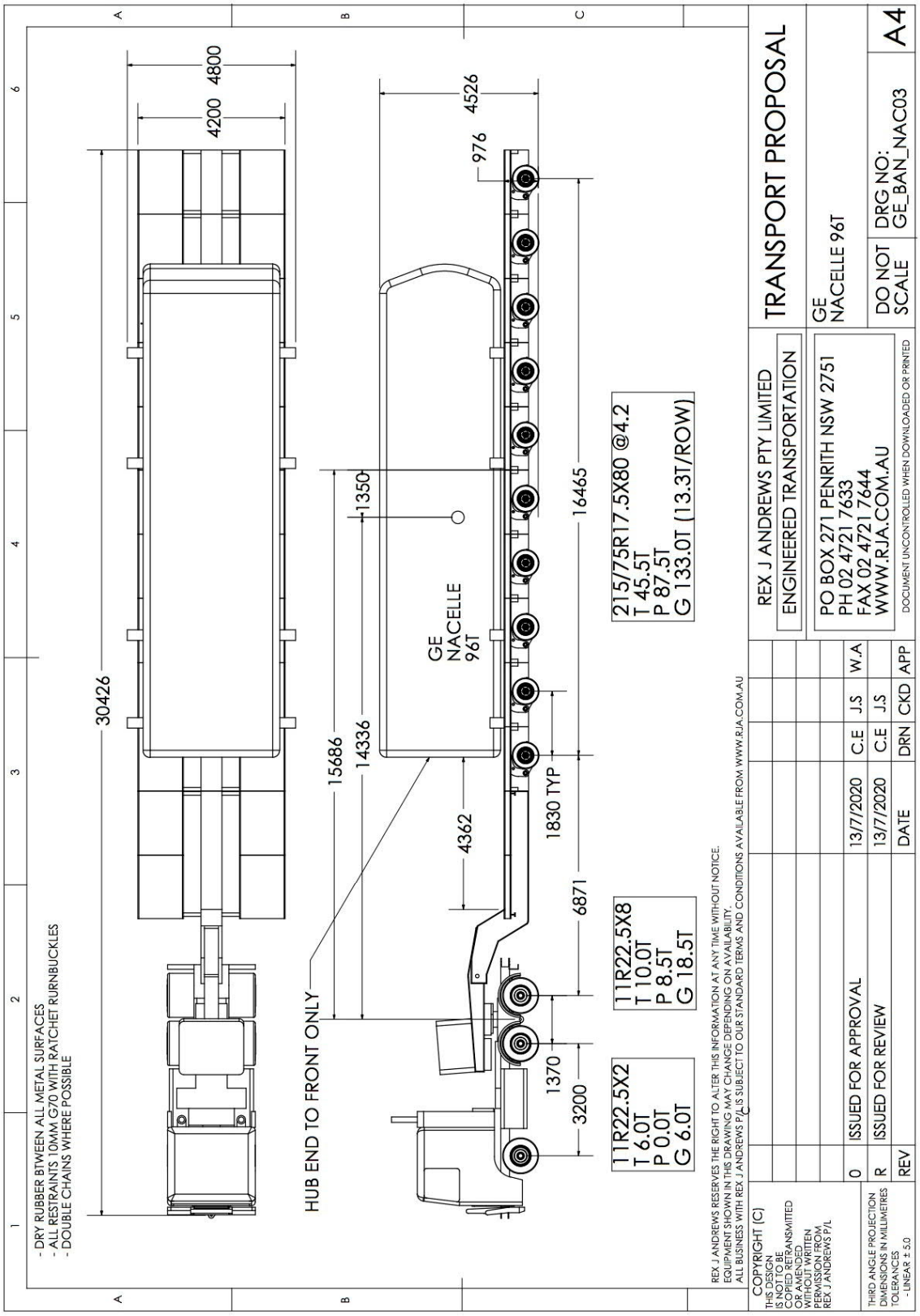
Blade diagram (158 rotor split blade):



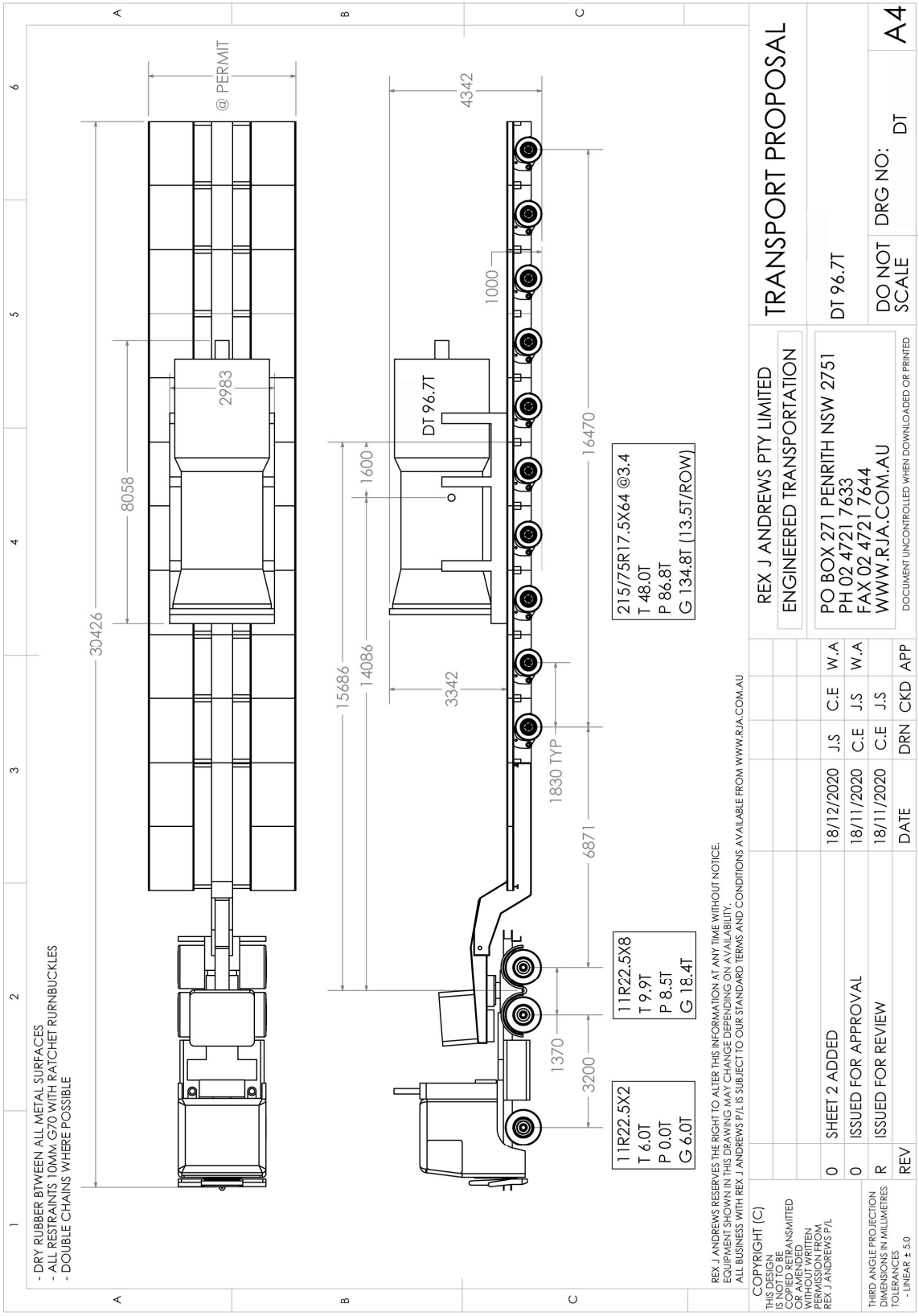
Hub combination example:



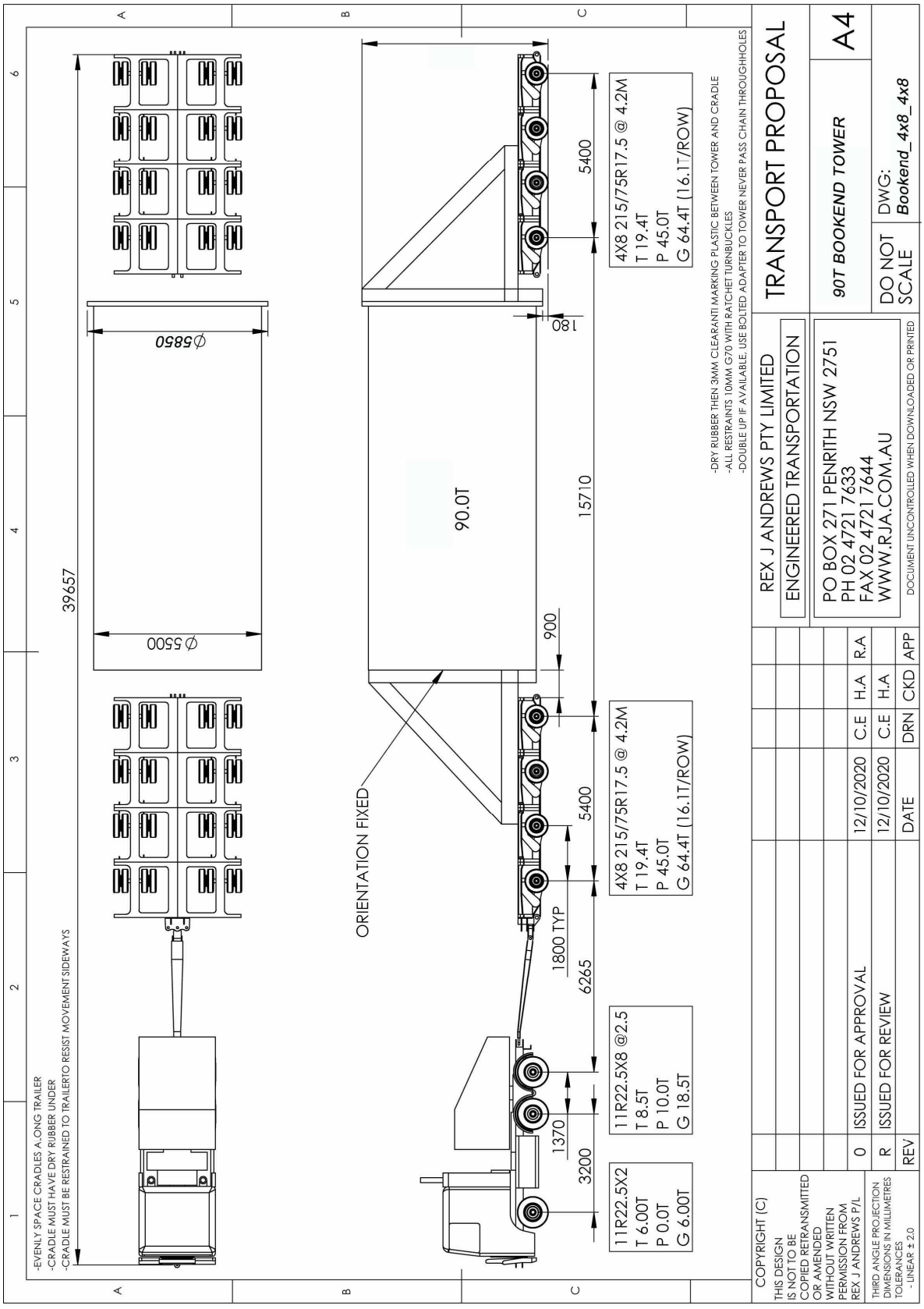
Machine Head combination:



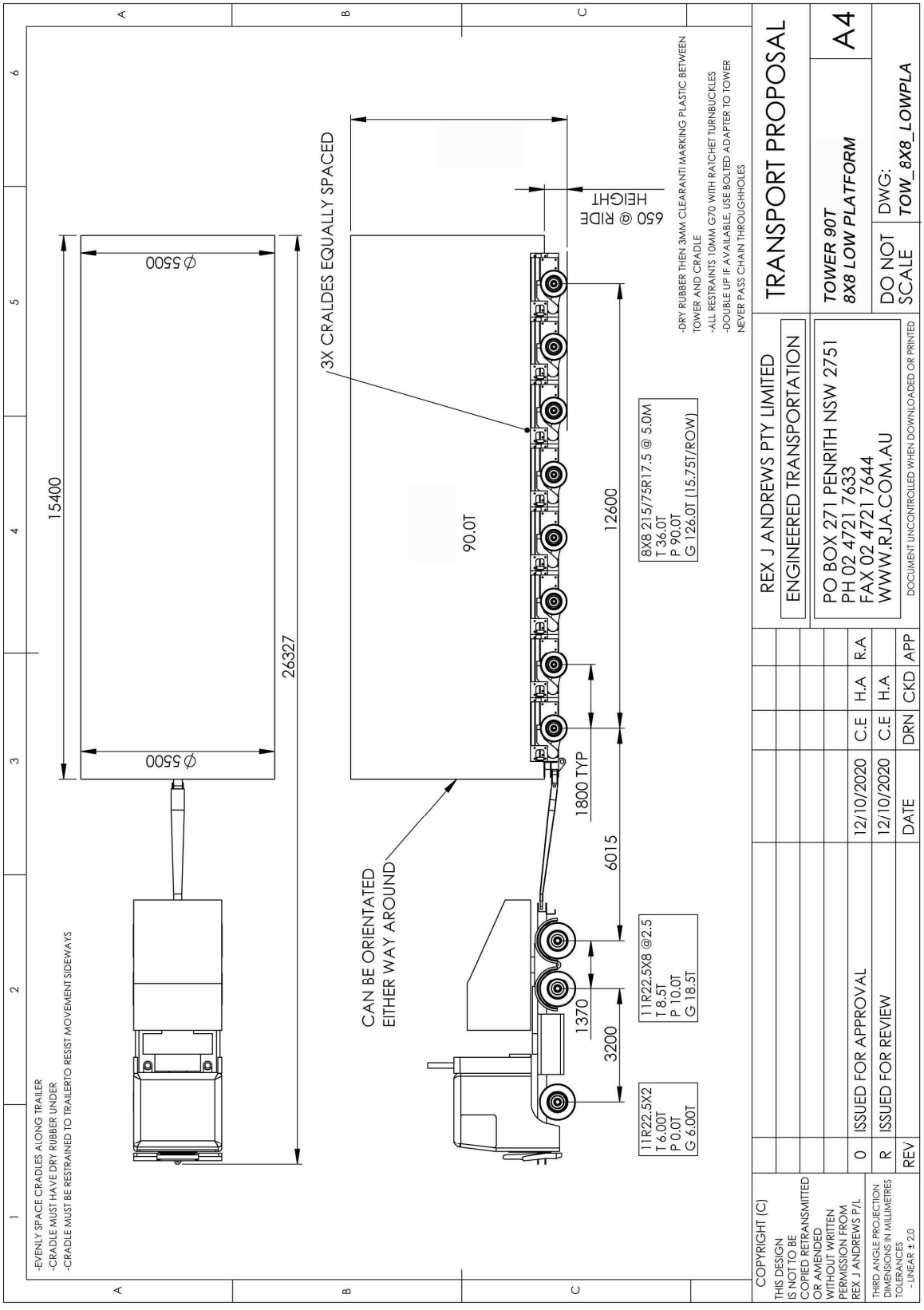
Drivetrain combination example:



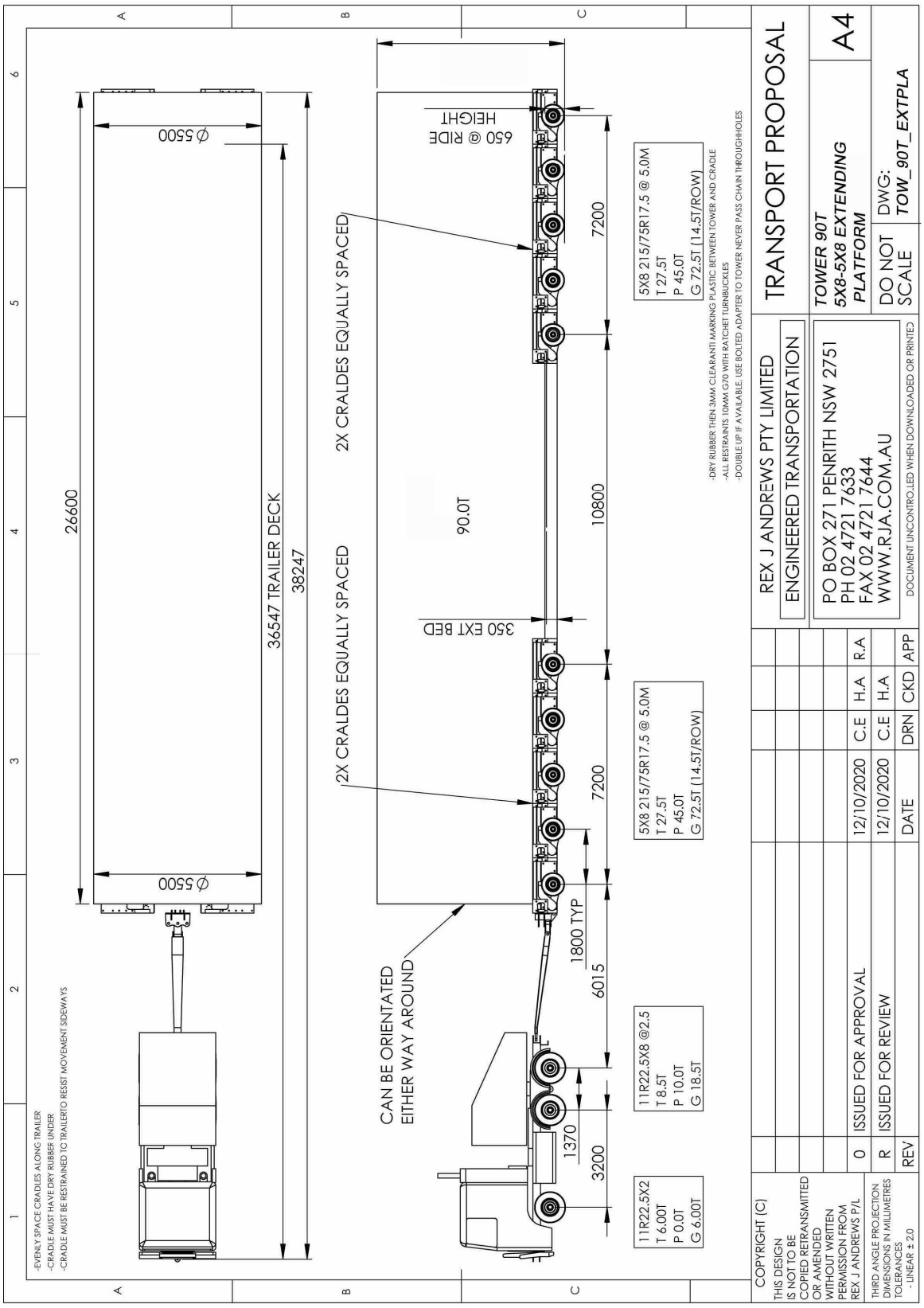
Tower Trailer Bookend:



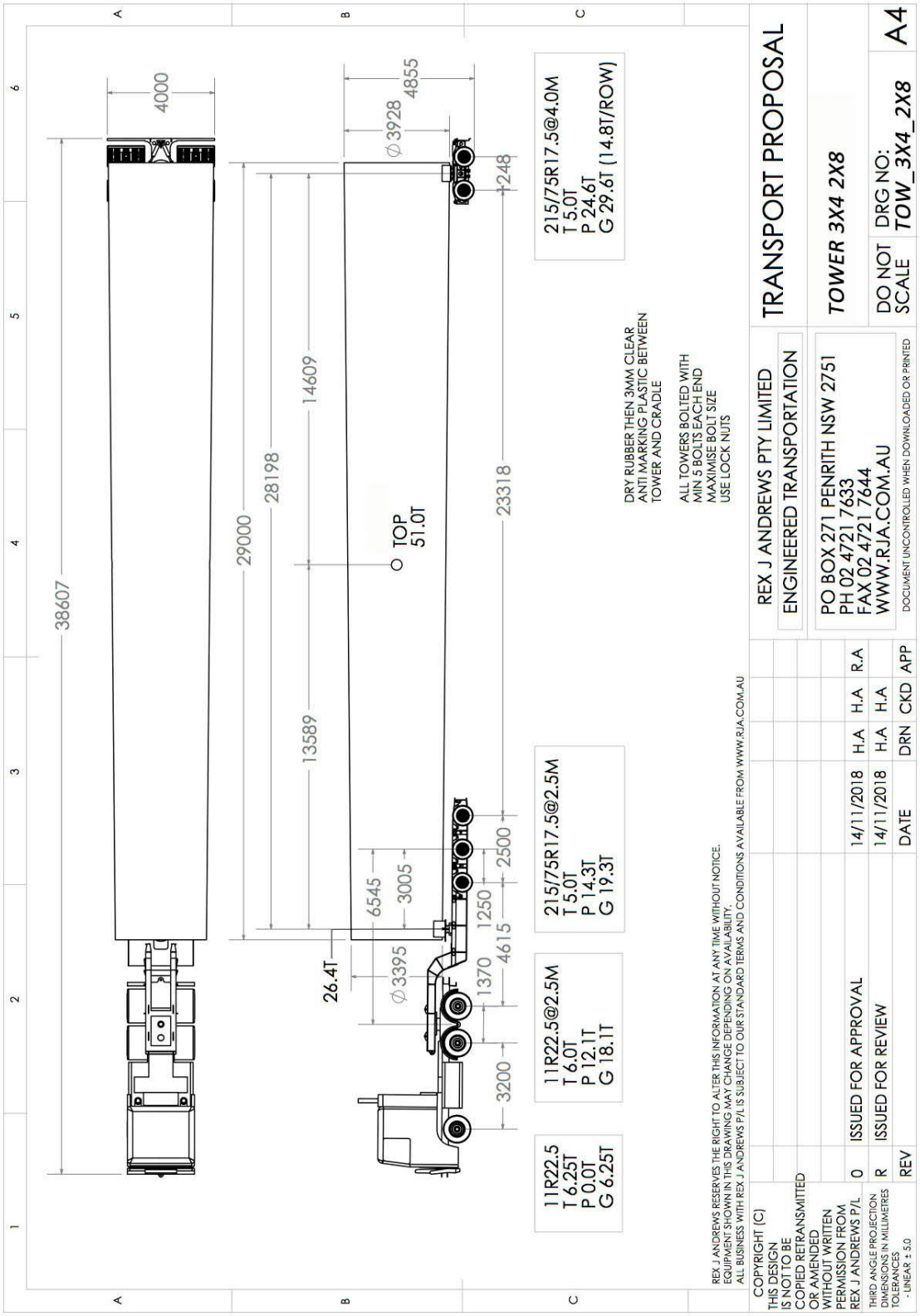
Tower trailer 8x8:



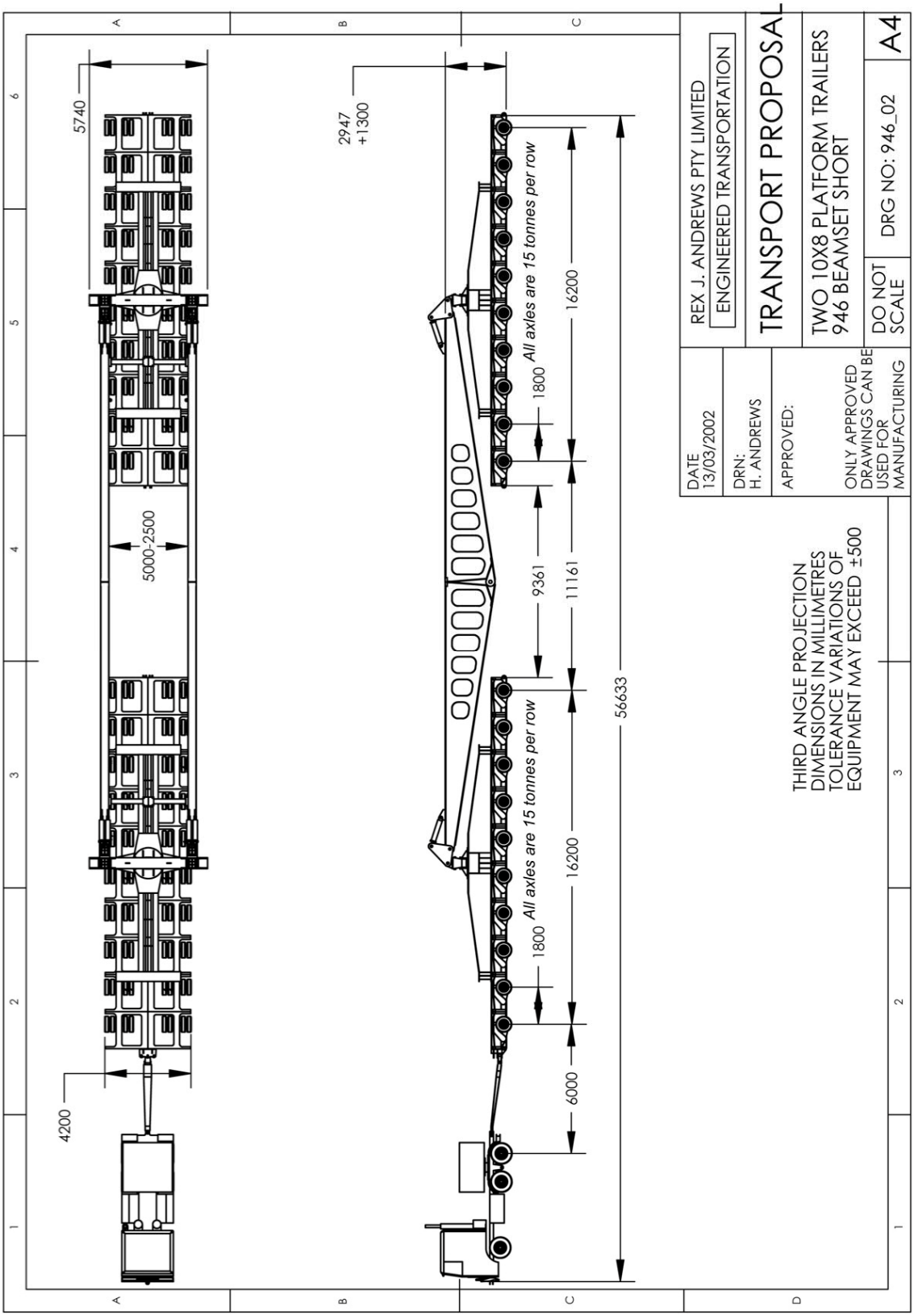
Tower trailer extending 5x8_5x8:



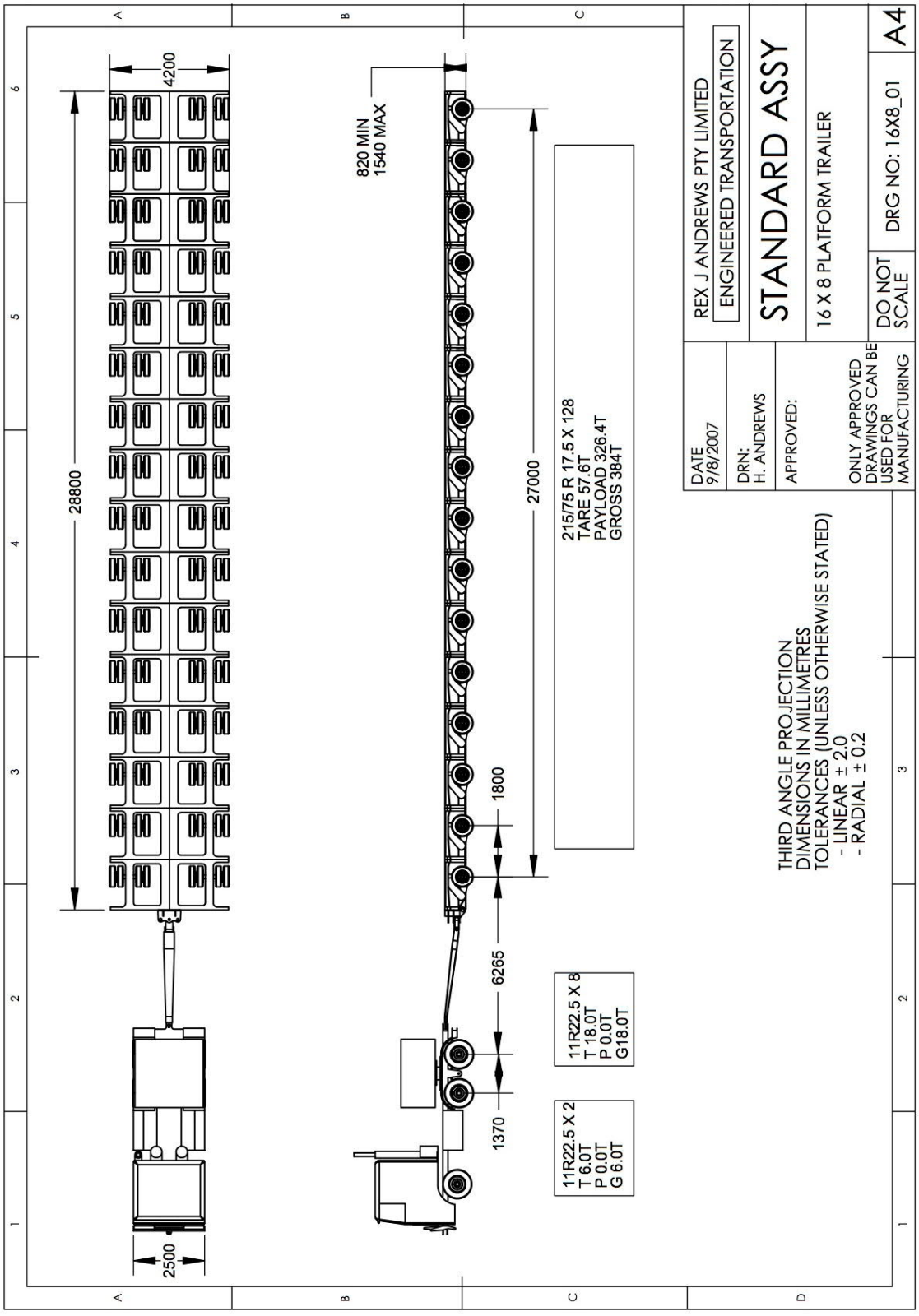
Tower trailer Dolly and Jinker:



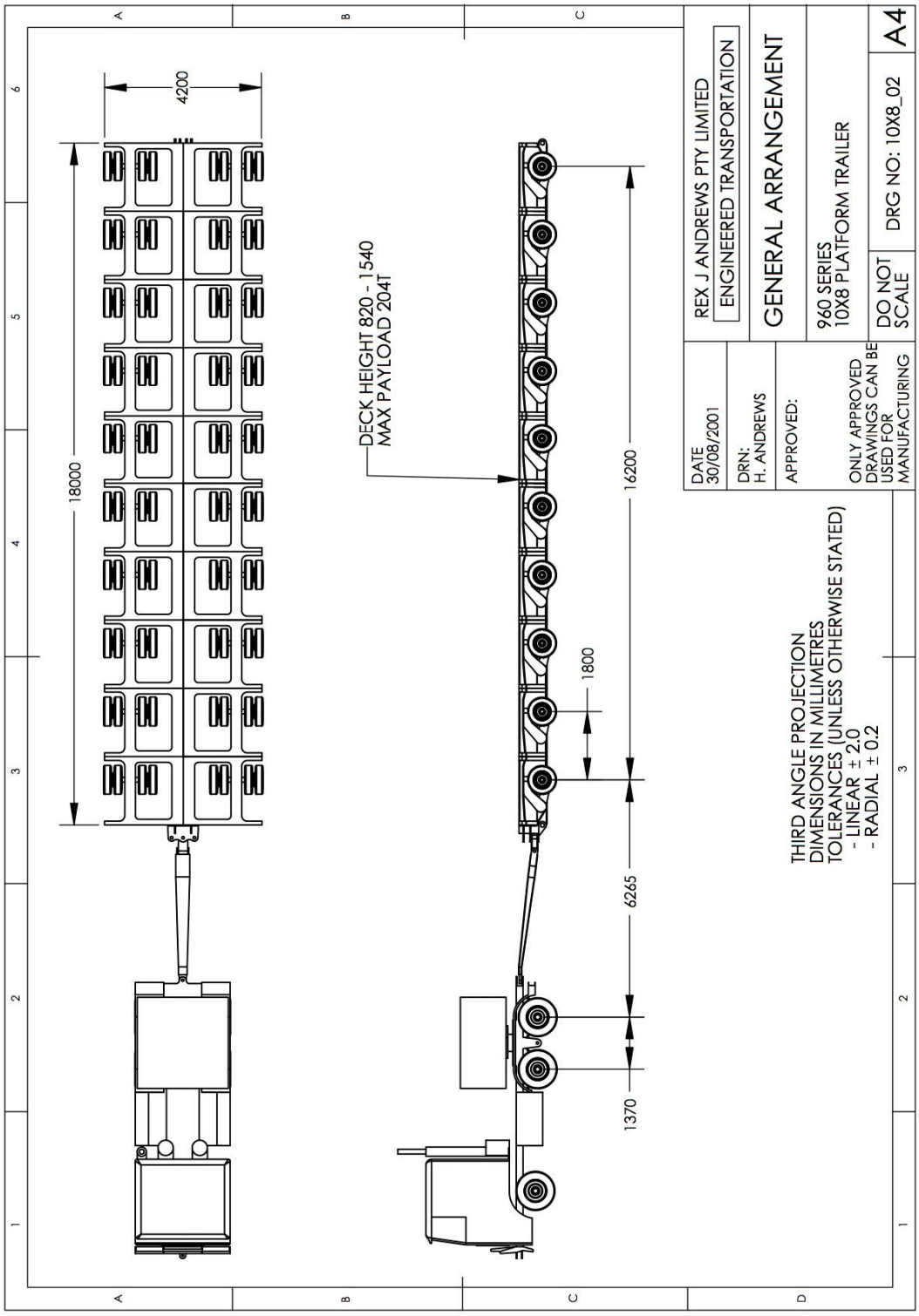
Transformer trailer 10x8-10x8 beamset:



Transformer trailer 16x8 Platform:

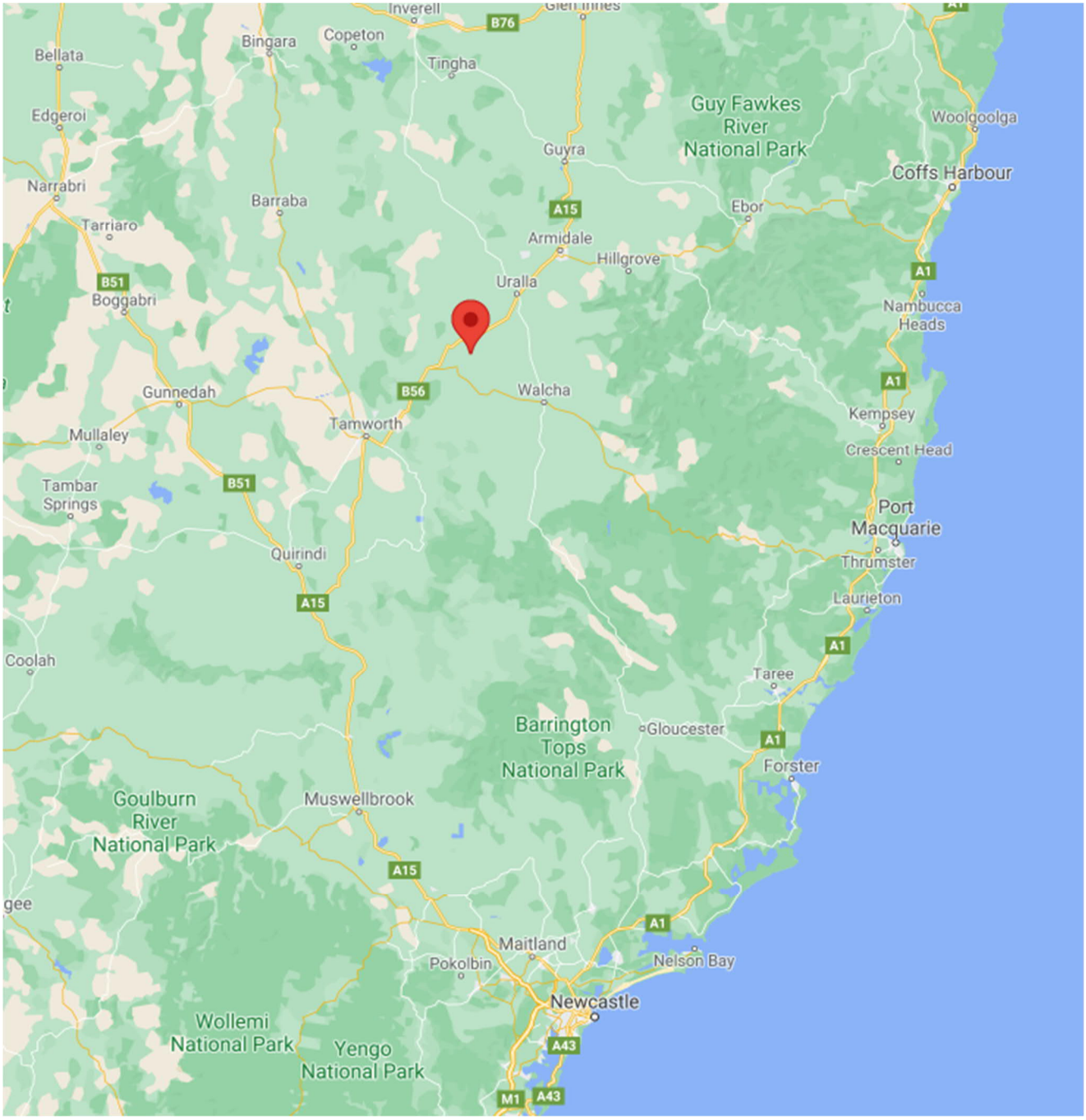


Crane trailer 10x8 Platform:



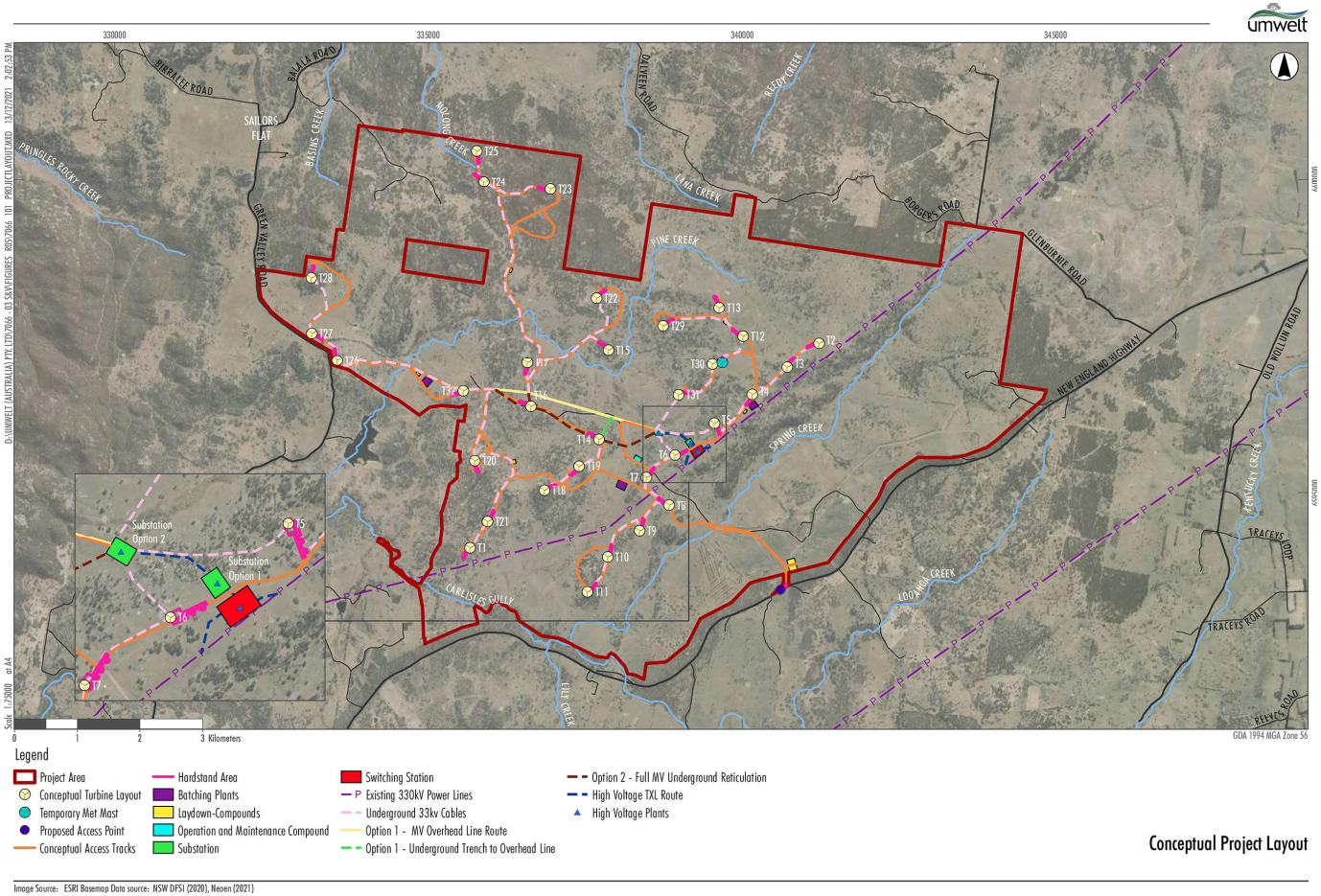
6.0 Thunderbolt Energy Hub site location

The Project Area is located approximately 47km northeast of Tamworth in the New England Tablelands of NSW near Kentucky.



7.0 Thunderbolt Windfarm Stage 1 – Project Area

The Project Area is located to the north of the New England Highway and includes the construction of up to 32 turbines and associated infrastructure.



8.0 Port of Import

The wind turbine equipment will be imported from various countries and will arrive on ships into the Port of Newcastle. The ideal berth for these shipments is the Mayfield #4 Berth. This facility has a hardstand storage area of roughly 100,000 s/q meters, adjacent to the berth.

Access from the storage to the public roads, is via a port operated road onto Selwyn Street. There will need to be a small amount of road modifications within the port.

Image 1: Mayfield #4 berth overview

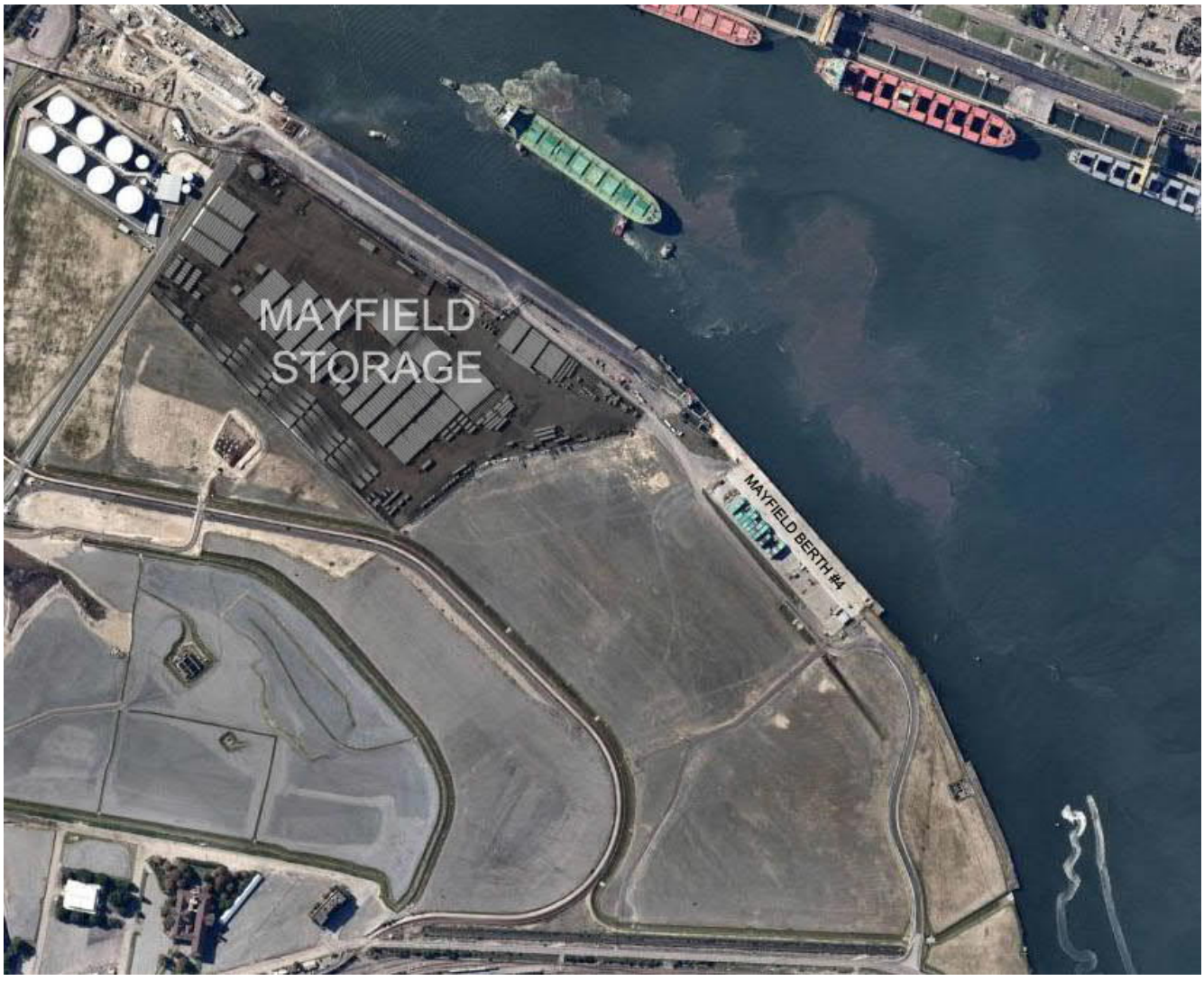


Image 2: Mayfield #4 Port storage area

9.0 Transport Summary:

We have based this study on the turbine components and imported towers entering Australia via the Port of Newcastle. The study will show 2 routes through to the Project Area.

ROUTE SURVEY 1: NEWCASTLE TO THUNDERBOLT ENERGY HUB STAGE 1.

COMPONENTS: Blades and loads under 5.2 metres in height.

DISTANCE: 350.0 kilometres

GPS LINK: https://goo.gl/maps/px5Z5iiXJxE2E3SL9

VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, New England Highway, (Tamworth bypass via Scott Road, Murray St, Marius St), New England Highway.

ROUTE SURVEY 2: NEWCASTLE TO THUNDERBOLT ENERGY HUB STAGE 1.

COMPONENTS: Towers and loads over 5.2 metres in height.

DISTANCE: 388.0 kilometres

GPS LINK: https://goo.gl/maps/Zp1XSB8guqUFxeMF7

VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, (Muswellbrook bypass via Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street, Dartbrook mine access Road), New England Highway, (Tamworth bypass via Scott Street, Marius Street), New England Highway.

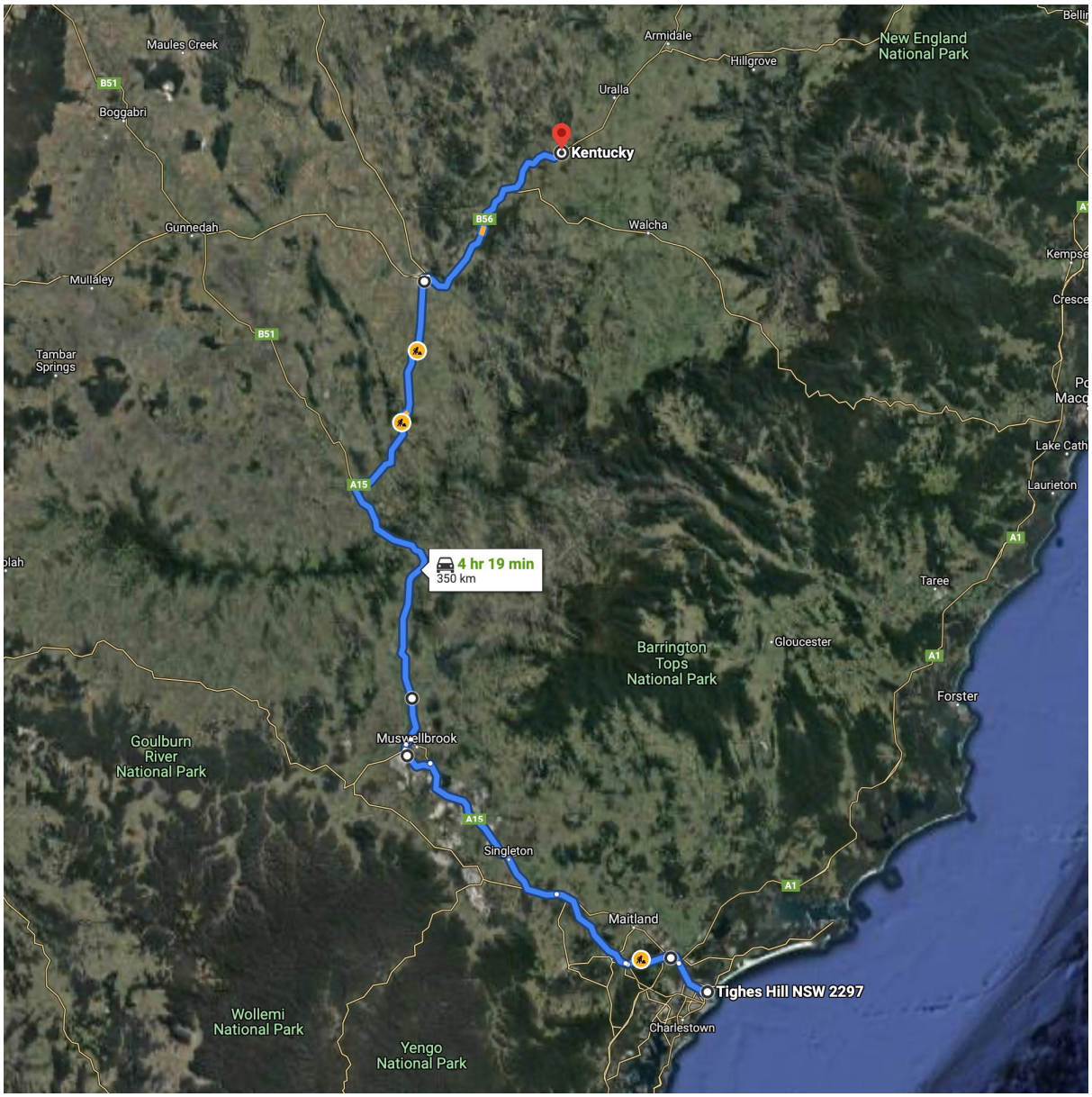
10.0 Route Survey 1: Newcastle to Thunderbolt Energy Hub Stage 1

COMPONENTS: Blades and smaller items.

DISTANCE: 350.0 kilometres

GPS LINK: https://goo.gl/maps/px5Z5iiXJxE2E3SL9

VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, New England Highway, (Tamworth bypass via Scott Road, Murray St, Marius St), New England Highway.



KEY	
MODIFICATIONS REQUIRED	
MINOR WORKS OR CAUTION	
PARKING	

KM index	Location	Section of road	Current clearance	Procedure	Comments
0.0	Mayfield	Mayfield #4 berth onto Selwyn Street https://goo.gl/maps/afLwPYKuNdm	Length: 70.0m Width: 8.0m	Moderate right hand turn	Hardstand will need to be added to the left side exit of the corner. The existing culvert will be okay. Some signs will need to be relocated and or made removable and a section of fence will need to be relocated.
0.4	Mayfield	Selwyn Street rail crossing https://goo.gl/maps/864FhMSaF9P2	Width: 9.0m	Travel directly ahead	Loads to travel over the crossing in the center of the road. Approval required crossing this line, likely cross with caution.
1.3	Mayfield	Selwyn Street onto Industrial Drive via George Street https://goo.gl/maps/brPRAckLr572	Length: 70.0m Width: 8.0m	Right hand turn	The first right hand turn through George Street will need a sign made removable and a disused pole on the overhang removed.
4.9	Mayfield	Industrial Drive under traffic signals https://goo.gl/maps/5DpD3b7KnT72	Clearance: Height: 5.4m	Travel directly ahead	The lowest traffic signal on route is at the intersection of Steel River Blvd. Trucks that exceed 5.3 metres will need to travel in the right-hand lane.
5.5	Mayfield West	Industrial Drive onto Maitland Road https://goo.gl/maps/Kn49dhWG2qG2	Length: 70.0m Width: 8.0m	Right hand turn	The blades will need to cross to the incorrect side of the intersection 200 metres prior, before crossing back over to the correct side 120 metres to the north of the intersection.
14.8	Tarro	New England Highway https://goo.gl/maps/aED5Y4ccdW3A47x37	Length: 90.0m Width: 8.0m	Left hand bend	No problems with this section of road.
17.4	Tarro	New England Highway onto John Renshaw Drive https://goo.gl/maps/SRDr5JigkBp	Length: 100.0m Width: 12.0m	Left hand merge	No problems with this section of road.
29.0	Buchanan	John Renshaw Drive onto the Hunter Expressway GPS link: https://goo.gl/maps/1STJ1PfQt9E2	Length: 65m Width: 6.0m	Right hand turn	Spotter to guide the load through this pinchpoint.
59.0	Branxton	The Hunter Expressway onto The New England Highway GPS link: https://goo.gl/maps/7rauNuxzqjq	Length: 100m Width: 12.0m	Travel directly ahead	No problems with this section of road.
80.3	Singleton	The New England Highway through Gowrie Gates rail overpass https://goo.gl/maps/GSbCNH4S5XpPX316A	Width: 10.0 metres Height: 5.7 metres	Travel directly ahead	Loads that exceed 5.6 metres in height are to detour this bridge via Route 1B.

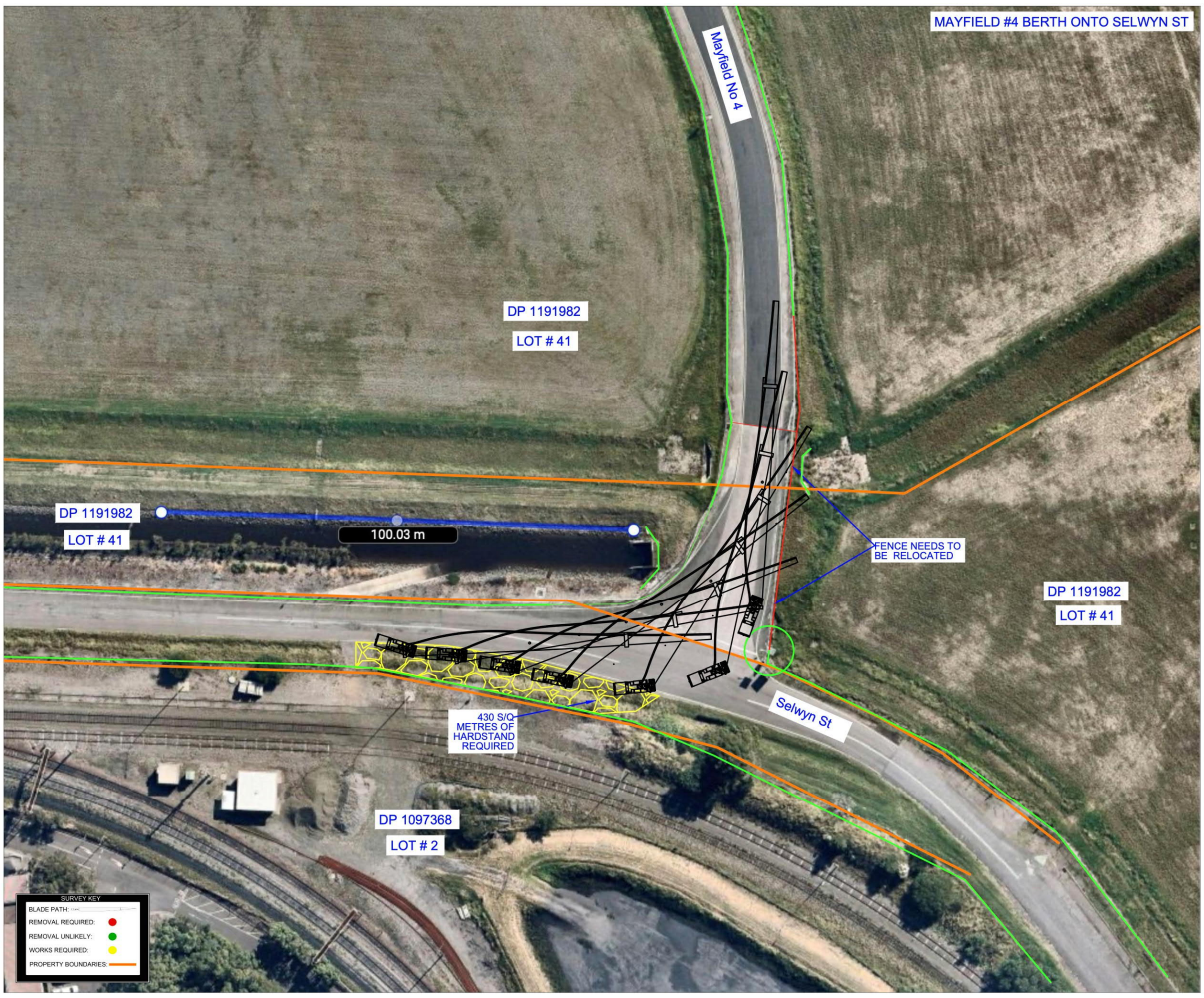
KM index	Location	Section of road	Current clearance	Procedure	Comments
83.0	Rixs Creek	New England Highway https://goo.gl/maps/z4X45LYKppXxcjCo8	Length: 80.0 m Width: 6.0m	Parking Bay	Suitable parking for Fatigue breaks.
109.0	Liddell	The New England Highway under Liddell Power station access Road https://goo.gl/maps/dhXHcoXXFQHb2gGX8	Width: 10.0 metres Height: 5.3 metres	Travel directly ahead	Loads that exceed 5.3 metres in height are to detour this bridge via Route 1. Loads that exceed 5.0 metres in height and under 5.3 metres in height are to travel under this structure in the far-right lane.
116.0	Muswellbrook	New England Highway onto Thomas Mitchell Drive https://goo.gl/maps/1KWaG5toCLVMG7Gf8	Length: 60.0 metres Width: 7.0 metres	Left hand turn	Blades to travel around this corner on the incorrect side of the road. Some signs will need to be removed and replaced for each load.
126.0	Muswellbrook	Thomas Mitchell Drive onto Denman Road https://goo.gl/maps/myJdcrZkvxovkrst5	Length: 60.0 metres Width: 7.0 metres	Right hand turn	Blades to travel around this corner on the correct side of the road. Some hardstand is required on the left side exit of the corner. Some signs will need to be made removable.
125.0	Muswellbrook	Denman Road onto New England Highway https://goo.gl/maps/gXgasV5AB4EnjfqDA	Length: 40.0 metres Width: 6.0 metres	Travel directly ahead.	No problems with this section of road.
129.5	Muswellbrook	New England Highway railway underpass https://goo.gl/maps/woZBzjFWNiom4xju7	Length: 65.0 m Width: 4.0m Height: 5.0m	Travel directly ahead	Modelling indicates the GE 158 split blade would not have adequate clearance to the rail bridge (by approximately 100mm). This is not due to the size of the blade but due to the current approach to packaging this particular model for transport. With a minor adjustment to the packaging the required clearance could be achieved. Once the turbine model is confirmed further detailed analysis and consultation with the manufacturer would be required to ensure appropriate clearances which may include consideration of packaging for haulage. . Note: all other loads over 4.0 metres in width and 5.0 metres in height are required to use either Route 2 or the Muswellbrook OSOM bypass via Bell Street.
130.0	Muswellbrook	New England Highway at Market Street https://goo.gl/maps/3kpU6XdCBmCW75gM7	Length: 30.0 metres Width: 7.0 metres	Travel directly ahead at the roundabout	No problems with this section of road.
196.0	Murrurundi	New England Highway (Township) https://goo.gl/maps/Sj3ixAkhujt	Length: 60.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.

KM index	Location	Section of road	Current clearance	Procedure	Comments
201.0	Murrurundi Hill	New England Highway Nowlands Gap https://goo.gl/maps/R5yufobPeMG2	Length: 120.0 m Width: 12.0m	Parking Bay	Suitable parking for Fatigue breaks.
205.0	Willow Tree	New England Highway https://goo.gl/maps/XLTq7CRV7EU2	Width: 7.0 metres Length: 35 metres Height: 5.2 metres	Kankool weighbridge	It is likely that the towers and defiantly the blades will not fit into this facility. We have engineered documentation showing correct weights for all loads.
212.0	Willow Tree Township	New England Highway https://goo.gl/maps/gw38qmvVfTC2	Length: 60.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.
214.0	Willow Tree Truck Stop N	New England Highway https://goo.gl/maps/RRdPVHupGCs	Length: 120.0 m Width: 12.0m	Parking Bay	Suitable parking for Fatigue breaks for small loads only.
233.0	Wallabadah	New England Highway https://goo.gl/maps/QWCyeHQSohS2	Length: 80.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.
259.0	Goono Goono	New England Highway https://goo.gl/maps/im4QhUfW24D2	Length: 120.0 m Width: 8.0m	Parking Bay	Emergency parking only. Incorrect side of the road
282.0	Tamworth	Roundabout on the New England Highway at Jack Smyth Drive https://goo.gl/maps/j1tpfb8JJf83jjt2A	66.0 metres clearance	Drive directly ahead	Signs to be made removable.
282.5	Tamworth	Roundabout on the New England Highway at Calala Lane https://goo.gl/maps/UM9a6UEw14GhSAXm8	66.0 metres clearance	Drive directly ahead	Signs to be made removable.
283.0	Tamworth	Roundabout on the New England Highway at Kurrawan Street https://goo.gl/maps/3J9dCHxtYim	66.0 metres clearance	Drive directly ahead	Signs to be made removable.
284.0	Tamworth	New England Highway onto the heavy vehicle bypass at Scott Road. https://goo.gl/maps/BXdwaSiLSBw	66.0 metres clearance	Loads to cut across the wrong side of the roundabout from correct side to correct side	A tree will need to be removed from within the road reserve on the blade overhang and some signs will need to be made removable.
285.0	Tamworth	Scott Road onto Murray Street https://goo.gl/maps/nix2oREeh6H2	66.0 metres clearance	Drive directly ahead	Signs to be made removable.
286.0	Tamworth	Murray Street onto New England Highway https://goo.gl/maps/45dffqHmUcs	66.0 metres clearance	Loads to cut across the wrong side of the roundabout from correct side to correct side. But travel through the incorrect side of the roundabout.	Signs to be made removable and no parking areas to be put in place.
288.0	East Tamworth	New England Highway https://goo.gl/maps/9cpBrT5qUAU2	Length: 200.0 m Width: 6.0m	Parking Bay	Suitable parking for Fatigue breaks
306.0	Moonbi	New England highway https://goo.gl/maps/E3TL2KkEctG2	Length: 60.0 m Width: 8.0m	Parking Bay	Suitable parking for Fatigue breaks.

KM index	Location	Section of road	Current clearance	Procedure	Comments
318.0	Moonbi range	New England highway https://goo.gl/maps/rwJQaAYkLTQ2	Length: 160.0 m Width: 6.0m	Parking Bay	Suitable parking for Fatigue breaks
350.0	Kentucky	New England Highway https://goo.gl/maps/tH1wgaBsDLzQ4pmy6	Length: 40.0 m Width: 8.0m	Left hand turn into site (AP3)	The corner will need to be redesigned to be suitable for the blades. Hard stand crosses the road reserve, through Crown Land and into the Project Area. Numerous trees will need to be removed and large area of hardstand added.

0.0 Km's: Mayfield #4 onto Selwyn Street at Mayfield.

Image 1:



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/afLwPYKuNdm

PROCEDURE: Right hand turn.

COMMENTS: Hardstand will need to be added to the left side exit of the corner. The existing culvert will be okay. Some signs will need to be relocated and or made removable and some fence will need to be relocated.

A spotter will need to keep the driver informed throughout the procedure.

ROAD MODIFICATIONS: A moderate amount of work is required.

0.4 Km's: Rail crossing over Selwyn Street at Mayfield.

Image 1:

GPS LINK FOR THIS LOCATION: https://goo.gl/maps/864FhMSaF9P2

PROCEDURE: Travel directly ahead over the crossing.

COMMENTS: Large width clearance and good ground clearance over this crossing.
Police and escorts to control local traffic either side of the crossing. ARTC approval will need to be obtained to travel over this crossing. Likely to cross with caution, no escort required.

ROAD MODIFICATIONS: No works are required.

1.3 Km's: Selwyn Street onto Industrial Drive, via George Street at Mayfield.

Image 1:

GPS LINK FOR THIS LOCATION: https://goo.gl/maps/brPRAckLr572

PROCEDURE: Right hand turn from Selwyn Street through George Street and onto Industrial Drive.

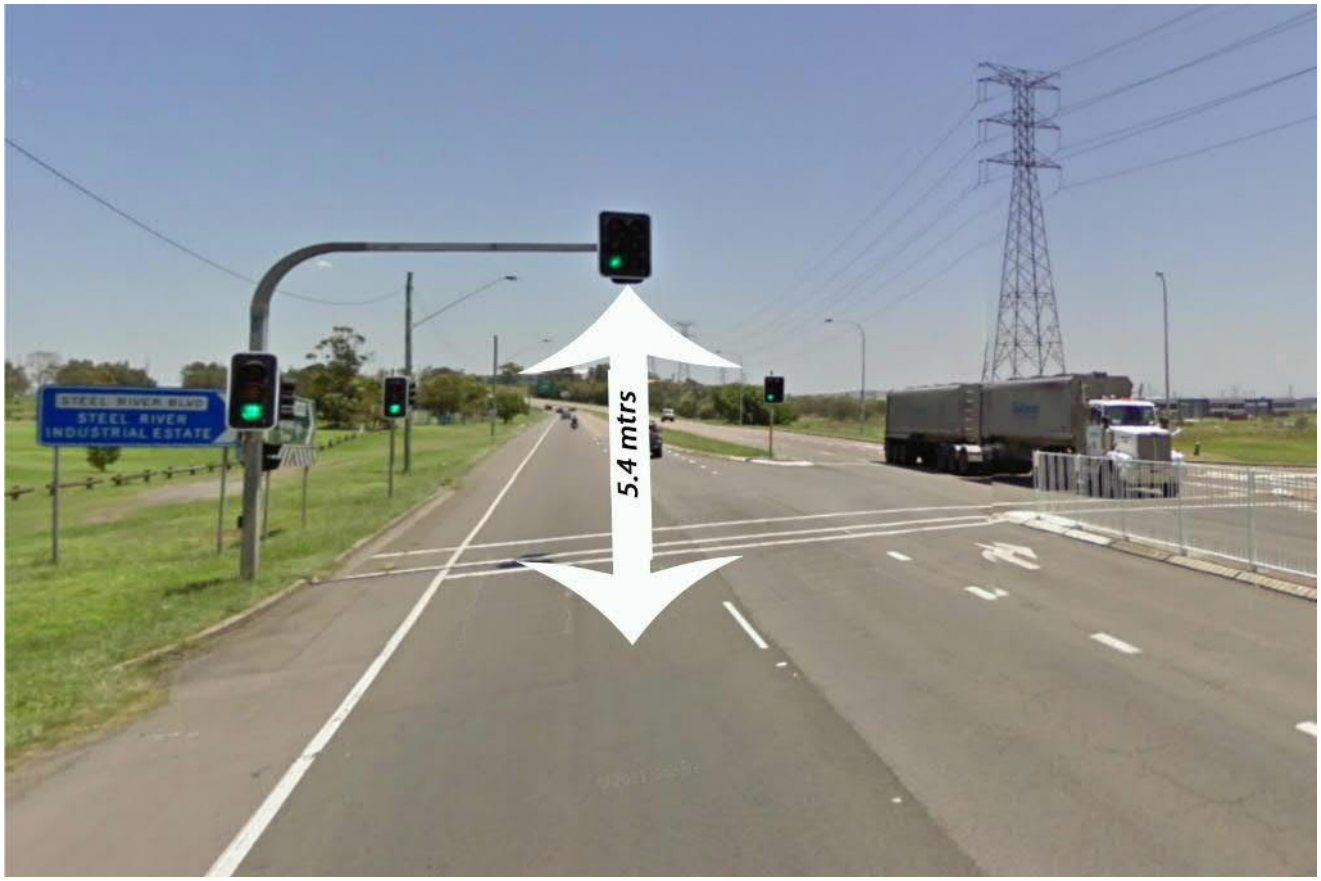
COMMENTS: The first right hand turn through George Street will need a sign made removable and a disused pole on the overhang removed.

A spotter would need to assist the load through this intersection.

ROAD MODIFICATIONS: A small amount of work is required.

4.9 Km's: Standard overhanging Traffic signals Mayfield to Hunter Expressway.

Image 1:



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/5DpD3b7KnT72

PROCEDURE: Overhanging signals while travelling through the intersection.

COMMENTS: The lowest traffic signal on route has 5.4 metres clearance. This signal is on the corner of Steel River Blvd at Mayfield West. Loads with an overall height of 5.3 or higher, can avoid this signal by travelling in the centre lane. Loads to slow down while doing this manoeuvre. All other signals exceed 5.6 metres high on this section of road.

ROAD MODIFICATIONS: No works are required.

5.5 Km's: Industrial Drive onto Maitland Road at Mayfield West.

Image 1:

GPS LINK FOR THIS LOCATION: https://goo.gl/maps/Kn49dhWG2qG2

PROCEDURE: Right hand turn from Industrial Drive onto Maitland Road.

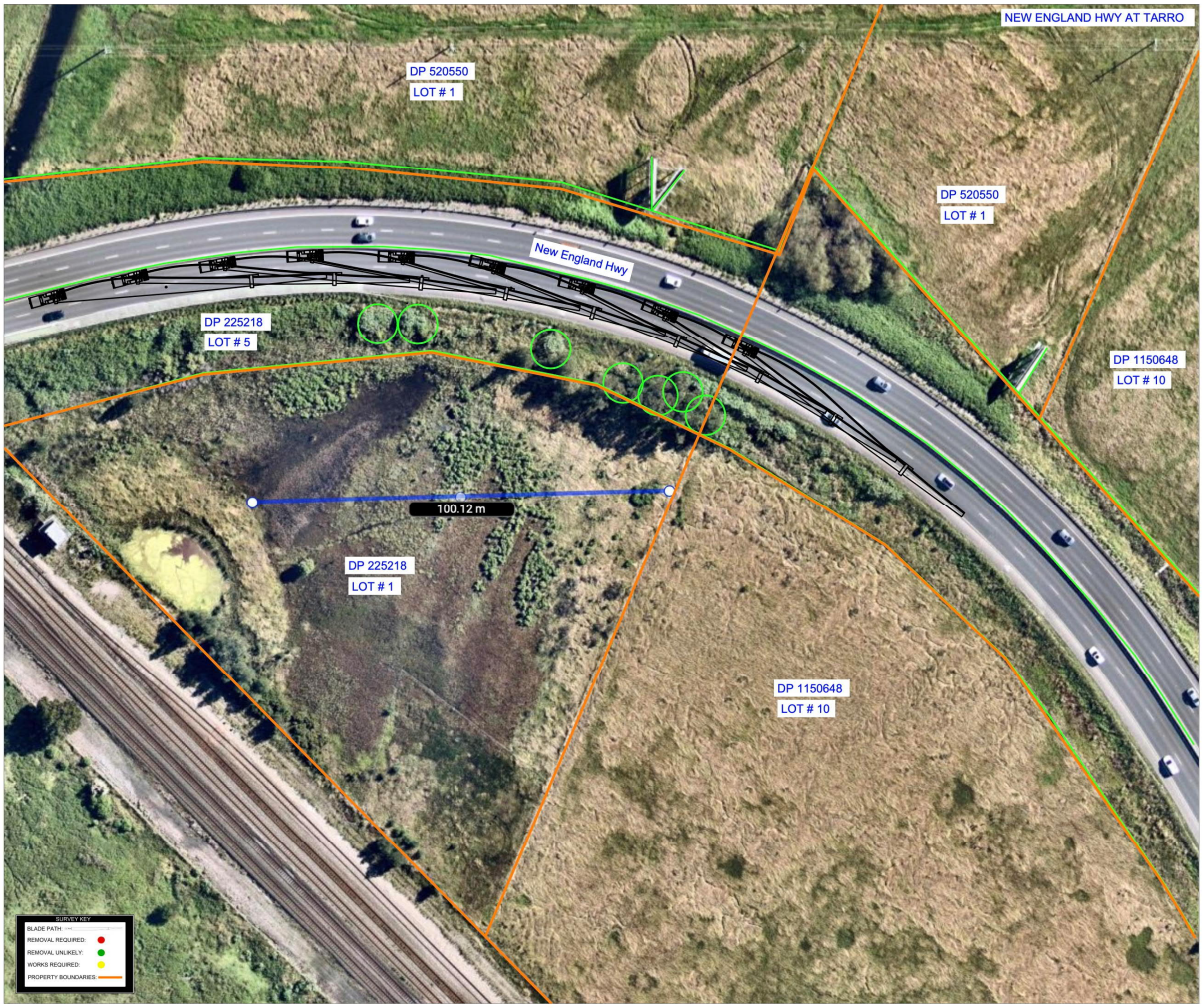
COMMENTS: The blades will need to cross to the incorrect side of the intersection 200 metres prior, before crossing back over to the correct side 120 metres to the north of the intersection.

Spotter to keep the driver informed throughout the procedure.

ROAD MODIFICATIONS: No works required.

14.8 Km's: New England Highway at Tarro.

Image 1:



GPS LINK FOR THIS LOCATION: https://goo.gl/maps/aED5Y4ccdW3A47x37

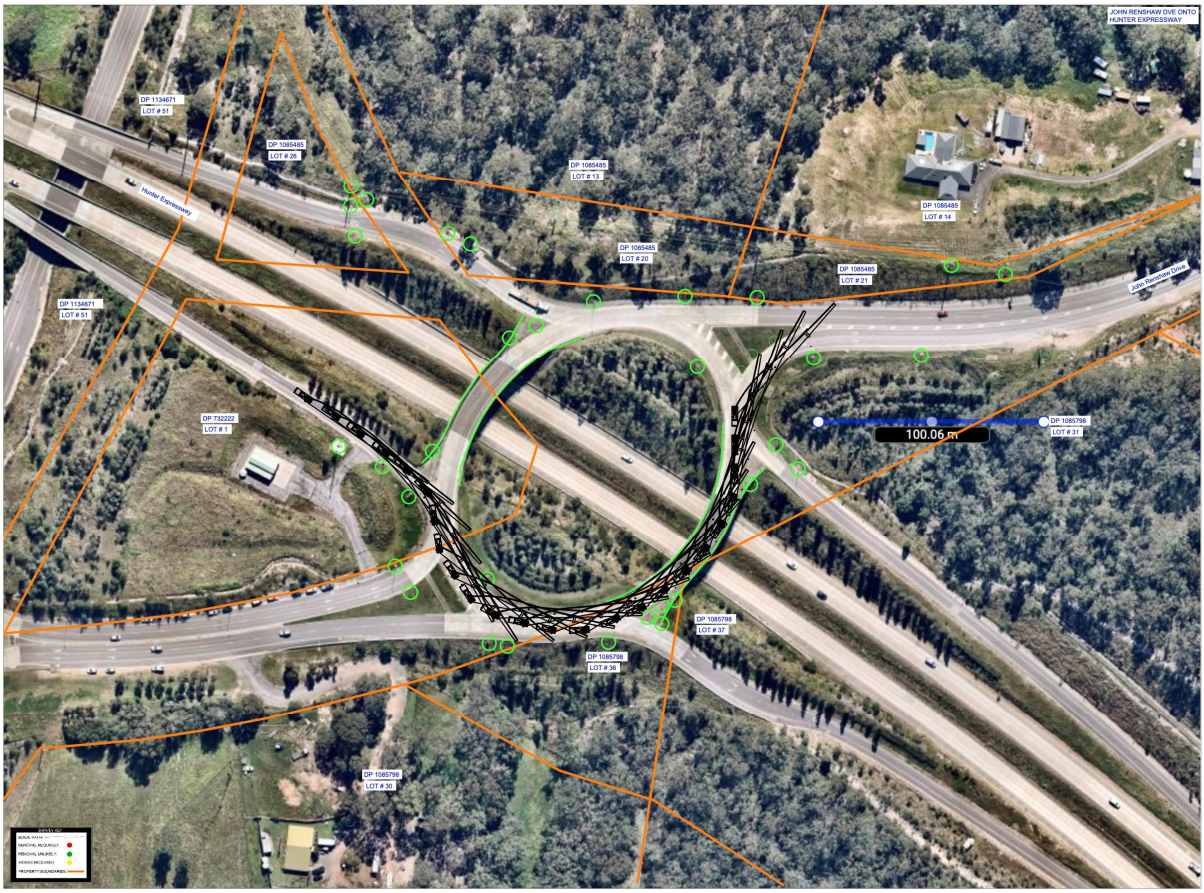
PROCEDURE: Right hand turn from Industrial Drive onto Maitland Road.

COMMENTS: Prime mover to travel around the corner in the right-hand lane. Spotter to keep the driver informed throughout the procedure.

ROAD MODIFICATIONS: No works required.

29.0 Km's: John Renshaw Drive onto the Hunter Expressway at Buchanan.

Image 1:



PROCEDURE: Right hand turn from John Renshaw drive onto the Hunter Expressway at the roundabout.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/cEnuC5th1p52

COMMENTS: Loads to travel around the roundabout on the correct side of the road.

Spotter to keep the driver informed throughout the procedure.

Traffic control and or police will be required to perform this procedure.

ROAD MODIFICATIONS: No works required.

116.0 Km's: New England Highway onto Thomas Mitchell Drive at Muswellbrook.

Image 1:

PROCEDURE: Left hand turn from the New England Highway onto Thomas Mitchell Drive.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/1KWaG5toCLVMG7Gf8

COMMENTS: Loads to turn from the incorrect side to the incorrect side. The signs in the center median will need to be removed and replaced for each blade movement.

Spotter to keep the driver informed throughout the procedure.

Police and escorts to control local traffic either side of the intersection.

ROAD MODIFICATIONS: Yes, a small amount of works is required.

126.0 Km's: Thomas Mitchell Drive onto Denman Road at Muswellbrook.

Image 1:

PROCEDURE: Right hand turn from Thomas Mitchell Drive onto Denman Road.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/myJdcrZkvxovkrst5

COMMENTS: Blades to travel around this corner on the correct side of the road. Some hardstand is required on the left side exit of the corner. And some signs will need to be made removable.

Spotter to keep the driver informed throughout the procedure.

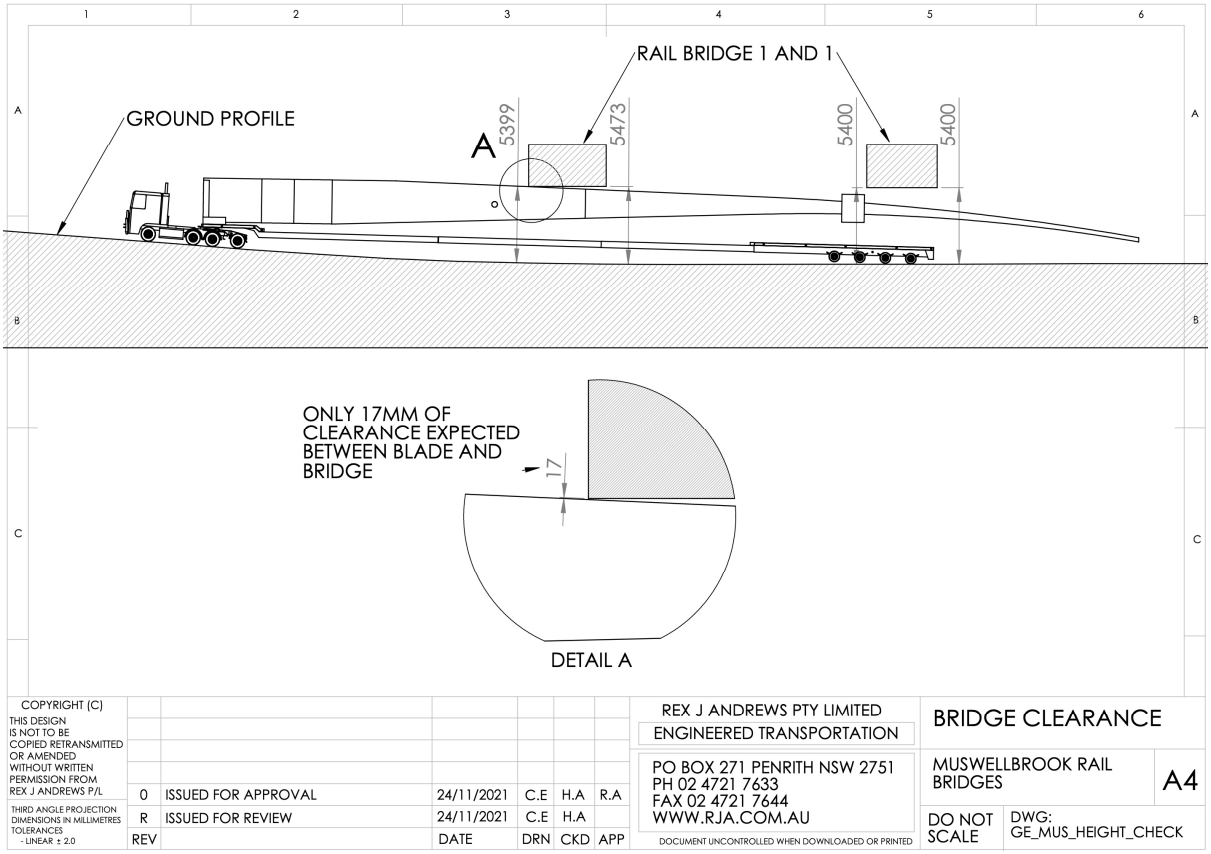
Police and escorts to control local traffic either side of the intersection.

ROAD MODIFICATIONS: Yes, a moderate amount of works is required.

129.5 Km's: The New England Highway under the rail overpasses at Muswellbrook.

Image 1:

Image 2:



PROCEDURE: Travel under rail overpass on the correct side of the road.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/woZBzjFWNiom4xju7

COMMENTS: Full studies would be required to determine what size split blade could fit under the rail bridges. The largest blades to have travelled under this rail overpass in the past were the Vestas V136 blade and the Goldwind GW121 blade.

We have modelled a GE 158 split blade as it is the only split blade that we have any information on and have inconclusive findings modelling this blade under the rail bridges. A complete survey of this underpass and detailed blade drawings would be needed before the any split blade type could be confirmed if it can travel under this structure.

If the chosen blade cannot travel under this structure, then Route 2 would need to be looked at as a suitable alternative.

Additionally, all other loads over 4.0 metres in width and 5.0 metres in height are to use either Route 2 or the Muswellbrook OSOM bypass via Bell Street.

ROAD MODIFICATIONS: Accurate designs of the underpass and the blade type is required before the possibility of travelling under the rail overpasses is confirmed.

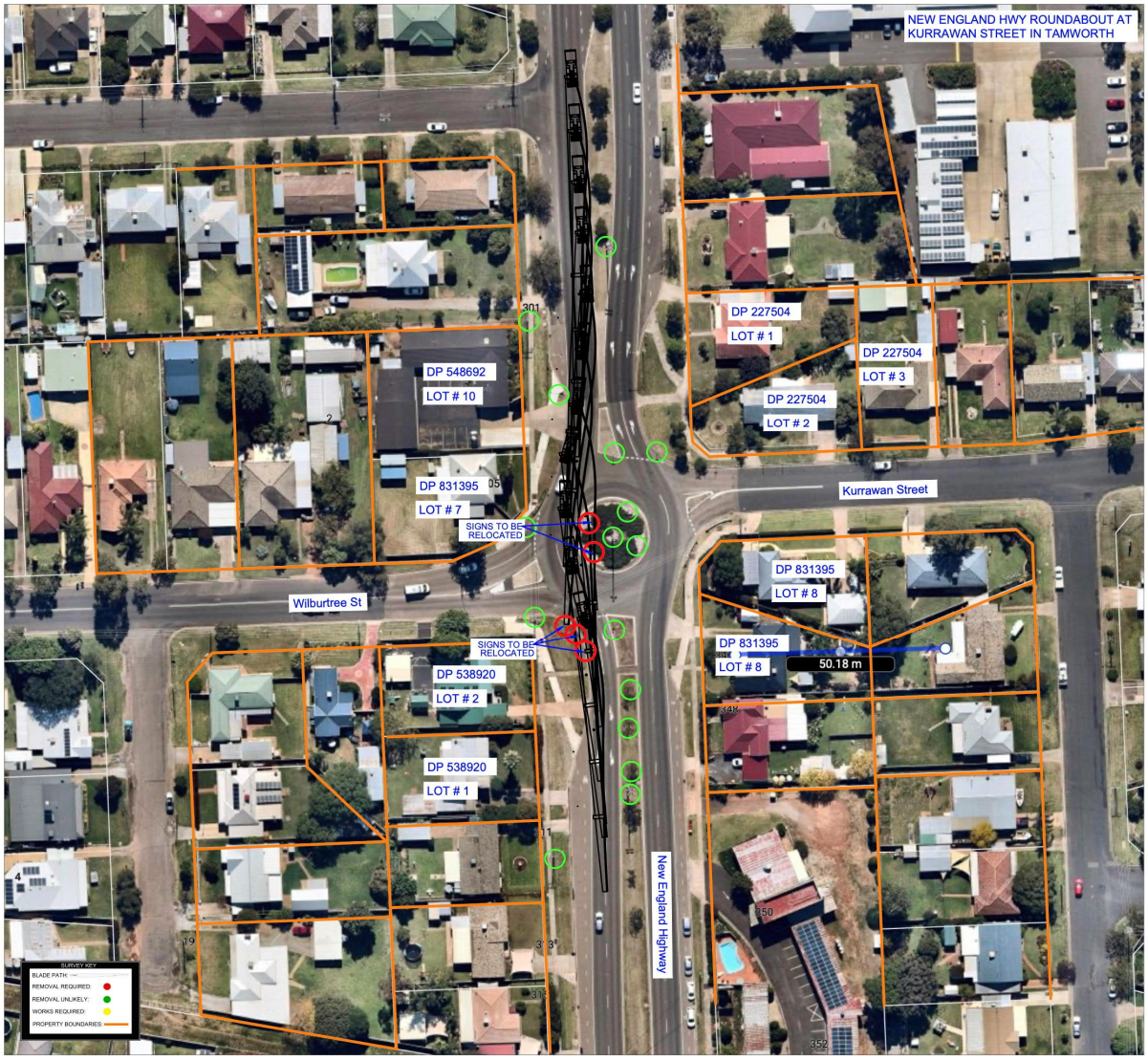
282.0 Km's: New England Highway and Jack Smyth Drive at Tamworth

PROCEDURE: Loads to travel straight ahead through the roundabout.
GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/j1tpfb8JJf83jjt2A
COMMENTS: Several signs will need to be made removable or relocated.
Spotter to keep the driver informed throughout the procedure.
Police and escorts to control local traffic either side of the intersection.
ROAD MODIFICATIONS: A small amount of work is required.

282.5 Km's: New England Highway and Calala Lane at Tamworth

PROCEDURE: Loads to travel straight ahead through the roundabout.
GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/UM9a6UEw14GhSAXm8
COMMENTS: Several signs will need to be made removable or relocated.
Spotter to keep the driver informed throughout the procedure.
Police and escorts to control local traffic either side of the intersection.
ROAD MODIFICATIONS: A small amount of work is required.

283.0 Km's: New England Highway and Wilburtree Street at Tamworth



PROCEDURE: Loads to travel straight ahead through the roundabout.
GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/jnxxpqLbWfoKyp5dA
COMMENTS: Several signs will need to be made removable or relocated.
Spotter to keep the driver informed throughout the procedure.
Police and escorts to control local traffic either side of the intersection.
ROAD MODIFICATIONS: A small amount of work is required.

284.0 Km's: New England Highway onto Scott Road at Tamworth

PROCEDURE: Loads to cut across the wrong side of the roundabout from correct side to correct side.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/EBDySH8meKgYWuPL8

COMMENTS: The swept path for this option will require the blade to travel on the incorrect side of the road and over the centre median strip.
A tree will need to be removed from within the road reserve on the overhang, and several signs made removable.

ROAD MODIFICATIONS: A moderate amount of work is required.

285.0 Km's: Scott Road onto Murray Street at Tamworth

PROCEDURE: Loads to travel through the roundabout on the correct side.
GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/nix2oREeh6H2
COMMENTS: Several signs will need to be made removable or relocated.
Spotter to keep the driver informed throughout the procedure.
Police and escorts to control local traffic either side of the intersection.
ROAD MODIFICATIONS: A small amount of work is required.

286.0 Km's: Murray Street onto New England Highway at Tamworth

PROCEDURE: Loads to cut across the wrong side of the roundabout from correct side to correct side but on the incorrect side of the roundabout.

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/45dffqHmUcs

COMMENTS: Signs to be made removable and no parking areas to be put in place.

Spotter to keep the driver informed throughout the procedure.

Police and escorts to control local traffic either side of the intersection.

ROAD MODIFICATIONS: A moderate amount of work is required.

350.0 Km's: New England Highway into potential site entrance AP3

PROCEDURE: Left hand turn from the New England Highway

GPS LINK FOR SECTION OF ROAD: https://goo.gl/maps/tH1wgaBsDLzQ4pmy6

COMMENTS: The corner will need to be redesigned to be suitable for the blades. Numerous trees will need to be removed and large area of hardstand added. These works are located within the road reserve and extend into Crown Land and the Project Area.

ROAD MODIFICATIONS: A large amount of work is required.

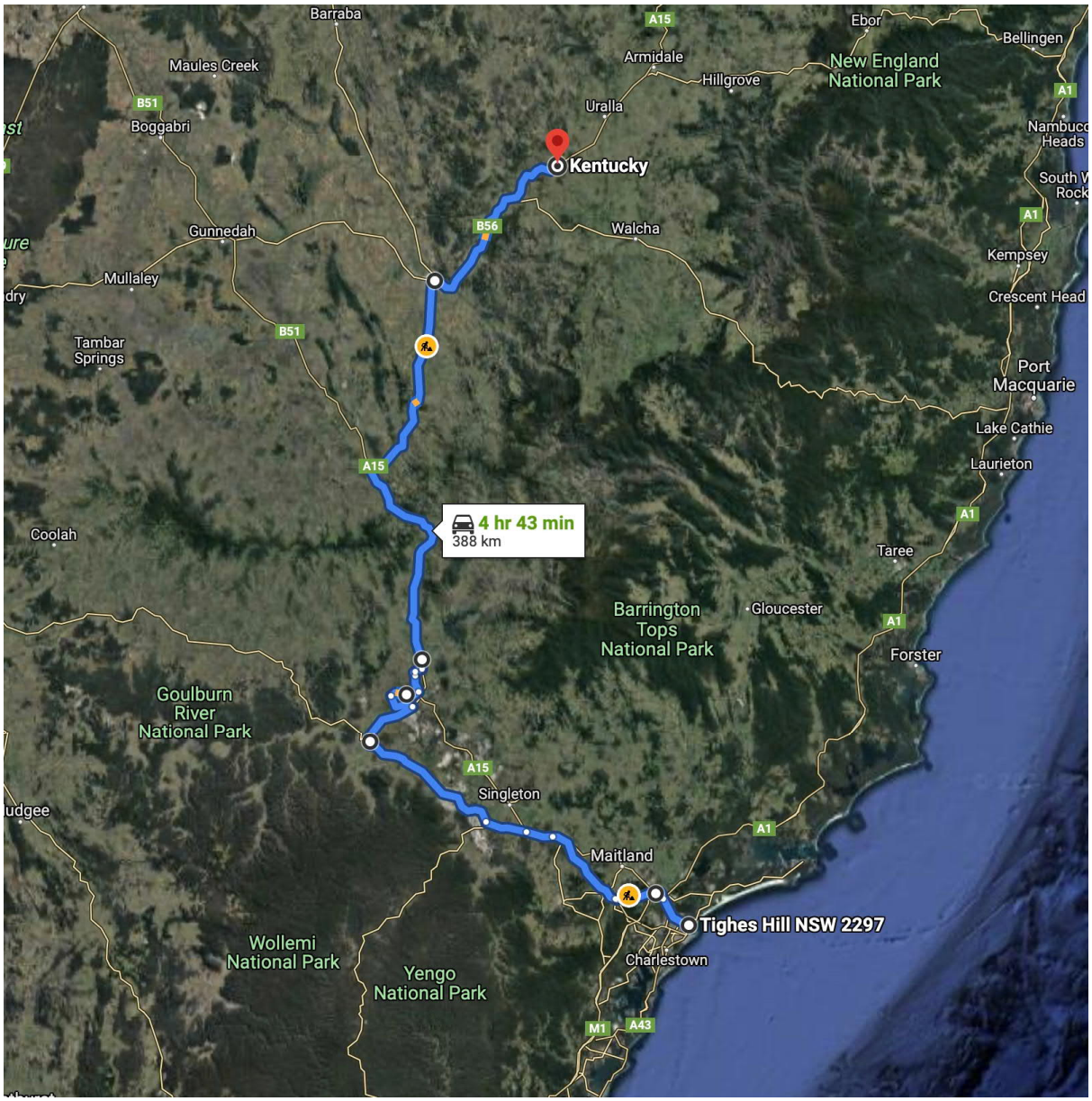
11.0 Route Survey 2: Newcastle to Thunderbolt Energy Hub stage 1

COMPONENTS: Towers and loads over 5.2 metres in height.

DISTANCE: 388.0 kilometres

GPS LINK: https://goo.gl/maps/Zp1XSB8guqUFxeMF7

VIA: Selwyn Street, George Street, Industrial Drive, Maitland Road, New England Highway, John Renshaw Drive, Hunter Expressway, New England Highway, Golden Highway, Denman Road, (Muswellbrook bypass via Bengalla Road, Wybong Road, Kayuga Road, Ivermein Street, Stair Street, Dartbrook mine access Road), New England Highway, (Tamworth bypass via Scott Street, Marius Street), New England Highway.



KEY	
MODIFICATIONS REQUIRED	
MINOR WORKS OR CAUTION	
PARKING	

KM index	Location	Section of road	Current clearance	Procedure	Comments
0.0	Mayfield	Mayfield #4 berth onto Selwyn Street https://goo.gl/maps/afLwPYKuNdm	Length: 60.0m Width: 8.0m	Moderate right hand turn	No problems with this section of road
0.4	Mayfield	Selwyn Street rail crossing https://goo.gl/maps/864FhMSaF9P2	Width: 9.0m	Travel directly ahead	Loads to travel over the crossing in the center of the road. Approval required crossing this line, likely cross with caution.
1.3	Mayfield	Selwyn Street onto Industrial Drive via George Street https://goo.gl/maps/brPRAckLr572	Length: 50.0m Width: 8.0m	Right hand turn	No problems with this section of road
4.9	Mayfield	Industrial Drive under traffic signals https://goo.gl/maps/5DpD3b7KnT72	Clearance: Height: 5.4m	Travel directly ahead	The lowest traffic signal on route is at the intersection of Steel River Blvd. Trucks that exceed 5.3 metres will need to travel in the right-hand lane.
5.5	Mayfield West	Industrial Drive onto Maitland Road https://goo.gl/maps/Kn49dhWG2qG2	Length: 50.0m Width: 8.0m	Right hand turn	No problems with this section of road
14.8	Tarro	New England Highway https://goo.gl/maps/aED5Y4ccdW3A47x37	Length: 90.0m Width: 8.0m	Left hand bend	No problems with this section of road.
17.4	Tarro	New England Highway onto John Renshaw Drive https://goo.gl/maps/SRDr5JigkBp	Length: 100.0m Width: 12.0m	Left hand merge	No problems with this section of road.
29.0	Buchanan	John Renshaw Drive onto the Hunter Expressway GPS link: https://goo.gl/maps/1STJ1PfQt9E2	Length: 55.0m Width: 8.0m	Right hand turn	No problems with this section of road
59.0	Branxton	The Hunter Expressway onto The New England Highway GPS link: https://goo.gl/maps/7rauNuxzqjq	Length: 100m Width: 12.0m	Travel directly ahead	No problems with this section of road.
67.0	Whittingham	The New England Highway onto the Golden Highway GPS link: https://goo.gl/maps/nAnfkYfeUn42	Length: 60.0m Width: 8.0m	Left Hand turn	No problems with this section of road

KM index	Location	Section of road	Current clearance	Procedure	Comments
67.4	Whittingham	Golden Highway GPS link: https://goo.gl/maps/R86RFuPnmFU2	Length: 115.0 m Width: 9.0m	Parking Bay	Suitable parking for Fatigue breaks.
68.0	Whittingham	Golden Highway over rail bridge GPS link: https://goo.gl/maps/5NwDQofandvvMKfY9	Width: 9.0m	Travel directly ahead in the centre of the road.	Approval from Rail company required to cross this structure. Travel over this structure may have specific conditions.
77.3	Whittingham	Golden Highway over rail bridge GPS link: https://goo.gl/maps/qTxSbkxPu87L5hx4A	Width: 9.0m	Travel directly ahead in the centre of the road.	Approval from Rail company required to cross this structure. Travel over this structure may have specific conditions.
77.4	Whittingham	Golden Highway intersection with the Putty Road GPS link: https://goo.gl/maps/7hQdEmK1EgE2	Length: 40.0m Width: 7.0m	Left hand turn	No problems with this section of road
77.5	Mount Thorley	Golden Highway GPS link: https://goo.gl/maps/zGvdupDuixx	Length: 100.0 m Width: 10.0m	Parking Bay	Suitable parking for Fatigue breaks.
80.6	Mount Thorley	Golden Highway over rail bridge GPS link: https://goo.gl/maps/ipGU4USXmWZ8GkJs6	Width: 9.0m	Travel directly ahead in the centre of the road.	Approval from Rail company required to cross this structure. Travel over this structure may have specific conditions.
80.8	Mount Thorley	Putty Road under Mt Thorley Road https://goo.gl/maps/SMzSLP1kvQYDMqa86	Heights: Left: 6.6 metres Centre: 6.3 Metres Right: 6.3 metres	Travel under the bridge in the left lane	Mt Thorley underpass is 6.3 metres in the centre of the road. Towers to pass under this structure on the correct side.
80.9	Mount Thorley	Golden Highway intersection with the Putty Road GPS link: https://goo.gl/maps/VyA42n1CqZx	Length: 70.0m Width: 8.0m	Right hand turn	No problems with this section of road
98.0	Warkworth	Golden Highway GPS link: https://goo.gl/maps/Y6V6EXaCwxq	Length: 100.0 m Width: 8.0m	Parking Bay	Suitable parking for Fatigue breaks.
107.0	Jerrys Plains	Golden Highway through Jerrys Plains village GPS link: https://goo.gl/maps/WgSCRsJ9ZGt	Length: 50.0m Width: 8.0m	Left hand than right hand turn	No problems with this section of road
126.0	Ogilvy	Golden Highway GPS link: https://goo.gl/maps/58Tj9ojs7CC2	6% gradient	Travel directly ahead	This section of road has a steep mountain range that will require additional pull trucks to assists loads that exceed 80T gross weight.

KM index	Location	Section of road	Current clearance	Procedure	Comments
131.9	Denman	Golden Highway onto Denman Road GPS link: https://goo.gl/maps/sf4PNnycxB32	Length: 65.0m Width: 8.0m	Right hand turn	No problems with this section of road
149.0	Muswellbrook	Denman Road onto Bengalla Road https://goo.gl/maps/CJYMtSMTttJ2	Length: 60.0m Width: 8.0m	Left hand turn	No problems with this section of road
158.5	Muswellbrook	Bengalla Road onto Wybong Road https://goo.gl/maps/vibQtvHkxXE2	Length: 60.0m Width: 8.0m	Right hand turn	No problems with this section of road
168.1	Muswellbrook	Wybong Road onto Kayuga Road https://goo.gl/maps/xVscKUT1isJ2	Length: 40.0m Width: 7.0m	Left hand turn	No problems with this section of road
173.0	Muswellbrook	Kayuga Road onto Ivermein Street https://goo.gl/maps/JpTfmcsZ6Sk	Length: 110.0m Width: 7.0m	Travel directly ahead	No problems with this section of road.
174.0	Muswellbrook	Ivermein Street onto Stair Street https://goo.gl/maps/ddMHa4CmXK32	Length: 40.0m Width: 7.0m	Right hand turn	No problems with this section of road
174.8	Muswellbrook	Stair Street onto Dartbrook Road access https://goo.gl/maps/u9vSXiSV7Jt	Length: 60.0m Width: 7.0m	Right hand turn	No problems with this section of road
177.0	Muswellbrook	Dartbrook access Road onto New England Highway https://goo.gl/maps/twTsmUKaED82	Length: 60.0m Width: 7.0m	Left hand turn	No problems with this section of road
208.0	Wingen	New England Highway https://goo.gl/maps/z4ekan9E9RXMJ2kS7	Length: 110.0m Width: 8.0m	Left hand bend	No problems with this section of road.
233.0	Murrurundi	New England highway (Township) https://goo.gl/maps/Sj3ixAkhujt	Length: 60.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.
238.0	Murrurundi Hill	New England highway Nowlands Gap https://goo.gl/maps/R5yufobPeMG2	Length: 120.0 m Width: 12.0m	Parking Bay	Suitable parking for Fatigue breaks.
245.0	Willow Tree	New England highway https://goo.gl/maps/XLTg7CRV7EU2	Width: 7.0 metres Length: 35 metres Height: 5.2 metres	Kankool weighbridge	It is likely that the towers and defiantly the blades will not fit into this facility. Engineered documentation showing correct weights for all loads will be required.
252.0	Willow Tree Township	New England highway https://goo.gl/maps/gw38qmvVfTC2	Length: 60.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.
253.0	Willow Tree Truck Stop	New England highway https://goo.gl/maps/RRdPVHupGCs	Length: 120.0 m Width: 12.0m	Parking Bay	Suitable parking for Fatigue breaks for small loads only.
269.0	Wallabadah	New England highway https://goo.gl/maps/QWCyeHOSohS2	Length: 80.0 m Width: 5.0m	Parking Bay	Suitable parking for Fatigue breaks.
301.0	Goono Goono	New England highway https://goo.gl/maps/im4QhUfW24D2	Length: 120.0 m Width: 8.0m	Parking Bay	Emergency parking only. Incorrect side of the road

KM index	Location	Section of road	Current clearance	Procedure	Comments
319.0	Tamworth	Roundabout on the New England Hwy at Jack Smyth Drive https://goo.gl/maps/j1tpfb8JJf83jjt2A	Length: 70.0 m Width: 8.0m	Drive directly ahead	Spotter to guide load through this roundabout.
321.0	Tamworth	Roundabout on the New England Hwy at Calala Lane https://goo.gl/maps/UM9a6UEw14GhSAXm8	Length: 70.0 m Width: 8.0m	Drive directly ahead	Spotter to guide load through this roundabout.
321.30	Tamworth	Roundabout on the New England Hwy at Kurrawan Street https://goo.gl/maps/3J9dCHxtYim	Length: 70.0 m Width: 8.0m	Drive directly ahead	Spotter to guide load through this roundabout.
322.0	Tamworth	New England Highway onto the heavy vehicle bypass at Scott Road. https://goo.gl/maps/BXdwaSiLSBw	Length: 66.0 m Width: 8.0m	Loads to cut across the wrong side of the roundabout from correct side to correct side	Spotter to guide load through this roundabout. Tree removed from within road reserve. Police and/or Pilots to control local traffic while load crosses to the incorrect side of the road.
324.0	Tamworth	Scott Road onto Murray Street https://goo.gl/maps/nix2oREeh6H2	Length: 66.0 m Width: 8.0m	Drive directly ahead	Spotter to guide load through this roundabout.
324.2	Tamworth	Murray Street onto New England Highway https://goo.gl/maps/45dffqHmUcs	Length: 66.0 m Width: 8.0m	Loads to cut across the wrong side of the roundabout from the correct side and back onto the correct side.	Spotter to guide load through this roundabout. Police and/or Pilots to control local traffic while load crosses to the incorrect side of the road.
325.0	East Tamworth	New England highway https://goo.gl/maps/9cpBrT5qUAU2	Length: 200.0 m Width: 6.0m	Parking Bay	Suitable parking for Fatigue breaks
344.0	Moonbi	New England highway https://goo.gl/maps/E3TL2KkEctG2	Length: 60.0 m Width: 8.0m	Parking Bay	Suitable parking for Fatigue breaks.
356.0	Moonbi range	New England highway https://goo.gl/maps/rwJQaAYkLTQ2	Length: 160.0 m Width: 6.0m	Parking Bay	Suitable parking for Fatigue breaks
364.0	Bendemeer	New England highway https://goo.gl/maps/dhjFHAUB2YBYwEhT9	Length: 100.0 m Width: 15.0m	Oxley Hwy intersection	See route A for details from this point to proposed site entrances for stage 2.
388.0	Kentucky	New England Highway https://goo.gl/maps/tH1wgaBsDLzQ4pmy6	Length: 40.0 m Width: 8.0m	Left hand turn into site (AP3)	Entrance to Project Area New Intersection required the corner will need to be redesigned to be suitable for the blades. Numerous trees will need to be removed and large area of hardstand added. These works are located within the Road Reserve and extend across Crown Land and into the Project Area

12.0 Conclusion Both Routes:

The analysis indicates that the components would need to be transported on two different routes through to the Project Area.

Route survey 1 will be used to transport the split blades and smaller loads under 5.2 metres in height to the Project Area.

Route survey 2 will be used to transport towers and larger loads over 5.2 metres in height to the Project Area.

NEWCASTLE:

- Upgrades required while exiting the port.
- Upgrades required on the corner of Selwyn Street and Industrial Drive.

MUSWELLBROOK:

- Works are required on Thomas Mitchell Drive back onto Denman Road. This will require some hardstand and sign relocation or made removable.
- The transportation housing for the split blade would need to be designed to provide for adequate clearance to travel under the Muswellbrook rail overpass on route 1. Further detailed analysis and consultation with manufacturers will be undertaken during the detailed design phase to ensure adequate clearances for transportation of blades along Route 1.
- Other height restricted loads will detour Muswellbrook via Route 2. This would be subject to further approvals from Muswellbrook council and Dartbrook mine.

TAMWORTH:

- Several roundabouts will require minor works through the town.

THUNDERBOLT ENERGY HUB ACCESS POINTS:

- The proposed entrance to the Project Area off the New England Highway is positioned along stretches of road with good line of sight but will still require police & pilots to travel at least 800 metres past the site entry to warn oncoming motorists of the loads ahead.
- Site entrance will need to be constructed to allow a suitable swept path of the largest loads

OVERHEAD STRUCTURES: (5.8 Maximum loaded height)

- The lowest structure on route 1 is at the Liddell overpass and has a maximum clearance of 5.2 metres. Loads that exceed 5.2 metres will need to detour via Route 2.

- The lowest structure on route 2 is the overhead gantry at Hexham. It has an overall clearance of 5.9 metres. We have allowed 100mm of clearance which would make the maximum loaded height of 5.8 metres.
- The traffic signal overhanging the road on Industrial Drive is 5.4 metres in the left lane, however if the high loads pass under this in the right-hand lane, then they will not be restricted.

(Overhead structures summary)

Loads up to 5.8m loaded height can travel from Newcastle through to Thunderbolt using route 2.

OVERHEAD UTILITIES:

Both routes will need to be checked by an authorised scoping company. It is likely that route 1 will require a 5.2 metre height clearance, and route 2 with at least 5.8 metres height clearance is required for this project.

BRIDGES:

There are a number of bridges along the routes that will require bridge assessments.

RAIL ASSETS:

There are a number of rail overbridges and crossings on route that will require approval from authorities before loads can access the routes.

VEGETATION REMOVAL:

A minor amount of work is required up until the Site entrance.

PAVEMENT:

The pavement on the main routes have adequate Highway pavement up until the proposed site entrances.

ROADWORKS:

Further consultation is recommended with government authorities at least 18 months prior to turbine transport to understand if the project would conflict with any upcoming roadworks. Development of a Transport Management Plan (TMP) will

include the management of the transport of the OSOM turbine components, including movement dates in consultation with TfNSW.

SUMMARY OF THE ROUTES:

- After reviewing the routes, we consider that the split blades could be transported along the highway through Muswellbrook, subject to detailed blade and transportation housing design. Previous analysis indicates that blades of a maximum length of 66 metres will fit under the rail overpasses on a conventional blade trailer. Larger split blades are a technology that is currently in development, the GE blade (currently the only available split blade model) would not have adequate clearance (only millimetres) to the rail bridges, however, this is not due to the blade itself but due to the current transportation housing design and only a minor change (approx. 100mm) is required to allow appropriate clearance. Although adequate clearance is not provided modelling the GE blade, transportation options (such as carrying the load set lower in the trailer) or modifications to the transportation housing from the manufacturer could provide for adequate clearance. Neoen will need to consult with the manufacturer of the selected blade to ensure adequate clearance at this point of the route.
- All proposed works along the route would be contained within the road reserve.
- Further route analysis (and consultation with relevant manufacturers) will be undertaken once the turbine components and manufacturer are confirmed during the detailed design phase to ensure adequate clearance is provided.
- The further route analysis will also include reassessment of both routes to confirm the works required at the time of construction given a number of other developers within the New England REZ are proposing similar works, however the timing is unknown.

13.0 Approvals:

At a minimum, the following are required for approval to access these routes.

- NHVR
- TfNSW
- Newcastle Council
- Muswellbrook Council
- Tamworth Regional council
- Armidale Regional Council
- NSW Police
- Ausgrid
- Essential Energy
- Telstra
- CRN JHG (Rail)
- ARTC (Rail)

14.0 References:

Rex J Andrews Pty. Ltd.
Rex J Andrews Route survey # 320REV01
Umwelt
Neoen
Google Earth/Maps
Nearmaps
NHVR
NHVAS Maintenance Management (NHVAS21193)
NHVAS Basic Fatigue Management (NHVAS21193)

Disclaimer: This route study is a guide only; government approvals would be required before these routes could be deemed suitable for transporting the components over the listed routes.

Any, and all parties using information contained this submission do so at own risk.

RJA accept no responsibility for the use of all information contained within this report.

Actual approved routes may differ from those surveyed.

Proposed routes may change subject to approvals from authorities.

This study was undertaken using data supplied by Rex J Andrews P/L. Equipment and swept paths might vary if using transport methodology other than the data supplied by Rex J Andrews.

Appendix B – SIDRA Results (Existing)

MOVEMENT SUMMARY

Site: 1 [EXIST 2021 AM Peak (Project Peak) (Site Folder: Existing)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Existing Property Access Configuration
Project Traffic Peak (6-7am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	50	12	53	24.0	0.033	0.0	LOS A	0.0	0.2	0.02	0.03	0.02	99.2
6	R2	2	1	2	50.0	0.033	9.2	LOS A	0.0	0.2	0.02	0.03	0.02	67.3
Approach		52	13	55	25.0	0.033	0.4	NA	0.0	0.2	0.02	0.03	0.02	97.4
NorthWest: TBWF Stg 1 Access														
7	L2	2	1	2	50.0	0.004	6.5	LOS A	0.0	0.1	0.21	0.54	0.21	50.4
9	R2	2	1	2	50.0	0.004	6.8	LOS A	0.0	0.1	0.21	0.54	0.21	49.7
Approach		4	2	4	50.0	0.004	6.7	LOS A	0.0	0.1	0.21	0.54	0.21	50.1
SouthWest: New England Highway														
10	L2	2	1	2	50.0	0.051	9.1	LOS A	0.0	0.0	0.00	0.02	0.00	67.7
11	T1	74	28	78	37.8	0.051	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	99.5
Approach		76	29	80	38.2	0.051	0.2	NA	0.0	0.0	0.00	0.02	0.00	98.3
All Vehicles		132	44	139	33.3	0.051	0.5	NA	0.0	0.2	0.01	0.04	0.01	95.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [EXIST 2021 PM Peak (Project Peak) (Site Folder: Existing)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Existing Property Access Configuration
Project Traffic Peak (5-6pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	153	34	161	22.2	0.096	0.0	LOS A	0.0	0.2	0.01	0.01	0.01	99.7
6	R2	2	1	2	50.0	0.096	9.6	LOS A	0.0	0.2	0.01	0.01	0.01	67.5
Approach		155	35	163	22.6	0.096	0.1	NA	0.0	0.2	0.01	0.01	0.01	99.1
NorthWest: TBWF Stg 1 Access														
7	L2	2	1	2	50.0	0.005	6.8	LOS A	0.0	0.2	0.31	0.56	0.31	50.1
9	R2	2	1	2	50.0	0.005	8.0	LOS A	0.0	0.2	0.31	0.56	0.31	49.4
Approach		4	2	4	50.0	0.005	7.4	LOS A	0.0	0.2	0.31	0.56	0.31	49.7
SouthWest: New England Highway														
10	L2	2	1	2	50.0	0.087	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.8
11	T1	143	26	151	18.2	0.087	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.8
Approach		145	27	153	18.6	0.087	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.1
All Vehicles		304	64	320	21.1	0.096	0.2	NA	0.0	0.2	0.01	0.02	0.01	97.8

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [EXIST 2021 AM Peak (NE Highway Peak) (Site Folder: Existing)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Existing Property Access Configuration
New England Highway Peak (10-11am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	177	37	186	20.9	0.110	0.0	LOS A	0.0	0.2	0.01	0.01	0.01	99.7
6	R2	2	1	2	50.0	0.110	9.8	LOS A	0.0	0.2	0.01	0.01	0.01	67.6
Approach		179	38	188	21.2	0.110	0.1	NA	0.0	0.2	0.01	0.01	0.01	99.2
NorthWest: TBWF Stg 1 Access														
7	L2	2	1	2	50.0	0.005	7.0	LOS A	0.0	0.2	0.34	0.57	0.34	49.9
9	R2	2	1	2	50.0	0.005	8.5	LOS A	0.0	0.2	0.34	0.57	0.34	49.2
Approach		4	2	4	50.0	0.005	7.7	LOS A	0.0	0.2	0.34	0.57	0.34	49.5
SouthWest: New England Highway														
10	L2	2	1	2	50.0	0.102	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.8
11	T1	165	35	174	21.2	0.102	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.8
Approach		167	36	176	21.6	0.102	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.2
All Vehicles		350	76	368	21.7	0.110	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.1

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [EXIST 2021 PM Peak (NE Highway Peak) (Site Folder: Existing)]

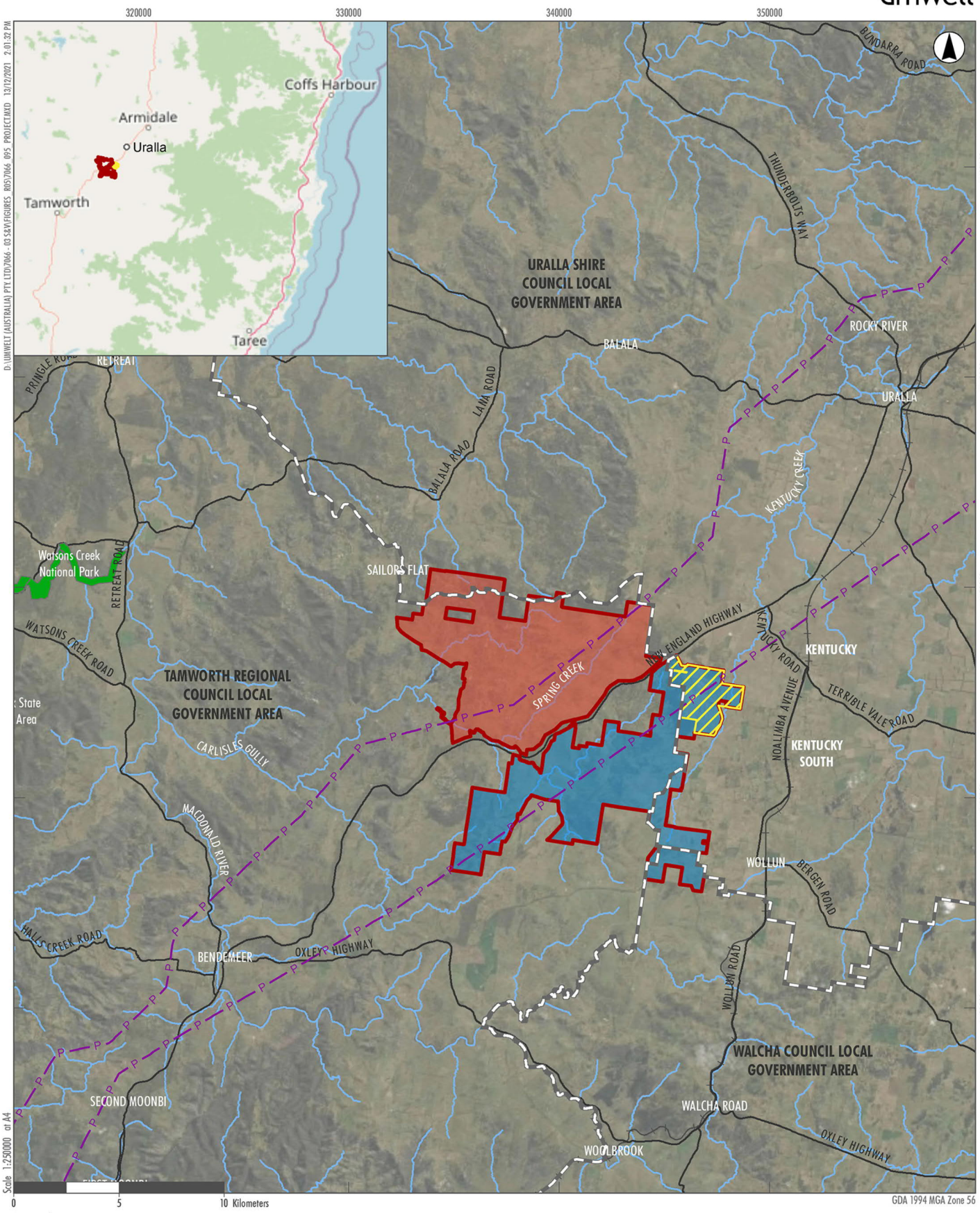
New England Highway / Thunderbolt Wind Farm Stage 1 Access
Existing Property Access Configuration
New England Highway Peak (3-4pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	189	41	199	21.7	0.117	0.0	LOS A	0.0	0.2	0.01	0.01	0.01	99.7
6	R2	2	1	2	50.0	0.117	9.9	LOS A	0.0	0.2	0.01	0.01	0.01	67.6
Approach		191	42	201	22.0	0.117	0.1	NA	0.0	0.2	0.01	0.01	0.01	99.2
NorthWest: TBWF Stg 1 Access														
7	L2	2	1	2	50.0	0.005	7.0	LOS A	0.0	0.2	0.36	0.58	0.36	49.8
9	R2	2	1	2	50.0	0.005	8.7	LOS A	0.0	0.2	0.36	0.58	0.36	49.1
Approach		4	2	4	50.0	0.005	7.9	LOS A	0.0	0.2	0.36	0.58	0.36	49.4
SouthWest: New England Highway														
10	L2	2	1	2	50.0	0.108	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.8
11	T1	180	31	189	17.2	0.108	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.8
Approach		182	32	192	17.6	0.108	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.3
All Vehicles		377	76	397	20.2	0.117	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix C – Proposed Plan of Development

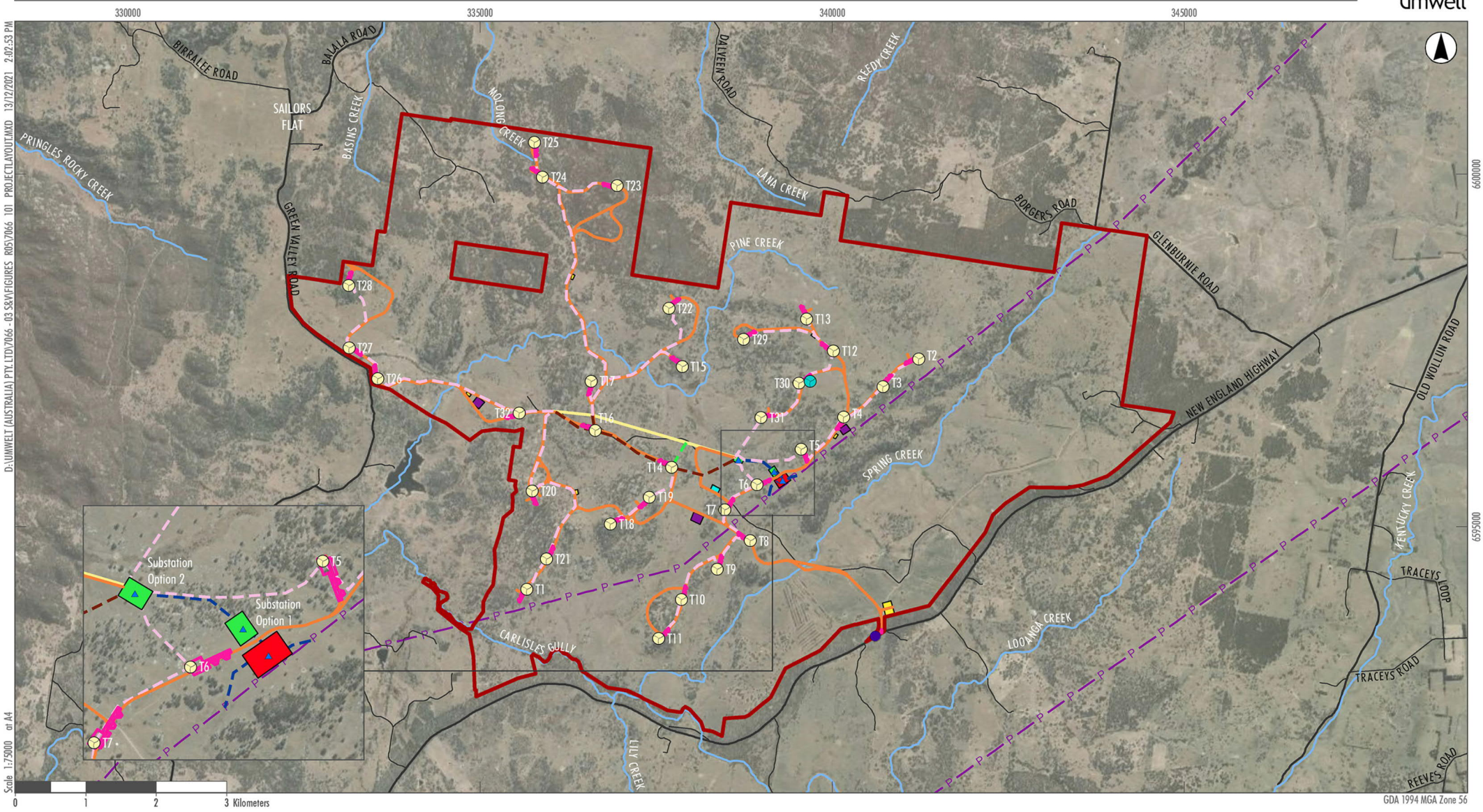


Legend

- Thunderbolt Energy Hub
- Stage 1 Project Area
- Stage 2 Project Area - Subject to separate Approval Process
- Thunderbolt Solar Farm - Subject to separate Approval Process
- Local Government Areas
- National Park
- P Existing 330kV Power Lines
- Watercourse
- Road
- Railway

Thunderbolt Energy Hub

Image Source: ESRI Basemap, Data source: DFSI (2020), Neoen (2020)



Legend

- Project Area
- Conceptual Turbine Layout
- Temporary Met Mast
- Proposed Access Point
- Conceptual Access Tracks
- Hardstand Area
- Batching Plants
- Laydown-Compounds
- Operation and Maintenance Compound
- Substation
- Switching Station
- Existing 330kV Power Lines
- Underground 33kv Cables
- Option 1 - MV Overhead Line Route
- Option 1 - Underground Trench to Overhead Line
- Option 2 - Full MV Underground Reticulation
- High Voltage TXL Route
- High Voltage Plants

Conceptual Project Layout

Image Source: ESRI Basemap Data source: NSW DFSI (2020), Neoen (2021)

Appendix D – Preliminary Site Access Intersection Layout

PRELIMINARY

FOR INFORMATION ONLY

SURVEYOR											
ADDRESS:											
CO-ORDINATE DATUM											
HEIGHT DATUM											
	DRAWING No.	REFERENCE DRAWING TITLE	A	19/11/2021	PRELIMINARY ONLY	AJB		AJB			
			REV	DATE	REVISION DESCRIPTION	DFT	DFT CHK	DES	DES CHK		

	BY	DATE
REVIEWED		
RPEQ ENG		

RPEQ No:

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SCALE: 1:1000 @ A3

PREPARED BY UMW0121-003

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CLIENT UMWELT AUSTRALIA
PROJECT THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
TITLE
THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
NEW ENGLAND HIGHWAY / SITE ACCESS INTERSECTION
OPTION 1 - INDICATIVE INTERSECTION CONFIGURATION (BAL / CHRs)

A1 | DRAWING NUMBER UMW0121-003_SK001 | REVISION A

DRAWING LOCATION: C:\ACCESS TRAFFIC\PROJECTS\2021\UMW0121-0034. TECHNICAL\2. LAYOUT\ATC ACCESS SKETCH TITLE.DWG

PLOT DATE:

PRELIMINARY

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ADDRESS:										RPEQ ENG	
CO-ORDINATE DATUM											
HEIGHT DATUM			A	19/11/2021	PRELIMINARY ONLY	AJB		AJB		RPEQ No:	
	DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DFT	DFT CHK	DES	DES CHK	SCALE: 1:500 @ A3	© Access Traffic Consulting Pty Ltd

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CLIENT UMWELT AUSTRALIA
PROJECT THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
TITLE
THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
NEW ENGLAND HIGHWAY / SITE ACCESS INTERSECTION
OPTION 1 - ACCESS INTERSECTION SWEPT PATHS (26m B DOUBLE) 1 OF 2

A1 | DRAWING NUMBER UMW0121-003_SK002 | REVISION A

DRAWING LOCATION: C:\ACCESS TRAFFIC\PROJECTS\2021\UMW0121-003\4. TECHNICAL\2. LAYOUT\ATC-ACCESS SWEPTECH TITLE.DWG

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PRELIMINARY

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ADDRESS:											
CO-ORDINATE DATUM											
HEIGHT DATUM											
	DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DFT	DFT CHK	DES	DES CHK		
			A	19/11/2021	PRELIMINARY ONLY	AJB		AJB			

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REVIEWED		
RPEQ ENG		

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CLIENT UMWELT AUSTRALIA

PROJECT THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)

TITLE
THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
NEW ENGLAND HIGHWAY / SITE ACCESS INTERSECTION
OPTION 1 - ACCESS INTERSECTION SWEPT PATHS (26m B DOUBLE) 2 OF 2

A1

DRAWING NUMBER UMW0121-003_SK003

REVISION A

DRAWING LOCATION: C:\ACCESS TRAFFIC\PROJECTS\2021\UMW0121-0034. TECHNICAL\2. LAYOUT\ATC-ACCESS SKETCH TITLE.DWG

PLOT DATE:

PRELIMINARY

ADDITIONAL HARDSTAND AREA

FOR INFORMATION ONLY

DRAWING LOCATION: C:\ACCESS TRAFFIC\PROJECTS\2021\UMW0121-003\4. TECHNICAL\2. LAYOUT\ATC ACCESS SKETCH TITLE.DWG

PLOT DATE:

SURVEYOR										
ADDRESS:										
CO-ORDINATE DATUM										
HEIGHT DATUM			A	29/11/2021	PRELIMINARY ONLY	AJB		AJB		
	DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	DFT	DFT CHK	DES	DES CHK	

	BY	DATE
REVIEWED		
RPEQ ENG		

RPEQ No:

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CLIENT UMWELT AUSTRALIA

PROJECT THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)

TITLE
THUNDERBOLT ENERGY HUB WIND FARM (STAGE 1)
NEW ENGLAND HIGHWAY / SITE ACCESS INTERSECTION
OPTION 1 - PROPOSED BLADE (65m PIECE) TRANSPORT VEHICLE SWEPT PATH

A1	DRAWING NUMBER	REVISION
	UMW0121-003_SK004	A

Appendix E – Project Traffic Impact Calculations

UMW0121-003 | Thunderbolt Wind Farm Project

Site Properties

Site Components

Element	Qty	Unit
Number of Turbines	32	ea
Number of Met Masts	6	ea
Length of Access Tracks	45,860	m
Number of Substations	1	ea
Number of Switching Stations	1	ea
Number of Turbine Construction Hardstand Areas	32	ea
Number of Batch Plant Areas	3	ea
Number of Main Construction Compound / Laydown Areas	1	ea
Number of Satelite Construction Compound / Laydown Areas	5	ea
Number of Operational and Maintenance Facility Areas	1	ea
Length of Underground Powerline Cable	34,800	m
Length of Overahead Powerline Cable	5,800	m
Water	100	ML

Site Areas (Each Area)

Element	Number	Hardstand Area	Unit	% Gravel	Gravel Area	% Concrete	Concrete Area	Unit
Substation	1	26,000	m2	90%	23,400	10%	2,600	m2
Switching Station	1	13,000	m2	90%	11,700	10%	1,300	m2
Turbine Construction Hardstands	32	9,300	m2	100%	297,600			
Batch Plants	3	15,000	m2	95%	42,750	5%	2,250	m2
Main Construction Compound / Laydown	1	24,000	m2	95%	22,800	5%	1,200	m2
Satelite Construction Compound / Laydown	5	3,000	m2	95%	14,250	5%	750	m2
Operational and Maintenance Facility	1	9,000	m2	95%	8,550	5%	450	m2

Concrete Composition

Element	Composition	Unit
Cement	15%	%
Sand/Aggregates	75%	%
Steel	5%	%
Water	5%	%
Total	100%	%

Material Assumptions

Element	Qty	Unit
Access Track Width	7.5	m AVG
Access Track Pavement Depth	0.3	m
Substation Area Concrete Depth	0.25	m
Switching Station Area Slab Concrete Depth	0.25	m
Batch Plant Area Slab Concrete Depth	0.2	m
Main Construction Compound / Laydown Area Slab Concrete Depth	0.2	m
Satelite Construction Compound / Laydown Area Slab Concrete Depth	0.2	m
Operational and Maintenance Facility Slab Concrete Depth	0.2	m
Substation Area Gravel Depth	0.3	m
Switching Station Area Gravel Depth	0.3	m
Turbine Hardstands Area Gravel Depth	0.3	m
Batch Plant Area Gravel Depth	0.3	m
Main Construction Compound / Laydown Area Gravel Depth	0.3	m
Satelite Construction Compound / Laydown Area Gravel Depth	0.3	m
Operational and Maintenance Facility Gravel Depth	0.3	m
Concrete Sand/Aggregates Mass	1.8	t/m3
Concrete Cement Mass	1.51	t/m3
Concrete Steel Mass	7.8	t/m3
Concrete Water Mass	1	t/m3
Wet Concrete Mass	2.5	t/m3
Power Line Length per Roll / Drum	250	m
Power Line Mass per Roll / Drum	2.925	tonnes
Overhead Powerline Poles	22.0	ea
Underground Powerline Trench Width	0.45	m
Underground Powerline Bedding Sand Depth	0.3	m

Movements

Turbine Components & Equipment

Element	Task	Qty per Turbine	Unit	Site Qty	Vehicle Type	Vehicle Capacity	Movements
Concrete volume in turbine footings	E	1000	m3				
Concrete sand/aggregates for turbine footings	E	750	m3	24,000	Truck & 4 Axle Dog	20	1,200
Reinforcing steel for turbine footings	E	50	m3	1,600	Semi	3.4	471
Other concrete supplies for turbine footings	E	150	m3	4,800	Semi	17.5	274
Wet concrete for turbine footings	E	2,400	tonnes	76,800	Concrete Truck	14.4	5,333
Turbine Blades	F	3	each	96	Special	1	96
Turbine Nacelles	F	1	each	32	Special	1	32
Turbine Drive Trains	F	1	each	32	Special	1	32
Turbine Hubs	F	1	each	32	Special	1	32
Tower Sections	F	7	each	224	Special	1	224
Escorting LV	F	26	each	832	LV	1	832
Cranes for turbine erection	G	10	each	320	Special	1	320
						Total	8,846

Mobilisation / Site Establishment

Element	Task	Qty per Area	Unit	Site Qty	Vehicle Type	Vehicle Capacity	Movements
Overall Construction Site Establishment	A	100	each	100	Semi	1	100
Substation Establishment	C	75	each	75	Semi	1	75
Switching Station Establishment	C	25	each	25	Semi	1	25
Batch Plant Establishment	A	25	each	75	Semi	1	75
Main Construction Compound / Laydown Establishment	A	100	each	100	Semi	1	100
Satelite Construction Compound / Laydown Establishment	C	25	each	125	Semi	1	125
Operational and Maintenance Facility Establishment	C	75	each	75	Semi	1	75
						Total	475

Demobilisation

Element	Task	Qty per Unit	Unit	Site Qty	Vehicle Type	Vehicle Capacity	Movements
Overall Construction Site Demobilisation	H	100	each	100	Semi	1	100
Substation Demobilisation	H	75	each	75	Semi	1	75
Collector Station Demobilisation	H	25	each	25	Semi	1	25
Batch Plant Demobilisation	H	25	each	75	Semi	1	75
Main Construction Compound / Laydown Demobilisation	H	100	each	100	Semi	1	100
Satelite Construction Compound / Laydown Demobilisation	H	25	each	125	Semi	1	125
Operational and Maintenance Facility Demobilisation	H	75	each	75	Semi	1	75
						Total	475

Construction Materials

Element	Task	Qty per Unit	Unit	Volume (m3)	Site Qty (tonnes)	Vehicle Type	Vehicle Capacity (tonnes)	Movements
Substation Slab Wet Concrete	C	2.5	t/m3	650	1,625	Concrete Truck	14.4	113
Substation Slab Concrete Sand/Aggregates	C	1.8	t/m3	488	878	Truck & 4 Axle Dog	36	25
Substation Slab Cement	C	1.51	t/m3	98	147	Semi	26.5	6
Substation Slab Reinforcing Steel	C	7.8	t/m3	33	254	Semi	26.5	10
Switching Station Slab Wet Concrete	C	2.5	t/m3	325	813	Concrete Truck	14.4	57
Switching Station Slab Concrete Sand/Aggregates	C	1.8	t/m3	244	439	Truck & 4 Axle Dog	36	13
Switching Station Slab Cement	C	1.51	t/m3	49	74	Semi	26.5	3
Switching Station Slab Reinforcing Steel	C	7.8	t/m3	16	127	Semi	26.5	5
Batch Plant Area Slab Wet Concrete	A	2.5	t/m3	1,350	3,375	Concrete Truck	14.4	235
Batch Plant Area Slab Reinforcing Steel	A	7.8	t/m3	68	527	Semi	26.5	20
Main Construction Compound / Laydown Slab Wet Concrete	A	2.5	t/m3	240	600	Concrete Truck	14.4	42
Main Construction Compound / Laydown Slab Concrete Sand/Aggregates	A	1.8	t/m3	180	324	Truck & 4 Axle Dog	36	10
Main Construction Compound / Laydown Slab Cement	A	1.51	t/m3	36	54	Semi	26.5	3
Main Construction Compound / Laydown Slab Reinforcing Steel	A	7.8	t/m3	12	94	Semi	26.5	4
Satelite Construction Compound / Laydown Slab Wet Concrete	C	2.5	t/m3	750	1,875	Concrete Truck	14.4	131
Satelite Construction Compound / Laydown Slab Concrete Sand/Aggregates	C	1.8	t/m3	563	1,013	Truck & 4 Axle Dog	36	29
Satelite Construction Compound / Laydown Slab Cement	C	1.51	t/m3	113	170	Semi	26.5	7
Satelite Construction Compound / Laydown Slab Reinforcing Steel	C	7.8	t/m3	38	293	Semi	26.5	12
Operational and Maintenance Facility Slab Wet Concrete	C	2.5	t/m3	90	225	Concrete Truck	14.4	16
Operational and Maintenance Facility Slab Concrete Sand/Aggregates	C	1.8	t/m3	68	122	Truck & 4 Axle Dog	36	4
Operational and Maintenance Facility Slab Cement	C	1.51	t/m3	14	20	Semi	26.5	1
Operational and Maintenance Facility Slab Reinforcing Steel	C	7.8	t/m3	5	35	Semi	26.5	2
Internal Access Road Gravel Pavement Materials	B	1.8	t/m3	103,185	185,733	Truck & 4 Axle Dog	36	5,160
Road Intersection Pavement Materials	B	1.8	t/m3	1,000	1,800	Truck & 4 Axle Dog	36	50
Turbine Hardstand Area Gravel	B	1.8	t/m3	89,280	160,704	Truck & 4 Axle Dog	36	4,464
Substation Area Gravel	C	1.8	t/m3	7,020	12,636	Truck & 4 Axle Dog	36	351
Switching Station Area Gravel	C	1.8	t/m3	3,510	6,318	Truck & 4 Axle Dog	36	176
Batch Plant Area Gravel	A	1.8	t/m3	12,825	23,085	Truck & 4 Axle Dog	36	642
Main Construction Compound / Laydown Area Gravel	A	1.8	t/m3	6,840	12,312	Truck & 4 Axle Dog	36	342
Satelite Construction Compound / Laydown Area Gravel	C	1.8	t/m3	4,275	7,695	Truck & 4 Axle Dog	36	214
Operational and Maintenance Facility Area Gravel	C	1.8	t/m3	2,565	4,617	Truck & 4 Axle Dog	36	129
Underground Powerline Cable	D				1,221	Semi	26.5	47
Underground Powerline Bedding Sand	D	1.8	t/m3	4,698	8,456	Truck & 4 Axle Dog	36	235
Overhead Powerline Cable	D				204	Semi	26.5	8
Overhead Powerline Poles	D				22	Semi	1	22
Water - Overall	W	1	t/m3	100,000	100,000	Semi Water Truck	26.5	3,774
							Total	16,362

ACCESS TRAFFIC CONSULTING

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Site Vehicle Movement Summary

Assumed Work Days per Month 24 days

TASK A - MOBILISTATION & SITE ESTABLISHMENT

Task Transport Duration 1 months A

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Overall Construction Site Establishment	100	Semi	50	Tamworth	Tamworth - New England Highway - Site Access	A
			50	Armidale	Armidale - New England Highway - Site Access	A
Batch Plant Area Establishment	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	A
Construction Compound Establishment	100	Semi	50	Tamworth	Tamworth - New England Highway - Site Access	A
			50	Armidale	Armidale - New England Highway - Site Access	A
Batch Plant Area Slab Wet Concrete	235	Concrete Truck	118	Tamworth	Tamworth - New England Highway - Site Access	A
			118	Armidale	Armidale - New England Highway - Site Access	A
Batch Plant Area Slab Reinforcing Steel	20	Semi	10	Tamworth	Tamworth - New England Highway - Site Access	A
			10	Armidale	Armidale - New England Highway - Site Access	A
Construction Compound Area Slab Wet Concrete	42	Concrete Truck	42	Internal Batch Plant	Internal	A
Construction Compound Area Slab Concrete Sand/Aggregates (to Batch Plant)	10	Truck & 4 Axle Dog	5	Tamworth	Tamworth - New England Highway - Site Access	A
			5	Armidale	Armidale - New England Highway - Site Access	A
Construction Compound Area Slab Cement (to Batch Plant)	3	Semi	2	Tamworth	Tamworth - New England Highway - Site Access	A
			2	Armidale	Armidale - New England Highway - Site Access	A
Construction Compound Area Slab Reinforcing Steel	4	Semi	2	Tamworth	Tamworth - New England Highway - Site Access	A
			2	Armidale	Armidale - New England Highway - Site Access	A
Batch Plant Area Gravel	642	Truck & 4 Axle Dog	321	Tamworth	Tamworth - New England Highway - Site Access	A
			321	Armidale	Armidale - New England Highway - Site Access	A
Construction Compound Area Gravel	342	Truck & 4 Axle Dog	171	Tamworth	Tamworth - New England Highway - Site Access	A
			171	Armidale	Armidale - New England Highway - Site Access	A

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	767	767	32
Tamworth - New England Highway - Site Access	767	767	32

TASK B - INTERNAL ACCESS AND ROAD UPGRADES

Task Transport Duration (Internal Access Tracks & Turbine Hardstands) 8 months A

Task Transport Duration (Intersection Upgrades) 1 months B

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Internal Access Track & Turbine Hardsand Gravel Pavement Materials	9,624	Truck & 4 Axle Dog	4,812	Tamworth	Tamworth - New England Highway - Site Access	A
			4,812	Armidale	Armidale - New England Highway - Site Access	A
Access Intersetion Gravel Pavement Materials	50	Truck & 4 Axle Dog	25	Tamworth	Tamworth - New England Highway - Site Access	B
			25	Armidale	Armidale - New England Highway - Site Access	

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	4,837	627	27
Tamworth - New England Highway - Site Access	4,837	627	27

TASK C - SITE INFRASTRUCTURE AREAS

Task Transport Duration (Site Area Establishment) 1 months A

Task Transport Duration (Site Area Construction) 8 months B

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Substation Establishment	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	A
Switching Station Area Establishment	25	Semi	13	Tamworth	Tamworth - New England Highway - Site Access	A
			13	Armidale	Armidale - New England Highway - Site Access	A
Satelite Construction Compound / Laydown Establishment	125	Semi	63	Tamworth	Tamworth - New England Highway - Site Access	A
			63	Armidale	Armidale - New England Highway - Site Access	A
Operational and Maintenance Facility Establishment	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	A
Substation Slab Wet Concrete	113	Concrete Truck	113	Internal Batch Plant	Internal	B
Substation Slab Concrete Sand/Aggregates (to Batch Plant)	25	Truck & 4 Axle Dog	13	Tamworth	Tamworth - New England Highway - Site Access	B
			13	Armidale	Armidale - New England Highway - Site Access	B
Substation Slab Cement (to Batch Plant)	6	Semi	3	Tamworth	Tamworth - New England Highway - Site Access	B
			3	Armidale	Armidale - New England Highway - Site Access	B
Substation Slab Reinforcing Steel	10	Semi	5	Tamworth	Tamworth - New England Highway - Site Access	B
			5	Armidale	Armidale - New England Highway - Site Access	B
Switching Station Slab Wet Concrete	57	Concrete Truck	57	Internal Batch Plant	Internal	B
Switching Station Slab Concrete Sand/Aggregates (to Batch Plant)	13	Truck & 4 Axle Dog	7	Tamworth	Tamworth - New England Highway - Site Access	B
			7	Armidale	Armidale - New England Highway - Site Access	B
Switching Station Slab Cement (to Batch Plant)	3	Semi	2	Tamworth	Tamworth - New England Highway - Site Access	B
			2	Armidale	Armidale - New England Highway - Site Access	B
Switching Station Slab Reinforcing Steel	5	Semi	3	Tamworth	Tamworth - New England Highway - Site Access	B
			3	Armidale	Armidale - New England Highway - Site Access	B
Satelite Construction Compound Area Slab Wet Concrete	131	Concrete Truck	131	Internal Batch Plant	Internal	B
Satelite Construction Compound Area Slab Concrete Sand/Aggregates (to Batch Plant)	29	Truck & 4 Axle Dog	15	Tamworth	Tamworth - New England Highway - Site Access	B
			15	Armidale	Armidale - New England Highway - Site Access	B
Satelite Construction Compound Area Slab Cement (to Batch Plant)	7	Semi	4	Tamworth	Tamworth - New England Highway - Site Access	B
			4	Armidale	Armidale - New England Highway - Site Access	B
Satelite Construction Compound Area Slab Reinforcing Steel	12	Semi	6	Tamworth	Tamworth - New England Highway - Site Access	B
			6	Armidale	Armidale - New England Highway - Site Access	B
Operational and Maintenance Facility Slab Wet Concrete	16	Concrete Truck	16	Internal Batch Plant	Internal	B
Operational and Maintenance Facility Slab Concrete Sand/Aggregates (to Batch Plant)	4	Truck & 4 Axle Dog	2	Tamworth	Tamworth - New England Highway - Site Access	B
			2	Armidale	Armidale - New England Highway - Site Access	B
Operational and Maintenance Facility Slab Cement (to Batch Plant)	1	Semi	1	Tamworth	Tamworth - New England Highway - Site Access	B
			1	Armidale	Armidale - New England Highway - Site Access	B
Operational and Maintenance Facility Slab Reinforcing Steel	2	Semi	1	Tamworth	Tamworth - New England Highway - Site Access	B
			1	Armidale	Armidale - New England Highway - Site Access	B
Substation Area Gravel	351	Truck & 4 Axle Dog	176	Tamworth	Tamworth - New England Highway - Site Access	B
			176	Armidale	Armidale - New England Highway - Site Access	B
Switching Station Area Gravel	176	Truck & 4 Axle Dog	88	Tamworth	Tamworth - New England Highway - Site Access	B
			88	Armidale	Armidale - New England Highway - Site Access	B
Construction Compound Area Gravel	214	Truck & 4 Axle Dog	107	Tamworth	Tamworth - New England Highway - Site Access	B
			107	Armidale	Armidale - New England Highway - Site Access	B
Operational and Maintenance Facility Area Gravel	129	Truck & 4 Axle Dog	65	Tamworth	Tamworth - New England Highway - Site Access	B
			65	Armidale	Armidale - New England Highway - Site Access	B

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	650	214	9
Tamworth - New England Highway - Site Access	650	214	9

TASK D - CABLING (UNDERGROUND & OVERHEAD)

Task Transport Duration (UG Cabling)	7	months	A
Task Transport Duration (OH Cabling)	2	months	B

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Underground Powerline Cable	47	Semi	24	Tamworth	Tamworth - New England Highway - Site Access	A
			24	Armidale	Armidale - New England Highway - Site Access	A
Underground Powerline Bedding Sand	235	Truck & 4 Axle Dog	118	Tamworth	Tamworth - New England Highway - Site Access	A
			118	Armidale	Armidale - New England Highway - Site Access	A
Overhead Powerline Cable	8	Semi	4	Tamworth	Tamworth - New England Highway - Site Access	B
			4	Armidale	Armidale - New England Highway - Site Access	B
Overhead Powerline Poles	22	Semi	11	Tamworth	Tamworth - New England Highway - Site Access	B
			11	Armidale	Armidale - New England Highway - Site Access	B

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	157	28	2
Tamworth - New England Highway - Site Access	157	28	2

TASK E - TURBINE FOUNDATIONS

Task Transport Duration (Turbine Foundations)	5	months	A

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Turbine Foundations Concrete Sand/Aggregates (to Batch Plant)	1,200	Truck & 4 Axle Dog	600	Tamworth	Tamworth - New England Highway - Site Access	A
			600	Armidale	Armidale - New England Highway - Site Access	
Turbine Foundations Cement (to Batch Plant)	274	Semi	137	Tamworth	Tamworth - New England Highway - Site Access	A
			137	Armidale	Armidale - New England Highway - Site Access	
Turbine Foundations Reinforcing Steel	471	Semi	236	Tamworth	Tamworth - New England Highway - Site Access	A
			236	Armidale	Armidale - New England Highway - Site Access	
Turbine Foundations Wet Concrete	5,333	Concrete Truck	5,333	Internal Batch Plant	Internal	

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	973	195	9
Tamworth - New England Highway - Site Access	973	195	9

TASK F - TURBINE TRANSPORTATION

Proposed Haulage Rate of 2 Turbines per Week		32	OSOM turbine components per week
		6	days a week haulage operations
	max	6	OSOM turbine components per day
	assume	2	LV escort vehicle per OSOM turbine component
		18	combined LV (escort) & HV (OSOM transport) per day

TASK G - TURBINE ERECTION

Task Transport Duration (5x Crane Movements)	1	day	· to or from each site area assumed to completed in one day.

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route
Heavy Crane for Turbine Erection to Site (WF-1)	10	B-Double	5	Tamworth	Tamworth - New England Highway - Site Access
			5	Armidale	Armidale - New England Highway - Site Access

Road Section	Total Trips	Trips / Month	Max Trips / Day
Midland Highway (Doveton St) (Ballarat-Burrumbeet Rd - Eyre St)	5	-	5
Midland Highway (Creswick Rd) (Macarthur St - Doveton St)	5	-	5

TASK H - FINALISATION / COMMISSIONING / DEMOBILISATION

Task Transport Duration (Demobilisation) 2 months A

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Overall Construction Area Demobilisation	100	Semi	50	Tamworth	Tamworth - New England Highway - Site Access	A
			50	Armidale	Armidale - New England Highway - Site Access	
Substation Demobilisation	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	
Switching Station Area Demobilisation	25	Semi	13	Tamworth	Tamworth - New England Highway - Site Access	A
			13	Armidale	Armidale - New England Highway - Site Access	
Batch Plant Area Demobilisation	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	
Construction Compound Demobilisation	100	Semi	50	Tamworth	Tamworth - New England Highway - Site Access	A
			50	Armidale	Armidale - New England Highway - Site Access	
Satelite Construction Compound Demobilisation	125	Semi	63	Tamworth	Tamworth - New England Highway - Site Access	A
			63	Armidale	Armidale - New England Highway - Site Access	
Operational and Maintenance Facility Demobilisation	75	Semi	38	Tamworth	Tamworth - New England Highway - Site Access	A
			38	Armidale	Armidale - New England Highway - Site Access	

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	290	145	7
Tamworth - New England Highway - Site Access	290	145	7

SITE WATER

Task Transport Duration (Site Water) 18 months A

Description	Project Volume	Vehicle	Project Vol Distrib.	Origin	Route	
Site Water	3,774	Semi Water Truck	1,887	Tamworth	Tamworth - New England Highway - Site Access	A
			1,887	Armidale	Armidale - New England Highway - Site Access	A

Road Section	Total Trips	Trips / Month	Max Trips / Day
Armidale - New England Highway - Site Access	1,887	105	5
Tamworth - New England Highway - Site Access	1,887	105	5

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Indicative Project Peak Daily Heavy Vehicle Movement Schedule

ID	TASK	DURATION	MONTH																	
			Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
			Q1 2024			Q2 2024			Q3 2024			Q4 2024			Q1 2025			Q2 2025		
A	Mobilisation & Site Establishment	1 M	64																	
B	Internal Access & Road Upgrades	8 M		54	54	54	54	54	54	54	54									
C	Site Infrastructure Areas	8 M			18	18	18	18	18	18	18	18								
D	Cabling (Underground & Overhead)	7 M				4	4	4	4	4	4	4								
E	Turbine Foundations	5 M			18	18	18	18	18											
F	Turbine Transportation	6 M								6	6	6	6	6	6					
G	Turbine Erection	9 M									10	10	10	10	10	10	10	10	10	
H	Finalisation / Commissioning / Demobilisation	6 M													14	14	14	14	14	14
W	Site Water	18 M	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
			74	64	100	104	104	104	104	92	102	48	26	26	40	34	34	34	34	24

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Project Staff Movement Summary

Project Timeframe

Element	Qty	Unit
Hours per day	12	hrs
Working days per week	6	days
Working days per month	24	days
Expected project length	18	months
Totals days	432	days

Construction Workforce

Element	Max Staff	Unit
Peak Workforce - Wind Farm	190	staff

Construction Workforce Distribution - Main Site

Location	Distribution	Unit	Qty	Vehicle Type	% Vehicle	Staff No. per Vehicle Type	Average Vehicle Capacity	Movements Round Trip (per day)
Tamworth	50%	%	95	LV	50%	48	2	24
				Mini Bus	50%	48	15	4
Armidale	50%	%	95	LV	50%	48	2	24
				Mini Bus	50%	48	15	4
							Total	56

Operations

Element	Qty	Unit
Hours per day	12	hrs
Working days per week	6	days
Working days per month	24	days
Peak Workforce	10	each

Location	Distribution	Unit	Qty	Vehicle Type	Vehicle Capacity	Movements 2-way (per day)
Tamworth	50%	%	5	LV	1	5
Armidale	50%	%	5	LV	1	5
					Total	5

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Indicative Project Staffing Schedule

No. days per week 6

ID	Duration (Days)	Work Activity	Max Staff	MONTH																	
				Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Sep-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Q1 2024			Q2 2024			Q3 2024			Q42024			Q1 2025			Q2 2025		
A	24	Mobilisation & Site Establishment	25	25																	
B	192	Internal Access & Road Upgrades	50		25	50	50	50	50	50	50	25									
C	192	Site Infrastructure Areas	25			15	25	25	25	25	25	25	15								
D	168	Cabling (Underground & Overhead)	25				15	25	25	25	25	25	15								
E	120	Turbine Foundations	50			50	50	50	50	50											
F	144	Turbine Transportation	20								20	20	20	20	20	20					
G	216	Turbine Erection	75									75	75	75	75	75	75	75	75	75	
H	144	Finalisation / Commissioning / Demobilisation	20													20	20	20	20	20	20
M	432	Management	20	10	10	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	10

Total Staff Numbers				MONTH																	
				Jan-24	Feb-24	Mar-24	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Sep-25
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
				Q1 2024			Q2 2024			Q3 2024			Q42024			Q1 2025			Q2 2025		
				35	35	135	160	170	170	170	140	190	145	115	115	135	115	115	115	115	30
Staff	Vehicle	100% Capacity	100% Utilisation by Staff	35	35	135	160	170	170	170	140	190	145	115	115	135	115	115	115	115	30
Required Staff Vehicle Movements	LV	2	50%	9	9	34	40	43	43	43	35	48	37	29	29	34	29	29	29	29	8
	Mini Bus	15	50%	2	2	5	6	6	6	6	5	7	5	4	4	5	4	4	4	4	1
			Total	11	11	39	46	49	49	49	40	55	42	33	33	39	33	33	33	33	9

ACCESS TRAFFIC CONSULTING

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Project Traffic Impact % Calculations

Construciton Phase

Road ID	Road Description	AADT Segment	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2024 AADT			2024 HV	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz
A15	New England Highway (Tamworth to Armidale)	35801	0.000	63.700	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,259	2,290	4,549	528	540
			63.700	105.000	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,259	2,290	4,549	528	540

Project Traffic (Daily) - Construction																								
Gazettal												A-Gazettal											Bi-Dir	
A	B	C	D	E	F	G	H	Water	Staff	Max	A	B	C	D	E	F	G	H	Water	Staff	Max		
32	27	9	2	9	18	5	7	5	28	94	32	27	9	2	9	18	5	7	5	28	94	188
32	27	9	2	9	0	5	7	5	28	76	32	27	9	2	9	0	5	7	5	28	76	152

Project Traffic % Impact		
Gaz %	A-Gaz %	Bi-Dir %
4.16%	4.10%	4.13%
3.36%	3.32%	3.34%

Peak Construction	
Gaz	A-Gaz
2,353	2,384
2,335	2,366

Operations Phase

Road ID	Road Description	AADT Segment	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2025 AADT			2025 HV	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz
A15	New England Highway (Tamworth to Armidale)	35801	0.000	63.700	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,281	2,313	4,594	533	546
			63.700	105.000	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,281	2,313	4,594	533	546

Project Traffic (Daily) Operations		
Gaz	A-Gaz	Bi Dir
6	6	12
6	6	12

Project Traffic % Impact		
Gaz %	A-Gaz %	Bi-Dir %
0.26%	0.26%	0.26%
0.26%	0.26%	0.26%

Operations	
Gaz	A-Gaz
2,287	2,319
2,287	2,319

Decommissioning Phase

Road ID	Road Description	AADT Segment	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2056 AADT			2056 HV	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz
A15	New England Highway (Tamworth to Armidale)	35801	0.000	63.700	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	3,105	3,149	6,254	725	743
			63.700	105.000	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	3,105	3,149	6,254	725	743

Project Traffic (Daily) Operations		
Gaz	A-Gaz	Bi Dir
66	66	132
53	53	106

Project Traffic % Impact		
Gaz %	A-Gaz %	Bi-Dir %
2.12%	2.09%	2.10%
1.71%	1.69%	1.70%

Operations	
Gaz	A-Gaz
3,171	3,215
3,159	3,202

Appendix F – Turn Warrants Assessment

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New England Highway / Site Access Intersection

Construction Peak Hour Intersection Volume Forecasts

CONSTRUCTION AM PEAK (6AM - 7AM)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2019	1	1	45	27	1	1	1	1	37	12	1	1
2020	1	1	45	27	1	1	1	1	37	12	1	1
2021	1	1	46	28	1	1	1	1	38	12	1	1
2022	1	1	46	28	1	1	1	1	38	12	1	1
2023	1	1	47	28	1	1	1	1	39	12	1	1
2024	1	1	47	28	1	1	1	1	39	13	1	1
2025	1	1	48	29	1	1	1	1	39	13	1	1
2026	1	1	48	29	1	1	1	1	40	13	1	1
2027	1	1	49	29	1	1	1	1	40	13	1	1
2028	1	1	49	30	1	1	1	1	40	13	1	1
2029	1	1	50	30	1	1	1	1	41	13	1	1
2030	1	1	50	30	1	1	1	1	41	13	1	1
2031	1	1	51	30	1	1	1	1	42	14	1	1
2032	1	1	51	31	1	1	1	1	42	14	1	1
2033	1	1	52	31	1	1	1	1	43	14	1	1
2034	1	1	52	31	1	1	1	1	43	14	1	1
2035	1	1	53	32	1	1	1	1	43	14	1	1
2036	1	1	53	32	1	1	1	1	44	14	1	1
2037	1	1	54	32	1	1	1	1	44	14	1	1
2038	1	1	54	33	1	1	1	1	45	14	1	1
2039	1	1	55	33	1	1	1	1	45	15	1	1
2040	1	1	55	33	1	1	1	1	46	15	1	1
2041	1	1	56	34	1	1	1	1	46	15	1	1
2042	1	1	57	34	1	1	1	1	47	15	1	1
2043	1	1	57	34	1	1	1	1	47	15	1	1
2044	1	1	58	35	1	1	1	1	47	15	1	1
2045	1	1	58	35	1	1	1	1	48	16	1	1
2046	1	1	59	35	1	1	1	1	48	16	1	1
2047	1	1	59	36	1	1	1	1	49	16	1	1
2048	1	1	60	36	1	1	1	1	49	16	1	1
2049	1	1	61	36	1	1	1	1	50	16	1	1
2050	1	1	61	37	1	1	1	1	50	16	1	1
2051	1	1	62	37	1	1	1	1	51	16	1	1
2052	1	1	62	37	1	1	1	1	51	17	1	1
2053	1	1	63	38	1	1	1	1	52	17	1	1
2054	1	1	64	38	1	1	1	1	52	17	1	1
2055	1	1	64	39	1	1	1	1	53	17	1	1
2056	1	1	65	39	1	1	1	1	53	17	1	1
PEAK CONSTRUCTION	26	9	0	0	0	4	2	5	0	0	24	8
IN CONSTRUCTION (2024)	27	10	47	28	1	5	3	6	39	13	25	9
CUMM CONSTRUCTION (2024)	27	10	57	34	1	5	3	6	47	15	25	9
PEAK OPERATIONS	5	1	0	0	1	1	1	1	0	0	5	1
OPERATIONS (2055)	6	2	64	39	2	2	2	2	53	17	6	2
PEAK DECOMMISSIONING	18	6	0	0	0	3	1	4	0	0	17	6
DECOMMISSIONING (2056)	19	8	65	39	1	4	3	5	53	17	18	7

CONSTRUCTION PM PEAK (5PM - 6PM)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
2019	1	1	115	25	1	1	1	1	117	33	1	1
2020	1	1	116	25	1	1	1	1	118	33	1	1
2021	1	1	117	26	1	1	1	1	119	34	1	1
2022	1	1	118	26	1	1	1	1	121	34	1	1
2023	1	1	120	26	1	1	1	1	122	34	1	1
2024	1	1	121	26	1	1	1	1	123	35	1	1
2025	1	1	122	27	1	1	1	1	124	35	1	1
2026	1	1	123	27	1	1	1	1	125	35	1	1
2027	1	1	125	27	1	1	1	1	127	36	1	1
2028	1	1	126	27	1	1	1	1	128	36	1	1
2029	1	1	127	28	1	1	1	1	129	36	1	1
2030	1	1	128	28	1	1	1	1	131	37	1	1
2031	1	1	130	28	1	1	1	1	132	37	1	1
2032	1	1	131	28	1	1	1	1	133	38	1	1
2033	1	1	132	29	1	1	1	1	134	38	1	1
2034	1	1	134	29	1	1	1	1	136	38	1	1
2035	1	1	135	29	1	1	1	1	137	39	1	1
2036	1	1	136	30	1	1	1	1	139	39	1	1
2037	1	1	138	30	1	1	1	1	140	39	1	1
2038	1	1	139	30	1	1	1	1	141	40	1	1
2039	1	1	140	31	1	1	1	1	143	40	1	1
2040	1	1	142	31	1	1	1	1	144	41	1	1
2041	1	1	143	31	1	1	1	1	146	41	1	1
2042	1	1	145	31	1	1	1	1	147	41	1	1
2043	1	1	146	32	1	1	1	1	149	42	1	1
2044	1	1	147	32	1	1	1	1	150	42	1	1
2045	1	1	149	32	1	1	1	1	152	43	1	1
2046	1	1	150	33	1	1	1	1	153	43	1	1
2047	1	1	152	33	1	1	1	1	155	44	1	1
2048	1	1	153	33	1	1	1	1	156	44	1	1
2049	1	1	155	34	1	1	1	1	158	44	1	1
2050	1	1	157	34	1	1	1	1	159	45	1	1
2051	1	1	158	34	1	1	1	1	161	45	1	1
2052	1	1	160	35	1	1	1	1	162	46	1	1
2053	1	1	161	35	1	1	1	1	164	46	1	1
2054	1	1	163	35	1	1	1	1	166	47	1	1
2055	1	1	165	36	1	1	1	1	167	47	1	1
2056	1	1	166	36	1	1	1	1	169	48	1	1
PEAK CONSTRUCTION	2	5	0	0	24	8	26	9	0	0	0	4
IN CONSTRUCTION (2024)	3	6	121	26	25	9	27	10	123	35	1	5
CUMM CONSTRUCTION (2024)	3	6	145	32	25	9	27	10	148	42	1	5
PEAK OPERATIONS	1	1	0	0	5	1	5	1	0	0	1	1
OPERATIONS (2055)	2	2	165	36	6	2	6	2	167	47	2	2
PEAK DECOMMISSIONING	1	4	0	0	17	6	18	6	0	0	0	3
DECOMMISSIONING (2056)	3	5	166	36	18	7	19	8	169	48	1	4

Development Scenario - Schedule Tasks B,C,D,F,G + Site Water + Project Staff

Staff Movements to Ogdens Road

Maximum Staff Expected	=	190
Local WF from Tamworth	=	95
Local WF LV from Tamworth	=	24
Local WF Mini Bus from Tamworth	=	4
Local WF from Armidale	=	95
Local WF LV from Armidale	=	24
Local WF Mini Bus from Armidale	=	4

Task	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak Staff	24	4	0	0	0	0	0	0	0	0	24	4
PM Peak Staff	0	0	0	0	24	4	24	4	0	0	0	0

Heavy Vehicle Movements to Thunderbolt Energy Hub Wind Farm (Stage 1) Site Access

Task	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
B	0	27	0	0	0	27	0	27	0	0	0	27
C	0	9	0	0	0	9	0	9	0	0	0	9
D	0	2	0	0	0	2	0	2	0	0	0	2
F	12	6	0	0	0	0	12	6	0	0	0	0
G	0	5	0	0	0	5	0	5	0	0	0	5
Water	0	5	0	0	0	5	0	5	0	0	0	5
Total (12 hrs)	12	54	0	0	0	48	12	54	0	0	0	48
Peak Hour	2	5	0	0	0	4	2	5	0	0	0	4

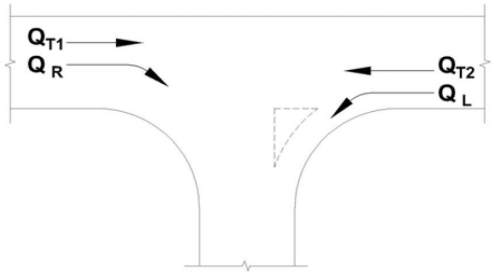
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**		
Year / Peak:	**2024 AM & PM**	Scenario:	**Construction (Project Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	51	158
Q_R =	34	6

Splitter Island? No

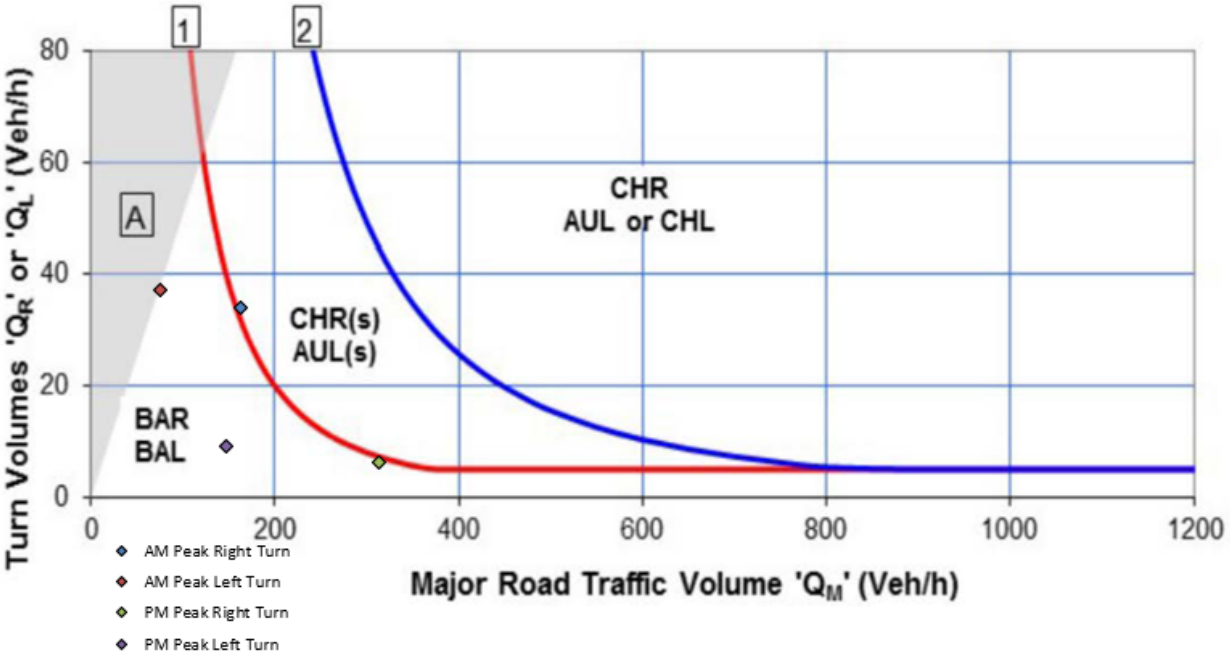
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	76	147
Q_L =	37	9

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	164	34
Left	76	37
PM Peak		
Right	314	6
Left	147	9



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

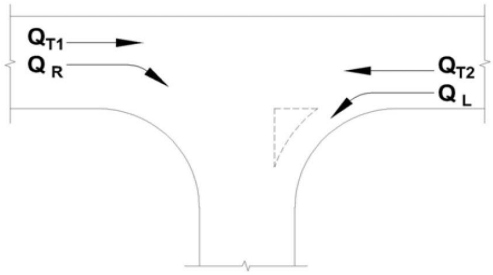
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**
Year / Peak:	**2024 AM & PM (Cummulative Construction)** Scenario: **Construction (Project Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	62	189
Q_R =	34	6

Splitter Island? No

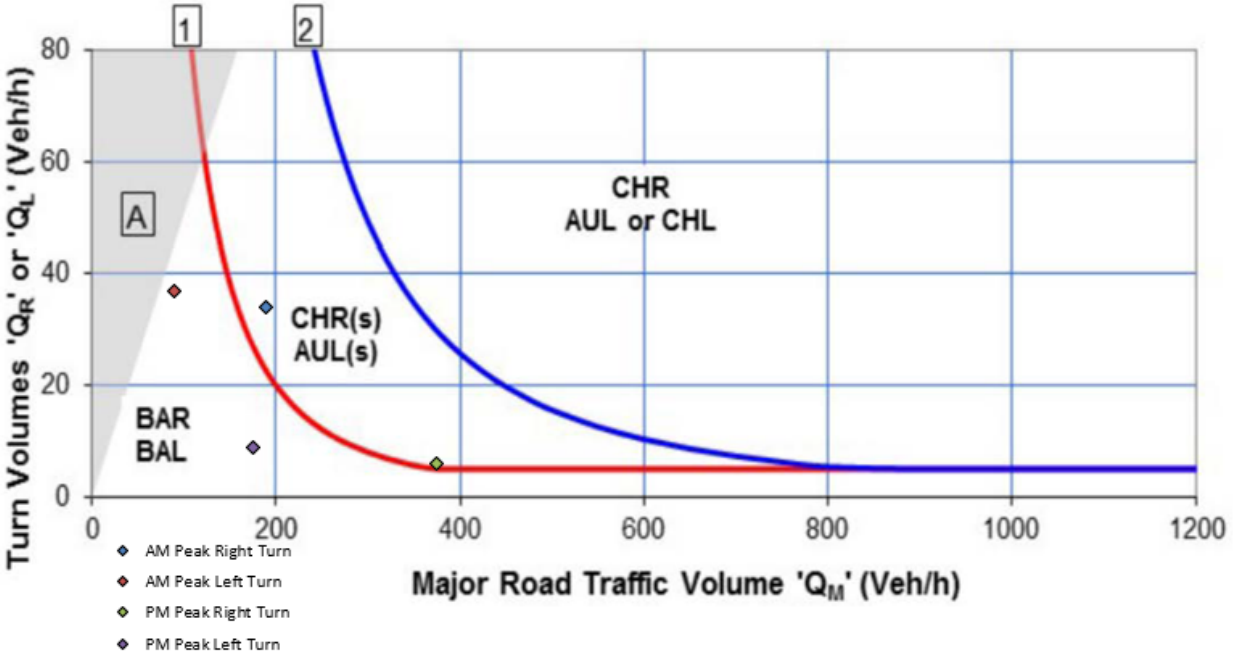
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	91	177
Q_L =	37	9

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	189	34
Left	91	37
PM Peak		
Right	375	6
Left	177	9



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

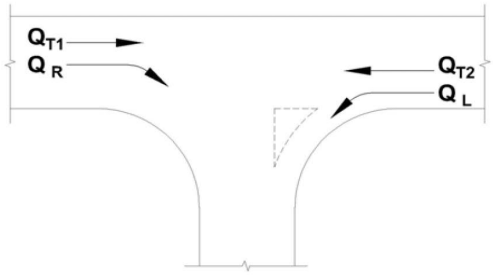
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**		
Year / Peak:	**2055 AM & PM**	Scenario:	**Operations (Project Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	70	215
Q_R =	9	5

Splitter Island? No

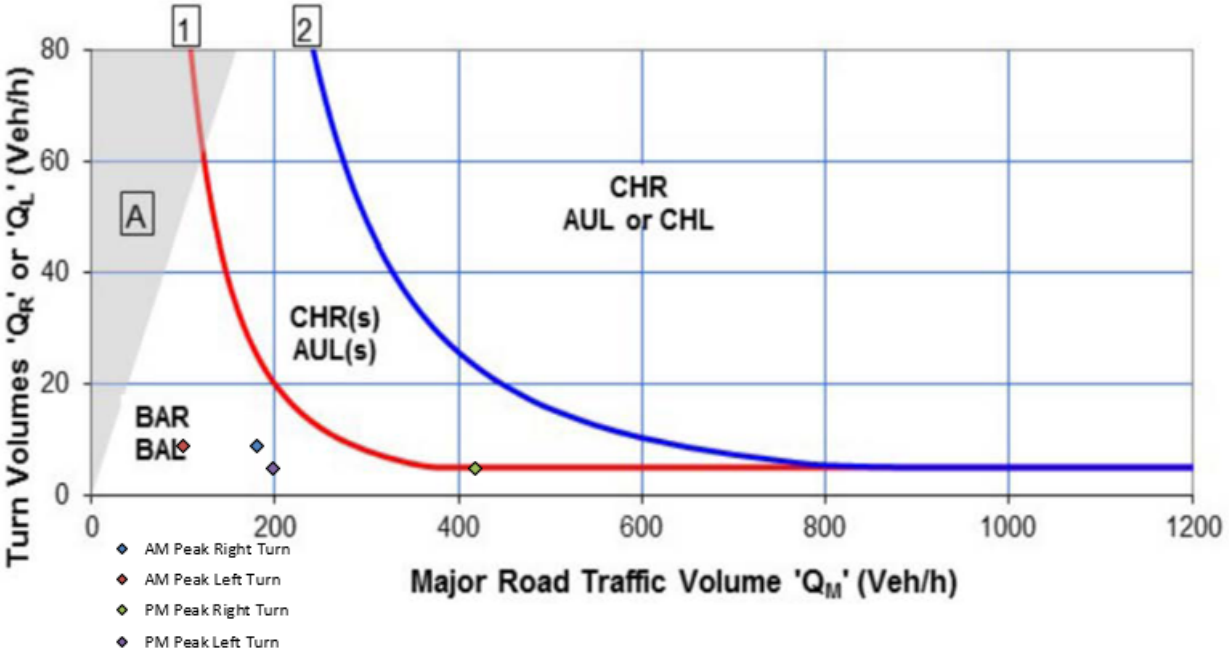
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	103	200
Q_L =	9	5

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	182	9
Left	103	9
PM Peak		
Right	420	5
Left	200	5



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

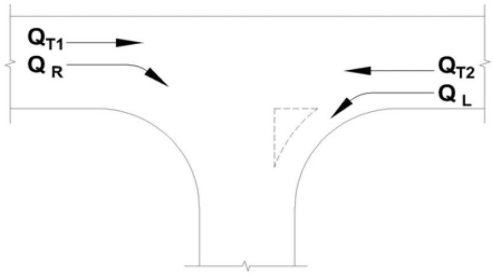
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**		
Year / Peak:	**2056 AM & PM**	Scenario:	**Decommissioning (Project Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	71	217
Q_R =	25	6

Splitter Island? No

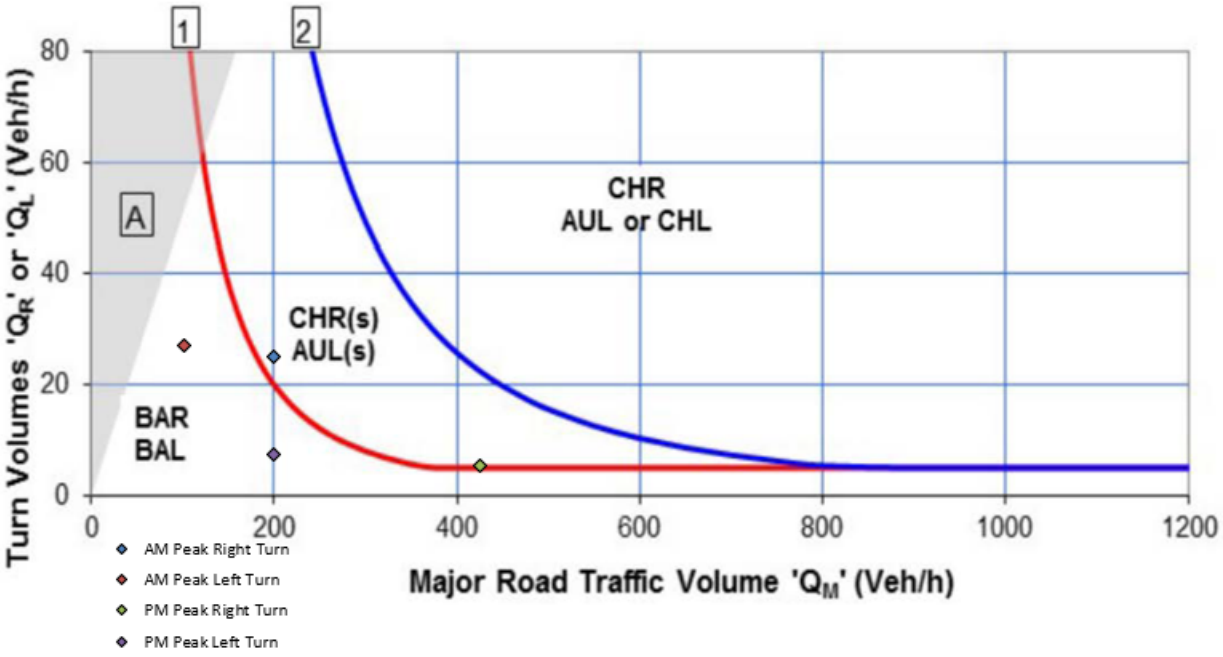
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	104	202
Q_L =	27	8

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	202	25
Left	104	27
PM Peak		
Right	427	6
Left	202	8



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

UMW0121-003 | Thunderbolt Wind Farm Project

New England Highway / Site Access Intersection

Construction Peak Hour Intersection Volume Forecasts

HIGHWAY AM PEAK (10AM - 11AM)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
YEAR	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2019	1	1	127	34	1	1	1	1	137	36	1	1
2020	1	1	128	34	1	1	1	1	138	36	1	1
2021	1	1	130	35	1	1	1	1	140	37	1	1
2022	1	1	131	35	1	1	1	1	141	37	1	1
2023	1	1	132	35	1	1	1	1	143	37	1	1
2024	1	1	133	36	1	1	1	1	144	38	1	1
2025	1	1	135	36	1	1	1	1	145	38	1	1
2026	1	1	136	36	1	1	1	1	147	39	1	1
2027	1	1	138	37	1	1	1	1	148	39	1	1
2028	1	1	139	37	1	1	1	1	150	39	1	1
2029	1	1	140	38	1	1	1	1	151	40	1	1
2030	1	1	142	38	1	1	1	1	153	40	1	1
2031	1	1	143	38	1	1	1	1	154	41	1	1
2032	1	1	145	39	1	1	1	1	156	41	1	1
2033	1	1	146	39	1	1	1	1	157	41	1	1
2034	1	1	147	39	1	1	1	1	159	42	1	1
2035	1	1	149	40	1	1	1	1	161	42	1	1
2036	1	1	150	40	1	1	1	1	162	43	1	1
2037	1	1	152	41	1	1	1	1	164	43	1	1
2038	1	1	153	41	1	1	1	1	166	43	1	1
2039	1	1	155	41	1	1	1	1	167	44	1	1
2040	1	1	157	42	1	1	1	1	169	44	1	1
2041	1	1	158	42	1	1	1	1	171	45	1	1
2042	1	1	160	43	1	1	1	1	172	45	1	1
2043	1	1	161	43	1	1	1	1	174	46	1	1
2044	1	1	163	44	1	1	1	1	176	46	1	1
2045	1	1	164	44	1	1	1	1	177	47	1	1
2046	1	1	166	44	1	1	1	1	179	47	1	1
2047	1	1	168	45	1	1	1	1	181	48	1	1
2048	1	1	169	45	1	1	1	1	183	48	1	1
2049	1	1	171	46	1	1	1	1	185	49	1	1
2050	1	1	173	46	1	1	1	1	187	49	1	1
2051	1	1	175	47	1	1	1	1	188	49	1	1
2052	1	1	176	47	1	1	1	1	190	50	1	1
2053	1	1	178	48	1	1	1	1	192	50	1	1
2054	1	1	180	48	1	1	1	1	194	51	1	1
2055	1	1	182	49	1	1	1	1	196	52	1	1
2056	1	1	184	49	1	1	1	1	198	52	1	1
PEAK CONSTRUCTION	7	5	0	0	5	4	7	5	0	0	5	4
IN CONSTRUCTION (2024)	8	6	133	36	6	5	8	6	144	38	6	5
CUMM CONSTRUCTION (2024)	8	6	160	43	6	5	8	6	173	45	6	5
PEAK OPERATIONS	1	1	0	0	1	1	1	1	0	0	1	1
OPERATIONS (2055)	2	2	182	49	2	2	2	2	196	52	2	2
PEAK DECOMMISSIONING	5	4	0	0	4	3	5	4	0	0	4	3
DECOMMISSIONING (2056)	6	5	184	49	5	4	6	5	198	52	5	4

HIGHWAY PM PEAK (3PM - 4PM)

GR %	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%	1.00%
	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
2019	1	1	146	30	1	1	1	1	145	40	1	1
2020	1	1	147	30	1	1	1	1	146	40	1	1
2021	1	1	149	31	1	1	1	1	148	41	1	1
2022	1	1	150	31	1	1	1	1	149	41	1	1
2023	1	1	152	31	1	1	1	1	151	42	1	1
2024	1	1	153	32	1	1	1	1	152	42	1	1
2025	1	1	155	32	1	1	1	1	154	42	1	1
2026	1	1	157	32	1	1	1	1	155	43	1	1
2027	1	1	158	32	1	1	1	1	157	43	1	1
2028	1	1	160	33	1	1	1	1	159	44	1	1
2029	1	1	161	33	1	1	1	1	160	44	1	1
2030	1	1	163	33	1	1	1	1	162	45	1	1
2031	1	1	165	34	1	1	1	1	163	45	1	1
2032	1	1	166	34	1	1	1	1	165	46	1	1
2033	1	1	168	34	1	1	1	1	167	46	1	1
2034	1	1	170	35	1	1	1	1	168	46	1	1
2035	1	1	171	35	1	1	1	1	170	47	1	1
2036	1	1	173	36	1	1	1	1	172	47	1	1
2037	1	1	175	36	1	1	1	1	173	48	1	1
2038	1	1	176	36	1	1	1	1	175	48	1	1
2039	1	1	178	37	1	1	1	1	177	49	1	1
2040	1	1	180	37	1	1	1	1	179	49	1	1
2041	1	1	182	37	1	1	1	1	180	50	1	1
2042	1	1	184	38	1	1	1	1	182	50	1	1
2043	1	1	185	38	1	1	1	1	184	51	1	1
2044	1	1	187	38	1	1	1	1	186	51	1	1
2045	1	1	189	39	1	1	1	1	188	52	1	1
2046	1	1	191	39	1	1	1	1	190	52	1	1
2047	1	1	193	40	1	1	1	1	192	53	1	1
2048	1	1	195	40	1	1	1	1	194	53	1	1
2049	1	1	197	40	1	1	1	1	195	54	1	1
2050	1	1	199	41	1	1	1	1	197	54	1	1
2051	1	1	201	41	1	1	1	1	199	55	1	1
2052	1	1	203	42	1	1	1	1	201	56	1	1
2053	1	1	205	42	1	1	1	1	203	56	1	1
2054	1	1	207	42	1	1	1	1	205	57	1	1
2055	1	1	209	43	1	1	1	1	207	57	1	1
2056	1	1	211	43	1	1	1	1	210	58	1	1
PEAK CONSTRUCTION	7	5	0	0	5	4	7	5	0	0	5	4
IN CONSTRUCTION (2024)	8	6	153	32	6	5	8	6	152	42	6	5
CUMM CONSTRUCTION (2024)	8	6	184	38	6	5	8	6	183	50	6	5
PEAK OPERATIONS	1	1	0	0	1	1	1	1	0	0	1	1
OPERATIONS (2055)	2	2	209	43	2	2	2	2	207	57	2	2
PEAK DECOMMISSIONING	5	4	0	0	4	3	5	4	0	0	4	3
DECOMMISSIONING (2056)	6	5	211	43	5	4	6	5	210	58	5	4

Development Scenario - Schedule Tasks B,C,D,F,G + Site Water + Project Staff

Task	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
AM Peak Staff	5	0	0	0	5	0	5	0	0	0	5	0
PM Peak Staff	5	0	0	0	5	0	5	0	0	0	5	0

Heavy Vehicle Movements to Thunderbolt Energy Hub Wind Farm (Stage 1) Site Access

Task	New England Highway SW				Site Access NW				New England Highway NE			
	L		T		L		R		T		R	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
B	0	27	0	0	0	27	0	27	0	0	0	27
C	0	9	0	0	0	9	0	9	0	0	0	9
D	0	2	0	0	0	2	0	2	0	0	0	2
F	12	6	0	0	0	0	12	6	0	0	0	0
G	0	5	0	0	0	5	0	5	0	0	0	5
Water	0	5	0	0	0	5	0	5	0	0	0	5
Total (12 hrs)	12	54	0	0	0	48	12	54	0	0	0	48
Peak Hour	2	5	0	0	0	4	2	5	0	0	0	4

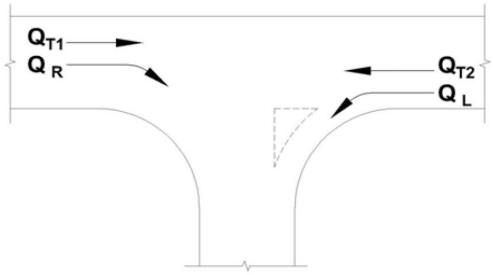
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**
Year / Peak:	**2024 AM & PM** Scenario: **Construction (NE Hwy Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	PM Peak
Q_{T1} =	182	194
Q_R =	11	11

Splitter Island? No

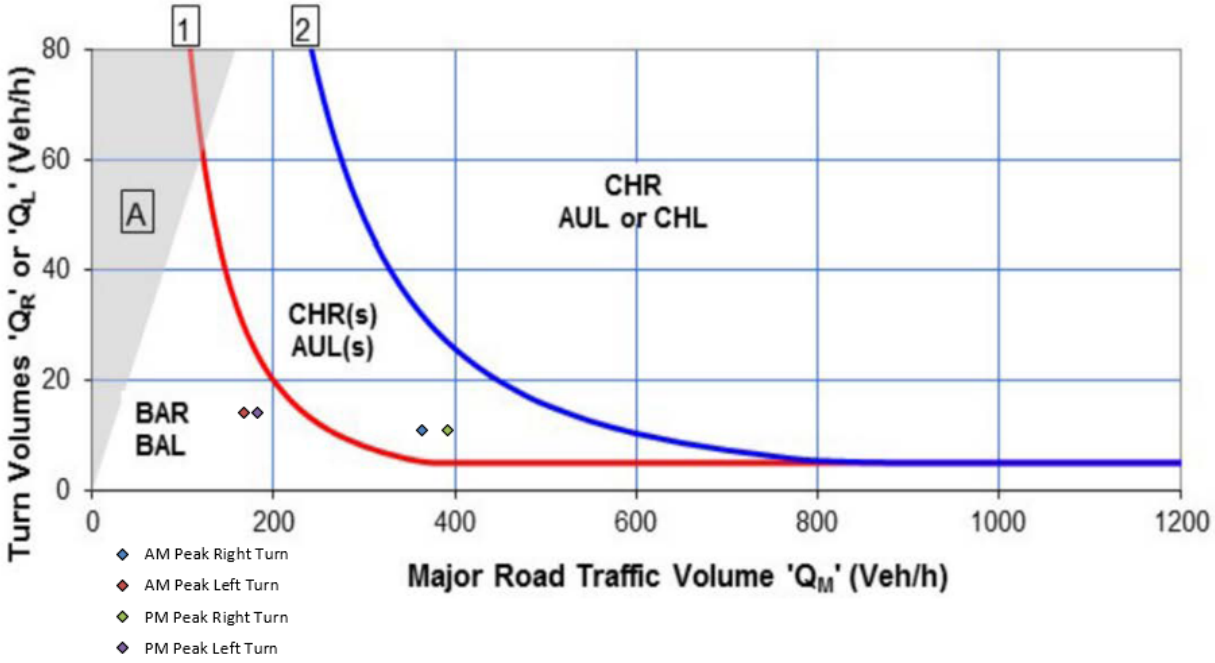
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	PM Peak
Q_{T2} =	169	185
Q_L =	14	14

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	365	11
Left	169	14
PM Peak		
Right	394	11
Left	185	14



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

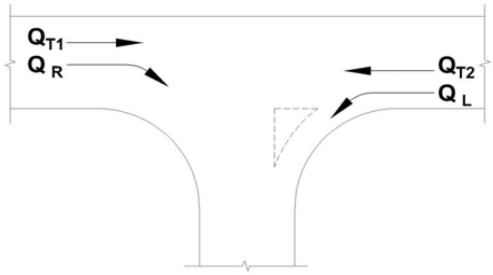
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**	
Year / Peak:	**2024 AM & PM (Cummulative Construction)**	Scenario: **Construction (NE Hwy Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	218	233
Q_R =	11	11

Splitter Island? No

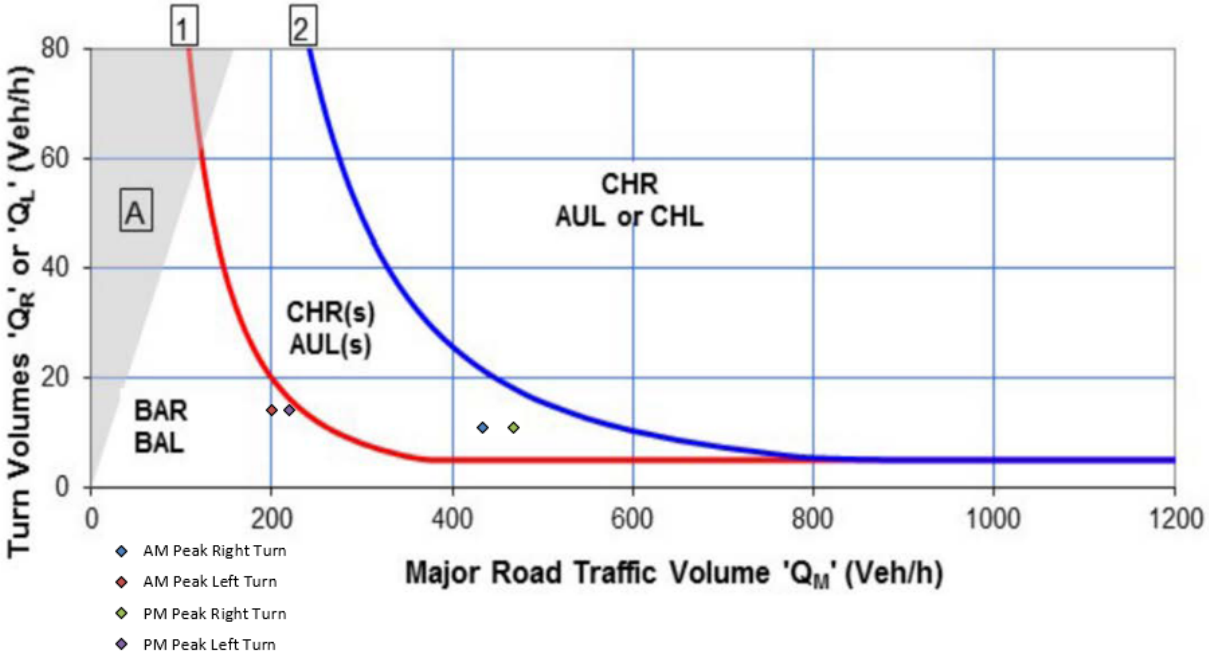
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	203	222
Q_L =	14	14

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	435	11
Left	203	14
PM Peak		
Right	469	11
Left	222	14



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

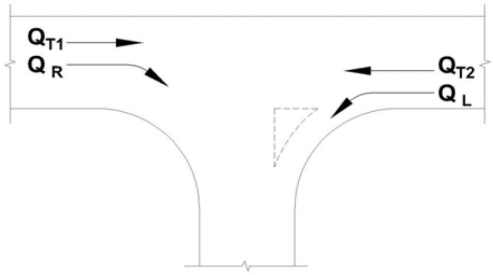
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**
Year / Peak:	**2055 AM & PM** Scenario: **Operations (NE Hwy Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	248	265
Q_R =	5	5

Splitter Island? No

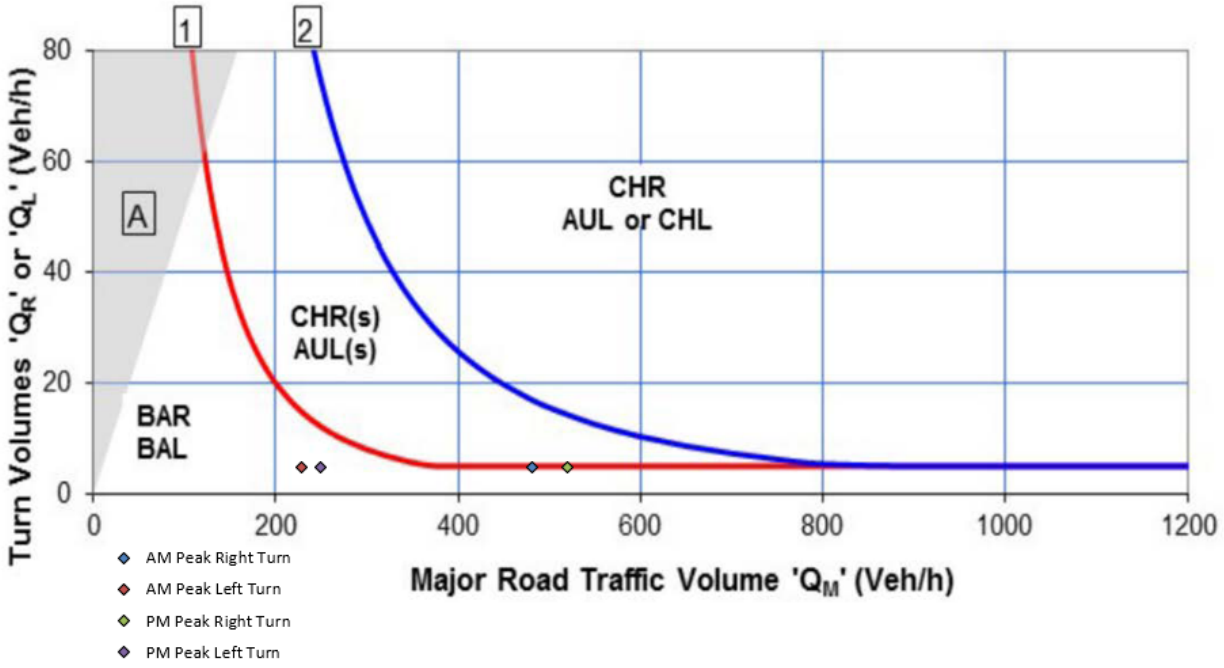
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	230	252
Q_L =	5	5

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	483	5
Left	230	5
PM Peak		
Right	521	5
Left	252	5



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

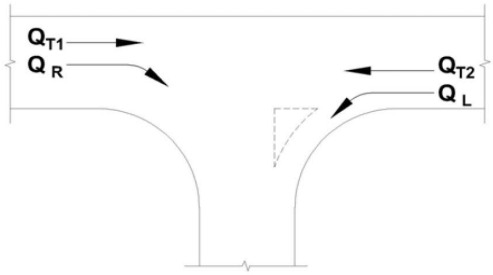
Intersection:	**New England Highway / Thunderbolt Energy Hub WF Site Access**	
Year / Peak:	**2056 AM & PM**	Scenario: **Decommissioning (NE Hwy Peak)**

Assessment based on Austroads Guide to Road Design, Part 4b. This warrant assessment applies only to turning movements from the major road only.

	AM Peak	*PM Peak*
Q_{T1} =	250	267
Q_R =	9	9

Splitter Island? No

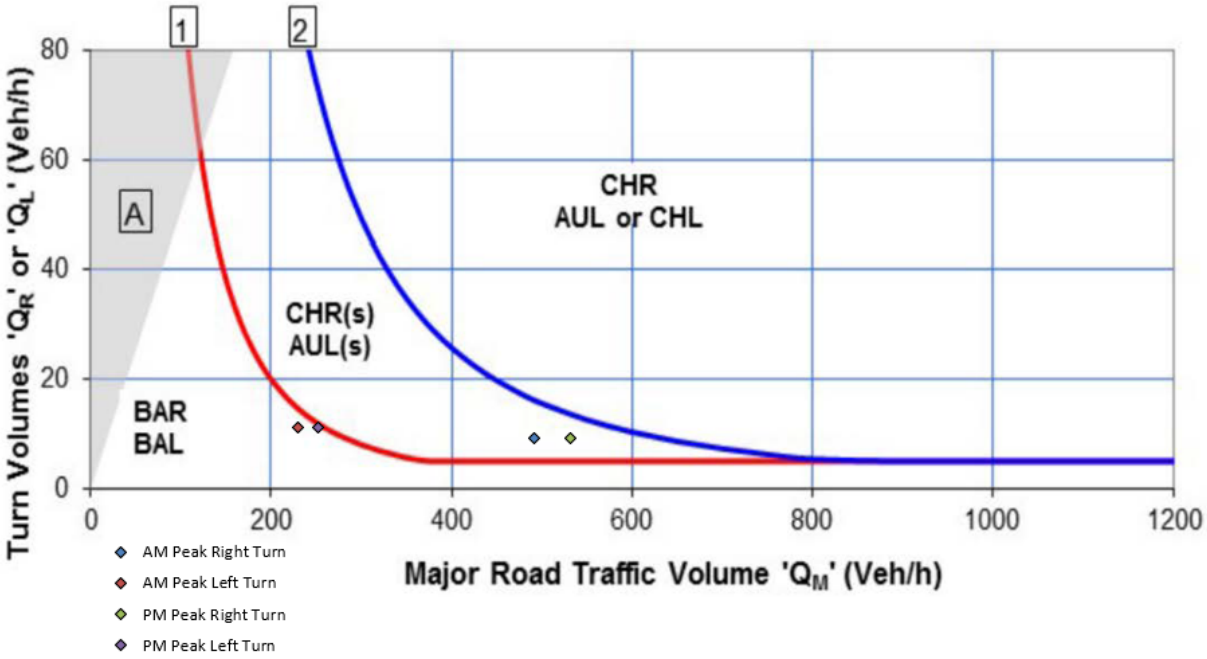
Design speed (km/h) 110



Thunderbolt WF Stg1 Access

	AM Peak	*PM Peak*
Q_{T2} =	233	254
Q_L =	11	11

Graph	Q_M	Q_R/Q_L
AM Peak		
Right	494	9
Left	233	11
PM Peak		
Right	533	9
Left	254	11



Recommended treatments:

Right Turn	CHRs
Left Turn	BAL

Legend

BAR	Basic Right Turn	BAL	Basic Left Turn
CHR(S)	Channelised Right Turn (short)	AUL(S)	Auxiliary Left Turn (short)
CHR	Channelised Right Turn	AUL	Auxiliary Left Turn
		CHL	Channelised Left Turn

Comments:

Prepared by:	A. Barrie
Reviewed by:	A. Barrie
Date:	6/02/2021

Appendix G – SIDRA Results (Project Scenarios)

MOVEMENT SUMMARY

Site: 1 [PEAK CONST 2024 AM Peak (Project Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (6-7am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	52	13	55	25.0	0.033	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
6	R2	34	9	36	26.5	0.026	8.6	LOS A	0.1	1.0	0.26	0.62	0.26	60.0
Approach		86	22	91	25.6	0.033	3.4	NA	0.1	1.0	0.10	0.24	0.10	79.1
NorthWest: TBWF Stg 1 Access														
7	L2	6	5	6	83.3	0.021	7.0	LOS A	0.1	0.9	0.29	0.58	0.29	44.9
9	R2	9	6	9	66.7	0.021	8.4	LOS A	0.1	0.9	0.29	0.58	0.29	46.5
Approach		15	11	16	73.3	0.021	7.8	LOS A	0.1	0.9	0.29	0.58	0.29	45.8
SouthWest: New England Highway														
10	L2	37	10	39	27.0	0.075	8.5	LOS A	0.0	0.0	0.00	0.22	0.00	71.8
11	T1	75	28	79	37.3	0.075	0.0	LOS A	0.0	0.0	0.00	0.22	0.00	92.7
Approach		112	38	118	33.9	0.075	2.8	NA	0.0	0.0	0.00	0.22	0.00	84.6
All Vehicles		213	71	224	33.3	0.075	3.4	NA	0.1	1.0	0.06	0.26	0.06	77.8

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [PEAK CONST 2024 PM Peak (Project Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (5-6pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	158	35	166	22.2	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
6	R2	6	5	6	83.3	0.006	10.7	LOS B	0.0	0.3	0.34	0.62	0.34	56.6
Approach		164	40	173	24.4	0.097	0.4	NA	0.0	0.3	0.01	0.02	0.01	97.2
NorthWest: TBWF Stg 1 Access														
7	L2	34	9	36	26.5	0.089	6.5	LOS A	0.4	3.0	0.37	0.62	0.37	54.0
9	R2	37	10	39	27.0	0.089	8.9	LOS A	0.4	3.0	0.37	0.62	0.37	53.4
Approach		71	19	75	26.8	0.089	7.7	LOS A	0.4	3.0	0.37	0.62	0.37	53.7
SouthWest: New England Highway														
10	L2	9	6	9	66.7	0.095	9.6	LOS A	0.0	0.0	0.00	0.04	0.00	62.7
11	T1	147	26	155	17.7	0.095	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	99.4
Approach		156	32	164	20.5	0.095	0.6	NA	0.0	0.0	0.00	0.04	0.00	96.2
All Vehicles		391	91	412	23.3	0.097	1.8	NA	0.4	3.0	0.07	0.14	0.07	84.4

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [PEAK CONST 2024 AM Peak (NE Highway Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (10-11am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	182	38	192	20.9	0.110	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	11	5	12	45.5	0.010	9.6	LOS A	0.0	0.4	0.34	0.62	0.34	58.6
Approach		193	43	203	22.3	0.110	0.6	NA	0.0	0.4	0.02	0.04	0.02	96.1
NorthWest: TBWF Stg 1 Access														
7	L2	11	5	12	45.5	0.038	7.0	LOS A	0.1	1.4	0.42	0.64	0.42	49.9
9	R2	14	6	15	42.9	0.038	10.2	LOS B	0.1	1.4	0.42	0.64	0.42	49.7
Approach		25	11	26	44.0	0.038	8.7	LOS A	0.1	1.4	0.42	0.64	0.42	49.8
SouthWest: New England Highway														
10	L2	14	6	15	42.9	0.113	9.0	LOS A	0.0	0.0	0.00	0.05	0.00	69.6
11	T1	169	36	178	21.3	0.113	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.7
Approach		183	42	193	23.0	0.113	0.7	NA	0.0	0.0	0.00	0.05	0.00	95.7
All Vehicles		401	96	422	23.9	0.113	1.1	NA	0.1	1.4	0.04	0.08	0.04	90.6

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [PEAK CONST 2024 PM Peak (NE Highway Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (3-4pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	194	42	204	21.6	0.118	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	11	5	12	45.5	0.010	9.7	LOS A	0.0	0.4	0.36	0.62	0.36	58.5
Approach		205	47	216	22.9	0.118	0.5	NA	0.0	0.4	0.02	0.03	0.02	96.3
NorthWest: TBWF Stg 1 Access														
7	L2	11	5	12	45.5	0.040	7.0	LOS A	0.1	1.4	0.43	0.65	0.43	49.7
9	R2	14	6	15	42.9	0.040	10.6	LOS B	0.1	1.4	0.43	0.65	0.43	49.5
Approach		25	11	26	44.0	0.040	9.0	LOS A	0.1	1.4	0.43	0.65	0.43	49.6
SouthWest: New England Highway														
10	L2	14	6	15	42.9	0.120	9.0	LOS A	0.0	0.0	0.00	0.05	0.00	69.7
11	T1	185	32	195	17.3	0.120	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.9
Approach		199	38	209	19.1	0.120	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.1
All Vehicles		429	96	452	22.4	0.120	1.1	NA	0.1	1.4	0.03	0.08	0.03	91.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [CUMULATIVE CONST 2024 AM Peak (Project Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (6-7am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	62	15	65	24.2	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
6	R2	34	9	36	26.5	0.026	8.7	LOS A	0.1	1.0	0.28	0.62	0.28	59.9
Approach		96	24	101	25.0	0.039	3.1	NA	0.1	1.0	0.10	0.22	0.10	80.8
NorthWest: TBWF Stg 1 Access														
7	L2	6	5	6	83.3	0.022	7.1	LOS A	0.1	0.9	0.32	0.59	0.32	44.7
9	R2	9	6	9	66.7	0.022	8.7	LOS A	0.1	0.9	0.32	0.59	0.32	46.3
Approach		15	11	16	73.3	0.022	8.1	LOS A	0.1	0.9	0.32	0.59	0.32	45.7
SouthWest: New England Highway														
10	L2	37	10	39	27.0	0.085	8.5	LOS A	0.0	0.0	0.00	0.20	0.00	72.3
11	T1	91	34	96	37.4	0.085	0.0	LOS A	0.0	0.0	0.00	0.20	0.00	93.5
Approach		128	44	135	34.4	0.085	2.5	NA	0.0	0.0	0.00	0.20	0.00	86.2
All Vehicles		239	79	252	33.1	0.085	3.1	NA	0.1	1.0	0.06	0.23	0.06	79.6

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [CUMULATIVE CONST 2024 PM Peak (Project Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (5-6pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	190	42	200	22.1	0.116	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	6	5	6	83.3	0.007	11.0	LOS B	0.0	0.3	0.37	0.62	0.37	56.5
Approach		196	47	206	24.0	0.116	0.3	NA	0.0	0.3	0.01	0.02	0.01	97.6
NorthWest: TBWF Stg 1 Access														
7	L2	34	9	36	26.5	0.097	6.7	LOS A	0.4	3.2	0.41	0.65	0.41	53.6
9	R2	37	10	39	27.0	0.097	9.7	LOS A	0.4	3.2	0.41	0.65	0.41	53.0
Approach		71	19	75	26.8	0.097	8.3	LOS A	0.4	3.2	0.41	0.65	0.41	53.3
SouthWest: New England Highway														
10	L2	9	6	9	66.7	0.113	9.6	LOS A	0.0	0.0	0.00	0.03	0.00	62.8
11	T1	177	32	186	18.1	0.113	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.5
Approach		186	38	196	20.4	0.113	0.5	NA	0.0	0.0	0.00	0.03	0.00	96.8
All Vehicles		453	104	477	23.0	0.116	1.6	NA	0.4	3.2	0.07	0.12	0.07	86.1

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [CUMULATIVE CONST 2024 AM Peak (NE Highway Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (10-11am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	218	45	229	20.6	0.132	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	11	5	12	45.5	0.011	9.8	LOS A	0.0	0.4	0.38	0.63	0.38	58.5
Approach		229	50	241	21.8	0.132	0.5	NA	0.0	0.4	0.02	0.03	0.02	96.6
NorthWest: TBWF Stg 1 Access														
7	L2	11	5	12	45.5	0.043	7.2	LOS A	0.2	1.5	0.46	0.67	0.46	49.4
9	R2	14	6	15	42.9	0.043	11.4	LOS B	0.2	1.5	0.46	0.67	0.46	49.2
Approach		25	11	26	44.0	0.043	9.5	LOS A	0.2	1.5	0.46	0.67	0.46	49.3
SouthWest: New England Highway														
10	L2	14	6	15	42.9	0.134	9.0	LOS A	0.0	0.0	0.00	0.04	0.00	69.7
11	T1	203	43	214	21.2	0.134	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.9
Approach		217	49	228	22.6	0.134	0.6	NA	0.0	0.0	0.00	0.04	0.00	96.3
All Vehicles		471	110	496	23.4	0.134	1.0	NA	0.2	1.5	0.03	0.07	0.03	91.8

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [CUMULATIVE CONST 2024 PM Peak (NE Highway Peak) (Site Folder: Construction)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (3-4pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	233	50	245	21.5	0.142	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	11	5	12	45.5	0.011	9.9	LOS A	0.0	0.4	0.39	0.63	0.39	58.4
Approach		244	55	257	22.5	0.142	0.5	NA	0.0	0.4	0.02	0.03	0.02	96.8
NorthWest: TBWF Stg 1 Access														
7	L2	11	5	12	45.5	0.045	7.3	LOS A	0.2	1.6	0.48	0.68	0.48	49.1
9	R2	14	6	15	42.9	0.045	11.9	LOS B	0.2	1.6	0.48	0.68	0.48	48.9
Approach		25	11	26	44.0	0.045	9.9	LOS A	0.2	1.6	0.48	0.68	0.48	49.0
SouthWest: New England Highway														
10	L2	14	6	15	42.9	0.142	9.0	LOS A	0.0	0.0	0.00	0.04	0.00	69.8
11	T1	222	38	234	17.1	0.142	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	99.0
Approach		236	44	248	18.6	0.142	0.5	NA	0.0	0.0	0.00	0.04	0.00	96.6
All Vehicles		505	110	532	21.8	0.142	1.0	NA	0.2	1.6	0.03	0.07	0.03	92.3

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [OPERATIONS 2055 AM Peak (Project Peak) (Site Folder: Operations)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (6-7am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	70	17	74	24.3	0.043	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
6	R2	8	2	8	25.0	0.006	8.6	LOS A	0.0	0.2	0.26	0.60	0.26	60.1
Approach		78	19	82	24.4	0.043	0.9	NA	0.0	0.2	0.03	0.06	0.03	93.6
NorthWest: TBWF Stg 1 Access														
7	L2	4	2	4	50.0	0.010	6.7	LOS A	0.0	0.4	0.30	0.56	0.30	50.2
9	R2	4	2	4	50.0	0.010	7.9	LOS A	0.0	0.4	0.30	0.56	0.30	49.4
Approach		8	4	8	50.0	0.010	7.3	LOS A	0.0	0.4	0.30	0.56	0.30	49.8
SouthWest: New England Highway														
10	L2	8	2	8	25.0	0.074	8.5	LOS A	0.0	0.0	0.00	0.05	0.00	75.8
11	T1	103	39	108	37.9	0.074	0.0	LOS A	0.0	0.0	0.00	0.05	0.00	98.2
Approach		111	41	117	36.9	0.074	0.6	NA	0.0	0.0	0.00	0.05	0.00	96.1
All Vehicles		197	64	207	32.5	0.074	1.0	NA	0.0	0.4	0.02	0.07	0.02	91.7

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [OPERATIONS 2055 PM Peak (Project Peak) (Site Folder: Operations)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (5-6pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	214	47	225	22.0	0.131	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	4	2	4	50.0	0.004	9.9	LOS A	0.0	0.2	0.37	0.61	0.37	58.3
Approach		218	49	229	22.5	0.131	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.6
NorthWest: TBWF Stg 1 Access														
7	L2	8	2	8	25.0	0.023	6.7	LOS A	0.1	0.7	0.42	0.62	0.42	53.9
9	R2	8	2	8	25.0	0.023	9.9	LOS A	0.1	0.7	0.42	0.62	0.42	53.4
Approach		16	4	17	25.0	0.023	8.3	LOS A	0.1	0.7	0.42	0.62	0.42	53.6
SouthWest: New England Highway														
10	L2	4	2	4	50.0	0.123	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.7
11	T1	201	36	212	17.9	0.123	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		205	38	216	18.5	0.123	0.2	NA	0.0	0.0	0.00	0.01	0.00	98.8
All Vehicles		439	91	462	20.7	0.131	0.5	NA	0.1	0.7	0.02	0.03	0.02	95.8

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [OPERATIONS 2055 AM Peak (NE Highway Peak) (Site Folder: Operations)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (10-11am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	248	52	261	21.0	0.151	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	4	2	4	50.0	0.004	10.1	LOS B	0.0	0.2	0.40	0.61	0.40	58.2
Approach		252	54	265	21.4	0.151	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.8
NorthWest: TBWF Stg 1 Access														
7	L2	4	2	4	50.0	0.015	7.4	LOS A	0.1	0.5	0.48	0.64	0.48	48.4
9	R2	4	2	4	50.0	0.015	12.5	LOS B	0.1	0.5	0.48	0.64	0.48	47.7
Approach		8	4	8	50.0	0.015	10.0	LOS A	0.1	0.5	0.48	0.64	0.48	48.0
SouthWest: New England Highway														
10	L2	4	2	4	50.0	0.143	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.7
11	T1	231	49	243	21.2	0.143	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		235	51	247	21.7	0.143	0.2	NA	0.0	0.0	0.00	0.01	0.00	98.9
All Vehicles		495	109	521	22.0	0.151	0.3	NA	0.1	0.5	0.01	0.02	0.01	97.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [OPERATIONS 2055 PM Peak (NE Highway Peak) (Site Folder: Operations)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (3-4pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	264	57	278	21.6	0.161	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	4	2	4	50.0	0.004	10.2	LOS B	0.0	0.2	0.41	0.62	0.41	58.1
Approach		268	59	282	22.0	0.161	0.2	NA	0.0	0.2	0.01	0.01	0.01	98.9
NorthWest: TBWF Stg 1 Access														
7	L2	4	2	4	50.0	0.016	7.5	LOS A	0.1	0.6	0.50	0.65	0.50	48.1
9	R2	4	2	4	50.0	0.016	13.3	LOS B	0.1	0.6	0.50	0.65	0.50	47.4
Approach		8	4	8	50.0	0.016	10.4	LOS B	0.1	0.6	0.50	0.65	0.50	47.8
SouthWest: New England Highway														
10	L2	4	2	4	50.0	0.153	9.1	LOS A	0.0	0.0	0.00	0.01	0.00	67.7
11	T1	252	43	265	17.1	0.153	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		256	45	269	17.6	0.153	0.2	NA	0.0	0.0	0.00	0.01	0.00	99.0
All Vehicles		532	108	560	20.3	0.161	0.3	NA	0.1	0.6	0.01	0.02	0.01	97.3

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [DECOMMISSIONING 2056 AM Peak (Project Peak) (Site Folder: Decommissioning)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (6-7am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	70	17	74	24.3	0.044	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
6	R2	25	7	26	28.0	0.020	8.8	LOS A	0.1	0.8	0.28	0.62	0.28	59.8
Approach		95	24	100	25.3	0.044	2.3	NA	0.1	0.8	0.07	0.16	0.07	84.9
NorthWest: TBWF Stg 1 Access														
7	L2	5	4	5	80.0	0.019	7.2	LOS A	0.1	0.8	0.34	0.59	0.34	45.1
9	R2	8	5	8	62.5	0.019	8.7	LOS A	0.1	0.8	0.34	0.59	0.34	46.9
Approach		13	9	14	69.2	0.019	8.1	LOS A	0.1	0.8	0.34	0.59	0.34	46.2
SouthWest: New England Highway														
10	L2	27	8	28	29.6	0.087	8.6	LOS A	0.0	0.0	0.00	0.14	0.00	72.4
11	T1	104	39	109	37.5	0.087	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	95.3
Approach		131	47	138	35.9	0.087	1.8	NA	0.0	0.0	0.00	0.14	0.00	89.5
All Vehicles		239	80	252	33.5	0.087	2.3	NA	0.1	0.8	0.05	0.17	0.05	83.5

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [DECOMMISSIONING 2056 PM Peak (Project Peak) (Site Folder: Decommissioning)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
Project Traffic Peak (5-6pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	217	48	228	22.1	0.133	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	5	4	5	80.0	0.006	11.0	LOS B	0.0	0.3	0.39	0.62	0.39	56.5
Approach		222	52	234	23.4	0.133	0.3	NA	0.0	0.3	0.01	0.01	0.01	98.2
NorthWest: TBWF Stg 1 Access														
7	L2	25	7	26	28.0	0.077	6.8	LOS A	0.3	2.6	0.44	0.67	0.44	52.9
9	R2	27	8	28	29.6	0.077	10.5	LOS B	0.3	2.6	0.44	0.67	0.44	52.1
Approach		52	15	55	28.8	0.077	8.7	LOS A	0.3	2.6	0.44	0.67	0.44	52.5
SouthWest: New England Highway														
10	L2	8	5	8	62.5	0.127	9.5	LOS A	0.0	0.0	0.00	0.03	0.00	63.9
11	T1	202	36	213	17.8	0.127	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.6
Approach		210	41	221	19.5	0.127	0.4	NA	0.0	0.0	0.00	0.03	0.00	97.5
All Vehicles		484	108	509	22.3	0.133	1.2	NA	0.3	2.6	0.05	0.09	0.05	89.5

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [DECOMMISSIONING 2056 AM Peak (NE Highway Peak) (Site Folder: Decommissioning)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (10-11am)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	250	52	263	20.8	0.152	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	9	4	9	44.4	0.009	10.0	LOS A	0.0	0.4	0.40	0.63	0.40	58.4
Approach		259	56	273	21.6	0.152	0.4	NA	0.0	0.4	0.01	0.02	0.01	97.5
NorthWest: TBWF Stg 1 Access														
7	L2	9	4	9	44.4	0.038	7.4	LOS A	0.1	1.3	0.50	0.68	0.50	49.1
9	R2	11	5	12	45.5	0.038	12.7	LOS B	0.1	1.3	0.50	0.68	0.50	48.3
Approach		20	9	21	45.0	0.038	10.3	LOS B	0.1	1.3	0.50	0.68	0.50	48.6
SouthWest: New England Highway														
10	L2	11	5	12	45.5	0.150	9.0	LOS A	0.0	0.0	0.00	0.03	0.00	69.0
11	T1	233	49	245	21.0	0.150	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.2
Approach		244	54	257	22.1	0.150	0.4	NA	0.0	0.0	0.00	0.03	0.00	97.3
All Vehicles		523	119	551	22.8	0.152	0.8	NA	0.1	1.3	0.03	0.05	0.03	93.8

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
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 [DECOMMISSIONING 2056 PM Peak (NE Highway Peak) (Site Folder: Decommissioning)]

New England Highway / Thunderbolt Wind Farm Stage 1 Access
Proposed Site Access Configuration (BAL/CHRs)
New England Highway Peak (3-4pm)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: New England Highway														
5	T1	268	58	282	21.6	0.163	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	99.9
6	R2	9	4	9	44.4	0.009	10.1	LOS B	0.0	0.4	0.42	0.63	0.42	58.4
Approach		277	62	292	22.4	0.163	0.3	NA	0.0	0.4	0.01	0.02	0.01	97.7
NorthWest: TBWF Stg 1 Access														
7	L2	9	4	9	44.4	0.040	7.5	LOS A	0.1	1.4	0.52	0.70	0.52	48.7
9	R2	11	5	12	45.5	0.040	13.5	LOS B	0.1	1.4	0.52	0.70	0.52	48.0
Approach		20	9	21	45.0	0.040	10.8	LOS B	0.1	1.4	0.52	0.70	0.52	48.3
SouthWest: New England Highway														
10	L2	11	5	12	45.5	0.159	9.0	LOS A	0.0	0.0	0.00	0.03	0.00	69.0
11	T1	254	43	267	16.9	0.159	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.3
Approach		265	48	279	18.1	0.159	0.4	NA	0.0	0.0	0.00	0.03	0.00	97.6
All Vehicles		562	119	592	21.2	0.163	0.7	NA	0.1	1.4	0.03	0.05	0.03	94.2

Site Level of Service (LOS) Method: Delay (SIDRA). 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.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix H – Project Pavement Loading Calculations

ACCESS TRAFFIC CONSULTING

UMW0121-003 | Thunderbolt Wind Farm Project

Project Pavement Loading Summary

TASK A - MOBILISTATION & SITE ESTABLISHMENT

Description	Project Volume	Vehicle	Origin	Route
Overall Construction Site Establishment	50	Semi	Tamworth	Tamworth - New England Highway - Site Access
	50		Armidale	Armidale - New England Highway - Site Access
Batch Plant Area Establishment	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38		Armidale	Armidale - New England Highway - Site Access
Construction Compound Establishment	50	Semi	Tamworth	Tamworth - New England Highway - Site Access
	50		Armidale	Armidale - New England Highway - Site Access
Batch Plant Area Slab Wet Concrete	118	Concrete Truck	Tamworth	Tamworth - New England Highway - Site Access
	118		Armidale	Armidale - New England Highway - Site Access
Batch Plant Area Slab Reinforcing Steel	10	Semi	Tamworth	Tamworth - New England Highway - Site Access
	10		Armidale	Armidale - New England Highway - Site Access
Construction Compound Area Slab Wet Concrete	42	Concrete Truck	Internal Batch Plant	Internal
Construction Compound Area Slab Concrete Sand/Aggregates (to Batch Plant)	5	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	5		Armidale	Armidale - New England Highway - Site Access
Construction Compound Area Slab Cement (to Batch Plant)	2	Semi	Tamworth	Tamworth - New England Highway - Site Access
	2		Armidale	Armidale - New England Highway - Site Access
Construction Compound Area Slab Reinforcing Steel	2	Semi	Tamworth	Tamworth - New England Highway - Site Access
	2		Armidale	Armidale - New England Highway - Site Access
Batch Plant Area Gravel	321	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	321		Armidale	Armidale - New England Highway - Site Access
Construction Compound Area Gravel	171	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	171		Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs
Concrete Truck (4 Axle Rigid) Unloaded (0%)	0.36	ESAs
Concrete Truck (4 Axle Rigid) Loaded (100%)	4.13	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	4,386	1,113
Tamworth - New England Highway - Site Access	4,386	1,113

TASK B - INTERNAL ACCESS AND ROAD UPGRADES

Description	Project Volume	Vehicle	Origin	Route
Internal Access Track & Turbine Hardsand Gravel Pavement Materials	4,812	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	4,812	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Access Intersetion Gravel Pavement Materials	25	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	25	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access

Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	29,748	7,933
Tamworth - New England Highway - Site Access	29,748	7,933

TASK C - SITE INFRASTRUCTURE AREAS

Description	Project Volume	Vehicle	Origin	Route
Substation Establishment	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38	Semi	Armidale	Armidale - New England Highway - Site Access
Switching Station Area Establishment	13	Semi	Tamworth	Tamworth - New England Highway - Site Access
	13	Semi	Armidale	Armidale - New England Highway - Site Access
Satelite Construction Compound / Laydown Establishment	63	Semi	Tamworth	Tamworth - New England Highway - Site Access
	63	Semi	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Establishment	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38	Semi	Armidale	Armidale - New England Highway - Site Access
Substation Slab Wet Concrete	113	Concrete Truck	Internal Batch Plant	Internal
Substation Slab Concrete Sand/Aggregates (to Batch Plant)	13	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	13	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Substation Slab Cement (to Batch Plant)	3	Semi	Tamworth	Tamworth - New England Highway - Site Access
	3	Semi	Armidale	Armidale - New England Highway - Site Access
Substation Slab Reinforcing Steel	5	Semi	Tamworth	Tamworth - New England Highway - Site Access
	5	Semi	Armidale	Armidale - New England Highway - Site Access
Switching Station Slab Wet Concrete	57	Concrete Truck	Internal Batch Plant	Internal
Switching Station Slab Concrete Sand/Aggregates (to Batch Plant)	7	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	7	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Switching Station Slab Cement (to Batch Plant)	2	Semi	Tamworth	Tamworth - New England Highway - Site Access
	2	Semi	Armidale	Armidale - New England Highway - Site Access
Switching Station Slab Reinforcing Steel	3	Semi	Tamworth	Tamworth - New England Highway - Site Access
	3	Semi	Armidale	Armidale - New England Highway - Site Access
Satelite Construction Compound Area Slab Wet Concrete	131	Concrete Truck	Internal Batch Plant	Internal
Satelite Construction Compound Area Slab Concrete Sand/Aggregates (to Batch Plant)	15	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	15	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Satelite Construction Compound Area Slab Cement (to Batch Plant)	4	Semi	Tamworth	Tamworth - New England Highway - Site Access
	4	Semi	Armidale	Armidale - New England Highway - Site Access
Satelite Construction Compound Area Slab Reinforcing Steel	6	Semi	Tamworth	Tamworth - New England Highway - Site Access
	6	Semi	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Slab Wet Concrete	16	Concrete Truck	Internal Batch Plant	Internal
Operational and Maintenance Facility Slab Concrete Sand/Aggregates (to Batch Plant)	2	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	2	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Slab Cement (to Batch Plant)	1	Semi	Tamworth	Tamworth - New England Highway - Site Access
	1	Semi	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Slab Reinforcing Steel	1	Semi	Tamworth	Tamworth - New England Highway - Site Access
	1	Semi	Armidale	Armidale - New England Highway - Site Access
Substation Area Gravel	176	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	176	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Switching Station Area Gravel	88	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	88	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Construction Compound Area Gravel	107	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	107	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Area Gravel	65	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	65	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	3,890	1,073
Tamworth - New England Highway - Site Access	3,890	1,073

TASK D - CABLING (UNDERGROUND & OVERHEAD)

Description	Project Volume	Vehicle	Origin	Route
Underground Powerline Cable	24	Semi	Tamworth	Tamworth - New England Highway - Site Access
	24	Semi	Armidale	Armidale - New England Highway - Site Access
Underground Powerline Bedding Sand	118	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	118	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Overhead Powerline Cable	4	Semi	Tamworth	Tamworth - New England Highway - Site Access
	4	Semi	Armidale	Armidale - New England Highway - Site Access
Overhead Powerline Poles	11	Semi	Tamworth	Tamworth - New England Highway - Site Access
	11	Semi	Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	942	259
Tamworth - New England Highway - Site Access	942	259

TASK E - TURBINE FOUNDATIONS

Description	Project Volume	Vehicle	Origin	Route
Turbine Foundations Concrete Sand/Aggregates (to Batch Plant)	600	Truck & 4 Axle Dog	Tamworth	Tamworth - New England Highway - Site Access
	600	Truck & 4 Axle Dog	Armidale	Armidale - New England Highway - Site Access
Turbine Foundations Cement (to Batch Plant)	137	Semi	Tamworth	Tamworth - New England Highway - Site Access
	137	Semi	Armidale	Armidale - New England Highway - Site Access
Turbine Foundations Reinforcing Steel	236	Semi	Tamworth	Tamworth - New England Highway - Site Access
	236	Semi	Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs
Truck & 4 Axle Dog Unloaded (0%)	1.64	ESAs
Truck & 4 Axle Dog Loaded (100%)	6.15	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	5,756	1,611
Tamworth - New England Highway - Site Access	5,756	1,611

TASK F - TURBINE TRANSPORTATION

Turbines	32	Special
Meteorology masts	6	Special

Full Turbine Transport Loaded	210.00	ESAs
Full Turbine Transport Loaded	60.00	ESAs
Met Mast Transport Loaded	7.91	ESAs
Met Mast Transport Unloaded	1.87	ESAs

	Loaded	Unloaded
Newcastle to Site Access (via NE Highway south)	6,767	1,931

TASK G - TURBINE ERECTION

Description	Project Volume	Vehicle	Origin	Route
Heavy Crane for Turbine Erection to Site (WF-1)	5	B-Double	Tamworth	Tamworth - New England Highway - Site Access
	5	B-Double	Armidale	Armidale - New England Highway - Site Access

B-Double Unloaded (0%)	1.69	ESAs
B-Double Loaded (100%)	6.91	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	35	8
Tamworth - New England Highway - Site Access	35	8

TASK H - FINALISATION / COMMISSIONING / DEMOBILISATION

Description	Project Volume	Vehicle	Origin	Route
Overall Construction Area Demobilisation	50	Semi	Tamworth	Tamworth - New England Highway - Site Access
	50	Semi	Armidale	Armidale - New England Highway - Site Access
Substation Demobilisation	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38	Semi	Armidale	Armidale - New England Highway - Site Access
Switching Station Area Demobilisation	13	Semi	Tamworth	Tamworth - New England Highway - Site Access
	13	Semi	Armidale	Armidale - New England Highway - Site Access
Batch Plant Area Demobilisation	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38	Semi	Armidale	Armidale - New England Highway - Site Access
Construction Compound Demobilisation	50	Semi	Tamworth	Tamworth - New England Highway - Site Access
	50	Semi	Armidale	Armidale - New England Highway - Site Access
Satelite Construction Compound Demobilisation	63	Semi	Tamworth	Tamworth - New England Highway - Site Access
	63	Semi	Armidale	Armidale - New England Highway - Site Access
Operational and Maintenance Facility Demobilisation	38	Semi	Tamworth	Tamworth - New England Highway - Site Access
	38	Semi	Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	1,607	487
Tamworth - New England Highway - Site Access	1,607	487

SITE WATER

Description	Project Volume	Vehicle	Origin	Route
Site Water	1,887	Semi Water Truck	Tamworth	Tamworth - New England Highway - Site Access
	1,887	Semi Water Truck	Armidale	Armidale - New England Highway - Site Access

Semi Unloaded (0%)	1.68	ESAs
Semi Loaded (100%)	5.54	ESAs

	Loaded	Unloaded
Armidale - New England Highway - Site Access	10,454	3,170
Tamworth - New England Highway - Site Access	10,454	3,170

ACCESS TRAFFIC CONSULTING

UMW0121-003 | Thunderbolt Wind Farm Project

Project Pavement Impact % Calculations

CONSTRUCITON PHASE

Road ID	Road Description	Seg.	AADT Segment		Base Data Year	Base Year AADT			Base Year HV%		Base Year HV		10 Yr GR%	2024 AADT			2024 HV		ESAs / HV	Days / Year	Background ESAs	
			Start (km)	End (km)		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz	Gaz	A-Gaz		Gaz	A-Gaz	Bi-Dir	Gaz	A-Gaz			Gaz	A-Gaz
A15	New England Highway (Tamworth to Armidale)	35801	0.000	63.700	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,259	2,290	4,549	528	540	1.97	548	569,064	582,667
			63.700	105.000	2019	2,149	2,179	4,328	23.36%	23.59%	502	514	1.00%	2,259	2,290	4,549	528	540	1.97	548	569,064	582,667

Road ID	Road Description	Seg.	AADT Segment		Project ESAs																		ESA Increase %	
			Start (km)	End (km)	Gaz										A-Gaz									
					A	B	C	D	E	F	G	H	Water	Total	A	B	C	D	E	F	G	H	Water	Total	Gaz %	A-Gaz %
A15	New England Highway (Tamworth to Armidale)	35801	0.000	63.700	4,386	29,748	3,890	942	5,756	6,767	35	1,607	10,454	63,584	1,113	7,933	1,073	259	1,611	1,931	8	487	3,170	17,585	11.17%	3.02%
			63.700	105.000	1,113	7,933	1,073	259	1,611	0	8	487	3,170	15,654	4,386	29,748	3,890	942	5,756	0	35	1,607	10,454	56,816	2.75%	9.75%

ACCESS TRAFFIC
CONSULTING

TRAFFIC IMPACT ASSESSMENTS | SITE FEASIBILITY STUDIES | INTERSECTION ANALYSIS
ROAD SAFETY AUDITS | ROAD SAFETY INVESTIGATIONS | PAVEMENT IMPACT ASSESSMENTS
TRANSPORT ROUTE ASSESSMENTS | TRANSPORT PLANNING | ACCESS MANAGEMENT STATEGIES
PEER REVIEWS | PARKING FACILITY DESIGN | SERVICE FACILITY DESIGN