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Dalvui Battery Energy Storage System

Traffic Impact Assessment

Tilt Renewables

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Document prepared by:

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Aurecon Centre
Level 8, 850 Collins Street
Docklands, Melbourne VIC 3008
PO Box 23061
Docklands VIC 8012
Australia

T +61 3 9975 3000

F +61 3 9975 3444

E melbourne@aurecongroup.com

W aurecongroup.com

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| Author signature | | Approver signature | |
| Name | Ben Simpson | Name | Greta Thraves |
| Title | Lead Engineer | Title | Manager Environment and Planning |



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1 Introduction

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1.1 Background

1.1.1 Dalvui BESS

A planning permit is currently being sought for a proposed Battery Energy Storage System (BESS) facility development located on the western part of 500 Dalvui Lane north east of the town of Terang (the Project). The Project includes:

- construction and operation of a BESS with an indicative output of 196 MW / 392 MWh, including ancillary infrastructure,
- connection upgrade works within the existing Terang Terminal Station (TGTS) located to the west of the BESS site, connecting to the BESS via an underground connection along Littles Lane and McCrae Street, and
- installation of a 66 kV transformer, either be within the BESS site or within the TGTS.

Aurecon Australasia Pty Ltd (Aurecon) has been engaged by Tilt Renewables (the Proponent) to prepare a transport impact assessment (TIA) for submission as part of a planning permit application for the Project.

1.2 Purpose of this Report

This report focuses on the anticipated parking, traffic and transport implications of the Project, including consideration of the following:

- traffic movements generated by the Project during construction and operation and maintenance phases,
- adequacy of proposed access arrangements and impacts to the wider local road network, including construction and operation and maintenance phases,
- adequacy of proposed car parking provision and layout arrangements, and
- adequacy of proposed internal vehicle and loading access and layout arrangements.

In preparing this assessment, a desktop review of the subject site and its environs has been completed, plans of the development (Dalvui BESS Indicative Site Layout) reviewed, and all relevant traffic data collected and analysed.

Relevant standards and guidelines relied upon are noted and referenced as necessary throughout this report.

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2 Existing Conditions

2.1 Subject Site

The subject site is located on the western portion of 500 Dalvui Lane in Terang (identified as Lot 2\PS543673) and is located east of the TGTS, approximately 1.5km northeast of the Terang township. The subject site has road frontages to Dalvui Lane and McCrae Street and is also bound by the Warrnambool railway line on its southern boundary.

The TGTS is owned and operated by AusNet Services and comprises two lots (Lot 1\TP337263 and Lot 1\TP429113).

The TGTS is situated within the Public Use Zone 1, while the BESS site is currently vacant land located within the Farming Zone 1. The land between Littles Lane and Princes Highway is classified as General Residential Zone. Princes Highway is a designated Transport Zone (TRZ2). All other surrounding land is covered by the Farming Zone as shown in Figure 2.

The location of the site and its surrounding road network is shown in Figure 1 and Figure 2.



Figure 1 Dalvui BESS Subject Site and Terang Terminal Station (openstreetmaps.org)

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Figure 2 Land Zoning Map

2.2 Transport Network

2.2.1 Road Network

Princes Highway

Princes Highway is a primary arterial road generally aligned north-east to south-west in the vicinity of the site and is managed by Regional Roads Victoria. It comprises a 7.0 m wide two-lane two-way undivided carriageway with 1.1 m sealed shoulders and is set within a 60 m wide road reserve (approximate in the vicinity of the subject site). There is no provision for bicycles or pedestrians along this section of highway.

Princes Highway provides connection to major centres including (but not limited to) Colac, Geelong and Melbourne to the east and Warrnambool and Portland to the west.

The intersection between Princes Highway and Little's Lane is located within an 80 km/h speed zone, which increases to 100 km/h the east and 60 km/h to the west in the Terang township. A 90 m channelised right turn and 85 m auxiliary left turn lanes (approximate) are provided on Princes Highway with its intersection with Little's Lane as illustrated below in Figure 3.

Princes Highway carries in the order of 4,400 vehicles per day¹.

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¹ VicRoads Open Data Portal (2020)

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Figure 3 Princes Highway / Littles Lane Intersection (source: Nearmap)

Littles Lane

Littles Lane is two-way local road managed by Corangamite Shire Council and is generally aligned in a north-south direction with a posted 60 km/hr speed limit. Between Princes Highway and McCrae Street, Littles Lane comprises a sealed 5.0 m carriageway set within a 20 m wide road reserve (approximate). North of McCrae Street, Littles Lane continues as an unsealed road with a 4.0 m wide gravel formation and terminates further north. There is no separate provision for bicycles or pedestrians along Littles Lane.

Littles Lane crosses the Warrnambool Railway Line approximately 150 m north of Princes Highway and includes an at-grade boom gate-controlled railway level crossing (recently constructed).

This section of Littles Lane also provides access to a transmission tower (located on a separate title to the east) and farmland to the west. There is no separate provision for bicycles or pedestrians along either section of Littles Lane. Littles Lane operates under a signed 60 km/h speed limit.

Littles Lane carries in the order of 160 vehicles per day².

McCrae Street

McCrae Street is two-way local road managed by Corangamite Shire Council and is generally aligned in an east-west direction with a 50 km/h speed limit. East of Littles Lane McCrae Street comprises a 7 m wide unsealed gravel carriageway, and west of Littles Lane a 5 m unsealed gravel carriageway, both set within a 20 m road reserve (approximate).

The western end of McCrae Street (between Terang-Mortlake Road and Littles Lane) has a signed 8 tonne truck limit.

McCrae Street carries in the order of 100 vehicles per day³.

2.2.2 Public Transport Network

The Warrnambool-Melbourne Railway Line (via Colac and Geelong) runs parallel to Princess Highway in the vicinity of the subject site and passes through the Terang township. The Warrnambool-Melbourne service comprises eight trains per weekday (four in each direction) and six trains per day during the weekend (three trains in each direction).

A V/Line bus service also connects Terang to Warrnambool and other surrounding regional centres and townships. Figure 4 illustrates the regional train and coach network.

² 2006 data provided by Corangamite Shire Council.

³ 2010 data provided by Corangamite Shire Council

The railway line crosses Littles Lane between Princes Highway and McCrae Street section at an at-grade boom gate-controlled level crossing.

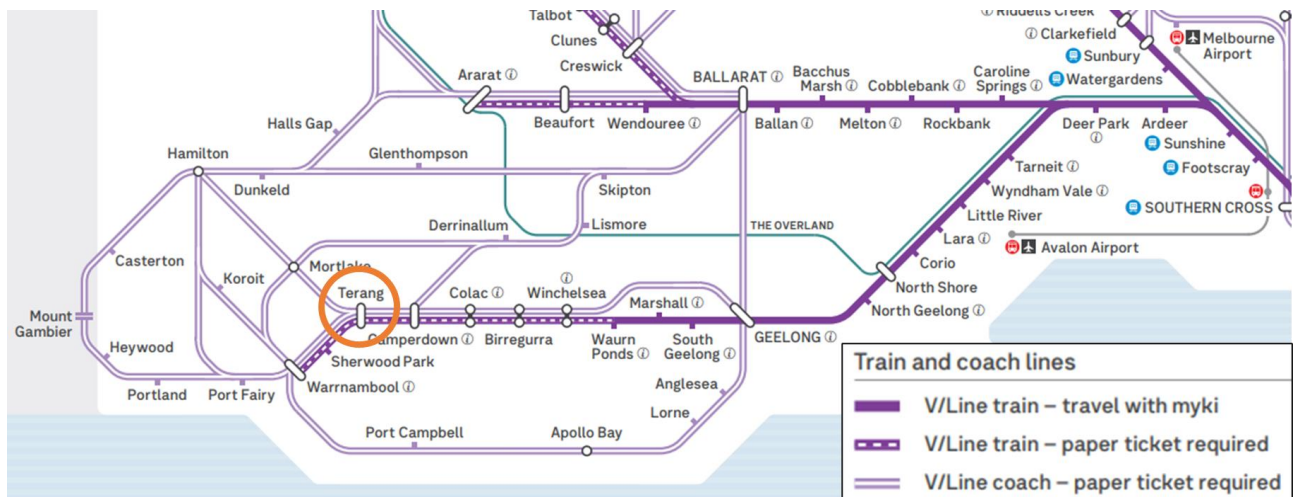


Figure 4 Regional Train and coach Network (Source: Public Transport Victoria)

2.2.3 Active Travel

There are currently no formal pedestrian and/or cyclist paths within the general vicinity of the subject site.

2.3 Traffic Volumes

2.3.1 Princes Highway

Existing traffic data for Princes Highway has been collated from VicRoads open data traffic volumes (2020) and summarised in Table 1 (Princes Highway west section which connects to Littles Lane).

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Table 1 Princes Highway – Existing Traffic Volumes

| Location | Direction | AM peak | PM peak | Daily |
|---|-----------|---------|---------|--------------------|
| Princes Highway West (btw Bourkes Rd / McKinnons Bridge-Noorat Rd) | Eastbound | 180 vph | 220 vph | 2,200 vpd (25% HV) |
| | Westbound | 170 vph | 180 vph | 2,200 vpd (23% HV) |

vph (vehicles per hour (approximate)), vpd (vehicles per day (approximate)), HV (heavy vehicles)

2.3.2 Littles Lane

Corangamite Shire Council provided traffic data for Littles Lane from 2006 that equates to 156 vehicles per day (two-way) with 6% heavy vehicles. To estimate existing traffic on Littles Lane, reference is made to TrafficWorks' publicly available Traffic Impact Assessment Report (TIAR) for a proposed BESS development nearby (190630: Battery Storage Facility, 70 Littles Lane, Terang - Traffic Impact Assessment (Terang BESS TIAR) which assumed:

- a conservative 2% p.a. linear growth rate to estimate existing daily traffic volumes,
- a 10% peak to daily factor to estimate peak hour volumes, and
- 20% northbound / 80% southbound movements in the AM peak and 80% northbound / 20% southbound movements in the PM peak.

For consistency, this assessment adopts the same assumptions as those outlined in the Terang BESS TIAR and outlined above. To this end, Table 2 has been prepared to summarise existing traffic volume estimates on Littles Lane.

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Table 2 Littles Lane – Existing Traffic Volumes (estimate)

| Location | Direction | AM peak | PM peak | Daily (two-way) |
|--|------------|---------|---------|-----------------|
| Littles Lane (north of Princes Highway) | Northbound | 4 vph | 17 vph | 210 vpd (6% HV) |
| | Southbound | 17 vph | 4 vph | |

vph (vehicles per hour (approximate)), vpd (vehicles per day (approximate)), HV (heavy vehicles)

2.3.3 McCrae Street

Similarly, Corangamite Shire Council has provided traffic data for McCrae Street from 2010 that equates to 104 vehicles per day (two-way) with 6% heavy vehicles. Again, reference is made to the Terang BESS TIAR to estimate existing traffic volumes on McCrae Street (same as those listed above):

In the absence of movement splits and/or assumptions in the above-mentioned report, it is assumed that McCrae Street has similar splits as follows: 20% eastbound / 80% westbound movements in the AM peak and 80% eastbound / 20% westbound movements in the PM peak.

For consistency, this assessment adopts the same assumptions as those outlined in the Terang BESS TIAR. To this end, Table 3 has been prepared to summarise existing traffic volume estimates on McCrae Street.

Table 3 McCrae Street – Existing Traffic Volumes (estimate)

| Location | Direction | AM peak | PM peak | Daily (2-way) |
|---------------|-----------|---------|---------|-----------------|
| McCrae Street | Eastbound | 3 vph | 10 vph | 130 vpd (6% HV) |
| | Westbound | 10 vph | 3 vph | |

vph (vehicles per hour (approximate)), vpd (vehicles per day (approximate)), HV (heavy vehicles)

Daily demand rounded to the nearest 10.

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2.4 Crash History

Two crashes occurred in the vicinity of the development site over the five-year period 2014 to 2019 (VicRoads' crash statistics). The first, a rear end collision (serious injury crash), occurred in 2014 on Princess Highway and the second, a left off carriageway into object/parked vehicle (serious injury crash) in 2017 on Dalvui-Mortlake Road. Refer to Figure 5 for crash locations and further details on the crashes.

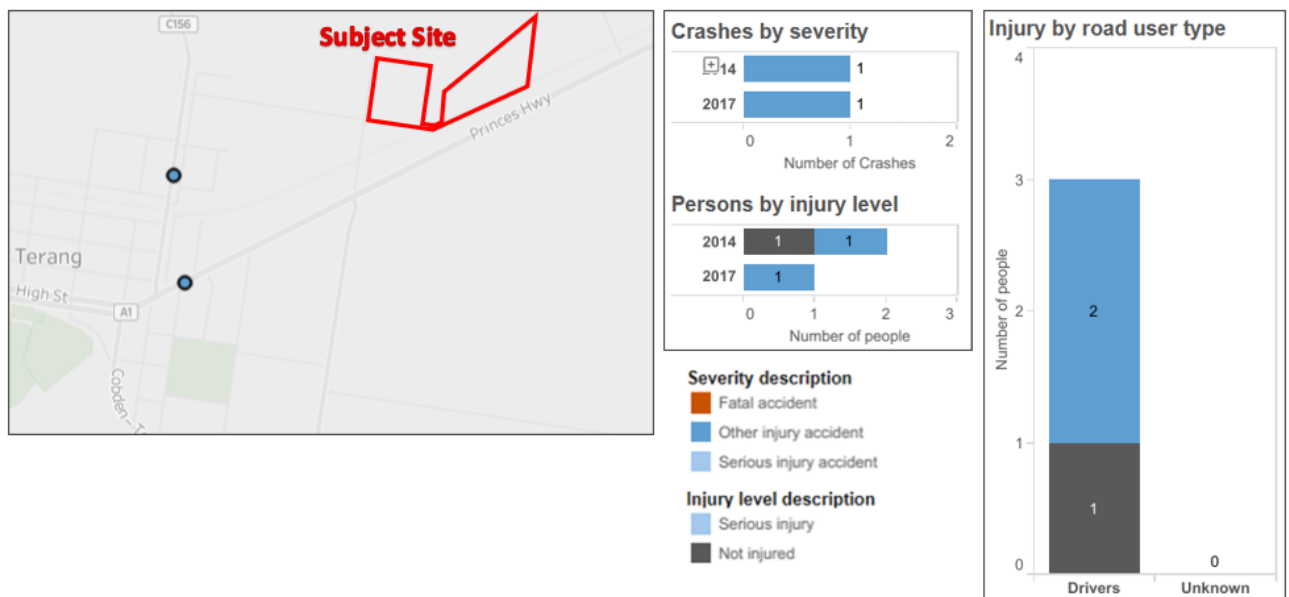


Figure 5 Crash Data (Source: VicRoads)

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3 Development Proposal

3.1 Dalvui BESS Facility

A planning permit is currently being sought for a BESS facility and associated ancillary infrastructure at 500 Dalvui Lane in Terang.

The Project includes the construction of a number of battery storage units with a capacity of 196 MW / 392 MWh storage, installation of a 66kV transformer and underground electrical connection to the TGTS.

Construction is indicatively estimated to begin as soon as practical in 2024.

The indicative layout of the Project is illustrated below in Figure 6. It should also be noted that this layout is indicative only and will be confirmed during detailed design, once a preferred BESS supplier has been selected.



Dalvui BESS
Indicative Site Layout Plan

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Figure 6 Indicative Layout

Vehicle access is proposed via the site’s existing McCrae Street access. Given the site’s narrow frontage to McCrae Street, a short one-way width access is proposed at the site’s entrance from McCrae Street. Notwithstanding, two-way simultaneous access widths are proposed on each side of this one-way width section (both within the BESS site and on McCrae Street) to enable vehicles to pass propped entry or exit vehicles.

The primary route for vehicles access to the site via Princes Highway, Littles Lane and then McCrae Street. It is proposed to upgrade McCrae Street between the site’s proposed access point and the existing TGTS access point to include a widened carriageway to provide an improved trafficable roadway suitable for construction and operation phases of the Project. This will also ensure two-way simultaneous movements are achievable.

Access within the BESS site is proposed via a main 6 m wide access road aligned along the site’s southern boundary with connection to McCrae Street, with secondary 4 m wide access roads providing access to each part of the proposed BESS facility as summarised in Figure 7.

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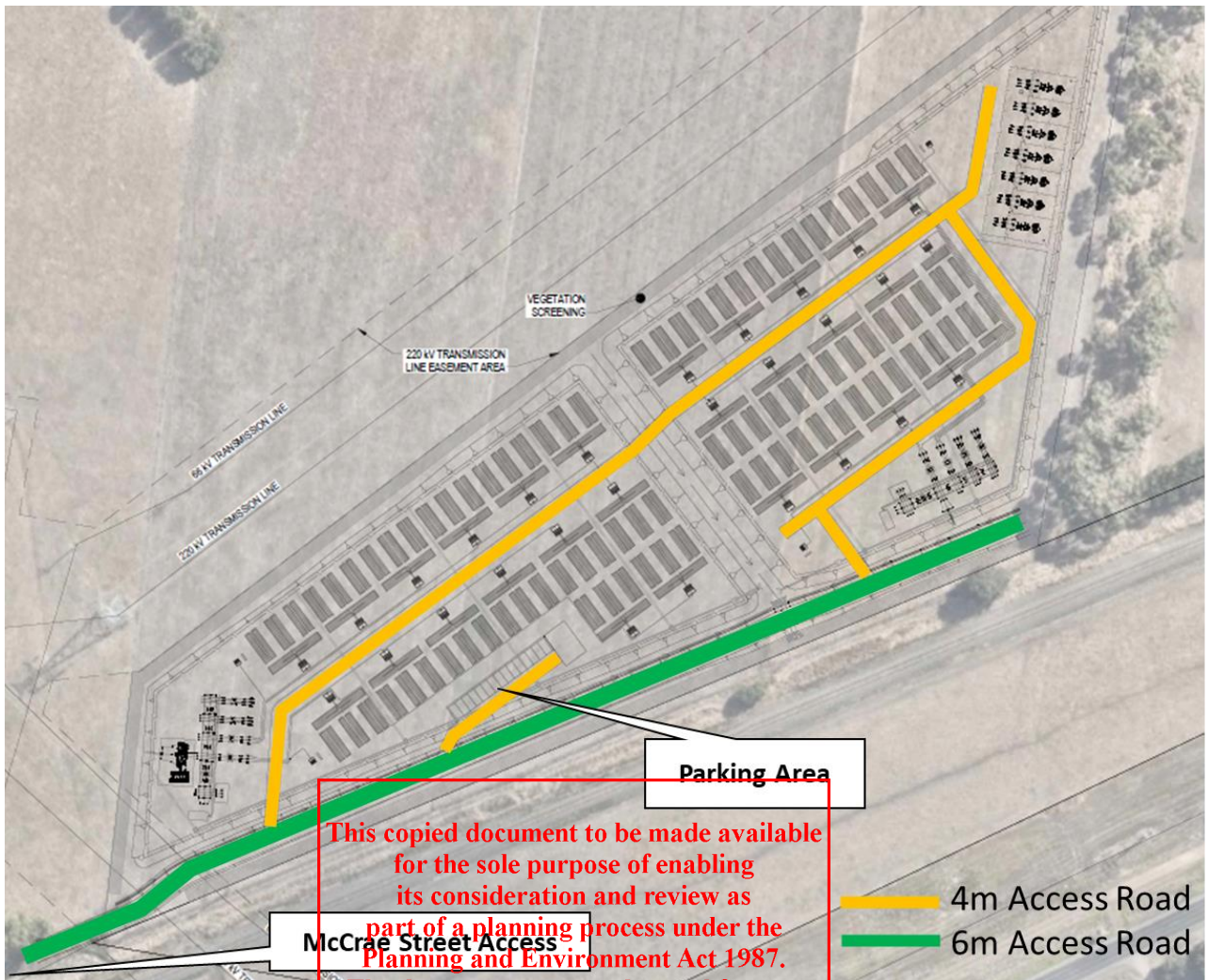


Figure 7 Dalvui BESS – Internal Access

A total of 15 permanent car parking spaces have been allowed as part of the indicative design to service staff parking demands during the operation and maintenance phase. The total number of car parking spaces will be confirmed post permit during the detail design phase following appointment of a preferred BESS supplier.

The proposed facility is expected to be remotely operated and normally not staffed, requiring infrequent inspections and maintenance activities by staff.

3.2 Construction Phase

On-site construction for the Project is largely limited to the preparation of footings, delivery and construction / installation of prefabricated items (control room, switching station, battery units, connection components, etc.).

It is anticipated that access to the site will be required for vehicles of a size up to 19m semi-trailers for delivery of concrete and steel, batteries and inverters. For civil material import, it is expected that vehicles of a size up to semi-trailer truck, and truck and quad (standard, 19m) are likely to be used for site access. The site buildings and plant are expected to be delivered using low loaded / float (standard). Staff are likely to travel to the site via passenger cars and/or small vans.

3.2.1 Vehicle Types

The following vehicle types are anticipated to deliver materials and equipment during the construction phase as summarised in Table 4.

Table 4 Anticipated Construction Phase Vehicle Types

| Load Type | Vehicle Type | Design Vehicle |
|--|---|--|
| Site Buildings and Plan | Low loader / float (standard) | 19m Semi-trailer |
| Staff / Visitor | Passenger vehicle (4x4, car, etc) | 99 th percentile car (B99 car) |
| Civil Material Import / Export (bulk earthworks) | Semi-trailer and Truck and Quad Dog | 19m Semi-trailer and 19m Truck and Dog |
| Concrete and Steel | Semi-trailer and Concrete Truck | 19m semi-trailer and ≈ 8.8m Medium Rigid Vehicle (MRV) |
| Batteries, inverters, transformers, conduits and cable | Semi-trailer | 19m Semi-trailer |
| Crane | Mobile 50-100t crane | ≤ 12.5m Heavy Rigid Vehicle (HRV) [1] |
| 66kV Transformer (x1) | Prime mover and custom multiple axle low platform trailer | N/A - Refer discussion below |

[1] Approximate equivalent as mobile cranes of this type have all wheel steering / multiple wheel steering with relatively smaller turning circles.

The majority of construction related vehicles will include vehicles of a size *up to* and including 19m semi-trailer trucks and 19m truck and quad dogs.

The one-off delivery of the 66kV transformer will include a prime mover truck with a multiple axle low platform ‘gooseneck’ trailer. An example of a similar 105 tonne transformer delivery vehicle is illustrated in Figure 8 below (total length in the order of 30m).

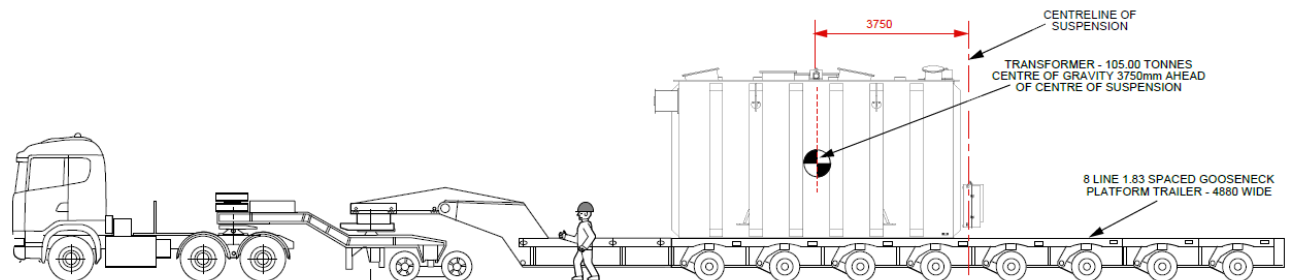


Figure 8 Example 105t Transformer Delivery Vehicle

Multiple axle low platform trailers of this type include independent hydraulic wheel height control to navigate longitudinal crests and dips and all wheel steering or multiple wheel electronic steering which provides higher degrees of turning control and relatively small turning circles (comparative to its 30 m length).

An excerpt of this example vehicle’s full lock (45°) turning circle is illustrated below in Figure 9.

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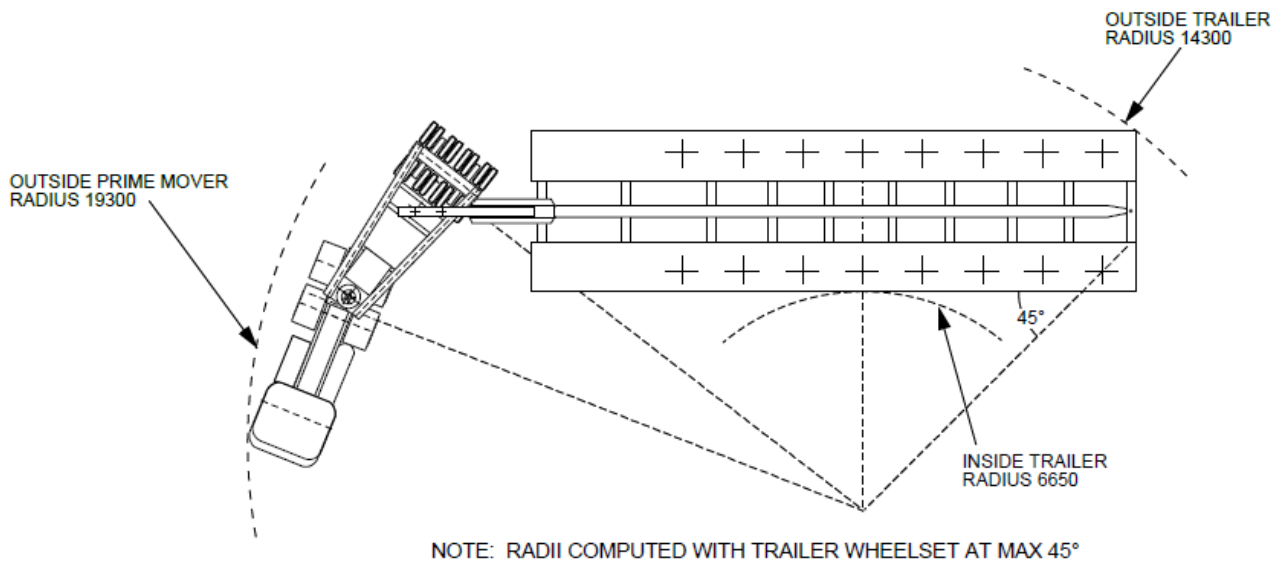


Figure 9 Example 105t Transformer Delivery Vehicle – Turning Circle

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Notwithstanding the above, construction vehicle types will be confirmed following appointment of a construction team (post permit).

Specific traffic management measures will be identified as necessary and detailed in an appropriate Traffic Management Plan (TMP). This is especially the case for OD / OSOM (Over Dimension / Over Size Over Mass) vehicles such as the transformer delivery vehicle above.

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3.2.2 Access Routes

Construction Vehicles and Deliveries

As discussed with the Proponent, it is expected that delivery of imported plant, equipment and materials will occur at one of three potential port of origins: Portland Port (145 km from site), Geelong Port (145 km from site) or Melbourne Port (205 km from site).

Non-imported plant, equipment and materials are expected to be sourced from various areas throughout Victoria and locally in Terang and its surrounds.

For each port of origin, there are convenient heavy vehicle approved access routes for delivery of plant, equipment, and materials (depending on their origin and vehicle size), including but not limited to:

- From Portland Port:
 - Henty Highway → Princes Highway → Littles Lane → McCrae Street to the Project site
- From Melbourne Port:
 - West Gate Freeway → Cook Street → Todd Road → West Gate Freeway → Princes Freeway → Princes Highway → Mahers Road → Princes Highway → Willis Street → Princes Highway → Warncoort-Birregurra Road → Princes Highway → Littles Lane → McCrae Street to the Project site
- From Geelong Port:
 - Corio Quay Road → Mackey Street → Separation Street → Anakie Road → Midland Highway → Princes Freeway → Princes Highway → Mahers Road → Princes Highway → Willis Street → Princes Highway → Warncoort-Birregurra Road → Princes Highway → Littles Lane → McCrae Street to the Project site

Delivery of the 66kV transformer is currently proposed via the Princes Highway / Littles Lane intersection and then the Littles Lane / McCrae Street intersection. Notwithstanding, a potential alternate route via the Princes Highway / Terang-Mortlake Road and Terang-Mortlake Road / McCrae Street intersections is also being considered by the project team. In the first instance this assessment considers the current proposed route via Princes Highway / Littles Lane.

Following appointment of a construction team, specific access routes would be confirmed and adopted for the construction phase and detailed in an appropriate TMP.

Workers

Based on information provided by the Proponent, it is understood approximately 50 full time construction workers are expected during construction. In regard to associated worker vehicle movements, this will depend on where workers live (and/or are housed if from Melbourne or further afield) which is expected to be highly varied.

It is expected that a large proportion of construction workers will comprise local staff from or housed in Camperdown and Colac to the east and Terang and Warrnambool to the west.

On this basis, the majority of construction workers will access the site via Princes Highway (from the east or west) and then via Littles Lane and McCrae Street.

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3.2.3 Site Access

The proposed McCrae Street site access point is proposed to service both construction phase and operation and maintenance phase related traffic movements. As discussed in Section 3.1, it is proposed to upgrade the eastern section of McCrae Street to include a wider carriageway to enable two-way simultaneous vehicle movements.

Further discussion on required external road upgrades to facilitate access are included in Section 4.2.4 of this report.

3.3 Operation and Maintenance Phase

BESS facilities are usually monitored remotely in real-time and do not require dedicated staff to be on-site at all times. Staff are however required to access the site from time to time for inspections and maintenance activities.

Based on information provided by the Proponent, it is understood that up to two (2) staff could typically be expected to be on-site at any time. Vehicle movements are expected to include light vehicles (passenger cars, utility vans / trucks).

3.3.1 Access Routes

Operation and maintenance staff access, much like construction staff, will also depend on where staff live. It is however expected that staff will be from local areas which would likely include Camperdown and Colac to the east and Terang and Warrnambool to the west.

Staff access routes to the proposed BESS facility will therefore be via Princes Highway (from the east or west) and then via Littles Lane and McCrae Street.

3.3.2 Site Access

The proposed McCrae Street site access point is proposed to service both construction phase and operation and maintenance phase related traffic movements.

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4 Car Parking and Access Assessment

4.1 Car Parking

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4.1.1 Statutory Requirement

Statutory requirements for the provision of car parking (under the operation and maintenance phase) are set out in Clause 52.06 of the Corangamite Planning Scheme (the Planning Scheme), with parking rates specified in Table 1 to Clause 52.06-5.

The Planning Scheme does not specifically incorporate a recommended parking rate for a BESS facility (utility installation land use). In such circumstances, the Planning Scheme notes:

In instances where a use is noted specific in Table 1 to Clause 52.06-5 or another provision within the planning scheme, car parking spaces are usually provided to the satisfaction of the responsible authority.

To this end, please refer to Section 4.1.2 for an assessment of anticipated parking demand and parking provision.

4.1.2 Parking Demand Assessment

A total of 15 car parking spaces have been allowed as part of the indicative design on-site during the operation and maintenance phase of the BESS facility. The total number of car parking spaces will be confirmed post permit during the detail design phase following appointment of a preferred BESS supplier.

As noted in Section 3.3, based on information provided by the Proponent, it is understood that up to two (2) staff could be expected to be on-site at any time.

The proposed provision of 15 permanent car parking spaces is therefore considered appropriate for nominal staff demands during the maintenance and operation phase of the BESS facility and also sufficient to accommodate additional parking demands during frequent and regular maintenance and operation activities.

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4.1.3 Parking Layout

Car parking spaces have been allowed with access from the internal access road located along the site's southern frontage. These car parking spaces are recommended to meet the dimensional requirements set out in Clause 52.06-9 of the Planning Scheme (i.e. minimum 2.6m wide x 4.9m long accessed from a 6.4m wide aisle).

The access aisle measures 4m wide and is recommended to be widened to 6.4m (minimum) adjacent the 90° parking spaces.

4.2 Access

As noted previously, primary access to the site is proposed via Princes Highway / Littles Lane, then via Littles Lane / McCrae Street and then via the site's McCrae Street access point. The below sets out an assessment of access via this route and internal access requirements.

In addition to the below access assessment, it is noted that any required traffic management treatments and/or mitigation works are to be identified and addressed by way of an approved TMP. This is the responsibility of the Proponent and would be prepared in consultation with the construction contractor.

4.2.1 Sight Distance

A desktop sight distance assessment has been undertaken at the following intersections in accordance with the requirements of Austroads' *Guide to Road Design* (Part 4A):

- Princes Highway / Littles Lane intersection based on an 80km/hr posted speed limit, and
- Littles Lane railway crossing based on 60km/hr posted speed limit.

The above assessments indicate that available sight distance at these locations meets the minimum requirements set out in the Austroads Guide.

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4.2.2 Princes Highway / Littles Lane

The Princes Highway / Littles Lane intersection appears to be appropriately designed to accommodate 19m semi-trailer trucks (and 19m truck and dog combinations).

Access for the one-off 66kV transformer delivery will need to be confirmed following specific vehicle detail confirmation following appointment of a construction contractor. A desktop spatial assessment (using computer-aided design (CAD)) of the example 105t transformer delivery vehicle indicates that access from Princes Highway to Littles Lane is achievable subject to the intersection being temporarily closed to enable full pavement width swept paths.

4.2.3 Littles Lane Railway Crossing

As described in Section 2.2.2, Littles Lane includes an at-grade boom gate-controlled railway crossing with eight trains per weekday (four in each direction) and six trains per day during the weekend (three trains in each direction).

Heavy vehicle movements across the railway crossing are recommended to be managed appropriately to mitigate any risk of construction vehicles propping or queuing on the railway crossing.

4.2.4 Littles Lane / McCrae Street

Swept Path Assessment

As noted in Section 3.2.1, the majority of vehicles expected to service the site during construction include a size *up to and including* 19m semi-trailer trucks and 19m truck and quad dogs. Specific confirmation of vehicle sizes and impacts will be addressed by way of an appropriate TMP when a construction company is engaged (post permit application).

To this end, concept swept path assessments have been undertaken at this intersection for these vehicles travelling to and from site as follows:

- 19m semi-trailer truck:
 - Figure 10 illustrates right turn from Littles Lane to McCrae Street (entry movement),
 - Figure 11 illustrates left turn from McCrae Street to Littles lane (egress movement), and
 - Figure 14 illustrates left turn from McCrae Street into the site while a 19m semi-trailer props within the site.
- 19m truck and dog:
 - Figure 12 illustrates right turn from Littles Lane to McCrae Street (entry movement), and
 - Figure 13 illustrates left turn from McCrae Street to Littles Lane (egress movement)

Note that existing power poles, pits, check valves and signage (poles) are indicatively shown on each figure.

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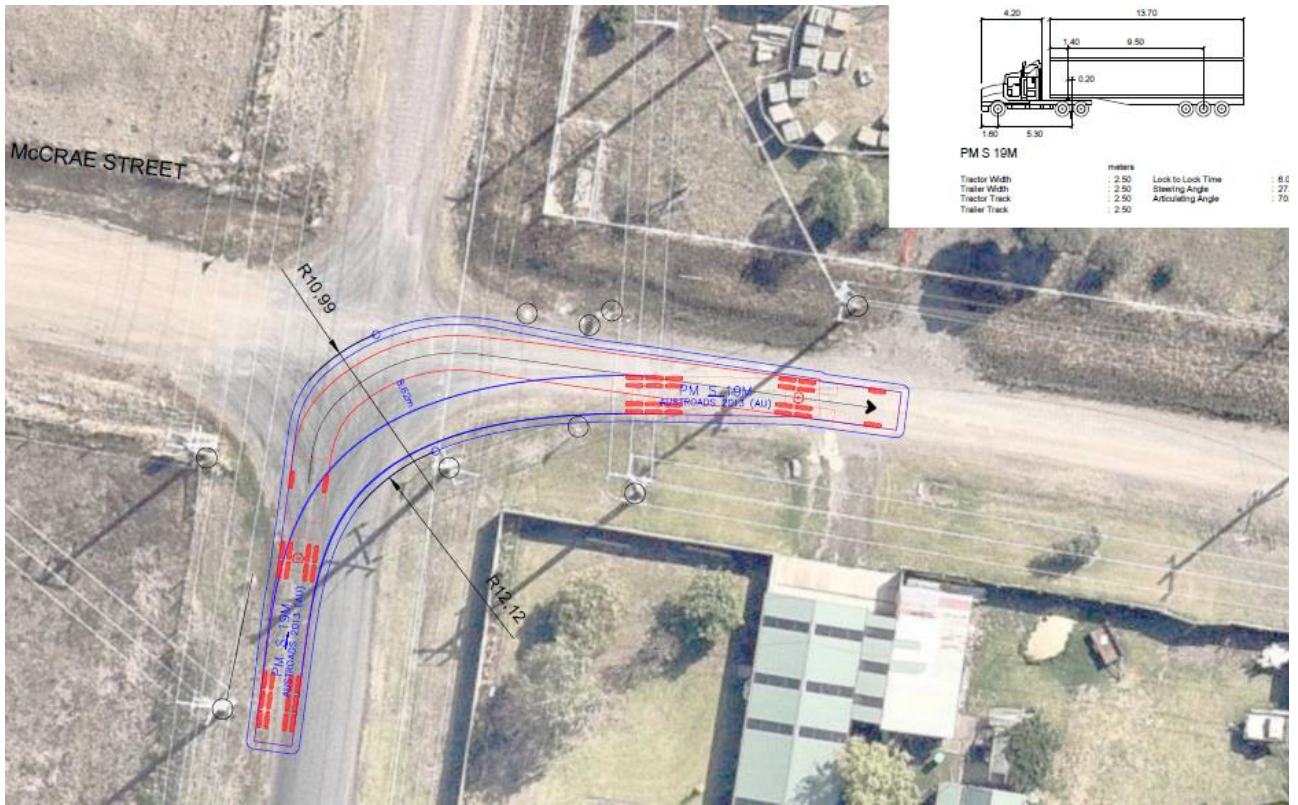


Figure 10 19m semi-trailer swept path (Little's Ln right turn eastbound to McCrae St)

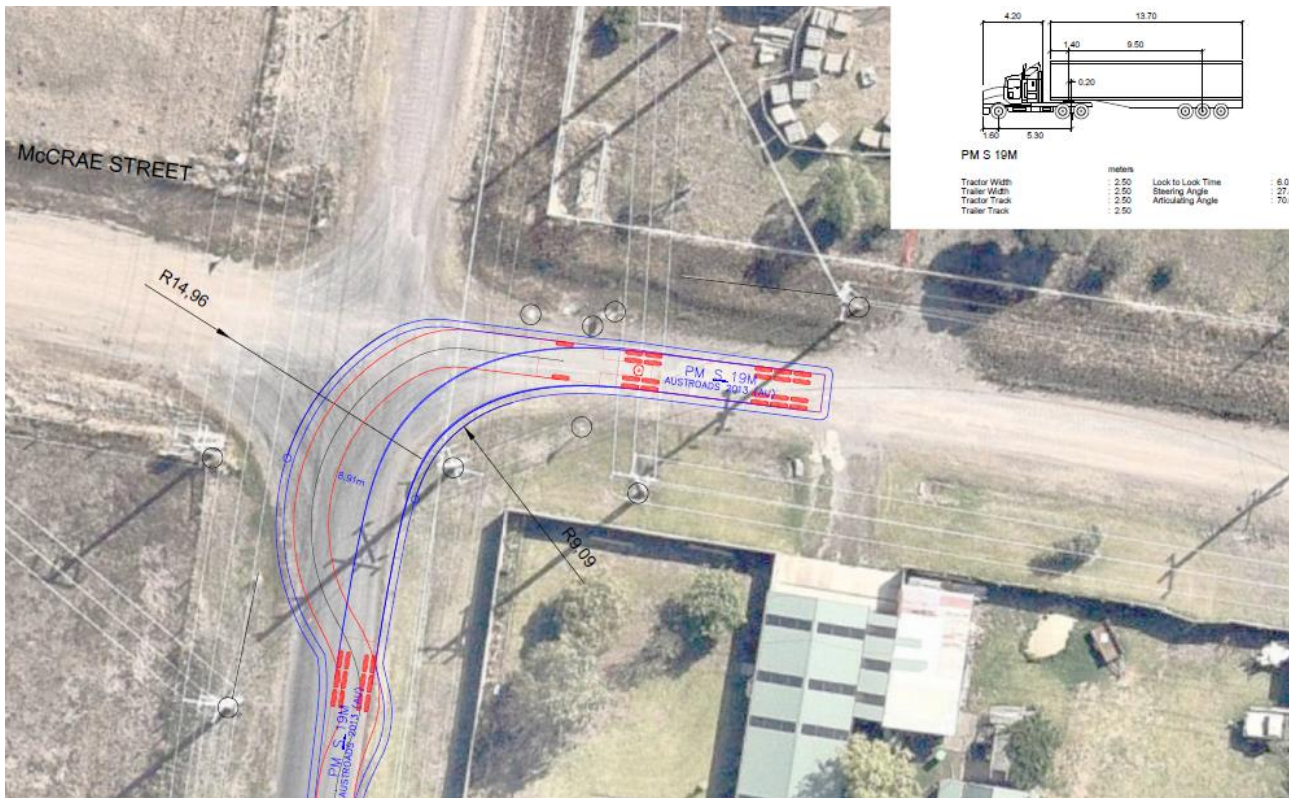


Figure 11 19m semi-trailer swept path (McCrae St left turn southbound to Little's Ln)

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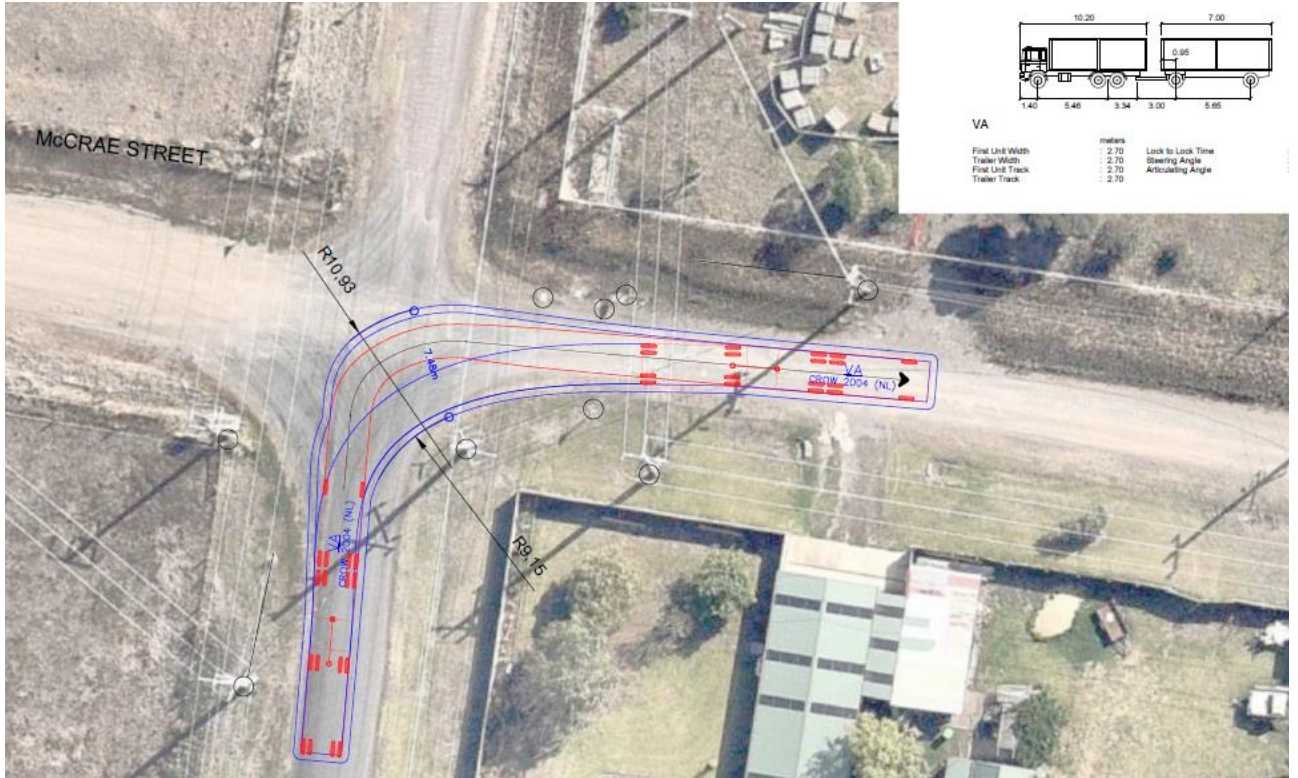


Figure 12 19m Truck and Dog swept path (Littles Lane right turn eastbound to McCrae St)

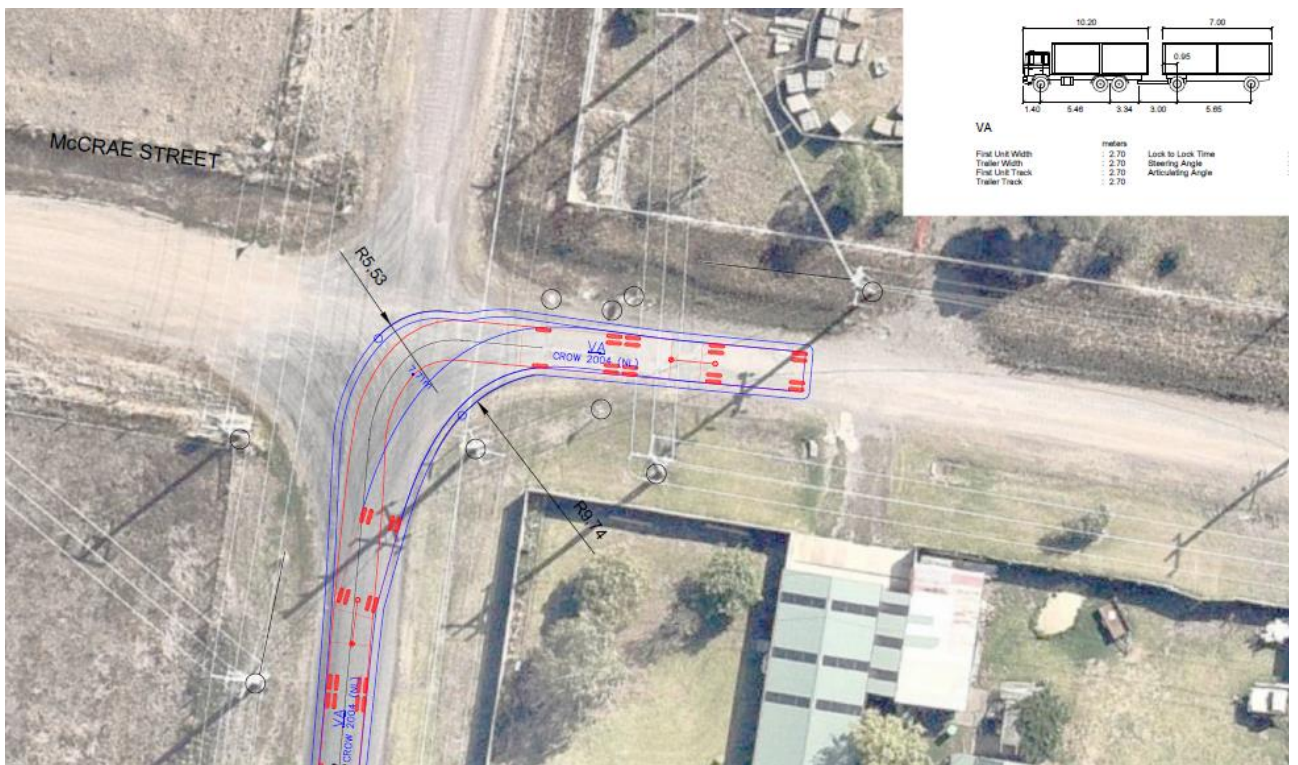


Figure 13 19m Truck and Dog swept path (McCrae St left turn southbound to Littles Ln)

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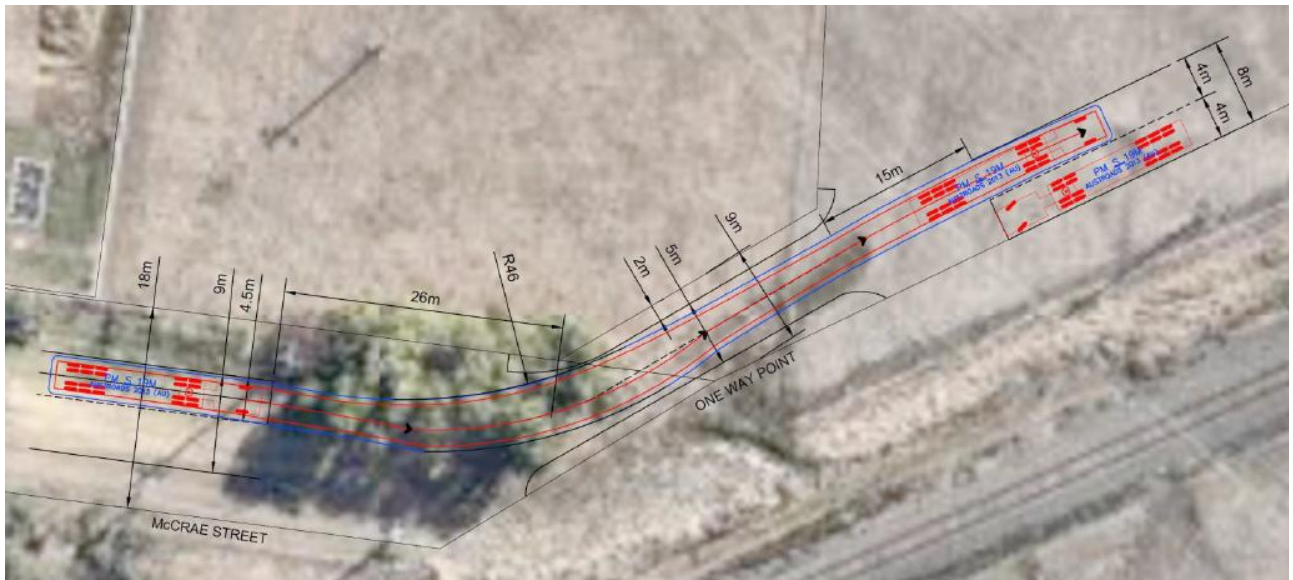


Figure 14 19m semi-trailer swept path (McCrae St left turn into site access)

On the basis of the above assessment, the following is noted and recommended:

- 19m semi-trailer and truck and dog combination trucks are anticipated to appropriately access the site via the proposed access route noting:
 - One-way movements (at a time) are required at the Littles Lane / McCrae Street intersection and at the McCrae Street access intersection at the BESS site as simultaneous movements with cars and/or other trucks are not achievable. These movements must be managed to ensure single vehicle movements at any one time at the intersection.
 - Vehicle movements are, where required, proposed to be managed as outlined above, with vehicles staging on approach to the intersection on Littles Lane and/or McCrae Street. Local road widening (gravel or paved shoulder, pavement widening, etc.) is therefore recommended on both Littles Lane and McCrae Street to provide passing area for management of these truck movements. Any required traffic management treatments and mitigation works are to be identified and addressed by way of an approved TMP.
 - Minor road widening (gravel or paved shoulder, pavement widening, etc.) is recommended at Littles Lane / McCrae Street intersection to accommodate vehicle swept paths as generally shown in the above concept swept path figures. Any required traffic management treatments and mitigation works are to be identified and addressed by way of an approved TMP, and
 - The two-way width on McCrae Street and along the internal access road (as illustrated in Figure 14) allows for vehicles to prop while other vehicles traverse the one-way width pinch point at the site's McCrae Street access point.
- A desktop spatial assessment (using CAD) of the *one-off* delivery of the 66kV transformer indicates:
 - This vehicle is not expected to be able to utilise the primary Littles Lane / McCrae Street access route without significant mitigation works at the Littles Lane / McCrae Street intersection (relocation of power poles, road widening, protection of check valve, pits, civil infrastructure within the verge, sign poles, etc.)
 - An alternate viable access route is therefore recommended (subject to approval from Council and Regional Roads Victoria (RRV) as part of an appropriate TMP) via Princes Highway (High St) / Terang-Mortlake Road and then via Terang-Mortlake Road / McCrae Street and along McCrae Street to site (noting the existing McCrae Street west 8t truck limit). A desktop spatial assessment (using computer-aided design (CAD)) of the example 105t transformer delivery vehicle indicates that his access route is achieved subject to appropriate traffic management and further detailed assessment.

The recommended access route for the one-off delivery of the 66kV transformer is illustrated in Figure 15.

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Figure 15 Recommended Transformer Delivery Route (openstreetmap.org)

The above access routes and required mitigation and management treatments will be confirmed and addressed appropriately by the proposed TMP, including Over Dimension (OD) / Over Size Over Mass (OSOM) vehicle movements.

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Height Clearance

It is noted that the 66 kV delivery vehicle is expected to have a minimum vertical clearance requirement in excess of 5 m (in the order of 5.2 m subject to confirmation of specific dimensional requirements).

It is therefore recommended that available height clearances are confirmed along the relevant access routes including the existing overhead power lines at the Little Lane / McCrae Street intersection (for construction vehicles, transformer delivery and CFA requirements). The Proponent will work with the relevant power company should the low voltage overhead wires require moving during construction.

4.2.5 Dalvui Bess Internal Access

Internal site access is provided by a main 6 m wide access road and two secondary 4 m wide access roads as summarised in Figure 7 in Section 3.1 of this report. The below includes a preliminary assessment of Country Fire Authority (CFA) requirements noting that an Emergency Management Plan (EMP) is expected to be completed in consultation with the CFA after a planning permit has been issued.

CFA Requirements

Internal access to the proposed BESS facility is expected to comply with the access requirements of the CFA, noting the following compliances and/or recommended changes. The Proponent will ensure these requirements will be reflected in the Project's detail design phase in consultation with the CFA once a preferred BESS supplier is chosen.

- CFA guidelines require a perimeter road for CFA appliances (vehicles) access to the entire site. While a perimeter road around the whole BESS facility is not currently proposed, subject to CFA approval a number of internal access roads are provided in addition to the southern boundary perimeter road (primary road access) which provides access to the various parts of the BESS facility.

- It is recommended that proposed internal access roads are sealed and comprise 'all-weather construction' and be able to accommodate 15 tonne CFA appliances (vehicles).
- Internal access roads comprise a min. 4 m trafficable width with a clear min. 4 m vertical clearance.
- Average grades are expected to be less than 1:7 with a max. 1:5 for no more than 50 m.
- Proposed internal access roads are expected to have dips of no more than 1:8 (sag and summit grades).
- The main internal access road is sufficiently wide (6 m) to allow two vehicles to pass (and effectively provide required 20 m x 6 m 'passing bays'). The remainder of secondary internal access roads comprise 4 m wide carriageways, however are sufficiently short that dedicated passing bays are not required under CFA guidelines.
- CFA guidelines require a minimum of two access points for CFA appliances (vehicles) to access the BESS facility. In this instance, one access is proposed via McCrae Street (noting the site's limited McCrae Street frontage), and a second 'emergency only' gated access will be determined during detailed design, however is possible at the north-east corner of the site.

Notwithstanding the above, it is recommended that an EMP be prepared in consultation with the CFA and other relevant stakeholders.

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5 Traffic Impact Assessment

5.1 Traffic Generation

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5.1.1 Construction Phase

Based on information provided by the Proponent, construction of the proposed BESS facility is understood to generate the following *peak* traffic movements during *peak* construction activities as summarised below and illustrated in Figure 16:

- 35 light vehicle one-way ('in' or 'out') vehicle movements per day, and
- 6 heavy vehicle (truck) one-way ('in' or 'out') vehicle movements per day.

This equates to a total of 41 'in' or 'out' movements over an entire day (i.e. one-way movements), or 82 'in' and 'out' movements over an entire day (i.e. total two-way movements).

It is noted that during non-peak construction activities, construction related traffic movements are expected to be significantly less.

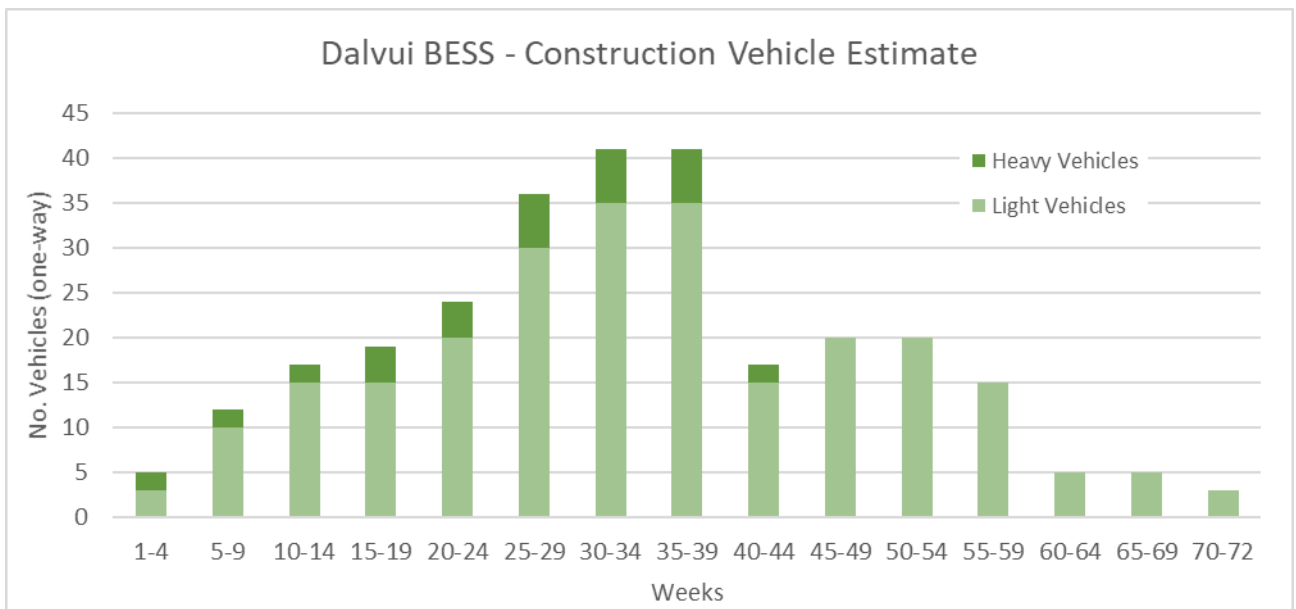


Figure 16 Dalvui BESS - Construction Vehicle Estimate (daily)

A 'worst-case' scenario of 18 month construction period has been assumed for the Project, a detailed construction program will be developed during the detailed design of the Project.

5.1.2 Operational and Maintenance Phase

As noted previously, BESS facilities are usually monitored remotely in real-time and do not require dedicated staff to be on-site. Staff are however required to access the site from time to time for inspections and maintenance activities. Based on information provided by the Proponent, it understood that up to two (2) staff could normally be expected to be on-site at any time.

On this basis, up to two entry and egress movements per day (two 'in' and two 'out') could be expected to be generated by the proposed BESS facility during normal operation, as well as occasional ad-hoc deliveries.

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5.2 Traffic Distribution

5.2.1 Construction Phase

For the purposes of this assessment, the following directional distributions have been assumed:

- 50% of the light vehicle traffic will be accessing the site to/from the east and 50% to/from the west (from Princes Highway), and
- 100% of the heavy vehicle traffic will be accessing the site to/from the east (from Princes Highway).

In addition, the following entry / exit splits ('in' / 'out' splits) have been conservatively (on the high side) assumed:

- AM Peak:
 - 95% of the light vehicles enter the site,
 - 5% of light vehicles leave the site, and
 - 100% heavy vehicle enter the site.
- PM Peak:
 - 5% of light vehicles enter the site,
 - 95% of light vehicles leave the site, and
 - 100% of heavy vehicles leave the site.

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The above is considered highly conservative as it assumes all two-way entry and exit movements (82 vpd) occur in two hours of the day (AM peak hour and PM peak hour).

Realistically, movements to and from the site will be spread further across the day with concentrated movements during the AM peak period and PM peak period.

5.2.2 Operational and Maintenance Phase

It is assumed that the staff directional distribution is the same as the construction phase, that is, 50% of the light vehicle traffic will be accessing the site to/from the east and 50% to/from the west.

It is also assumed that all 'in' movements occur in the AM peak hour and all 'out' movements occur in the PM peak hour (2 vph 'in' in the AM and 2 vph 'out' in the PM).

5.3 Impact Assessment

The performance measures adopted to assess the mid-block performance of the external road network (Princes Highway leads to the subject site) are *Level of Service* (LOS) and *Volume over Capacity Ratio* (V/C Ratio (DOS)).

- LOS is defined in the Austroads *Guide to Traffic Management* (Part 3) as a quantitative measure for ranking operating conditions, based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience.

LOS is rated from A (best, free flow conditions) to F (worst, breakdown in vehicle flow, congestion). LOS 'C' is considered a minimum desirable service level for both metropolitan fringe and rural areas.

Mid-block LOS levels for V/C Ratios have been adopted from the *Highway Capacity Manual* (2010).

- V/C Ratio is broadly defined as the volume versus the available capacity (sometimes referred to as DOS) and is calculated by dividing the total one-way volume on a road by the road's mid-block vehicle capacity based on lane types defined in Austroads *Guide to Traffic Management* (Part 3). For the purposes of this assessment, lane capacities of 900 vehicles per hour in each direction of travel have been assumed (based on a two-lane undivided carriageway).

On the above basis, an assessment of construction phase and maintenance and operation phase related traffic movements is included in the following section below.

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5.3.1 Construction Phase

An estimate of the additional traffic volumes generated during the construction phase is presented in Table 5 following the assumptions discussed in Section 5.1 and 5.2.

Table 5 Additional Traffic Volume – Construction Phase Assessment

| Direction | Additional Traffic Volume | |
|--------------|---------------------------|---------|
| | AM Peak | PM Peak |
| Entry (in) | 39 vph | 2 vph |
| Egress (out) | 2 vph | 39 vph |

vph (vehicles per hour (approximate))

These additional demands will access the site via Princes Highway, Littles Lane and McCrae Street to the McCrae Street site access.

It is noted that the peak hour traffic volume assessments below are considered *highly conservative* as construction work movements and construction vehicle and delivery movements are also expected to occur before and after the road network peak hours, also spread out over the day.

Notwithstanding, as noted previously it is recommended that any necessary traffic management treatments are documented and approved as part of an appropriate TMP.

Princes Highway

Table 6 below sets out a mid-block LOS assessment of Princes Highway combining the existing and additional demand during the construction phase.

Table 6 Princes Highway – Existing and Construction Phase Assessment

| Direction | Existing AM | | Construction AM | | Existing PM | | Construction PM | |
|-----------|-------------|-----|-----------------|-----|-------------|-----|-----------------|-----|
| | Volume | LOS | Volume | LOS | Volume | LOS | Volume | LOS |
| Eastbound | 181 vph | A | 199 vph | A | 220 vph | A | 244 vph | A |
| Westbound | 174 vph | A | 198 vph | A | 184 vph | A | 202 vph | A |

vph (vehicles per hour (approximate))

Table 6 above indicates that under a conservative assessment, the anticipated peak construction related traffic movements result in a net zero impact to operational service levels along Princes Highway (LOS A).

Littles Lane

Table 7 below sets out a mid-block LOS assessment of Littles Lane combining the existing and additional demand during the construction phase.

Table 7 Littles Lane – Existing and Construction Phase Assessment

| Direction | Existing AM | | Construction AM | | Existing PM | | Construction PM | |
|------------|-------------|-----|-----------------|-----|-------------|-----|-----------------|-----|
| | Volume | LOS | Volume | LOS | Volume | LOS | Volume | LOS |
| Northbound | 4 vph | A | 43 vph | A | 17 vph | A | 19 vph | A |
| Southbound | 17 vph | A | 19 vph | A | 4 vph | A | 43 vph | A |

vph (vehicles per hour (approximate))

Table 7 above indicates that under a conservative assessment, that while the peak construction related traffic movements increase the total traffic flows on Littles Lane, as the existing and additional traffic volume are both relatively low there is a net zero impact to operational service levels along Littles Lane (LOS A).

Notwithstanding, reference is made to Clause 56 of the Planning Scheme which indicates that Littles Lane could be considered to be classified as an 'Access Street Level 1' Road and therefore has an amenity-based capacity of 1,000-2,000 vehicle movements per day.

On this basis, traffic volumes on Littles Lane are expected to remain well within its amenity-based capacity at approximately 300 vehicle movements per day during the construction phase (approximate).

McCrae Street

Table 8 below sets out a mid-block LOS assessment of McCrae Street combining the existing and additional demand during the construction phase.

Table 8 Macrae Street – Existing and Construction Phase Assessment

| Direction | Existing AM | | Construction AM | | Existing PM | | Construction PM | |
|-----------|-------------|-----|-----------------|-----|-------------|-----|-----------------|-----|
| | Volume | LOS | Volume | LOS | Volume | LOS | Volume | LOS |
| Eastbound | 3 vph | A | 42 vph | A | 10 vph | A | 12 vph | A |
| Westbound | 10 vph | A | 12 vph | A | 3 vph | A | 42 vph | A |

vph (vehicles per hour (approximate))

Table 8 above indicates that under a conservative assessment, that while the peak construction related traffic movements increase the total traffic flows on McCrae Street, as the existing and additional traffic volume are both relatively low there is a net zero impact to operational service levels along Littles Lane (LOS A).

Notwithstanding, reference is made to Clause 56 of the Planning Scheme which indicates that McCrae Street could be considered to be classified as an 'Access Street Level 1' Road and therefore has an amenity-based capacity of 1,000-2,000 vehicle movements per day.

On this basis, traffic volumes on McCrae Street are expected to remain well within its amenity-based capacity at approximately 200 vehicle movements per day during the construction phase (approximate).

5.3.2 Operational and Maintenance Phase

During normal activities during the operation and maintenance phase up to two staff could be expected on-site which is expected to result in two vehicle movements 'in' in the AM and two vehicle movements 'out' in the PM.

Against existing volumes on McCrae Street, Littles Lane and Princes Highway, the Project's additional vehicle movements generated under the operation and maintenance phase (4 vpd), could not be expected to notably impact the capacity or safety of the surrounding road network.

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6 Summary

On the basis of the above discussions and analysis, the following is summarised:

- a) Three port options (Portland port, Melbourne port and Geelong port) are feasible with several convenient heavy vehicle approved access routes exist for access to the Project.
 - b) The indicative 15 permanent car parking spaces that have been allowed is considered appropriate in accordance with Clause 52.06 of the Planning Scheme and anticipated operation and maintenance phase staff parking demands. The total car parking provision will be confirmed during the detail design phase following appointment of a preferred BESS supplier and development of the final layout.
 - c) The proposed parking layout accords with the requirements of Clause 52.06 of the Planning Scheme subject to widening the car park access aisle to 6.4 m.
 - d) Construction (and operation and maintenance) phase vehicles are expected to appropriately access the site via Princes Highway, Littles Lane and McCrae Street noting the following:
 - o 19m semi-trailer trucks and 19m truck and dog combination trucks are expected to be able to access the site via the proposed access route noting proposed minor mitigation works and traffic management treatments discussed in Section 4.2.4,
 - o The largest and one-off delivery of the 66 kV transformer (prime mover and multiple axle low platform trailer) is recommended to occur via Princes Highway (High St) / Terang-Mortlake Road and then via Terang-Mortlake Road / McCrae Street and along McCrae Street to site (subject to Regional Road Victoria (RRV) and Council approval), and
 - o It is recommended that available height clearances are confirmed along the relevant access routes include the existing overhead power lines at the Littles Lane / McCrae Street intersection.
- Notwithstanding the above, any required traffic management treatments and mitigation works are to be identified and addressed by way of an approved TMP.
- e) The Project is expected to comply with access requirements of the CFA. An EMP is recommended to be completed in consultation with the CFA under the next phase of the Project.
 - f) The proposed BESS facility is estimated to generate the following vehicle movements during the *construction phase* during the peak construction period:
 - o 35 light vehicle one-way movements per day (total 70 vehicle movements per day), and
 - o 6 heavy vehicle one-way movements per day (total 12 vehicle movements per day).
 - g) The proposed BESS facility is estimated to generate the following vehicle movements during the *operation and maintenance phase*:
 - o 4 light vehicle movements per day (2 'in' in the AM and 2 'out' in the PM).
 - h) Against existing traffic volumes on Princes Highway, Littles Lane and McCrae Street;
 - o Construction phase vehicle movements are expected to have a net zero to impact to operation service levels along these roads,
 - o Construction phase vehicle movements are expected to result in traffic volumes on Littles Lane and McCrae Street to remain well within their respective amenity-based capacities nominated in the Planning Scheme, and
 - o Operation and maintenance vehicle movements are not expected to notably impact the capacity of safety of these roads (and the surrounding road network).

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Document prepared by

Aurecon Australasia Pty Ltd

ABN 54 005 139 873

Aurecon Centre

Level 8, 850 Collins Street

Docklands, Melbourne VIC 3008

PO Box 23061

Docklands VIC 8012

Australia

T +61 3 9975 3000

F +61 3 9975 3444

E melbourne@aurecongroup.com

W aurecongroup.com

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