

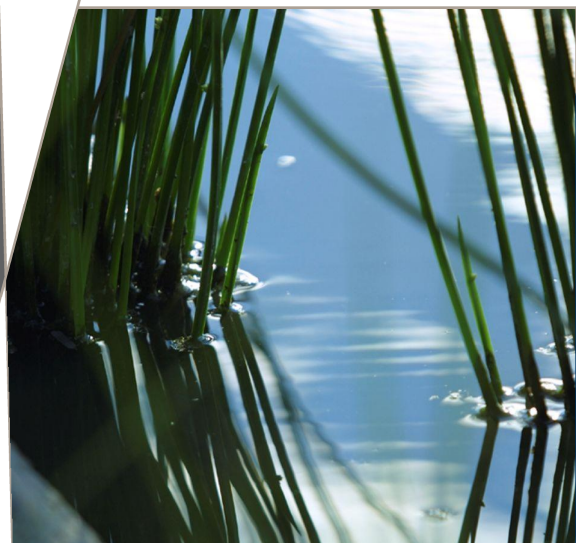
Traffic Impact Assessment

Tallawarra Lands

8201714202

Prepared for
BridgeHill Group

18 April 2019 (rev 4)



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1 Introduction

1.1 Overview

Cardno has been commissioned by BridgeHill Group to undertake a traffic impact study to assess the traffic impact of the proposed increase in development yield of the Tallawarra Lands site.

The BridgeHill Group have acquired some of the Tallawarra Lands in the Northern and Central Precincts from Energy Australia, and intend to develop new residential communities and a light industrial development and tourism facilities on those lands.

The Tallawarra Power Station (Stages A & B) is retained by Energy Australia, as well as surrounding buffer lands, and the Lakeside Precinct (south of Yallah Road).

Concept Approval (MP09_0131) was granted on 23 May 2013 by the Planning Assessment Commission as a delegate for the Minister for Planning and Infrastructure for a mixed use development including residential, commercial, industrial and retail development, public open space areas, new recreational facilities, environmental management, conservation areas and riparian corridors at Tallawarra Lands, Yallah. The approved concept plan is shown in **Figure 1-1** overleaf.

The proposed modification seeks to:

- > Increase the footprint for residential development in the Central and Northern precincts; and
- > Modify the overall approved residential yield from 1,010 to 1,494 lots.

This traffic study was undertaken in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the Department of Environment and Planning (DPE) on 23 January 2017. In particular, the investigations take into consideration any potential impacts to the proposed Albion Park Rail Bypass (APRB) scheme.



Figure 1-1 Tallawarra Lands Approved Concept Plan

1.2 Scope of Works

The main objective of this study is to evaluate the traffic impacts generated by the modified land use scheme, namely the proposed increase in residential yield. The scope of works for this study includes:

- > Reviewing and collating background documents in relation to the Tallawarra Lands revised development yield, land use assumptions and access arrangements;
- > Undertake traffic modelling analysis using the traffic models supplied by Roads and Maritime Services (Roads and Maritime) and previously used to inform the APRB design. The models were edited to reflect the updated development yield for Tallawarra Lands (Northern Shore and Central precincts).
- > Assess the impact of traffic associated with the cumulative impact of the revised development of the Northern and Central precincts of Tallawarra Lands.

1.3 Reference Documents

- > Tallawarra Lands Traffic Impact Assessment, February 2011;
- > Tallawarra Lands, Yallah: Request for Secretary's Environmental Assessment Requirements, November 2016;
- > Tallawarra Lands Economic Property Research Report, July 2017

2 Existing Conditions

2.1 Study Area

The Tallawarra Lands site is situated on the western foreshore of Lake Illawarra adjacent to the West Dapto release area (Local Government Area of Wollongong) and lies east of the M1 Princes Motorway as seen in **Figure 2-1**.

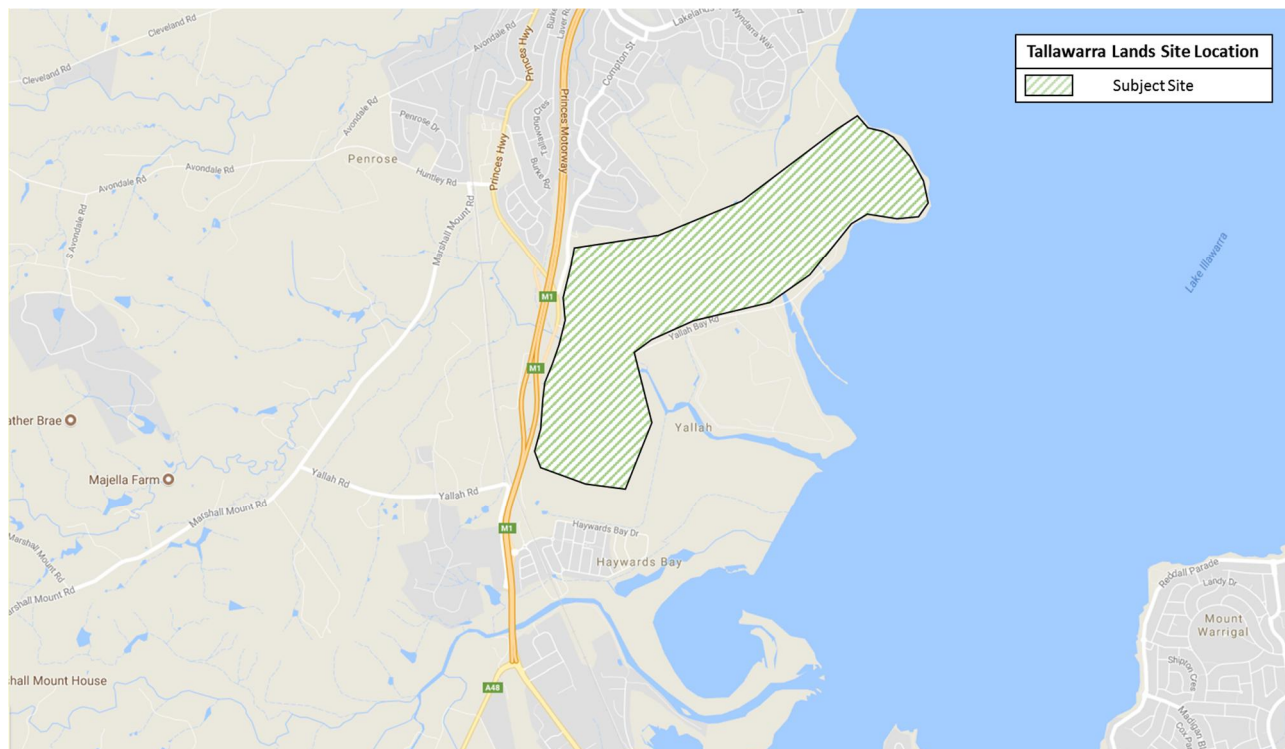


Figure 2-1 Tallawarra Lands Site Location

Source: DFP Planning consultants

2.2 Existing Access Arrangements

The study area is currently accessed through Yallah Bay Road, just north of Duck Creek and Gilba Road. The road network that currently surrounds the Tallawarra Lands site is comprised of the following strategic and local roads:

- M1 Princes Motorway, situated west of the subject site;
- Princes Highway;
- Cormack Avenue;
- Yallah Bay Road, currently providing east-west access from Princes Highway to the Tallawarra Power Station and foreshore areas;
- Gilba Road, which provides access to the northern area of the site via Koonawarra.

3 Land Use Modifications

3.1 Existing and Proposed Land Use

The full development of Tallawarra Lands is divided into three precincts (north shore, central and southern/Lakeside precinct) as illustrated in **Figure 3-1** below.



Figure 3-1 Approved Concept Plan

The increase in development is proposed to occur within the Central and Northern precincts with no changes to the Southern/Lakeside precinct as this area is to be retained in the ownership of Energy Australia. The overall increase is approximately 450 lots, resulting in a total number of dwellings of 1,494 lots compared to the existing Approved Concept Plan of 1,010 lots. **Table 3-1** below shows a breakdown of the number of lots to be developed between the three various precincts for the approved and modified cases. The corresponding land use occupation of the residential development will comprise 291,700 sq. meters of land.

Table 3-1 Approved and Proposed Residential Development Modifications

Item	Approved Concept Plan	Proposed Modifications
Central precinct	350 Lots	572 Lots
Northern Shore precinct	310 Lots	572 Lots
Southern/Lakeside precinct	350 Lots	350 Lots
Total	1,010 Lots	1,494 Lots

TRACKS traffic flow plots comparing the old residential yield of 1,010 lots to the proposed yield of 1,494 lots were produced to identify changes in trip demand and traffic assignment (2041 design horizon year without the Northern Interchange in place). These plots are documented in **Appendix A**.

Energy Australia currently owns the land occupying the Southern/Lakeside precinct. Energy Australia representatives have confirmed that this development will not be in place by 2026 and most unlikely by 2041. As part of the traffic modelling stage, the above assumption has been considered and included in the models accordingly. Additional scenarios were also modelled in order to assess the impact that the 350 lots of the Southern/Lakeside precinct would have on the traffic network. The modelling behind these scenarios replicate a more conservative approach as it assumes the full development of all three precincts (north, central and Lakeside).

3.2 Development Details

Development in the Tallawarra Lands site is proposed to comprise a variety of land uses. These include:

- **4,400 sq. m GFA of retail**, including cafes, restaurants and kiosks, specialty retail and one supermarket;
- **Medical centre** (550 sq.m GFA);
- **Clubhouse** (300 sq. m GFA);
- **Child care centre** (550 sq. m GFA);
- **196 hectares of open public space**, including town plazas, playground, central park, environmental conversion areas, artificial beach, boardwalk and wharf area and a 2.6 km lakeshore sculpture walk;
- **20.3 hectares for industrial uses**, comprising warehousing and trade units;
- **1,494 lots (291,700 sq. m GFA)**, including apartments, houses and terraces.

Detailed development layout for the central and northern precincts is illustrated in **Figure 3-2** and **Figure 3-3** respectively.

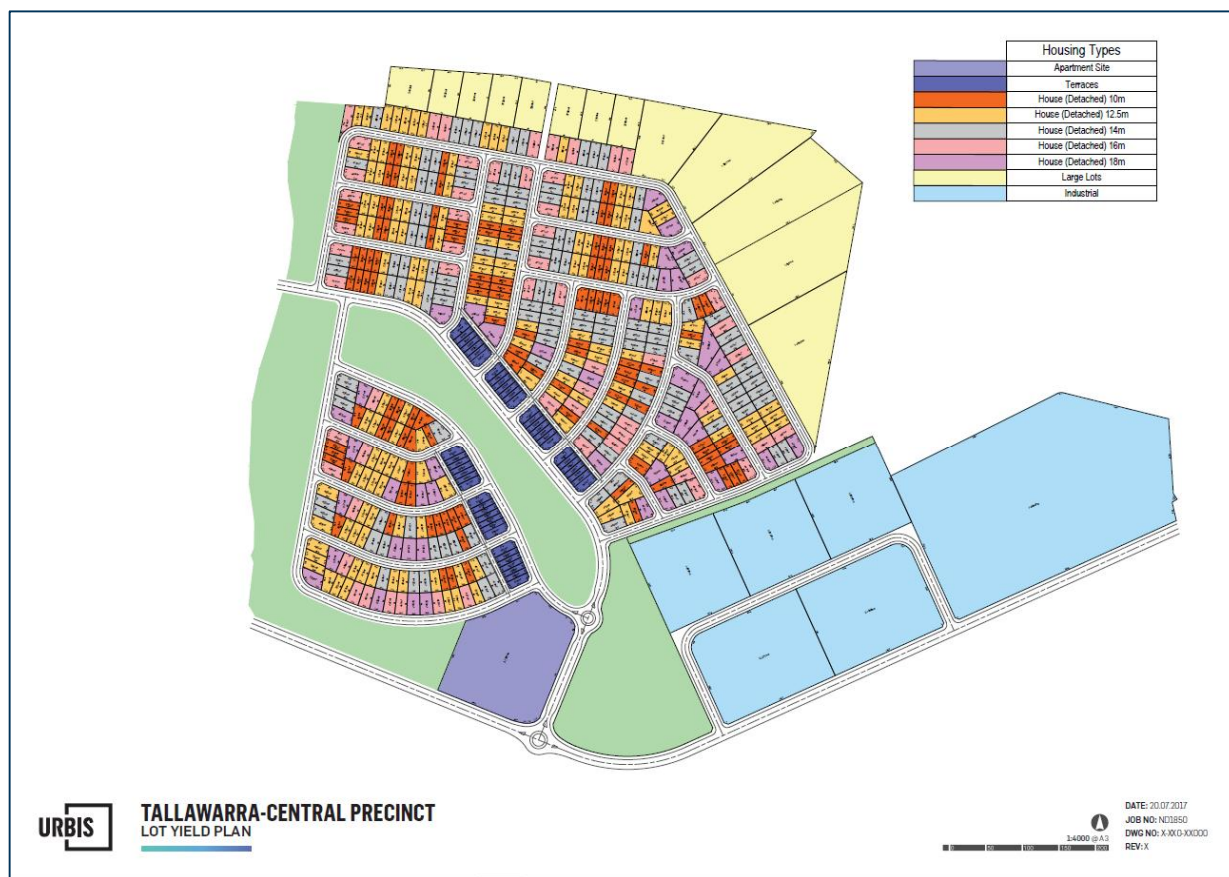


Figure 3-2 Central Precinct Lot Yield Layout
Source: Tallawarra Lands Economic Property Research, July 2017

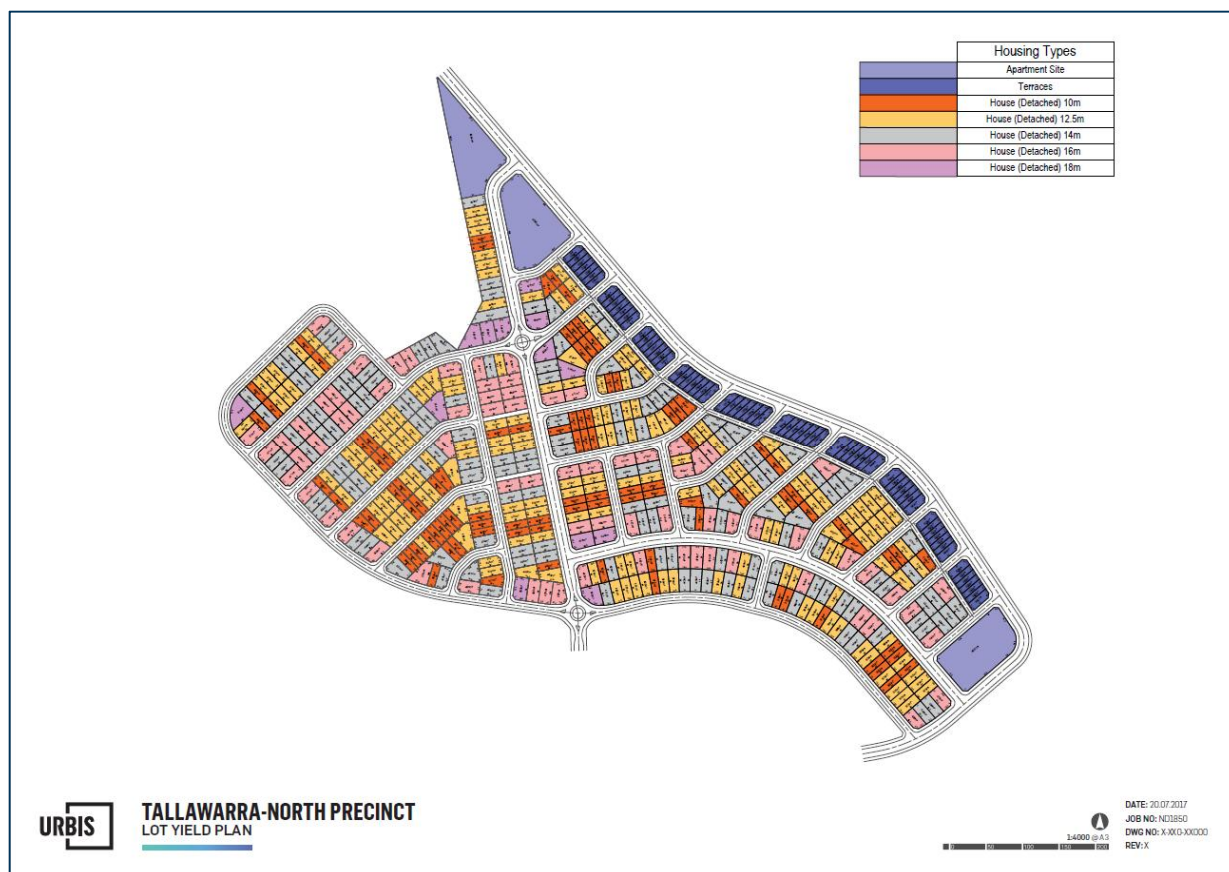


Figure 3-3 North Precinct Lot Yield Layout
Source: Tallawarra Lands Economic Property Research, July 2017

3.3 TRACKS Trip Generation Changes

3.3.1 Overview

The methodology adopted for this assessment consisted of firstly updating the WOLSH TRACKS model in accordance with the land use assumptions described above. The WOLSH TRACKS is a three-step generation, distribution and assignment model which covers the whole of the Illawarra Region. **Figure 3-4** shows the model extent and the Tallawarra Lands site in the context of the model.

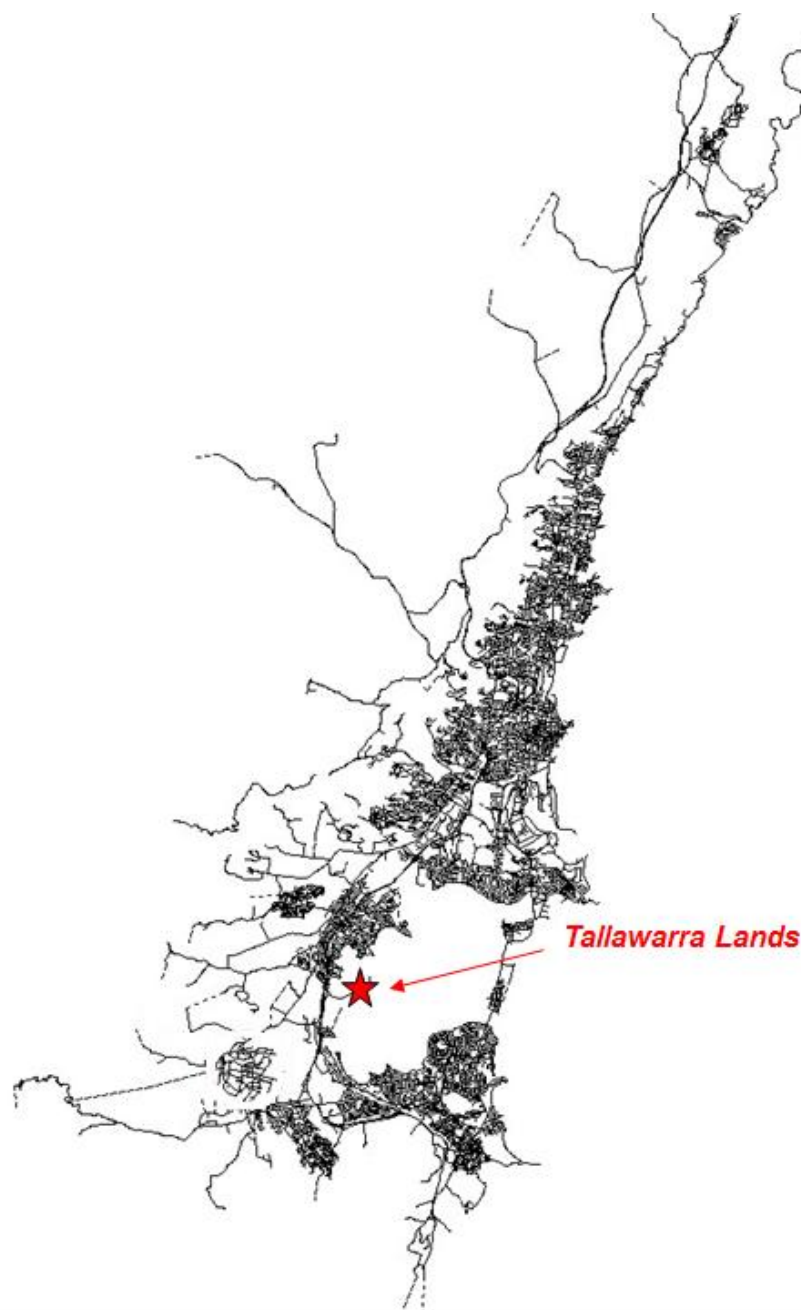


Figure 3-4 WOLSH TRACKS Model Extent

The purpose of the TRACKS model update is to extract traffic demand outputs in the form of origin destination matrices that are compatible with the AIMSUN model used in the detailed assessment (described in more detail below). This is identical to the approach adopted by Roads and Maritime as part of the APRB design development.

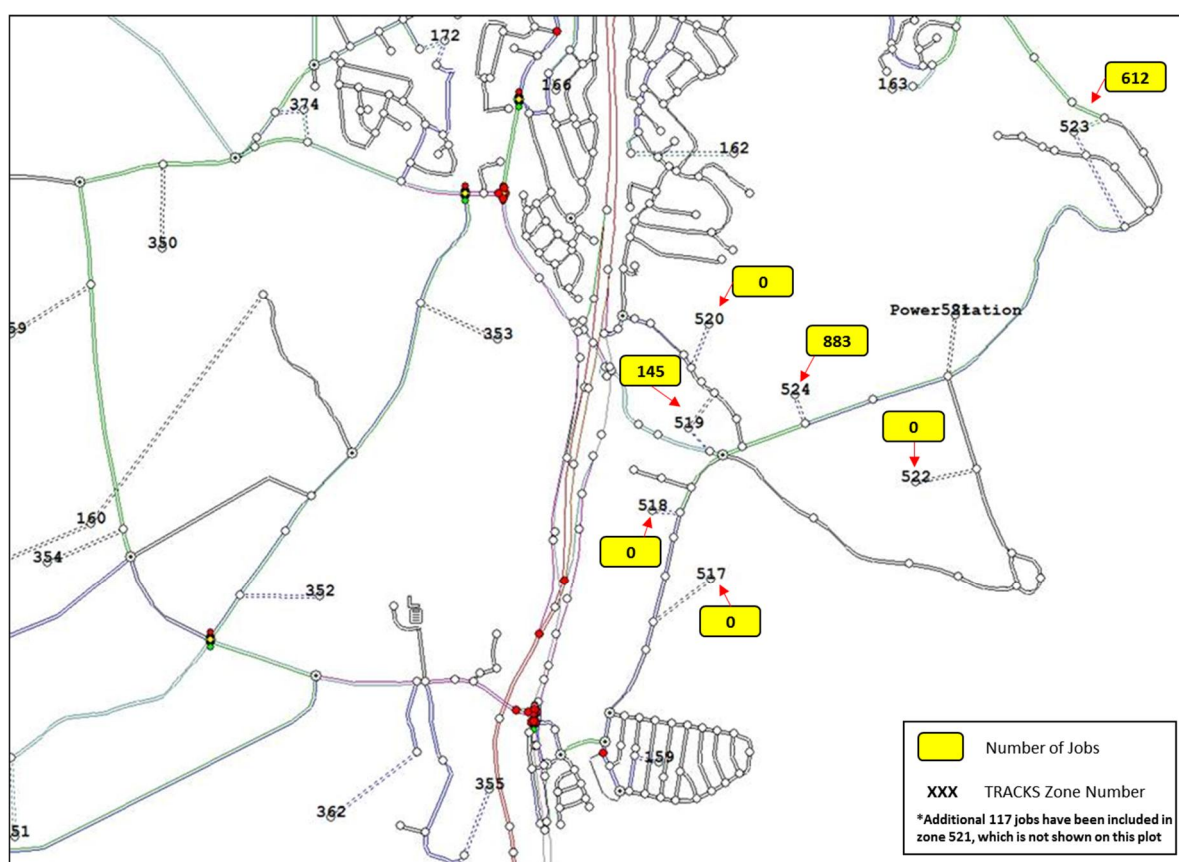
3.3.2 Employment and Residential Yield Update in TRACKS

Based on the economic property research developed by URBIS (Tallawarra Lands Economic Property Research, July 2017), the operations of the non-residential components of the Tallawarra Lands development will generate 2,760 jobs of which 1,640 would be direct and 1,121 indirect jobs.

For the modelling component of this assessment, only the direct jobs were considered given that indirect jobs are generally created elsewhere as a consequence of the development generating more work for other service organisations. In addition, these indirect jobs would have been included in the overall regional employment growth applied in TRACKS for the 2026 and 2041 design horizon years.

The indirect jobs have been spread throughout the background growth in regional jobs included in the future year models. Jobs in the future models were made up of specifically identified areas of job growth, mainly associated with the developments in Port Kembla, West Dapto, Calderwood, Tallawarra etc, and a general increase in jobs distributed throughout the model on a pro-rata basis to maintain a realistic employment to population ratio.

The figure below illustrates how the employment numbers were distributed in the various zones of the TRACKS model for the purpose of the land use update.



3.3.3 Study Area Access in TRACKS

Based on the the background document review, Cormack Avenue is proposed to be closed for general traffic between the section of Princes Highway and the northern entrance of the Central precinct. Access to the Princes Highway would be deviated through the central precinct and as a result, additional traffic would use Yallah Bay Rd.

For traffic modelling purposes, Cormack Avenue was maintained connected to the Princes Highway (as per the existing configuration). As described in Chapter 4, some of the scenarios evaluated included the “APRB northern interchange” and in these cases, Cormack Avenue was connected to the southbound motorway off-ramp. This is discussed in more detail below and illustrated in **Figure 4-2**.

The Yallah Bay Rd/Princes Hwy intersection was tested as a give-way priority junction and the indicative results show that the intersection would be performing satisfactorily. However, an upgrade on the intersection type from give-way to roundabout would most probably occur, as it would provide additional capacity and improved safety, especially for heavy vehicles and/or traffic turning right to Yallah Bay Road.

The TRACKS model also includes an access to the Tallawarra Lands via an extension of the current Gilba Road alignment.

Appendix B illustrates the trip generation/attraction around the Tallawarra Lands TRACKS zones based on the assumptions outlined above. It must be noted that the outputs shown in **Appendix B** must be read in conjunction with the scenario definition outlined in Chapter 4.

4 Traffic Assessment

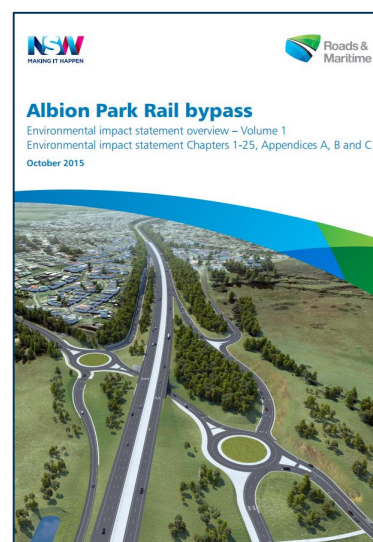
4.1 Methodology

4.1.1 APRB Background Information

The Princes Highway is the main north–south transport corridor linking Sydney and Wollongong to the NSW south coast and north-eastern Victoria. The highway is an important commuter, freight, bus and tourist route for the south coast. The section of the highway between Yallah and Oak Flats is also used as a local route for areas such as Albion Park, Albion Park Rail, Oak Flats, Yallah and Dapto.

Roads and Maritime is planning for an extension of the M1 Princes Motorway between Yallah and Oak Flats to bypass Albion Park Rail, also known as the Albion Park Rail bypass. The bypass would complete the ‘missing link’ for a high standard road between Sydney and Bomaderry. It would provide easy access to Dapto, Albion Park and Oak Flats. The bypass would reduce travel times for through and local traffic, improve the reliability of journeys through greater flood immunity and provide more consistent driving conditions. It would also divert a substantial proportion of through traffic onto the new motorway, reducing traffic volumes on the A1 Princes Highway through Albion Park Rail. This would improve local amenity and access, and reduce other traffic related impacts such as noise for nearby residents. The full construction of the bypass is assumed to be completed by 2021.

The previous report, Environmental Impact Statement Technical Paper 1 – Traffic and Transport, October 2015 (Hyder Cardno Joint Venture, 2015) details potential traffic and transport impacts of the project. The EIS (including the Traffic and Transport technical paper) was placed on public exhibition for community and stakeholder comment between October and November 2015. The EIS details the key construction and operational impacts including issues associated with traffic and transport, biodiversity, socio-economic, flooding and noise.



4.1.2 APRB Traffic Models

Subsequent to the 2015 Traffic and Transport report and EIS, Roads and Maritime developed APRB TRACKS and AIMSUN models for 2026 and 2041 design year horizons and tested a number of different options for each year.

The traffic modelling used to test the proposed yield modifications to the Tallawarra Lands site used the APRB AIMSUN models, which have been described as robust and fit-for-purpose and were officially issued by Roads and Maritime for the sole purpose of assessing traffic impacts of the Tallawarra Lands development. The following models have been used for this assessment:

- 2026 APRB Interim Stage 1: Scheme assessment 5 years after opening year without the Northern Interchange in place;
- 2026 APRB Interim Stage 2: Scheme assessment 5 years after opening year with the Northern Interchange in place;
- 2041 APRB Concept Design Stage 1: Scheme assessment 20 years after opening year without the Northern Interchange in place;
- 2041 APRB Design for Approval: Scheme assessment 20 years after opening year with the Northern Interchange in place.

4.1.3 TRACKS and AIMSUN Matrix Development Modifications

TRACKS is defined as a macroscopic or strategic level model, using land use forecasts to generate future year traffic volumes across a wide geographical area. It is a reliable resource to best forecast future route choice/trip assignment. However, TRACKS does not provide detailed outputs at a finer level to indicate road network behaviour.

AIMSUN modelling software has wide functionality and can simultaneously model at a strategic and microscopic level. This is advantageous because traffic demand from the TRACKS model can be imported directly into AIMSUN in the form of trip matrices. **Figure 4-1** shows the difference in network coverage between the TRACKS strategic model and APRB AIMSUN micro-simulation model.

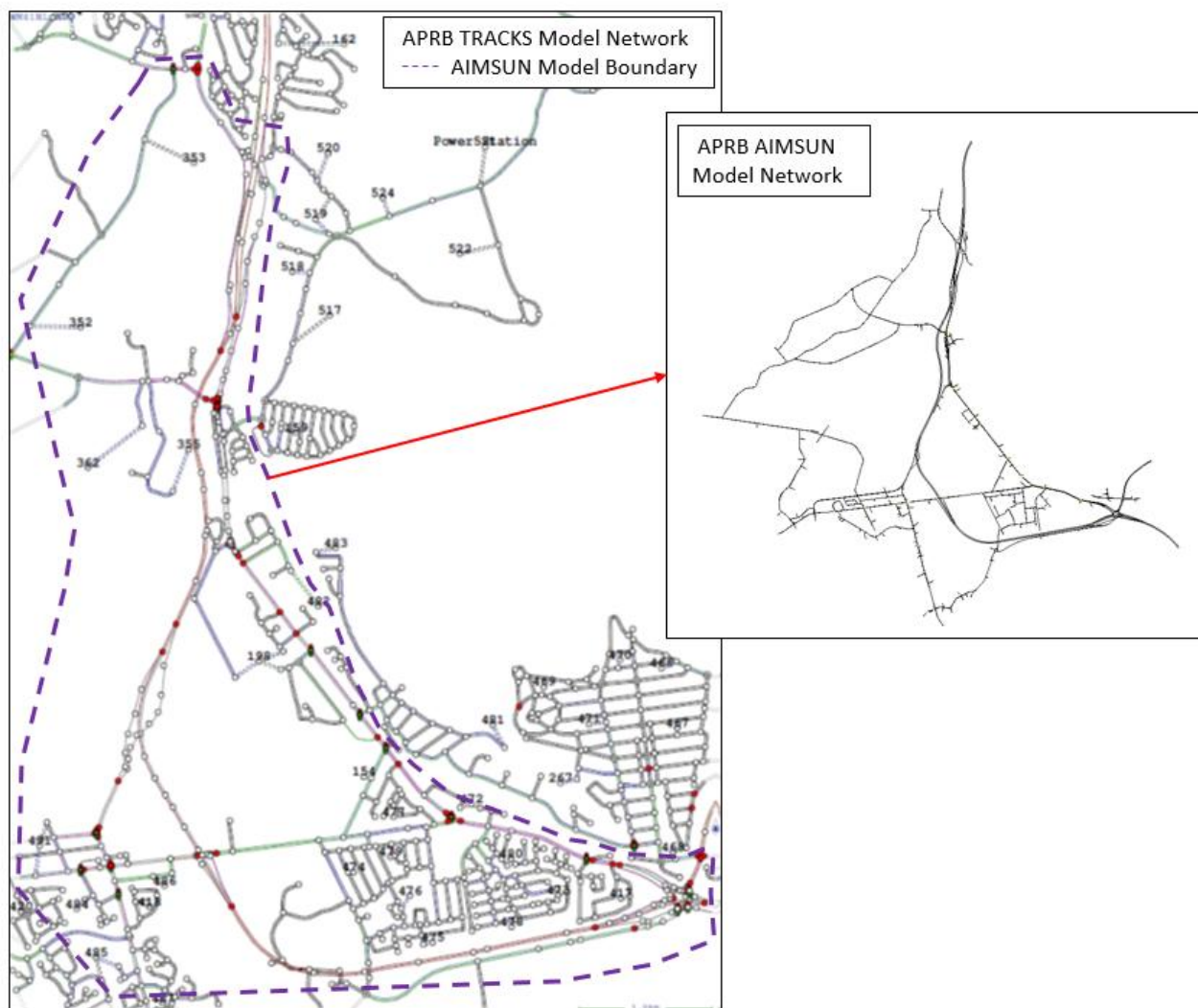


Figure 4-1 APRB TRACKS and AIMSUN Networks

As shown in **Figure 4-1**, TRACKS includes a significantly wider road network compared to AIMSUN, which also extends south to Shellharbour and north to Wollongong. As part of the trip assignment process, trips are assigned to the most cost-efficient/optimum generalised cost path along the entire network. After the TRACKS model has converged and the optimum paths for all vehicular traffic has been obtained, it is “windowed”/“cordoned” to match the AIMSUN network and zone structure. During this process, the already assigned trip demands for the specified area are extracted and can directly be used in AIMSUN.

In summary, the methodology adopted for the purpose of this assessment consists of the following key steps:

- Apply network geometry changes in TRACKS;
- Apply revised land use assumptions in TRACKS (residential lots and employment jobs).
- Generate trips in TRACKS based on the land use assumptions.
- Run new assignments and extract demand matrices for the various scenarios;
- Manipulate TRACKS 2026 and 2041 demand matrices in order to make them compatible with the AIMSUN zoning system and format. Interrogation and adjustment of the demand matrices was also undertaken;
- Analyse traffic impact of the proposed dwelling yield increase and identify intersection performance issues.

4.2 Modelled Scenarios and Assumptions

The following 6 scenarios were assessed by applying the increased number of lots and modified land use around Tallawarra Lands as specified in Chapter 3.

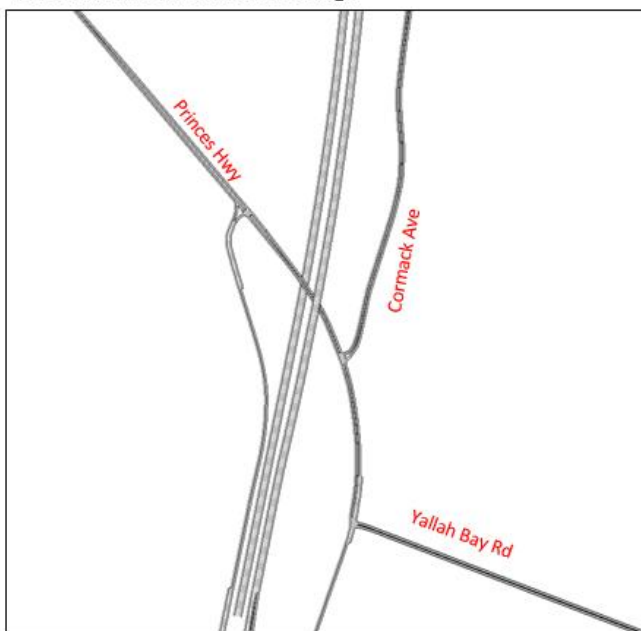
Table 4-1 Description of Modelled Scenarios

Scenario No	Year	Network Geometry		Development Yield (Number of Lots included)
		Northern Interchange in place	Haywards Bay Connection in place	
1	2026	✗	✗	1,144
2	2026	✓	✗	1,144
3	2041	✗	✗	1,144
4	2041	✓	✗	1,144
5	2041	✗	✓	1,494
6	2041	✓	✓	1,494

The network geometry differences between the “with” and “without” northern interchange scenarios can be seen in **Figure 4-2**. Access to the Central and Northern precincts without the northern interchange in place would maintain the existing network geometry/layout. Direct access to both directions of APRB main line would be available should the northern interchange be constructed.

As shown in **Table 4-1**, Scenarios 5 and 6 consist of adding the Lakeside precinct (therefore increasing the total number of dwellings to 1,494). This would also result in the “Haywards Bay Connection” being implemented which consists of a north-south road corridor linking Yallah Bay Road with Haywards Bay. It is understood that the implementation of this road corridor will not be feasible until such time as the Lakeside precinct is developed (owned by Energy Australia).

Without Northern Interchange



With Northern Interchange

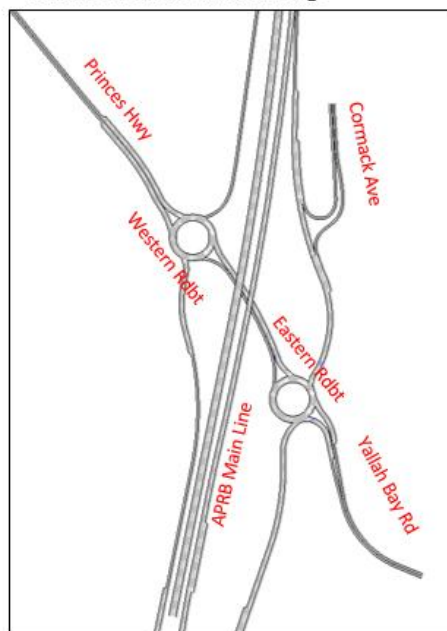


Figure 4-2 Network Geometry Configurations – With/Without Northern Interchange

The main assumptions adopted as part of the traffic modelling component of this assessment are as follows:

- > The Northern and Central precincts to be fully developed by 2026.
- > For Scenarios 5 and 6, the Lakeside precinct was assumed to be fully developed by 2041 (conservative modelling approach based on Energy Australia plans for the site);
- > Proposed development yield to increase from 1,010 to 1,144 lots for scenarios 1, 2, 3 and 4 and from 1,010 to 1,494 lots for scenarios 5 and 6;
- > AIMSUN models do not include the Fowlers Rd interchange. The AIMSUN model network coverage and boundaries can be seen in **Figure 4-3**. The model is restricted to Terry St/Ashburton Dr intersection to the south, Calderwood Rd and Illawarra Hwy/Tullimbar Ln to the west, Princes Motorway (just north of Yallah Bay Rd) to the north and New Lake Entrance/Pioneer Drive to the east. As the AIMSUN model coverage extended only until Cormack Avenue, only the western access to the site (Cormack Avenue/Princes Hwy and Yallah Bay Rd/Princes Hwy) was investigated. Consequently, any potential traffic impacts on Fowlers Rd were not assessed;
- > The network geometry assumptions for each scenario as specified in **Table 4-1** above;
- > The Cormack Avenue/Princes Hwy intersection remained open for general traffic in all scenarios;
- > The Yallah Bay Rd/Princes Hwy was modelled as a give-way intersection.

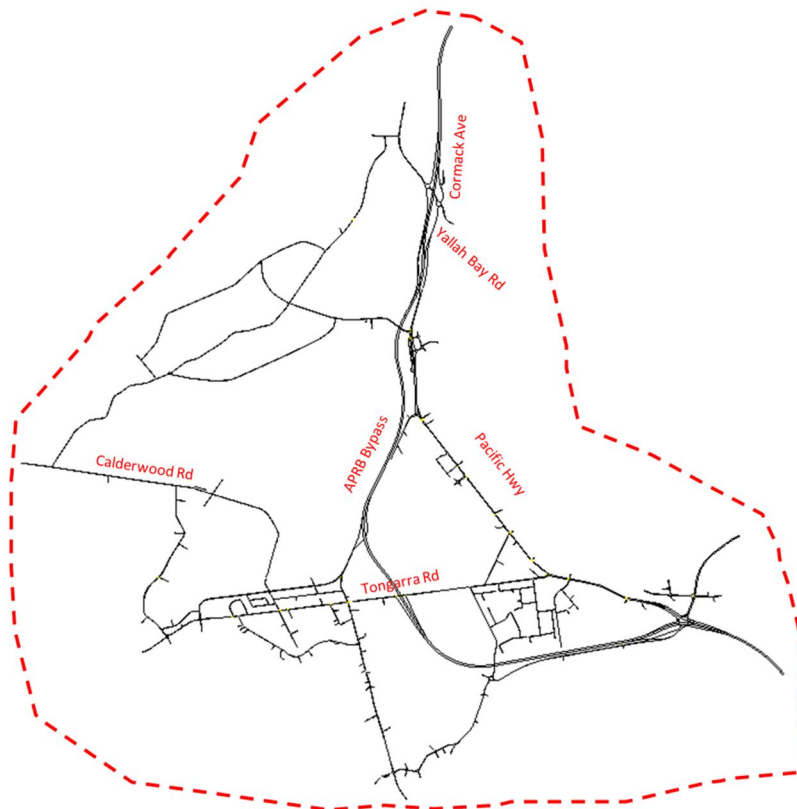


Figure 4-3 APRB AIMSUN Network Study Boundary

4.3 Intersection Performance Criteria

The key indicator of intersection performance is Level of Service, where results are placed on a continuum from 'A' to 'F' based on Average Delay as shown in **Table 4-2**. These criteria were applied during the intersection analysis of this assessment.

Table 4-2 Level of Service (LoS) Bounds

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

Source: Guide to Traffic Generating Developments 2002

4.4 Intersection Performance Analysis

4.4.1 Scenario 1

As outlined in **Table 4-1**, Scenario 1 assessed the revised development yield increase in Tallawarra Lands without the Northern Interchange and Haywards Bay connection in place (design year horizon 2026). The results are summarised below.

Table 4-3 Intersection Performance (Scenario 1)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1144 Lots)	
			AM	PM	AM	PM
1	2026 Interim year Stage 1	Northbound Exit Ramp	C	B	C	C
		Dapto Off-ramp / Princes Hwy	C	A	B	B
		Cormack Ave / Princes Hwy	C	B	B	B
		Yallah Bay Rd / Princes Hwy	A	A	A	A

A graphical representation of the intersection performance results is shown in the figure below.

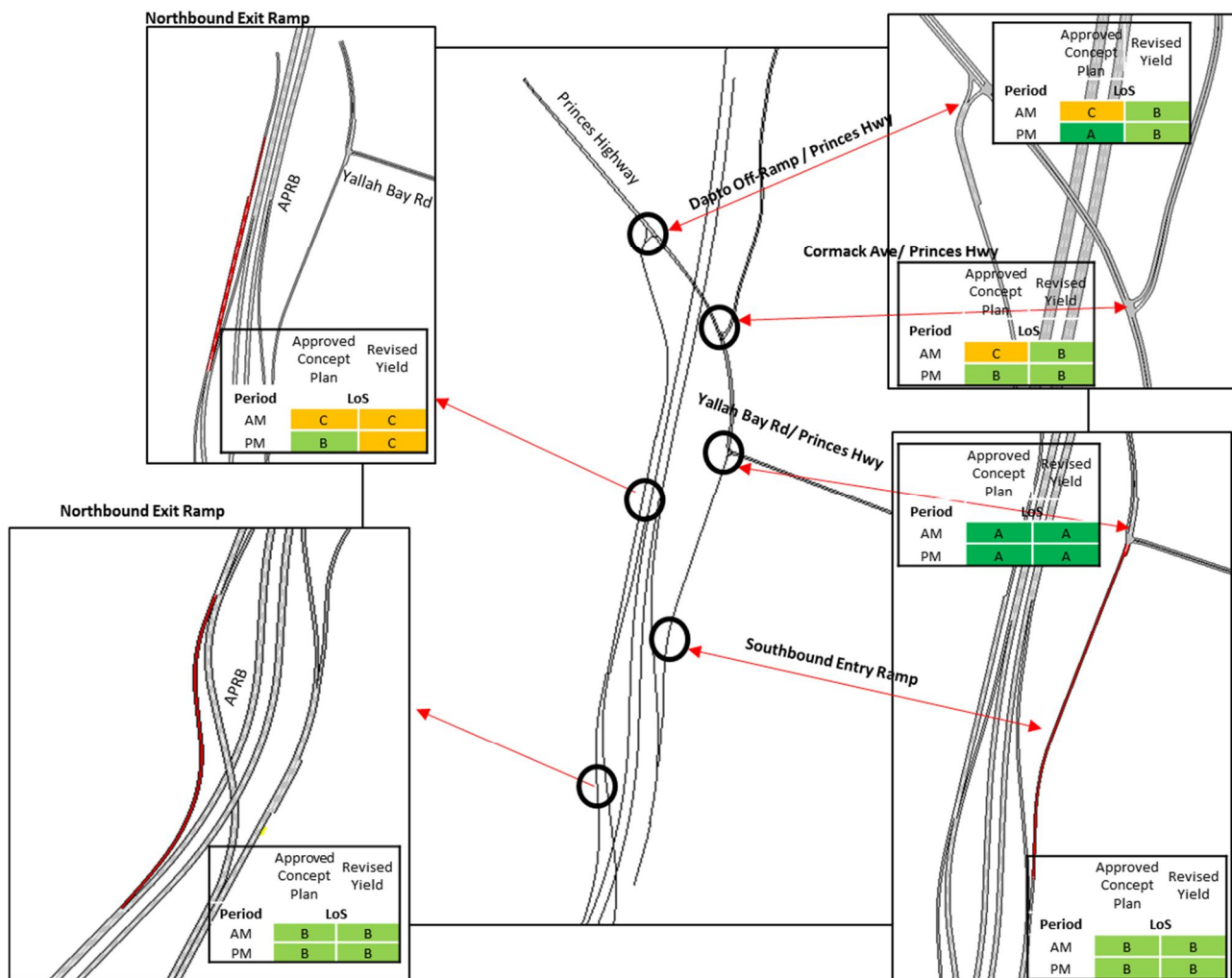


Figure 4-4 LoS Output Map - Scenario 1

4.4.2 Scenario 2

As outlined in **Table 4-1**, Scenario 2 assessed the revised development yield increase in Tallawarra Lands with the Northern Interchange but without the Haywards Bay connection (design year horizon 2026). The results are summarised below.

Table 4-4 Intersection Performance (Scenario 2)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1144 Lots)	
			AM	PM	AM	PM
2	2026 Interim year Stage 2	Northbound Entry Ramp	A	A	A	A
		Northbound Exit Ramp	B	C	B	C
		Southbound Entry Ramp	B	A	B	B
		Southbound Exit Ramp	B	B	A	B
		Western Rdbt	B	B	B	B
		Eastern Rdbt	B	B	B	B

A graphical representation of the intersection performance results is shown in the figure below.

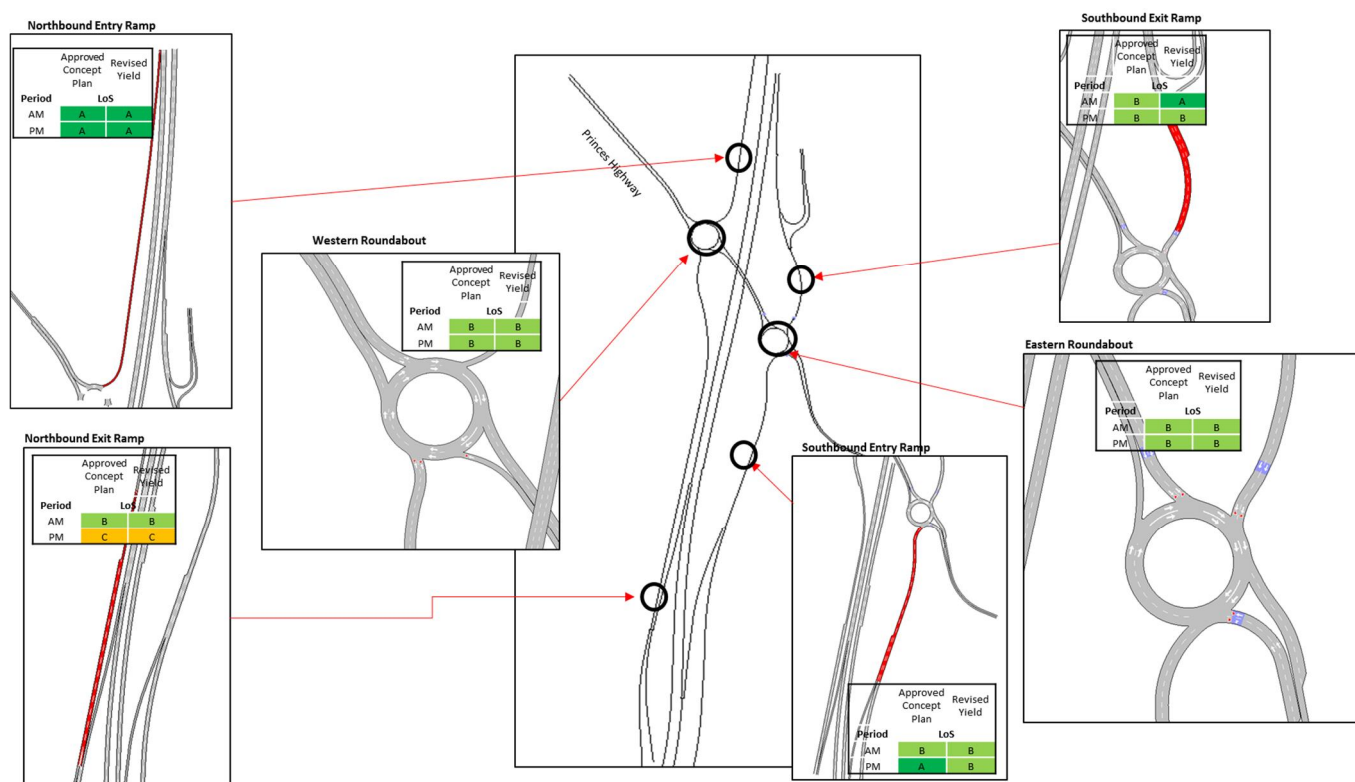


Figure 4-5 LoS Output Map - Scenario 2

4.4.3 Scenario 3

4.4.3.1 Existing Network Geometry Layout

As outlined in **Table 4-1**, Scenario 3 assessed the revised development yield increase in Tallawarra Lands without the Northern Interchange and Haywards Bay connection in place (design year horizon 2041).

Table 4-5 Intersection Performance (Scenario 3)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1144 Lots)	
			AM	PM	AM	PM
3	2041 Concept Design Stage 1	Northbound Exit Ramp	C	B	C	C
		Dapto Off-ramp / Princes Hwy*	D	B	D	E
		Cormack Ave / Princes Hwy	D	B	C	C
		Yallah Bay Rd / Princes Hwy	B	B	B	B

*Give-way at Dapto off-ramp / Princes Hwy

A graphical representation of the intersection performance results is shown in the figure below.

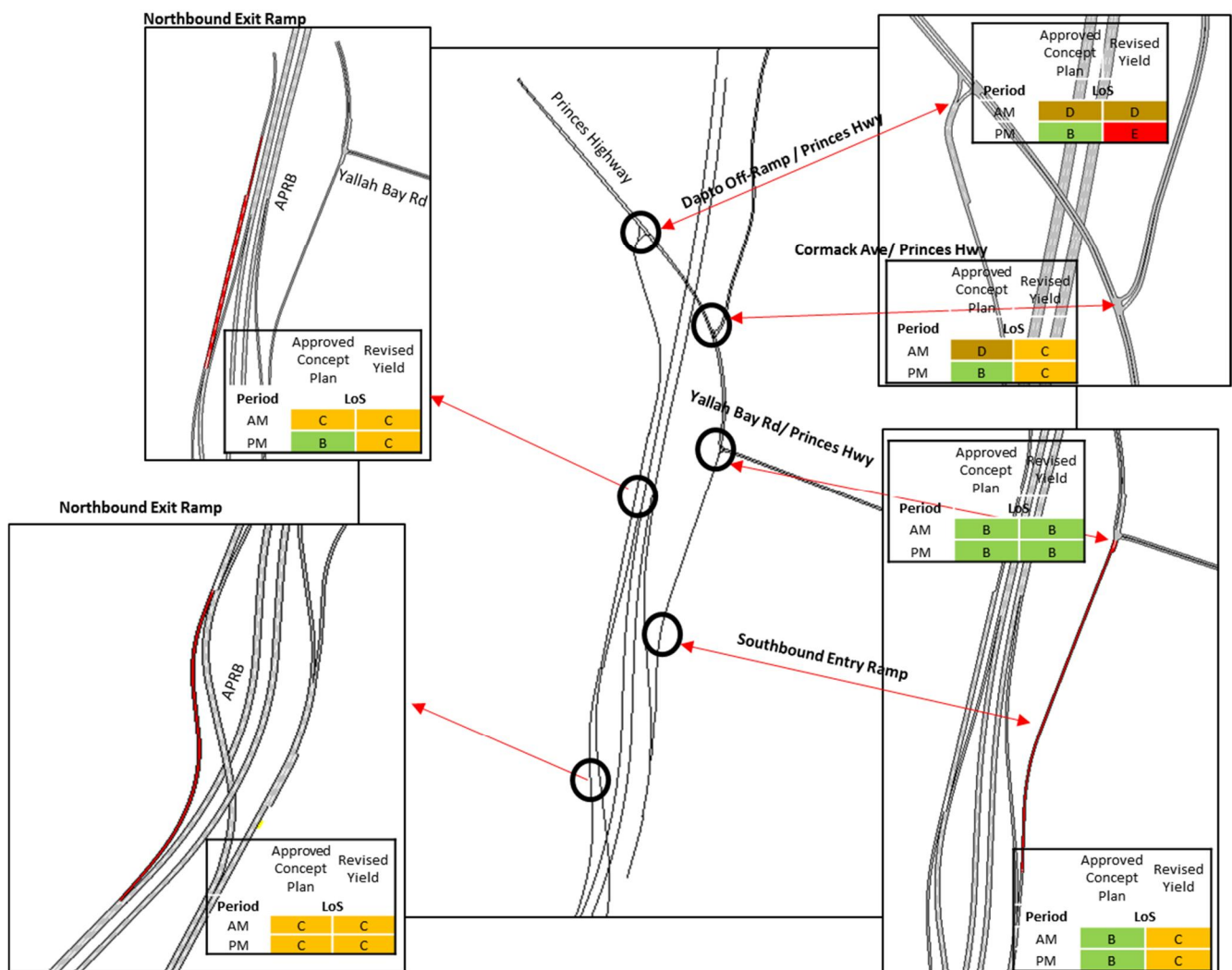


Figure 4-6 LoS Output Map - Scenario 3

4.4.3.2 Proposed Mitigation Measure

The intersection of Dapto off-ramp / Princes Hwy will experience capacity issues with LoS E in the PM peak with the revised yield of 1,144 lots by 2041. Additional modelling was undertaken to investigate possible mitigation measures that will improve the intersection's performance.

The proposed mitigation measure included the assessment of a 2-phase fixed traffic signal operation at Dapto off-ramp / Princes Hwy following the existing network geometry layout as seen in **Figure 4-7**.

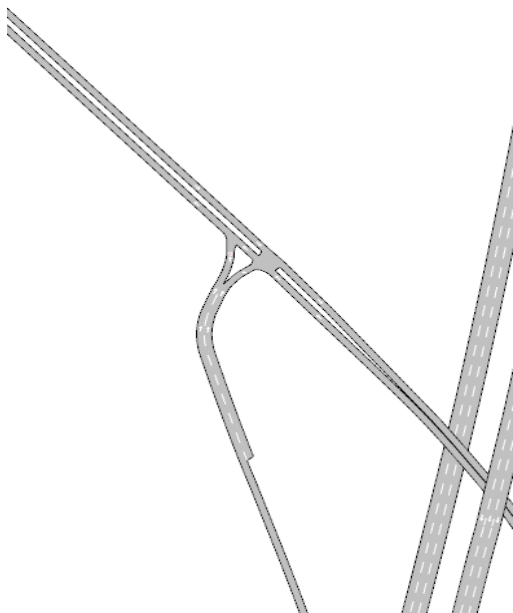


Figure 4-7 Proposed Mitigation Measure (2-Phase Traffic Signals) – Scenario 3

Modelling results of implementing traffic signals at Dapto off-ramp / Princes Highway suggests an improvement in intersection LoS compared to a give-way yield type as shown below:

Table 4-6 Intersection Performance with Mitigation Measure (Scenario 3)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1144 Lots)	
			AM	PM	AM	PM
3	2041 Concept Design Stage 1	Northbound Exit Ramp	C	B	C	C
		Dapto Off-ramp / Princes Hwy*	D	B	B	B
		Cormack Ave / Princes Hwy	D	B	B	C
		Yallah Bay Rd / Princes Hwy	B	B	B	B

*Traffic signals at Dapto off-ramp / Princes Hwy

4.4.4 Scenario 4

As outlined in **Table 4-1**, Scenario 4 assessed the revised development yield increase in Tallawarra Lands with the Northern Interchange but without the Haywards Bay connection (design year horizon 2041).

Table 4-7 Intersection Performance (Scenario 4)*

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1144 Lots)	
			AM	PM	AM	PM
4	2041 Design for Approval	Northbound Entry Ramp	A	A	A	A
		Northbound Exit Ramp	C	C	C	C
		Southbound Entry Ramp	C	B	C	B
		Southbound Exit Ramp	D	D	C	D
		Western Rdbt	A	A	A	B
		Eastern Rdbt	B	B	B	D

* As seen from the above results, the performance of the Western roundabout in the 2041 design horizon year is performing better than the 2026 design horizon year (scenario 2). This is due to the fact that in the 2041 Design for Approval model received, the give-way priority rules of the roundabout's western approach were not incorporated. During the future year model development in AIMSUN, traffic from the western approach at the Northern Interchange was not able to flush through in the network and a large number of vehicles were not able to dissipate through to the network unless the above technique was applied. The variation in LoS at the southbound exit ramp is presumed to be attributable to modified detailed road network coding in TRACKS and consequent minor variations in traffic assignment.

A graphical representation of the intersection performance results is shown in the figure below.

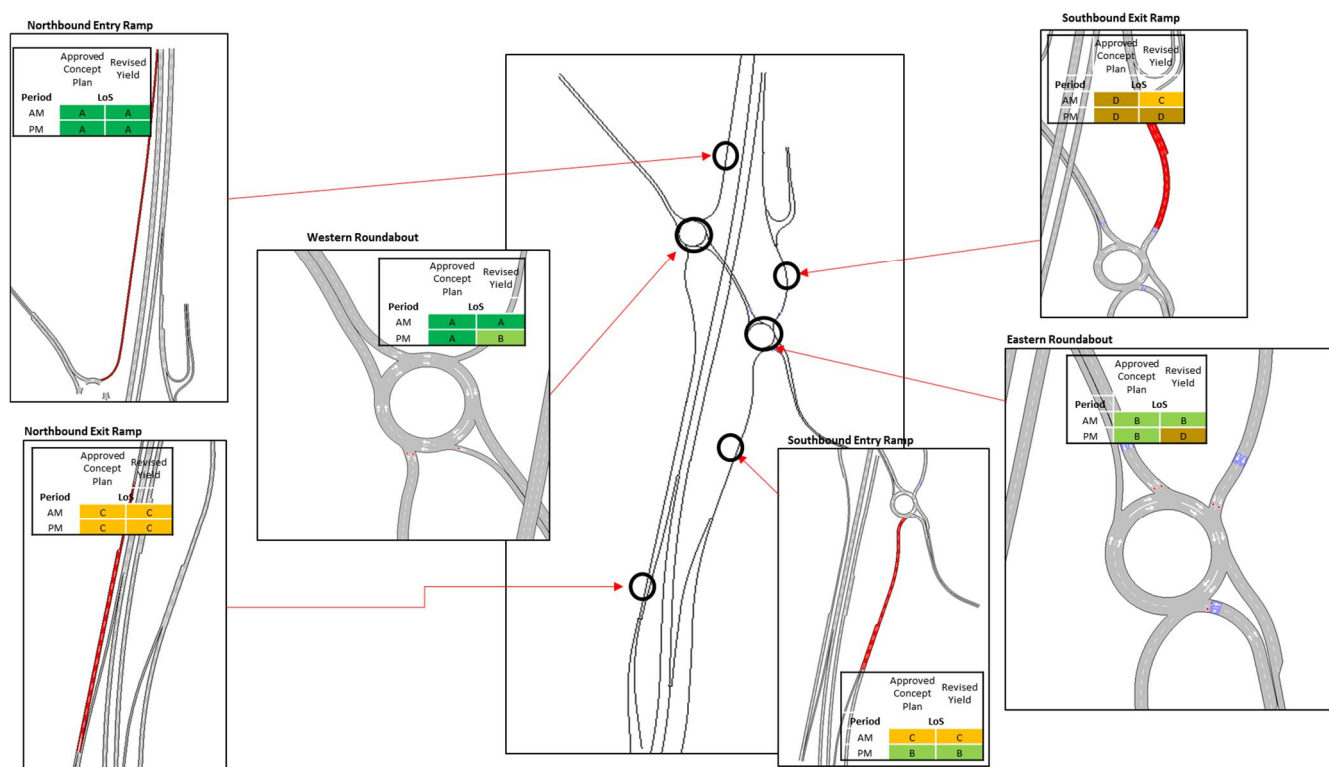


Figure 4-8 LoS Output Map - Scenario 4

4.4.5 Scenario 5

4.4.5.1 Existing Network Geometry Layout

As outlined in **Table 4-1**, Scenario 5 assessed the revised development yield increase in Tallawarra Lands without the Northern Interchange but with the Haywards Bay connection and Lakeside precinct (design year horizon 2041).

Table 4-8 Intersection Performance (Scenario 5)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1494 Lots)	
			AM	PM	AM	PM
5	2041 Concept Design Stage 1	Northbound Exit Ramp	C	B	C	C
		Dapto Off-ramp / Princes Hwy	D	B	C	F
		Cormack Ave / Princes Hwy	D	B	C	C
		Yallah Bay Rd / Princes Hwy	B	B	B	C

*Give-way at Dapto off-ramp / Princes Hwy

A graphical representation of the intersection performance results is shown in the figure below.

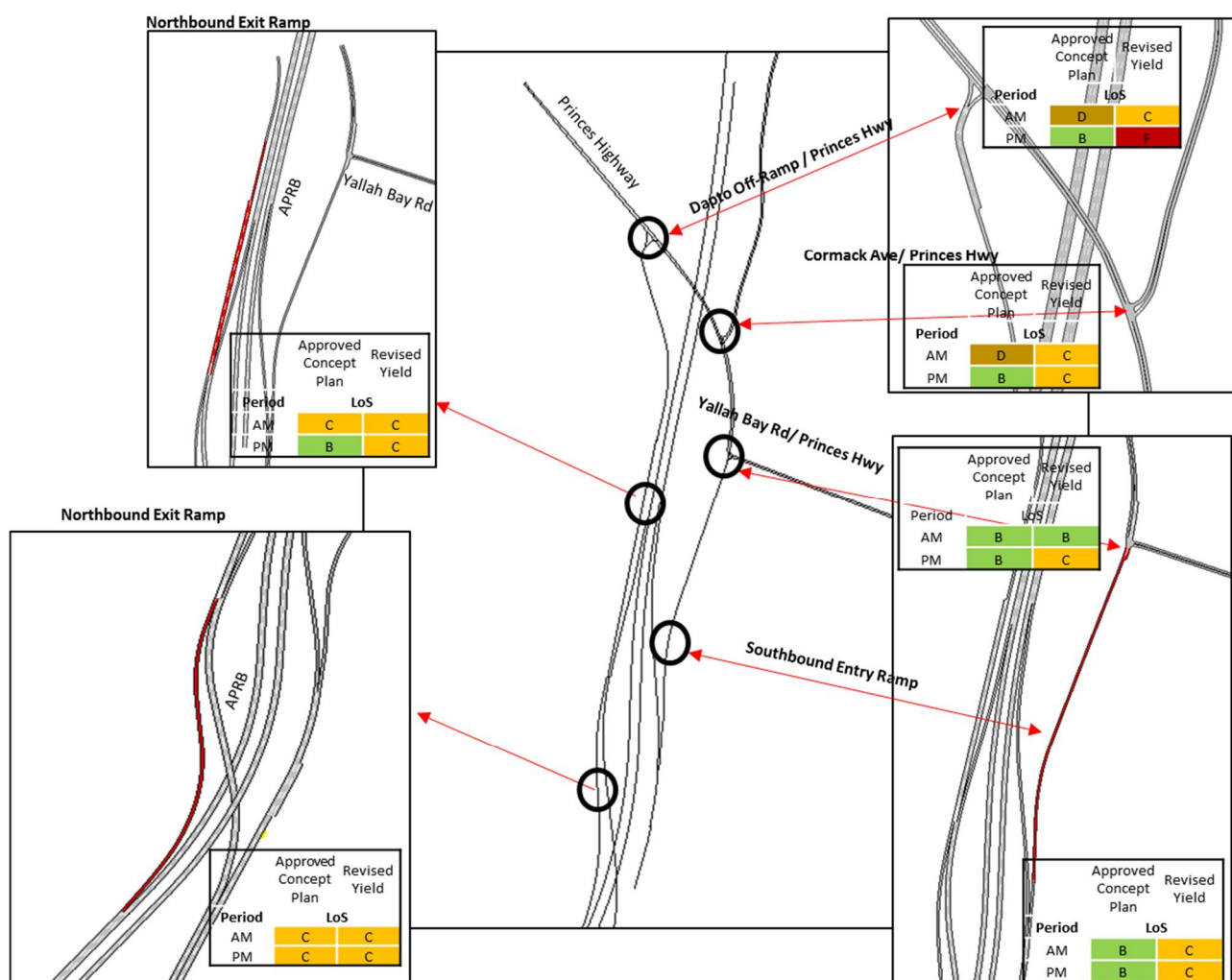


Figure 4-9 LoS Output Map - Scenario 5

4.4.5.2 Proposed Mitigation Measure

As identified in scenario 3, the intersection of Dapto off-ramp / Princes Hwy will also experience capacity issues with LoS F in the PM peak with the revised yield of 1,494 lots by 2041.

A 2-phase fixed traffic signal operation at Dapto off-ramp / Princes Hwy was assessed (identical mitigation measure applied in scenario 3).

Modelling results of implementing traffic signals at Dapto off-ramp / Princes Highway suggests an improvement in intersection LoS compared to a give-way yield type as shown below:

Table 4-9 Intersection Performance with Mitigation Measure (Scenario 5)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1494 Lots)	
			AM	PM	AM	PM
3	2041 Concept Design Stage 1	Northbound Exit Ramp	C	B	C	C
		Dapto Off-ramp / Princes Hwy*	D	B	C	C
		Cormack Ave / Princes Hwy	D	B	B	C
		Yallah Bay Rd / Princes Hwy	B	B	B	B

*Traffic signals at Dapto off-ramp / Princes Hwy

4.4.6 Scenario 6

As outlined in **Table 4-1**, Scenario 6 assessed the revised development yield increase in Tallawarra Lands with both Northern Interchange and Haywards Bay connection / Lakeside precinct in place (design year horizon 2041).

Table 4-10 Intersection Performance (Scenario 6)

Scenario	Model Used	Location	Approved Concept Plan (1010 Lots)		Revised Yield (1494 Lots)	
			AM	PM	AM	PM
6	2041 Design for Approval	Northbound Entry Ramp	A	A	A	A
		Northbound Exit Ramp	C	C	C	C
		Southbound Entry Ramp	C	B	C	C
		Southbound Exit Ramp	D	D	C	D
		Western Rdbt	A	A	A	A
		Eastern Rdbt	B	B	B	D

A graphical representation of the intersection performance results is shown in the figure below.

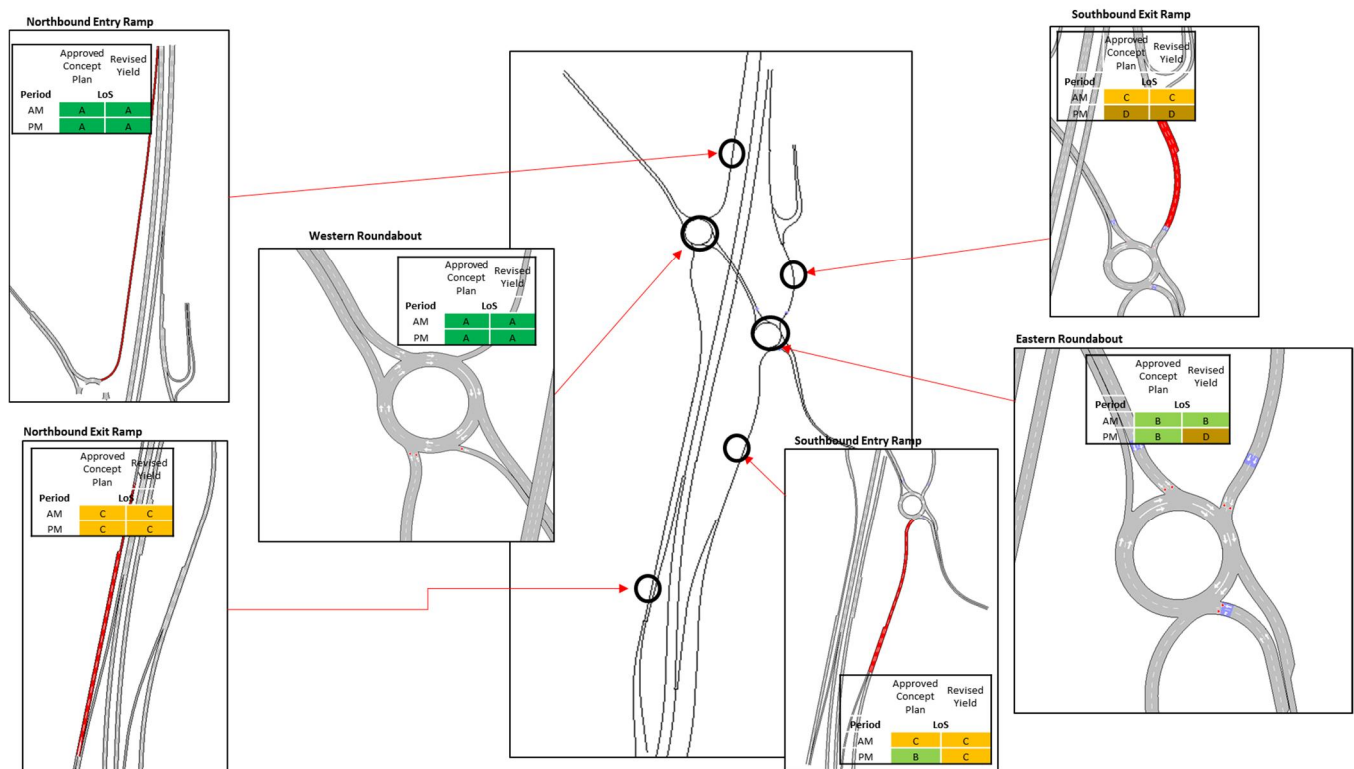


Figure 4-10 LoS Output Map – Scenario 6

The above results show that for all scenarios, the operational performance of all intersections of relevance to the assessment operate at LoS D or better for both peak periods. The only exception is the intersection of Dapto off-ramp and Princes Highway in which the intersection is performing at an unsatisfactory LoS (E or worse) on the PM peak for scenarios 3 and 5. This occurs with the revised land use of Tallawarra Lands (1,494 lots) but not with the approved 1,010 lots yield. Potential mitigations measures that would improve the performance of this intersection include changing the intersection type to traffic signals or roundabout.

The figure below demonstrates the location and current geometry of the failing intersection as described above and showcases the potential alternative treatments of this intersection to improve its operational performance.

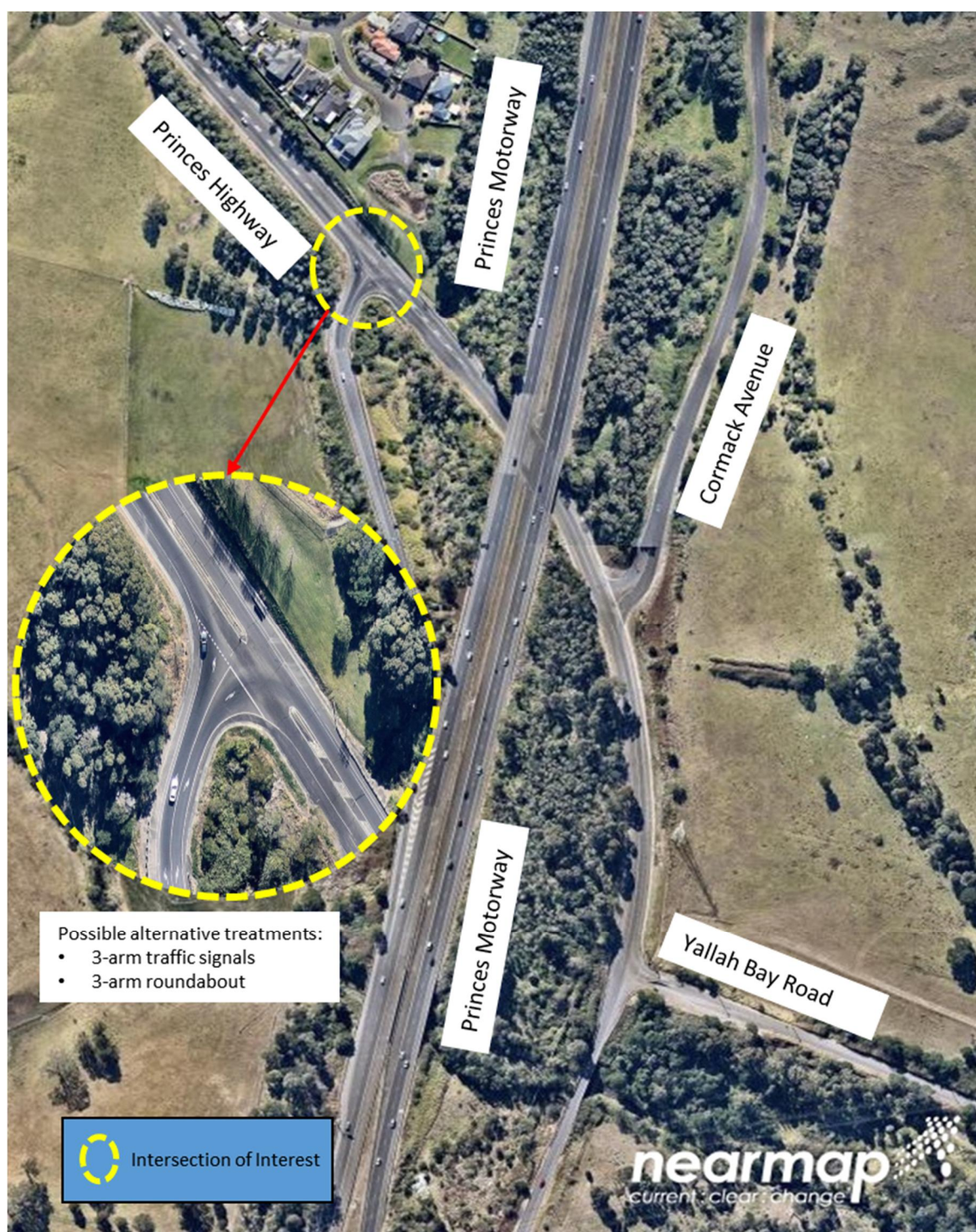


Figure 4-11 Dapto Off-Ramp/Princes Highway Intersection (Existing Geometry)

5 Public Transport Analysis

5.1 Existing Public Transport

The existing availability of public transport services has been evaluated. Based on an understanding of existing public transport, this report makes recommendations for potential enhancement of public transport opportunities compatible with proposed land use changes.

Public transport in the immediate walking catchment of 800m to the site boundaries is limited to public bus services. A map of the existing bus network is shown in **Figure 5-1**.

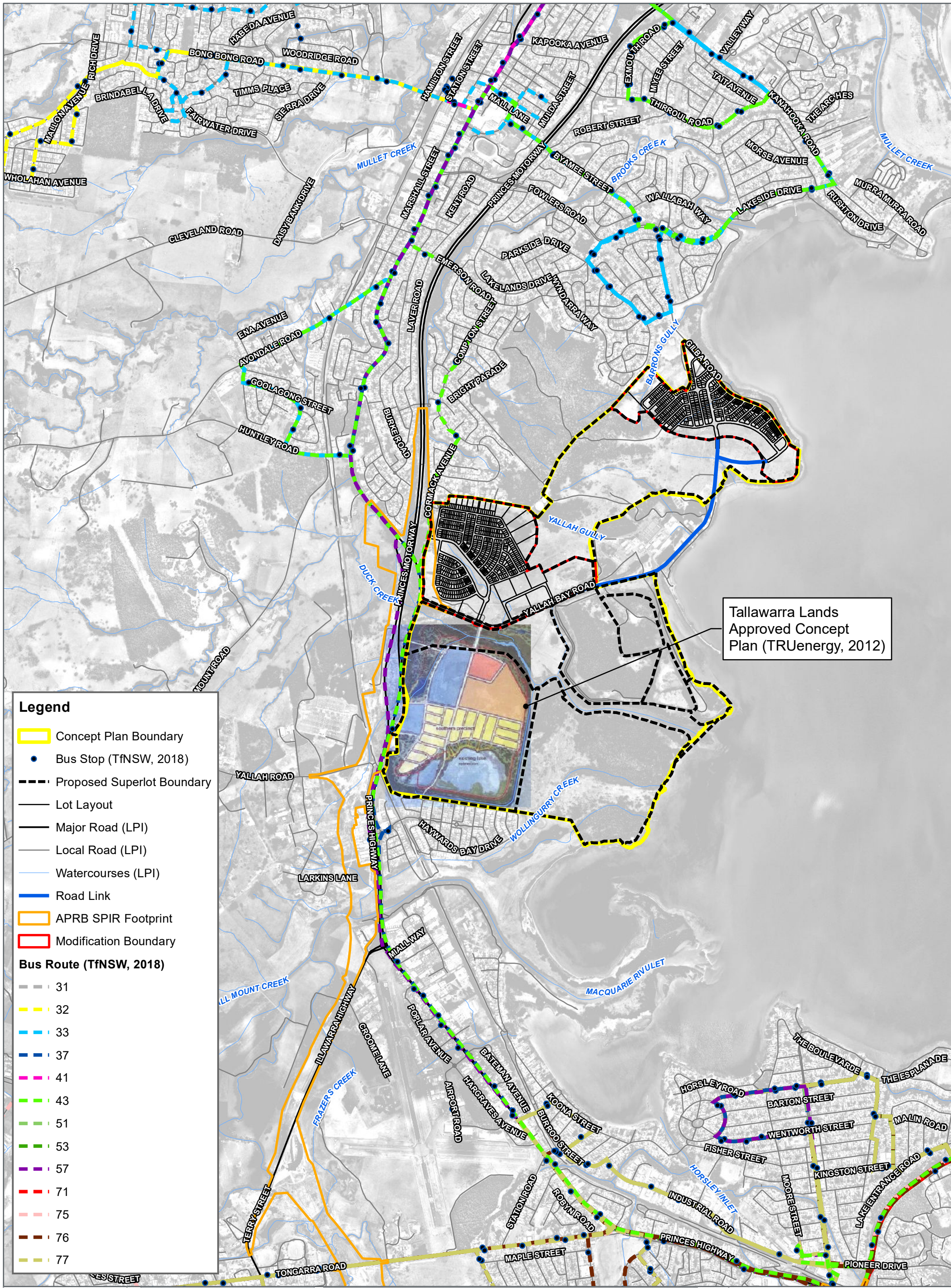
The nearest bus route to the Northern Precinct is Route 33 with the nearest stop near the intersection of Gilba Crescent and Illaroo Parade. This stop is approximately 475m from the northern edge of the Northern precinct. Route 33 provides services Dapto (including Dapto Railway Station), Kanahooka and north to Wollongong (including Wollongong Rail Station) via Unanderra (including Unanderra Railway Station) and Figtree. Route 33 also connects with other local bus routes north of the site and south to Oak Flats and Albion Park rail (including the Albion Park Rail Station).

The nearest existing bus stops to the site are located at the intersection of the Princes Motorway and Haywards Bay Drive. The bus stop is serviced by District Route 43 which connects to Oak Flats and Albion Park rail (including Albion Park Railway Station) and Shellharbour Shopping centre.

In summary the existing bus route network has a high level of local and regional connectivity to established urban areas and to the rail network for weekday and weekend services typical of the level of service in the Illawarra urban area.

5.2 Proposed Public Transport

The compact nature of the proposed urban footprint within the North, Central and Lakeside Precincts and the hierarchical road network make the Tallawarra Lands highly suited to the efficient extension of bus services through the site. **Figure 5-2** shows a proposed bus network throughout the site.



Tallawarra Lands
Approved Concept
Plan (TRUenergy, 2012)

Legend

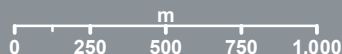
- Concept Plan Boundary
- Bus Stop (TfNSW, 2018)
- Proposed Superlot Boundary
- Lot Layout
- Major Road (LPI)
- Local Road (LPI)
- Watercourses (LPI)
- Road Link
- APRB SPIR Footprint
- Modification Boundary

Bus Route (TfNSW, 2018)

- 31
- 32
- 33
- 37
- 41
- 43
- 51
- 53
- 57
- 71
- 75
- 76
- 77



1:25,000 Scale at A3

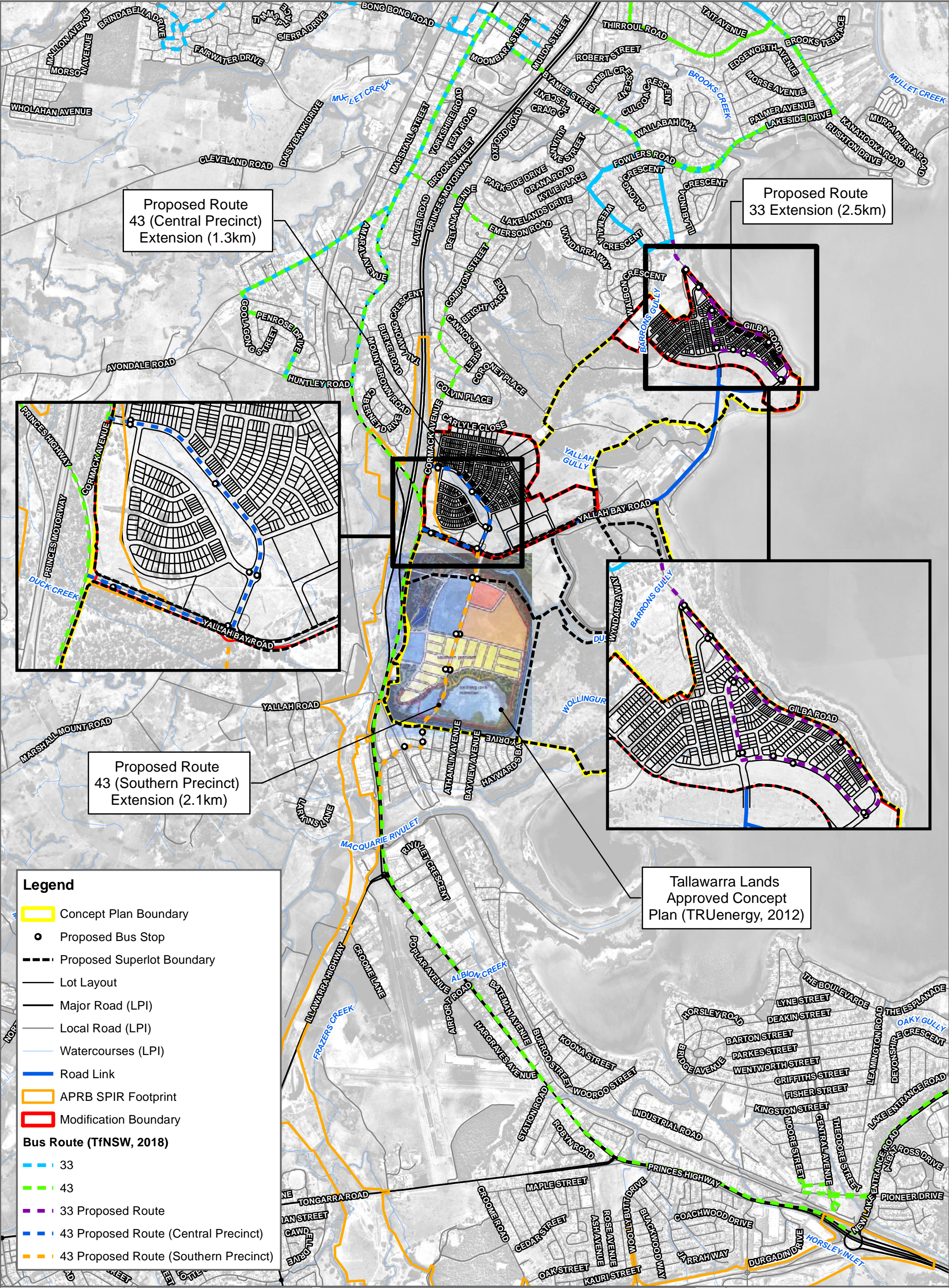


Existing Bus Network

TALLAWARRA LANDS



Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2019-05-01 | Project: 8201714201
Coordinate System: GDA 1994 MGA Zone 56
Map: 82017142-01-GS-059-ExistingBusRoutePlanning.mxd 08
Aerial imagery supplied by nearmap (March, 2019)



1:25,000 Scale at A3

0 250 500 750 1,000

Proposed Bus Network

TALLAWARRA LANDS

Yallah Bay Road will be the primary collector road through the Tallawarra Lands and more than 80% of proposed new residential land and new employment lands will be within 500m radius of Yallah Bay Road. Extensions of existing Bus Routes 33 and 43 as shown in **Figure 5-2** can readily service new residential land, new employment lands and the proposed local business centre providing a regional-scale link.

New local routes can be extended from Yallah Bay Road:

- North-south through the Lakeside Precinct within 500m of all new residential and employment lands and enhancing route and bus stop opportunities within the established residential area of Haywards Bay to the south (see proposed Route 43 in **Figure 5-2**);
- In a loop through the Central Precinct adjacent to the new Local Business Centre and playing fields and within 300m walking distance of all proposed new residential lots (see proposed Route 33 extension in **Figure 5-2**); and
- In a loop through the Northern Precinct within 300m walking distance to all proposed new residential lots (see proposed Route 33 extension in **Figure 5-2**).

In summary, the proposed new routes are ideally located to optimise opportunities for bus journeys to service new residential, employment and recreational land in the Tallawarra Lands as well as improve existing bus services for Haywards Bay residents. New routes will connect on local and regional scales and provide services to rail stations for multi-mode trips.

6 Other movement opportunities

Other opportunities for movement alternatives to private vehicles have also been considered and identified to best match the proposed land use changes as well as enhance quality of life, health and wellbeing of future residents consistent with the principles and guidelines published by the Premier's Council for Active Living and *Better Placed* as published by the Government Architect NSW.

Shared pathways for walking and cycling are intended to be provided as a network within the road verges, public open space areas and within environmental management lands and the foreshore reserve where compatible with environmental management requirements. Each precinct is compact and easily navigable for walking and cycling. The local business centre and playing fields are centrally located and the majority of residential lots are less than a kilometre radius. It is intended that, where supported by detailed ecological investigations and conservation management plans, areas of land identified for environmental management shall also be available for public access compatible with the sensitivity of ecological assets.

The Tallawarra Lands precinct represent an opportunity to enhance and extend the walking and cycling routes on and/or near the foreshore of Lake Illawarra subject to future approvals and plans of management and agreements with adjoining landowners.

7 Summary and Conclusions

The key findings of the traffic impact study described in this report are summarised below:

- > The proposed revision of development yield at the Tallawarra Lands site does not result in any critical network operational concerns or significant differences when compared with the approved yield (as tested by Roads and Maritime as part of the APRB design development);
- > The intersection performance at Dapto off-ramp/Princes Hwy in the PM peak shows potential capacity issues by 2041, which can be addressed by converting it to traffic signal or roundabout control. After testing traffic signals at this intersection, LoS results improved from E to B in the PM peak of Scenario 3 and F to C in the PM peak of Scenario 5 compared to the give-way design;
- > The development of the Lakeside precinct and consequential delivery of the Haywards Bay Link are dependent on Energy Australia plans for the site. It is understood that the development of this precinct is not likely to take place in the near future but should this go ahead, the network operation would be identical to that without this development (and it does not require any upgrades to the external road network);
- > No substantial issues at the operation/performance of the remaining intersections along all scenarios compared to the original APRB models. LoS was calculated at D or better, which is deemed satisfactory;
- > Modelling results of this assessment focuses on the revised yield of 1,494 lots. Since the completion of this assessment, multiple revisions of layouts plans for the Central and Northern precincts have been prepared with the total number of lots been reduced to 1,353. Considering the lower residential yield of overall Tallawarra, the traffic assessment can be described as a conservative approach
- > Existing bus routes can be readily extended to accommodate efficient new through routes and loop routes within walking distance of all new residential, commercial and employment lands. Those bus routes can provide connectivity to the rail network and to local and regional bus networks. New routes have the potential for service improvements for existing residents of Haywards Bay to the south of the Tallawarra lands; and
- > Walking and cycling opportunities are intended to be integrated with the future development of the Tallawarra lands with future networks to be distributed in the public road network, public open space areas and other lands of environmental management subject to compatibility with future conservation and vegetation management plans. The aim is to achieve compliance with PCAL and Better Placed principles in a manner which enhances appreciation for and management of the environmental assets of the site and surrounds.

APPENDIX

A

2041 CHANGE FLOW PLOTS

APPENDIX

B

TRACKS TRIP
GENERATION/DISTRIBUTION

