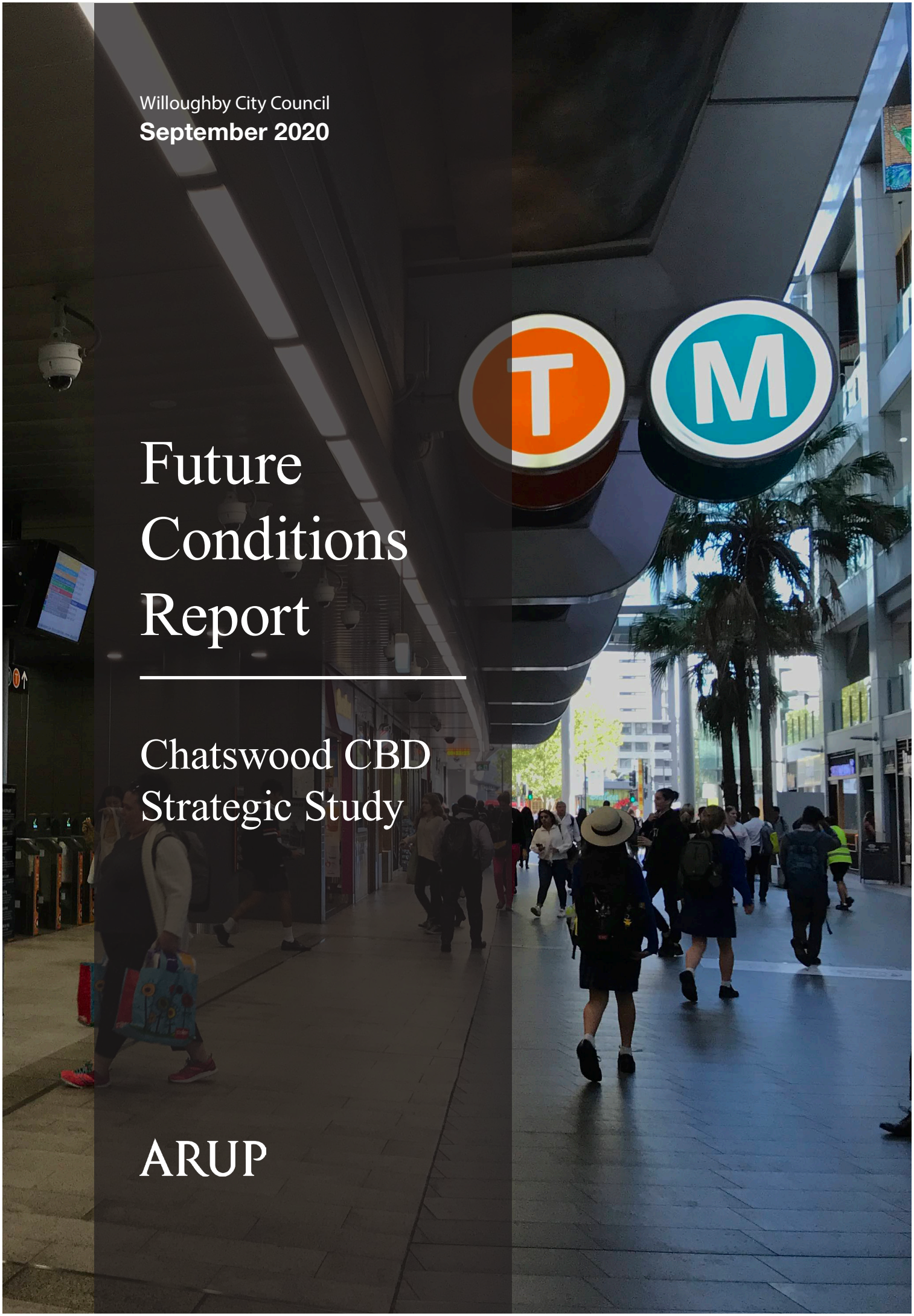
Willoughby City Council

September 2020

Future Conditions Report

Chatswood CBD Strategic Study



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Executive Summary

The Chatswood CBD Planning and Urban Design Strategy (CCPUDS) outlines a 20 year vision for the precinct. This includes aspirations for increased growth in population and employment when compared to the Transport for NSW (TfNSW) base forecasts.

The purpose of this study is to compare the growth scenarios presented in the CCPUDS to the TfNSW base forecasts to ascertain the likely impact on the future transport network. This includes consideration of changes to the transport network in the future, with the introduction of Sydney Metro being the key differentiator between existing and future scenarios.

The TfNSW Sydney Strategic Travel Model (STM) and Sydney Traffic Forecasting Model (STFM) were deemed the appropriate models to compare the forecasts, given the horizon years being tested were up to 20 years in the future. The outputs of the strategic models have been interrogated and presented in this report to explain and quantify the expected impacts on the transport network.

Key Findings

Analysing the change in demand between the horizon years indicated a significant uplift in trips to and from the precinct. The models indicate Chatswood will be a major centre in the future attracting a large number of inbound trips in the AM peak. The Chatswood Interchange will be the focal point of these trips and this will have significant impacts on the urban realm in the vicinity of the interchange.

The first principles approach used to assess walking and cycling trips indicated walking will continue to be a major mode within the precinct. This is attributed to the uplift in public transport trips from Sydney Metro which will also have walk components and land use densification.

Cycling trips will increase, however, conservative mode share aspirations suggest cycling will remain a less popular mode of travel. Improved facilities and infrastructure could aid cycling in surpassing these estimations.

Private vehicle trips will increase despite the mode shift towards public transport. Notable impacts to the operation of roads generally occur within the precinct with only minor impacts transferring onto the surrounding arterial roads. The models were only used to assess the relative impact on the capacity of streets.

The comparison of the base and uplift scenarios for 2026 and 2036 indicated only minor changes to the impacts on the transport network. These are generally related to the distribution of population and employment across the Travel Zones within the CBD. The findings of the study conclude that the CCPUDS will have an impact in the same order of magnitude as the current TfNSW forecasts and we expect the future transport network will be able to accommodate this demand.

Recommendations

This study concludes that the impact of the CCPUDS on the future transport network can be accommodated. Further measures can be used to refine and support Willoughby City Council's (WCC) aspirations for the Chatswood CBD.

To address the endorsement letter received from the Department of Planning, Industry and Environment on 9 July 2020, recommendations have been developed. These should be included in the finalised CCPUDS and can be implemented as the strategy is implemented over the next 20 years . Each recommendation has been linked to a Strategic Direction in the WCC Integrated Transport Strategy (Section 2.2).

Walking and Cycling

1. Further consideration for supporting and integrating bicycle transport including bicycle infrastructure and facilities within the CBD precinct including opportunities to form links to the Principle Bike Network and harness the potential of micromobility as this technology continues to develop (ITS Strategic Direction 1).
2. Further enhance provision of end of trip facilities in the CBD. This could include adjustment to end of trip facility requirements for new developments in the precinct to support investment in future cycling infrastructure and encourage mode shift (ITS Strategic Direction 5).

Land use and Public Realm

3. A local place plan for the Chatswood CBD. This should adopt the Movement and Place approach using guidance in the recently released Practitioners Guide to Movement and Place. Focus should be given to multi-function corridors such as Victoria Avenue and Anderson Street (ITS Strategic Direction 3).
4. Undertake further analysis of key corridors (such as Victoria Avenue and Anderson Street) to understand how road space allocation can be adjusted to align with future aspirations and where future development can support the vision for these corridors (ITS Strategic Direction 3).

Public transport

5. Improve understanding of the increased passenger volumes expected to use Chatswood Station due to the completion of Sydney Metro City and South West, and enhanced bus services to the Northern Beaches, and how this will impact the public realm beyond the confines of the Station. This would include measures to harness the opportunities created by increased pedestrian traffic for surrounding land uses and enhancing place in the vicinity of the Station (ITS Strategic Direction 1 and 2).
6. This investigation noted some potential capacity issues on bus services within the CBD. A review of bus services connecting to Chatswood should be undertaken. This should consider future growth forecasts, supporting Sydney Metro and opportunities for technological innovation. The review would include bus priority, speeds and reliability. This would need to be

conducted in conjunction with or led by TfNSW (ITS Strategic Direction 2).

7. In collaboration with or supporting TfNSW, assess the capacity of Chatswood Interchange and understand how the layout could be optimised to support growth in public transport usage and enhance connectivity to sustainable modes. This would include review of bus stops and layover capacity on both sides of Chatswood Station. This may need to incorporate future requirements relating to the enhanced bus services to the Northern Beaches (ITS Strategic Direction 2).

Travel Demand Management

8. Build upon the Travel Demand Management Strategy in the CCPUDS to develop a suite of short, medium and long-term measures to support the future aspirations of the precinct and sustainable travel patterns. These would align with Travel Demand Management guidance provided by the NSW Government which can be found online (ITS Strategic Direction 1).

Road network and parking

9. Consider speed limit reductions on corridors with a higher place focus to support human centred design, encourage street activity and enable safe crossing movements (ITS Strategic Direction 3).
10. Assess traffic movements within the precinct to identify key routes and develop measures to adjust major traffic flows to avoid key corridors (such as Victoria Avenue and Anderson Street) improving place in the heart of the precinct (ITS Strategic Direction 4).
11. Formulate parking innovations to address parking issues in the precinct with a focus on encouraging the use of off-street parking. This may include a review of parking charges, implementation of expanded car share schemes and parking guidance systems (which would need to be cognisant of the aim to re-route traffic to avoid certain corridors). This could be developed as a Parking Management Plan for the precinct (ITS Strategic Direction 4).
12. Consider car share and on-demand provisions throughout the precinct and whether these are suitable for forecast demand given the increased popularity of ridesharing services (ITS Strategic Direction 4).
13. Undertake a review of parking rates that apply to developments within the precinct to support the Travel Demand Management approach and encourage shift to sustainable modes (ITS Strategic Direction 5).

Loading and servicing

14. Review on street loading and servicing to optimise these operations and reduce the impact on street environments within the precinct. Optimisation may include encouraging new developments to combine basement provisions to minimise access points. This would require more detailed interrogation along key corridors (such as Victoria Avenue and Anderson street) where on street servicing can be integral to the function of shop front retail (ITS Strategic Direction 4).

15. Encourage loading and servicing for new development on-site within basements enabling vehicles to enter / exit in a forward direction to again optimise these operations and reduce the impact on street environments (ITS Strategic Direction 4).

1 Introduction

Arup were commissioned by a consortium of developers to undertake this study as part of the Chatswood CBD Strategic Transport Study (CCSTS) and have collaborated with Willoughby City Council (WCC) and Transport for NSW (TfNSW) throughout.

The Future Conditions report builds upon the findings from the Existing Conditions report, previously prepared by Arup. This report has been developed to assess the impact of increased employment and dwelling forecasts outlined in the Chatswood CBD Planning and Urban Design Strategy (CCPUDS) on the future transport network in Chatswood.

These have been tested at 2026 and 2036 horizon years using the TfNSW Strategic modelling suite. The assessment captures the impacts on walking, cycling, public transport services and the road network.

The future scenarios have been compared to the existing base TfNSW forecasts to identify any significant differences. This comparison has been used to validate the proposed growth numbers in the CCPUDS and identify critical issues that may need to be investigated in the future.

Research has also been undertaken into any planned schemes within the precinct which may impact travel behaviour in the future. The changing demand between the horizon years was assessed to capture the changing travel patterns in Chatswood over the next 20 years.

The transport networks in the TfNSW strategic models for each of the horizon years were reviewed to confirm planned infrastructure was incorporated. No changes were made the to the transport network in the strategic models as part of this study.

Each mode has been assessed using varying methodologies dependent on the granularity of the outputs from the TfNSW strategic models. Issues relating to each mode have been identified and recommendations developed to support the CCPUDS.

Recommendations have been formulated to satisfy the request in the Department of Planning, Industry and Environment's letter dated 9th July 2020 and they could be integrated into an updated or finalised CCPUDS.

1.1 CCSTS methodology

This report is part of a suite of documents being developed as part of the CCSTS. The roadmap of documents being produced for the CCSTS is outlined in Figure 1.

Studies relating to the future land use scenarios, parking rates and the existing conditions within the precinct have been submitted and approved by WCC and TfNSW. The three documents which have been delivered are:

- Future Land Use Scenarios note

- Parking Rates Benchmarking study
- Existing Conditions report

This report will combine the findings of the other deliverables to investigate the impacts on the future transport network, identify any detrimental impacts and produce recommendations for the precinct.

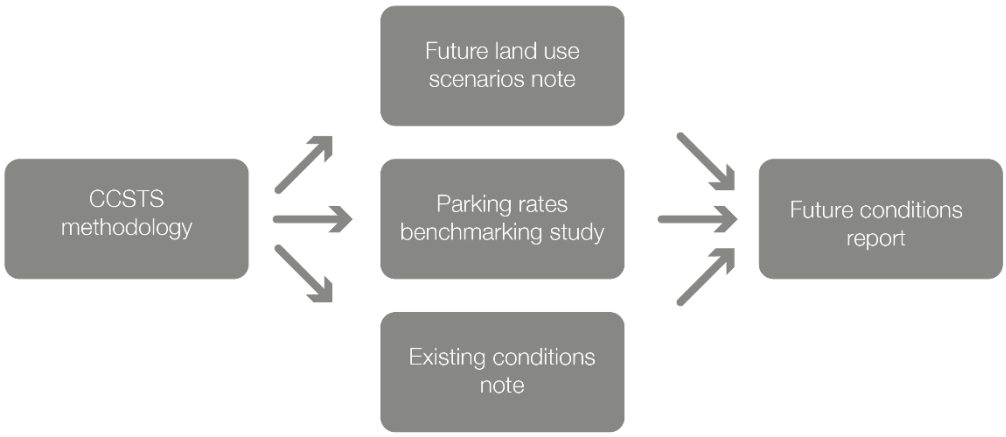

Figure 1: CCSTS document roadmap

2 Future Committed and Planned projects

A range of infrastructure schemes and initiatives are planned in and around Chatswood CBD in the coming years. These will influence how people travel to and from the precinct accommodating increasing demands and influencing mode share. Therefore, these schemes need to be considered when assessing the future horizon years. Several of the key schemes are summarised in this section.

2.1 Sydney Metro

In 2019, Metro Northwest began operating between Tallawong and Chatswood. In 2024, Metro City & Southwest will form a continuation of the line, running between Chatswood and Bankstown, as shown in Figure 2. This Metro line will provide a rapid direct connection to the Sydney CBD, increasing capacity between Chatswood and the Sydney CBD significantly.

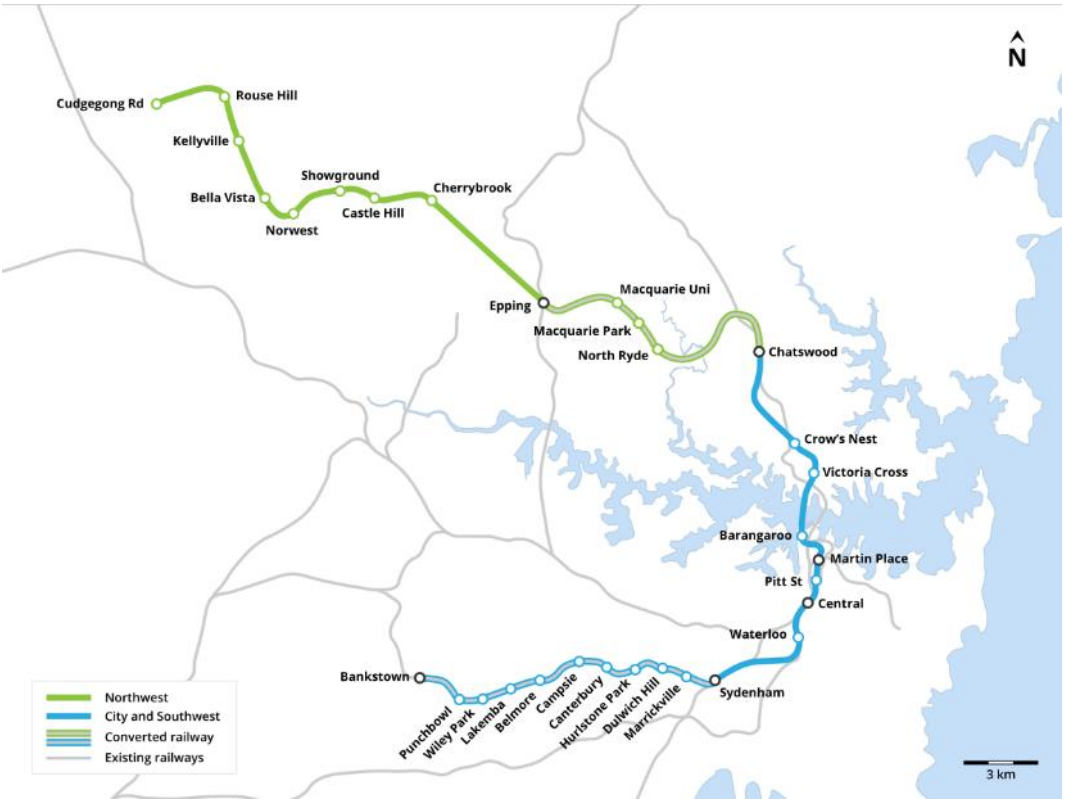

Figure 2: Sydney Metro alignment (Source: TfNSW)

2.2 Willoughby ITS 2036

The Integrated Transport Strategy (ITS) developed by WCC, sets the broad direction for managing transport in the Willoughby Local Government Area to 2036. The ITS contains a number of strategic directions informed by the outcomes from WCC's Community Strategic Plan. The outcomes and directions are as follows:

- **Green** - our transport system will be sustainable and promote greater levels of walking and cycling;
- **Connected and inclusive** - our transport system will provide excellent local and regional connectivity and be accessible to all;
- **Liveable** - our transport system will contribute to the development of vibrant, liveable and safe places;
- **Prosperous and vibrant** - our transport system will support our local economy by efficiently managing congestion and parking demand; and
- **Effective and accountable** - our transport system will embrace smart technology and respond to community needs.

The ITS also contains a range of actions relating to Chatswood CBD. These are summarised below.

Walking and Cycling

- Implementation of actions as outlined in Chatswood CBD PAMP
- A new pedestrian link between Chatswood interchange and new plaza on Help St - aligning crossings and removing obstacles to connectivity
- Pedestrian crossing improvements at Albert Avenue / Thomas Lane, Chatswood
- Design and implementation of the Chatswood to St Leonards shared path along the Pacific Highway
- Investigate opportunities and locations to provide additional bicycle parking and end-of-trip facilities, including working with Sydney Trains to investigate additional end-of-trip facilities and secure bicycle parking at Chatswood station

Public transport and connectivity

- Work with TfNSW on the development and implementation of a trial on the use of electric autonomous buses to/from the Chatswood CBD.
- The B-Line bus rapid transit link connecting Chatswood to Dee Why via Frenchs Forest
- Work with TfNSW to identify and implement improvements and upgrades (including detailed designs), to the Chatswood and St Leonards interchanges so that they continue to be premium multimodal hubs, supporting increasing use of Public Transport. Further projects may flow from this action.

Vibrant and liveable places

- Provision of a shuttle bus for workers from outside the Chatswood CBD
- A Movement and Place Local Area Plans for Chatswood CBD

Safe places

- Complete a study and develop priority actions that create 40km/h shared zones in high pedestrian areas within Chatswood CBD

- Prepare a report on the feasibility of having CCTV cameras installed within the road reserve on designated streets within the Chatswood CBD.

An efficient road network

- Develop and complete priority actions highlighted in Chatswood CBD Traffic Study (2012)
- Provide an appropriate number of car share spaces in the Chatswood and St Leonards CBDs and local centres
- Provide appropriate level of taxi/rideshare spaces in the Chatswood and St Leonards CBDs and local centres
- Review key travel pattern objectives and outcomes outlined in Willoughby Economic Development Study and develop formal innovative Parking Management Plans, which includes parking pricing, for Chatswood CBD and St Leonards strategic centres utilising information contained in Street Parking Strategy and off-street parking locations.
- Undertake a review of fees and charges for on-street parking prices in Chatswood CBD that enables off-street parking to become a more attractive option for motorists and encourages freer flow of traffic on street and regular turnover of vehicles.

Smart technology

- Implement trial of Mobility as a Service (MaaS) in Chatswood CBD in conjunction with the program currently being trialled by TfNSW across Sydney. Trial to take into consideration walking, cycling, taking the bus, catching the train, driving, riding as a passenger, taxi, renting a car, carsharing, bikesharing, ridesharing, ridesourcing.
- Implement parking guidance system consisting of variable message boards across the Chatswood CBD to guide parking to off-street carparking stations.

Effective policymaking and regulation

- Undertake a review of both on and off-street parking rates within Chatswood CBD, as part of fees and charges schedule, to incentivise EV, off peak utilisation, car sharing facilities at existing and proposed electric vehicle charging stations.
- Implement driver awareness and education programs that will encourage drivers within the Chatswood CBD to utilise real-time digital inventory of on-street parking supply and information that can better inform them of the location and availability of car parking spaces and time and fee restrictions. This education program to align itself with the timing of implementation of parking guidance (technology) app.

2.3 Pacific Highway shared path

WCC has proposed a shared pedestrian and bicycle path that runs along Pacific Highway between Mowbray Road and St Leonards Station. The 3.5 kilometre route forms part of the wider bicycle network and will improve north-south

connectivity to a range of key places of interest. Initial proposals for this shared path would located within the existing verge and footpath as the Pacific Highway environment is not suitable for bicycles to mix with traffic.

2.4 Chatswood to St Leonards Bicycle Route Improvement Plan

Willoughby City Council have proposed a north-south separated bicycle route linking Chatswood with St Leonards via Artarmon. The proposed route and facilities will provide a safe, direct, accessible and amenable bicycle link for residents, commuters and visitors. The route will improve north-south connectivity for active travel in Willoughby. Safety is a key consideration for this plan and the aim is for bicycles to be separated from traffic along large portions of the route.

2.5 Anderson Street cycling improvements

Improvements to bicycle facilities and access along Anderson Street are being pursued through a Planning Proposal for 58 Anderson Street, Chatswood. The associated bike network improvements would include providing missing links in the existing bicycle lanes across intersections and widening of Anderson Street to support provision of acceptable widths for kerbside parking, bicycle lanes and traffic lanes.

2.6 Parking Guidance System

To support the Travel Demand Management approach outlined in the CCPUDS, the implementation of a parking guidance system in Chatswood CBD has been proposed. The function of the parking guidance system would be to direct motorists who enter the CBD to available car parking spaces through the introduction of a dynamic signage system.

The purpose of this scheme is to manage the existing and future on- and off-street car parking in a manner that sustains and enhances the CBD environment.

2.7 Enhanced bus services to the Northern Beaches

Future Transport 2056 outlines plans for improved bus services between the Northern Beaches and Chatswood in the form of rapid, high frequency buses. This scheme would target a catchment which currently does not have a direct public transport connection to Chatswood. The scheme would link to the Planned Precinct at Frenchs Forest, providing connectivity to the Northern Beaches Hospital as well as planned future growth in the area.

3 Uplift scenarios

TfNSW have a suite of strategic models used to undertake forecasting and scenario testing across the Greater Sydney Metropolitan Area. The Sydney Strategic Travel Model (STM) was selected as the appropriate tool to test the future scenarios outlined in the CCPUDS. The Sydney Traffic Forecasting Model (STFM) was then used to provide greater detail on the impact to the road network. Model version 3.62 was used for STM and STFM.

Horizon years of 2026 and 2036 were selected to broadly align with the CCPUDS 10 and 20 year visions. To assess each horizon year a base and uplift scenario run was required. The strategic model runs undertaken were as follows:

- 2026 base (TfNSW forecasts)
- 2026 uplift (CCPUDS forecasts)
- 2036 base (TfNSW forecasts)
- 2036 uplift (CCPUDS forecasts)

The TfNSW strategic models require population and employment inputs by Travel Zone to generate results. As part of the CCSTS methodology uplift scenarios were developed for the 2026 and 2036 horizon years using the forecasts outlined in the CCPUDS. WCC and TfNSW were involved in the development of these uplift scenarios. Further detail on the process is presented in the Land Use Scenarios Technical Note in **Appendix A**.

The Travel Zones within the Chatswood CBD are presented on

Figure 3.

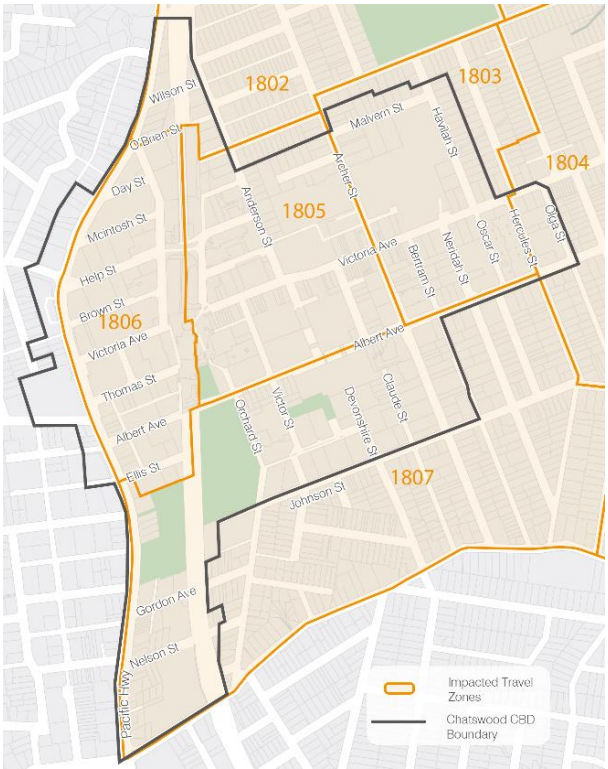

Figure 3: Travel Zones within the Chatswood CBD

3.1 2026 Scenarios

Table 1 includes the 2026 uplift scenario alongside the base population and employment forecasts from the TfNSW strategic models for the Travel Zones within the study area.

Table 1: 2026 base and uplift scenarios

Travel Zones	2026 TfNSW base		2026 uplift	
	Population	Employment	Population	Employment
1802	1,655	171	1,900	700
1803	1,112	4,564	2,300	5,100
1805	2,923	8,030	3,600	8,000
1806	5,256	15,580	5,300	13,500
1807	3,756	1,159	4,200	2,200
Total	**14,711**	**29,504**	**17,300**	**29,500**

2026 uplift population forecasts are approximately 20% higher than the base forecasts. The distribution of population across the Travel Zones is similar in both scenarios. Employment forecasts are almost identical; however, the distributions vary with the base forecast showing a higher value in Travel Zone 1806. This is related to employment growth being distributed to other Travel Zones in the uplift scenario. The differences in population and employment forecasts by Travel Zone are presented in Figure 4.

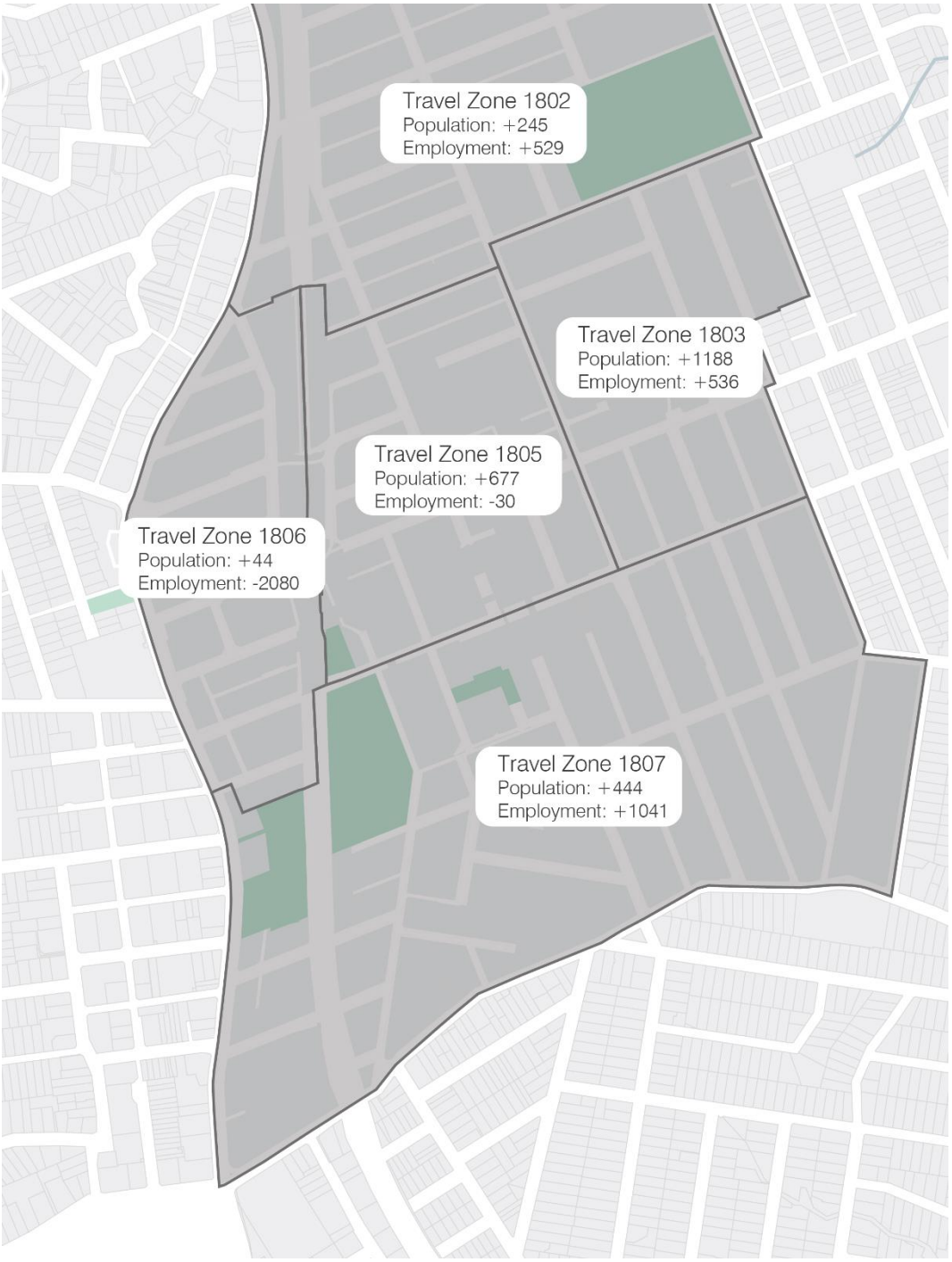

Figure 4: 2026 uplift and base scenario population and employment distribution differences

3.2 2036 Scenarios

Table 2 includes the 2036 uplift scenario tested alongside the base forecasts from the TfNSW strategic models for the Travel Zones within the study area.

Table 2: 2036 growth scenarios

Travel Zones	2036 TfNSW base		2036 uplift	
	Population	Employment	Population	Employment
1802	1,738	182	2,600	1,000
1803	1,410	4,937	4,300	5,900
1805	3,393	8,810	5,300	9,100
1806	5,629	16,990	6,300	14,000
1807	4,001	1,259	5,500	3,100
Total	**16,171**	**32,178**	**24,000**	**33,100**

The uplift population forecast is 48% higher than the TfNSW forecasts with a similar distribution which relates to an increased number of dwellings being proposed in the CCPUDS. 2036 uplift employment forecasts are approximately 3% higher than the base forecasts and as in 2026 the distributions vary with the base forecast showing a higher value in Travel Zone 1806. The differences in population and employment forecasts for the 2036 horizon year are presented in Figure 5.

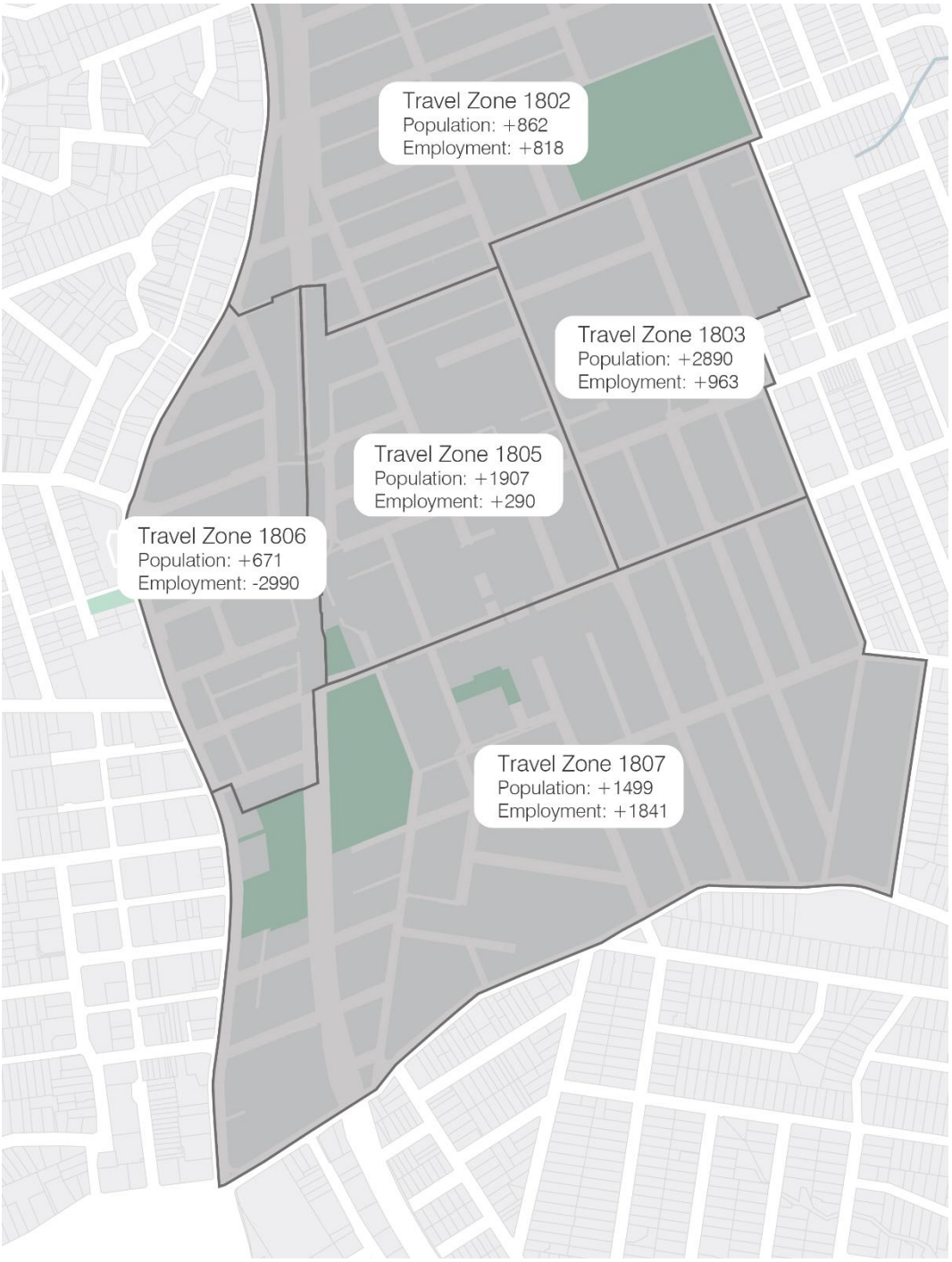

Figure 5: 2036 uplift and base scenario population and employment differences

The uplift scenarios implement a significant growth in population throughout the precinct whereas employment is similar in magnitude to the base forecasts. For employment the key difference is the distribution across the five Travel Zones.

4 Strategic Model Network and Inputs

A key aspect of assessing the impacts on the transport network is understanding how the transport network is expected to look in the horizon years. As part of this study TfNSW assumptions in relation to the transport network have been adopted and no changes to the model networks have been made.

To ascertain TfNSW's predictions for the future transport network the bus, rail and road networks in the TfNSW strategic models were compared between the 2016, 2026 and 2036 models.

We note that there may be some differences between the future model transport network and the detailed delivering and staging of the network by TfNSW in the future.

4.1 Population and Employment distribution

A key input into the model is the population and employment forecast, these have been adopted from the CCPUDS as outlined in section 2. The model requires these forecasts to be distributed by travel zone and balanced across the Greater Sydney Metropolitan Area.

This redistribution has been undertaken to incorporate the adjusted values in the Chatswood Travel Zones. It should be noted that the magnitude of change in any Travel Zones outside of the Chatswood CBD is relatively small.

4.1.1 Employment

The difference in employment distribution between the base and uplift scenarios in 2036 have been compared on Figure 6. Analysis of the employment redistribution in 2026 has not been included as the change was minor as outlined in Section 3.1.

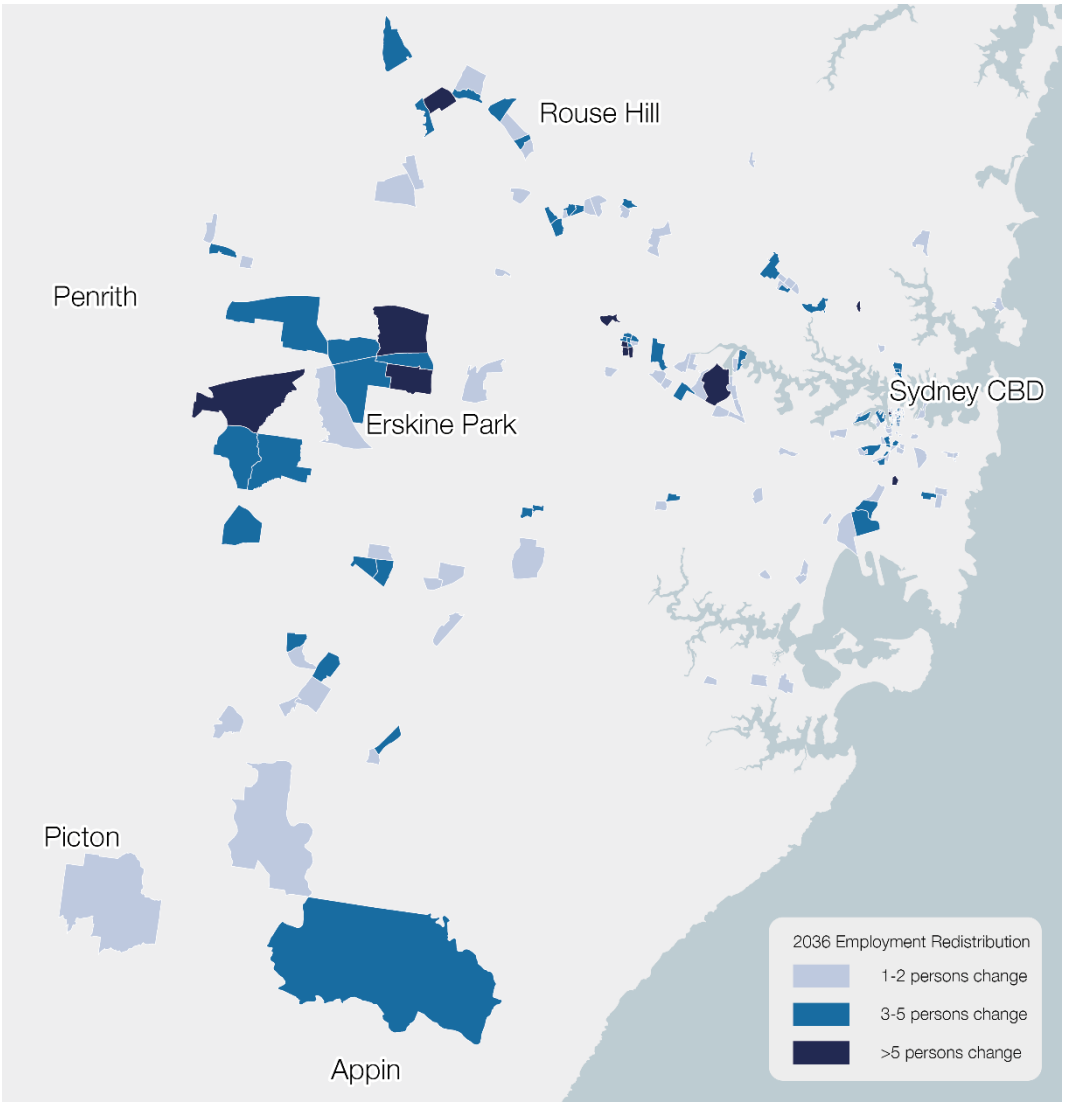

Figure 6: Employment distribution differences 2036

This figure indicates that employment has been redistributed from across the Greater Sydney Metropolitan Area including Western Sydney and a range of suburbs along the Sydney Metro - North West corridor. Zones where the most jobs where redistributed from were Luddenham Park and the Parramatta CBD.

4.1.2 Population

The difference in population distribution between the base and uplift scenarios in 2026 and 2036 have been compared on Figure 7 and Figure 8.

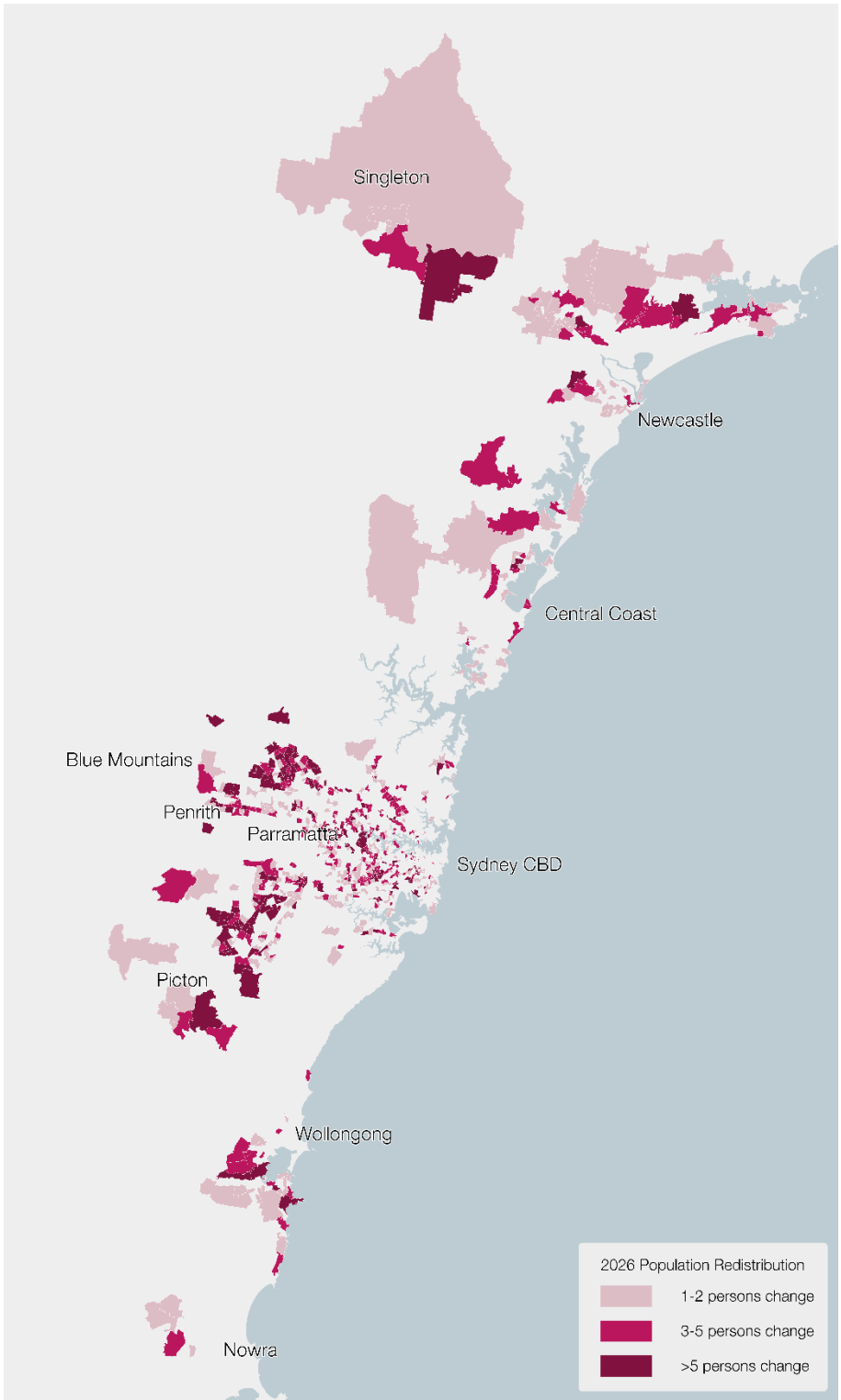

Figure 7: Population distribution differences 2026

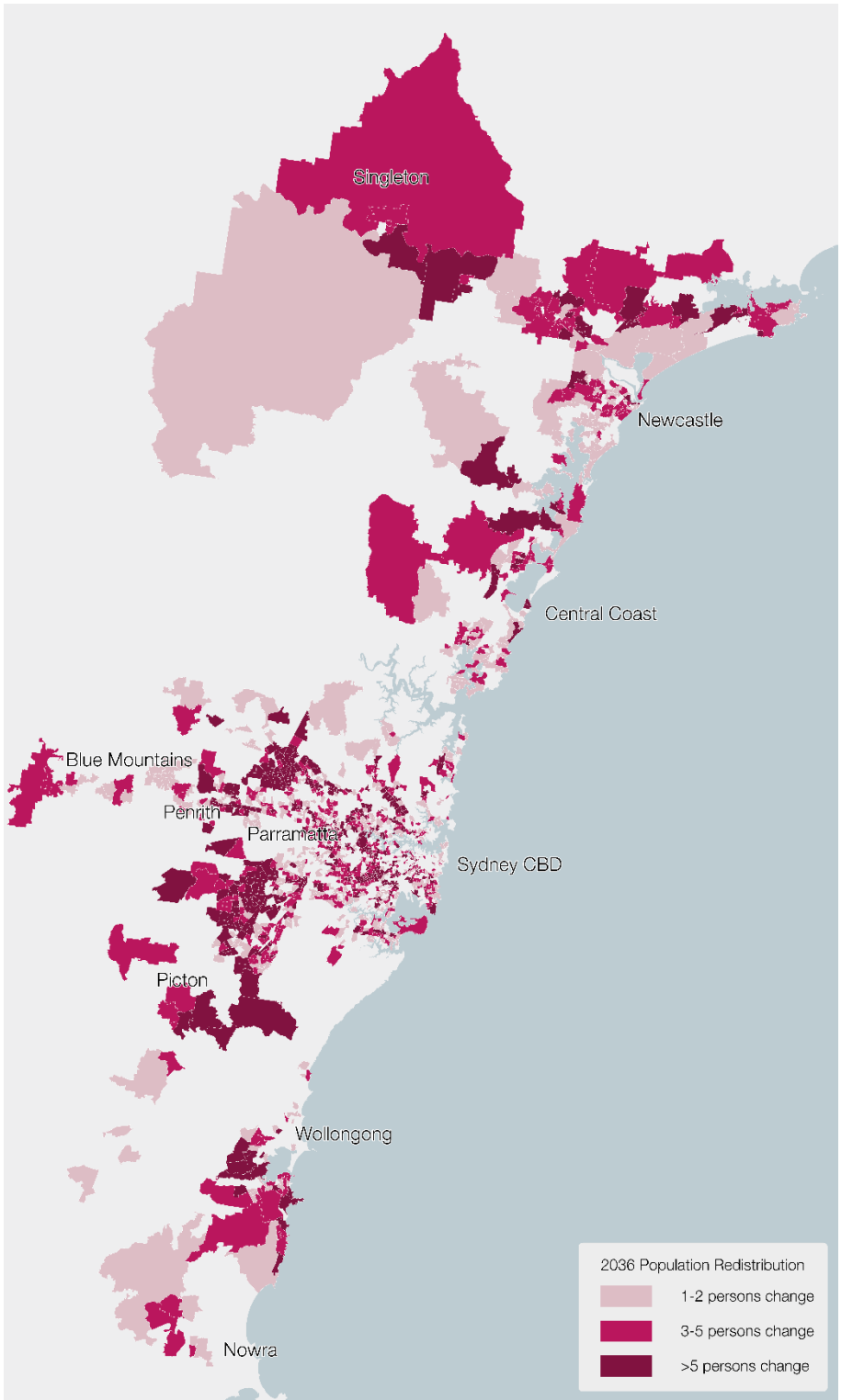

Figure 8: Population distribution differences 2036

These figures indicate that to accommodate increased population growth in Chatswood, growth has been redistributed from locations across New South Wales, including Sydney and urban centres in Newcastle, Central Coast and Wollongong. Trends are broadly similar in 2026 and 2036. Due the greater magnitude of change in 2036, more Travel Zones are affected, and others see changes of more than five people. Areas outside Chatswood that experienced the largest change in population distribution were Kellyville, Rosehill and Homebush.

4.2 Bus

Bus services in the 2016, 2026 and 2036 models were compared to identify changes to the bus network. Bus routes 284 and 343 are not present in the 2026 or 2036 model networks, removing direct bus connections to Kingsford and Duffys Forest.

One new bus route, the 530, is added in 2026 and 2036 which connects to Burwood. The 194 is also adjusted. In 2016, this service runs through to City whereas in future years it will terminate at Chatswood. The frequency of these bus routes in 2026 and 2036 are presented in Table 3.

Table 3: Frequency of new or adjusted bus routes in 2026 and 2036 models

No.	Bus Route	Peak hour frequency (buses per hour)	
		2026	2036
194	Chatswood to St Ives	5	6
530	Chatswood to Burwood	11	12

Figure 9 indicates the direction these routes approach Chatswood CBD from and the roads they use.

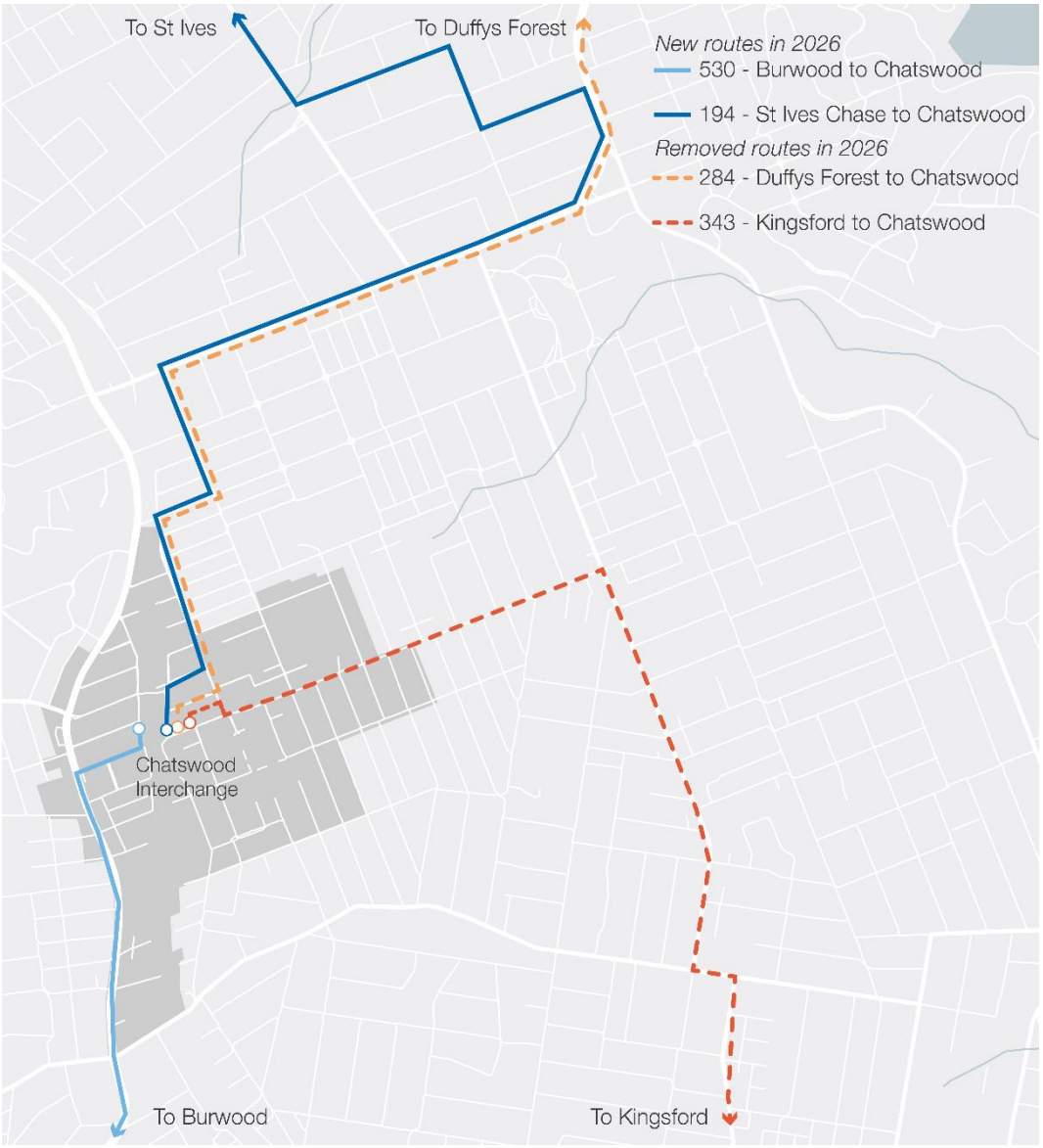

Figure 9: Changes to bus routes in 2026

All other bus services have a standard growth factor of 14% applied for each of the horizon years. For example, a bus service with a frequency of 2 buses per hour in 2016 would increase to 2.28 in 2026 and 2.59 in 2036. Note that the STM applies these frequencies as decimal figures rather than rounding to the nearest whole number and all service frequencies are consistent between the base and uplift cases.

4.3 Rail

In the 2026 and 2036 models, the rail network in Chatswood consists of the:

- T1 North Shore Line;
- Central Coast Newcastle Line; and
- Metro Northwest and City & Southwest (formerly the Epping to Chatswood Line)

The changes to the frequencies on these lines between the 2016, 2026 and 2036 models are outlined in Table 4.

Table 4: Rail line frequency comparison

Rail Line	Direction	2016 Frequency (1-hr)	2026 Frequency (1-hr)	2036 Frequency (1-hr)
T1 North Shore	North	16	20	20
	South	11	16	16
Central Coast & Newcastle	North	0[1]	0[1]	0[1]
	South	4	4	4
Epping to Chatswood / Metro Northwest & City & Southwest	North	4	20	20
	South	4	20	20
Total		**39**	**80**	**80**

Most of the increases in frequency can be attributed to the introduction of Metro services with smaller improvements to the frequency of the T1 North Shore Line. There are no changes to frequency or services between 2026 and 2036.

Train services approach Chatswood Station via three spurs. For southbound services T1 North Shore and Central Coast and Newcastle trains use the northern spur, where Sydney Metro uses the north western spur to access Chatswood. All northbound services use the southern spur. The increases in train frequencies on each of the spurs are presented on Figure 10.

[1] Northbound CCN trains originate at Hornsby

Figure 10: Frequency increases on Rail spurs

4.4 Road network

The road network in and around the precinct is identical in the 2016, 2026 and 2036 models. The road network from the STFM is presented in Figure 11 and highlights that only major links within the Chatswood CBD are present in the STFM model.

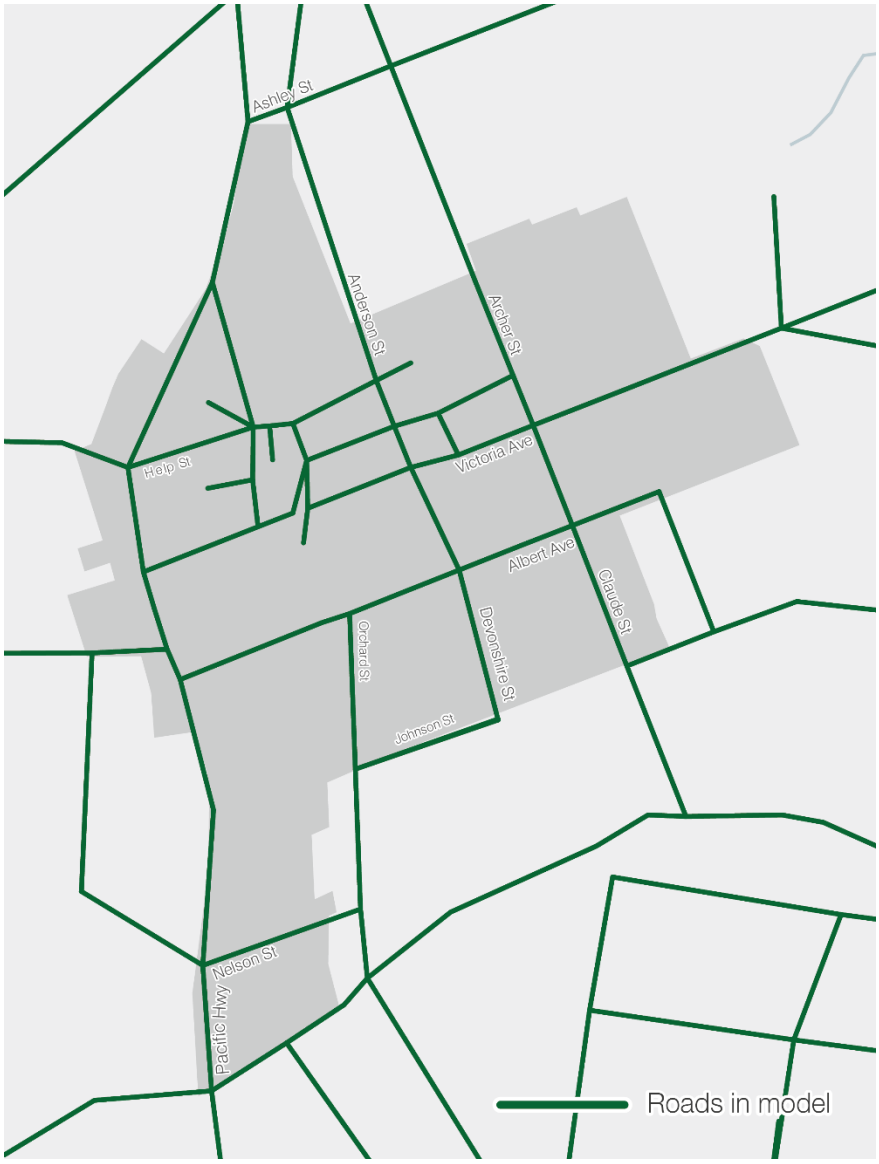

Figure 11: STFM road network

This is a limitation of the STFM as there a large number of streets within Chatswood CBD which are not captured. Discrepancies will exist between the actual and modelled network capacities and certain vehicle routes will not be possible in the model compared to the existing road network.

4.5 Non-committed schemes

There are number of other potential transport schemes that may benefit public transport use in Chatswood in the future. These include:

- An improved bus services between the Northern Beaches and Chatswood which is identified in the FTS and would provide a public transport connection to the Planned Precinct at Frenchs Forest; and
- The T9 Northern train line, which operates between Hornsby and Gordon via Epping and the Sydney CBD.

As these schemes are not currently committed that have been excluded in the strategic modelling assessment.

5 Future travel trends in Chatswood

The primary purpose of this investigation is to compare the base and uplift scenarios and identify and critical issues. However, it is important to understand how travel patterns in Chatswood will change between the different horizon years. This section will provide detail on the future travel trends for the Chatswood CBD by interrogating the STM outputs.

5.1 Change in demand

The change in demand in the 2-hour peak for private vehicle and public transport trips have been analysed for the base and uplift scenarios, as outlined in Table 5 and Table 6.

Table 5: 2-hour peak change in demand – Base scenario

Scenario	Inbound trips		Outbound trips	
	Private vehicle	Public Transport	Private vehicle	Public Transport
2016	11100	9200	1800	2000
2026 base	11800	14800	1800	2400
2036 base	12700	17500	1900	2800
Overall change	**+1600**	**+8300**	**+100**	**+800**

Figures are subject to rounding

Table 6: 2-hour peak change in demand – Uplift scenario

Scenario	Inbound trips		Outbound trips	
	Private vehicle	Public Transport	Private vehicle	Public Transport
2016	11100	9200	1800	2000
2026 uplift	11700	13900	2300	3200
20236 uplift	12800	16400	3100	4600
Overall change	**+1700**	**+7200**	**+1300**	**+2600**

Figures are subject to rounding

The data indicates reflects that the overall magnitude of inbound trips increases more than outbound trips for the base and uplift scenario. The largest change will be in inbound public transport trips which is likely attributed to the introduction of Sydney Metro Northwest, City and Southwest, combined with an uplift in employment. The key difference between the base and uplift scenarios is a greater number of outbound trips, attributed to a higher population in the Chatswood CBD. A key result of this is approximately 1300 extra private vehicle trips. The assessment of the road network using STFM later in this document will confirm whether this has a detrimental impact on the road network.

The volumes of vehicles on the network in all scenarios were also analysed. Plots of these on the STFM network can found in **Appendix B.**

5.2 Change in Boardings and Alightings at Chatswood Station

Passenger boardings and alightings can be used as an indicator for travel demand and growth, particularly given the Chatswood CBD is primarily served by the railway station. Boardings and alightings are presented in Table 7 and were adjusted to peak hour values using a 61.2% factor derived from Opal data at Chatswood Station. The metrics in Table 7 are defined by the following:

- Initial boarding – Passengers boarding a train service as the first public transport step of their trip;
- Transfer boarding / alighting – Passengers transferring to another rail service or public transport mode;
- Through – Passengers travelling through Chatswood Station on rail services; and
- Final alighting – Passenger alighting as the final public transport step of their trip.

Table 7: Peak hour Chatswood Station boardings and alightings comparison

Scenario	Initial boarding	Transfer boarding	Through	Transfer alighting	Final alighting
2016	2700	300	16900	300	4200
2026 Base	3400	7600	27500	7600	7700
2026 Uplift	3900	9300	34700	9300	8900
2036 Base	3800	7700	27500	7700	7400
2036 Uplift	4700	9300	34700	9300	8600

Figures are subject to rounding

Through passengers make up the largest proportion of the boardings and alightings with this increasing in future horizon years to align with increased rail service frequencies provided by Sydney Metro. In 2036, over 9,000 passengers are transferring at Chatswood Station compared with only 300 in 2016. This is likely linked to passengers transferring to and from the Sydney Metro, which provides a faster and more frequent public transport service to the Sydney CBD.

Initial boarding and Final alighting trips align with the high proportion of inbound trips presented in Section 5.1. The number of Final alightings are approximately double the Initial boarding trips in future years indicating Chatswood is a major destination in the AM peak.

The main difference between the base and uplift scenarios is in Initial boarding trips. Uplift scenarios have a higher number of Initial boardings trips likely related to the greater proposed population in Chatswood CBD in these scenarios. This

would result in, greater demand for travel. It is encouraging to see these additional trips being undertaken on public transport.

5.3 Change in Mode share

Table 8 provides a comparison of the private vehicle mode share between 2016 and the 2026 and 2036 scenarios. The mode share has been calculated as a percentage of private vehicle and public transport outputs from the TfNSW strategic models.

Table 8 Change in Mode Share

Scenario	Private vehicle mode share	
	Inbound	Outbound
2016	55%	48%
2026 Base	44%	42%
2026 Uplift	46%	42%
2036 Base	42%	40%
2036 Uplift	44%	40%

The mode shares indicate that in future years the private vehicle mode share will decrease for both inbound and outbound trips. When comparing the base and uplift scenarios the difference in inbound mode shares is related to greater public transport trips in the base scenarios. It should be noted that despite the mode shift the total number of private vehicle trips will increase as outlined in Section 5.1.

5.4 Walking and cycling demand

The TfNSW strategic models are not designed to accurately predict walking and cycling trips. Therefore, a combination of the strategic model outputs and expected mode shares were used to predict these trips. It should be noted that this is a first principles approach and all results are based on conservative estimates for future mode shares. Walking and cycling mode shares may differ in the future due to a broad range of factors such as people's perception of these modes, infrastructure provision and soft policy initiatives.

Only the uplift scenarios were assessed as the methodology used, dictated there would be minimal difference between the base and uplift scenarios.

To estimate the walk only mode share, existing mode shares from 2016 Journey to Work data relating to the Travel Zones within Chatswood CBD were used. For cycling an aspirational value was applied based on current Journey to Work data for the City of Sydney Local Government Area, which has one of the highest cycling mode shares in Sydney.

Household Travel Survey (HTS) data was also considered and used to support JTW data, but as HTS does not capture a cycling mode share in the AM Peak it

was deemed more appropriate to use the Journey to Work data to drive the mode shares.

The public transport and private vehicle mode shares from the TfNSW strategic models were adjusted to accommodate the walking and cycling mode shares. The adjusted mode shares for 2026 and 2036 are presented in Table 9 and Table 10.

Table 9: 2026 adjusted mode shares to include walking and cycling

Travel Zone	Inbound				Outbound			
	Walk only	Cycles	Public transport	Private vehicle	Walk only	Cycles	Public transport	Private vehicle
1802	5%	1%	27%	67%	11%	2%	39%	48%
1803	8%	1%	42%	49%	11%	2%	51%	36%
1805	9%	1%	52%	38%	11%	2%	53%	34%
1806	6%	1%	54%	39%	11%	2%	58%	29%
1807	7%	1%	23%	68%	11%	2%	44%	43%

Table 10: 2036 adjusted mode share to include walking and cycling

Travel Zone	Inbound				Outbound			
	Walk only	Cycles	Public transport	Private vehicle	Walk only	Cycles	Public transport	Private vehicle
1802	5%	2%	28%	65%	11%	3%	40%	46%
1803	8%	2%	43%	47%	11%	3%	51%	34%
1805	9%	2%	53%	36%	11%	3%	54%	32%
1806	6%	2%	55%	37%	11%	3%	59%	27%
1807	7%	2%	25%	66%	11%	3%	45%	41%

These mode shares have been applied to the overall trips output from the strategic models to understand the volume of walking and cycling trips in the AM peak hour.

We note that the Journey to Work data shows a lower walk mode share when compared to the 2016/17 HTS data (27%). This indicates a large number of walk trips will continue to occur outside AM peak period, however, these time periods are not assessed within this report.

5.4.1 Walking

To assess the number of walking trips in the AM peak hour, walk only and public transport trips have been considered. Public transport trips were considered as all of these will have a walking component at the start and end of the trip. The estimated number of walking trips[2] in 2026 are presented in Table 11. The values presented include intrazonal trips between the Travel Zones being assessed.

[2] A walk trip is defined as a walk only trip or the first / last leg of a public transport trip

Table 11: 2026 uplift scenario walking trips

Travel Zones	Inbound		Outbound	
	Walk only	Public transport	Walk only	Public transport
1802	10	50	40	140
1803	160	860	50	220
1805	380	2210	70	320
1806	480	4320	120	610
1807	40	140	90	340
Total	**1070**	**7580**	**370**	**1630**

Values displayed include intrazonal trips

When combining the walk only and public transport trips, there are estimated to be over 10,000 walking trips in the AM peak hour with a large proportion of these related to public transport. This suggests many of these trips will pass through the Chatswood Interchange and the urban realm connecting it to Chatswood CBD.

The number of walking trips estimated in 2036 are presented in Table 12.

Table 12: 2036 uplift scenario walking trips

Travel Zones	Inbound		Outbound	
	Walk only	Public transport	Walk only	Public transport
1802	10	80	50	190
1803	190	1000	90	410
1805	430	2550	100	490
1806	540	4930	140	770
1807	60	210	110	460
Total	**1230**	**8770**	**490**	**2320**

Values displayed include intrazonal trips

In 2036, overall walking trips increase to more than 12,000. These figures indicate walking will be a key mode within the precinct and streets in the centre of the CBD should prioritise walking. Further analysis should be undertaken to understand the impact of the increased pedestrian footfall on the public spaces surrounding the Chatswood Interchange.

5.4.2 Cycling

The expected cycling trips in the AM peak hour were generated by applying the aspirational mode share to the strategic model outputs. The cycling trips in 2026 are presented in Table 13.

Table 13: 2026 estimated cycling trips

Travel Zones	Inbound	Outbound
1802	2	7
1803	20	9
1805	43	12
1806	80	21
1807	6	15
Total	**151**	**64**

Values displayed include intrazonal trips

The calculations indicate approximately 200 cycling trips will occur in the AM peak hour. This indicates that if initiatives and facilities are provided to support cycling trips, a notable amount of demand will be generated.

The estimated cycling trips in 2036 are presented in Table 14.

Table 14: 2036 estimated cycling trips

Travel Zones	Inbound	Outbound
1802	6	15
1803	46	24
1805	96	27
1806	179	39
1807	16	30
Total	**343**	**135**

Values displayed include intrazonal trips

Similar trends can be seen in the 2036 calculations where cycling trips increase by approximately 25% increase from 2026, aligning with the uplift in overall demand.

6 Comparing the scenarios

The key focus of the study was to assess the varying impacts of the base and uplift scenarios on the surrounding transport network in 2026 and 2036. This forms a direct comparison between the TfNSW and CCPUDS forecast to understand This section compares the impacts on public transport and the road network.

6.1 Public Transport

The TfNSW strategic model results relating to rail and bus services were assessed to identify any differences between the base and uplift scenarios. Outputs from the STM are only intended to give a broad overview of the volume of public transport trips and the services they may use. To understand in more detail the impact on specific services the Public Transport Project Model (PTPM) would need to be used.

All findings have been shown as 1-hour peak. The STM/STFM models produce standard outputs results for a 2-hour AM peak. A conversion factor of 61.2% was used, based on 2016 Opal data from Chatswood Station.

6.2 Bus

6.2.1 Bus corridor utilisation

For the purpose of this assessment, a bus corridor is classed as any road used by buses. Bus corridors within the study area were analysed on a link by link basis to determine the utilisation of the bus corridors within the study area. Two sets of information were extracted from the strategic model:

- Total bus passenger volumes by link; and
- Total bus frequency by link (this may be a combination of several bus services).

To calculate the capacity for each service, a standard bus capacity of 60[3] was assumed, as identified in TfNSW's 12.5 metres two-door city bus – bus specification. Note this is seating capacity and does not include an estimation for standing passengers.

Figure 12 and Figure 13 show the bus corridor utilisations for both scenarios in 2026.

[3] An assumption was made that a bus capacity of 60 includes 45-50 seated passengers and 10-15 standing passengers

Figure 12: 2026 Base bus utilisation by link

Figure 13: 2026 Uplift bus utilisation by link

Figure 12 and Figure 13 indicate that links with the highest utilisation are Anderson Street, Victoria Avenue and streets connecting to the Chatswood interchange. These are similar to the corridors identified in the Existing Conditions report, which is not unexpected given the relatively minimal changes to the bus network in 2026. Analysis is for the AM peak hour and gives a good understanding of utilisation in the busiest period of the day. Inbound corridors see higher levels of utilisation in this period when compared to other parts of the day. Minimal differences in the utilisation between the base and uplift scenarios was noted in 2026.

Figure 14 and Figure 15 present the bus corridor utilisations for the base and uplift scenario in 2036.

Figure 14: 2036 Base bus utilisation by link

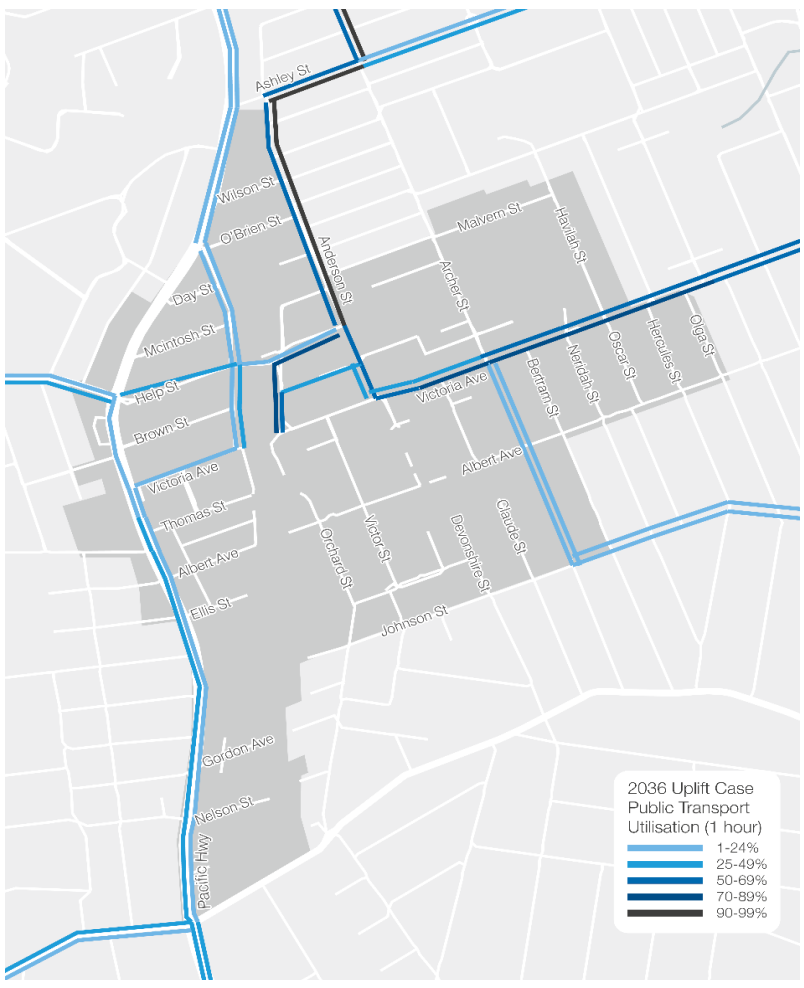

Figure 15: 2036 Uplift bus utilisation by link

Similar trends can be seen to the 2026 results, as presented in Figure 14 and Figure 15. Once again there are minimal differences in the utilisation between the base case and uplift case in 2036. Due to higher volumes of passengers in 2036, Anderson Street and Ashley Street approach 100% utilisation in the 2036 uplift scenario and will require further investigation

6.2.2 Key bus routes

Strategic modelling outputs were analysed to identify key bus routes within the study area. To determine the utilisation of the bus routes on certain links within the study area, two sets of information were extracted from the strategic model:

- Bus passenger volumes by route; and
- Total bus frequency by route.

The AM peak hour passenger volumes and levels of utilisation for services with a utilisation greater than 100% in 2026 are presented in Table 15.

Table 15: Bus routes with over 100% utilisation in 2026

Bus Route	Description	Direction	Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Utilisation	Uplift Utilisation
136	Manly to Chatswood	Inbound	6	490	490	128%	128%
278	Killarney Heights to Chatswood	Inbound	2	140	140	103%	103%
281	Davidson to Chatswood	Inbound	2	210	210	154%	154%
283	Belrose to Chatswood	Inbound	2	170	170	124%	124%

These services originate from areas that do not have rail connections and are all inbound services which align with AM peak travel patterns. Note that the 278, 281 and 283 all have relatively low hourly frequencies meaning it does not require a large volume of passengers for these services to become utilised. No difference is observed between the utilisations for the base and uplift scenarios.

Data relating to bus routes with utilisation values of over 100% in the 2036 scenarios are presented in Table 16.

Table 16: Bus routes with over 100% utilisation in 2036

Bus Route	Description	Direction	Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Utilisation	Uplift Utilisation
136	Manly to Chatswood	Inbound	7	530	530	121%	121%
278	Killarney Heights to Chatswood	Inbound	3	160	160	103%	103%
281	Davidson to Chatswood	Inbound	3	240	250	154%	161%
283	Belrose to Chatswood	Inbound	3	200	200	129%	129%

All the routes with over 100% utilisation in 2026 also experience high utilisations in 2036 despite small increases in service frequency. The 281 experience higher utilisation in the uplift scenario but generally the results the base and uplift scenarios are similar. These results indicate that further analysis will need to be undertaken to develop a range of bus services that can support the travel demand in the future.

A figure showing how utilisation changes along these routes and A list of all heavily utilised buses in 2026 and 2036 are included in **Appendix C.**

6.3 Rail

To determine the utilisation of the three rail lines, two sets of information were extracted from the strategic model:

- Total rail passenger volumes by rail line; and
- Total train frequency by rail line.

To calculate the capacity for each rail line, a standard train capacity of 900 and a standard metro capacity of 1100 was assumed, reflective of the capacity of the TfNSW Waratah train fleet and the Metro fleet. The utilisation for each rail service in the 2026 and 2036 base and uplift scenarios are presented in Table 17 and Table 18.

Table 17: 2026 AM peak hour rail service utilisation

Rail Line	Direction of travel		Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Case Utilisation	Uplift Case Utilisation
T1 North Shore	North	Inbound	20	1600	1600	9%	9%
		Outbound		1900	1900	11%	11%
	South	Inbound	16	12000	12000	83%	83%
		Outbound		7000	7000	49%	49%
Central Coast & Newcastle	North[4]	Inbound	-	-	-	-	-
		Outbound		-	-	-	-
	South	Inbound	4	2300	2300	64%	64%
		Outbound		1200	1200	33%	33%
Metro Northwest, City & Southwest	North	Inbound	20	8800	8700	40%	40%
		Outbound		5800	5800	26%	26%
	South	Inbound	20	18100	18000	82%	82%
		Outbound		22700	22900	103%	104%

Figures are subject to rounding

[4] In the model northbound CCN trains in the AM peak originate at Hornsby via Strathfield so do not pass through Chatswood

The 2026 data indicates that larger proportions of passengers are heading in a southbound direction towards the Sydney CBD aligning with commuter patterns. Metro services carrying the largest volume of passengers which is likely related to the journey time savings this service provides and the highest capacity of all services. When comparing the base and uplift scenarios there is minimal difference between the passenger volumes or service utilisations. Southbound Metro services show a small uplift of 200 passengers in the uplift scenario. It should be noted Metro services leaving Chatswood in a southbound direction are showing high utilisation values.

Table 18: 2036 AM peak hour rail service utilisation

Rail Line	Direction of travel		Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Utilisation	Uplift Utilisation
T1 North Shore	North	Inbound	20	1800	1800	10%	10%
		Outbound		2200	2300	12%	13%
	South	Inbound	16	14400	14500	100%	101%
		Outbound		8400	8600	58%	60%
Central Coast & Newcastle	North[5]	Inbound	-	-	-	-	-
		Outbound		-	-	-	-
	South	Inbound	4	2800	2800	78%	78%
		Outbound		1500	1500	42%	42%
Metro North West, City and Southwest	North	Inbound	20	10200	10100	46%	46%
		Outbound		6800	6900	31%	31%
	South	Inbound	20	23600	23500	107%	107%
		Outbound		28900	29500	131%	134%

Figures are subject to rounding

[5] In the model northbound CCN trains in the AM peak originate at Hornsby via Strathfield so do not pass through Chatswood

6.4 Traffic

Outputs from the STFM have been used to determine traffic conditions on road links within and around the Chatswood CBD precinct. 2026 and 2036 base and uplift scenario volumes were extracted from the model. We note that large number of streets within the precinct are not included in the model road network as presented in Section 4.4.

Traffic data from 2019 was used to convert the 2-hour peak volumes from the model to 1-hour volumes. A conversion factor of 56% was used, based on counts on Anderson Street, Help Street and Victoria Avenue.

6.4.1 Difference in flows

The difference plots, presented in Figure 16 and Figure 17, show the differences on road links between the base and uplift scenarios in 2026 and 2036. A positive value indicates an increase in traffic flows in the uplift scenario and vice versa for decreases.

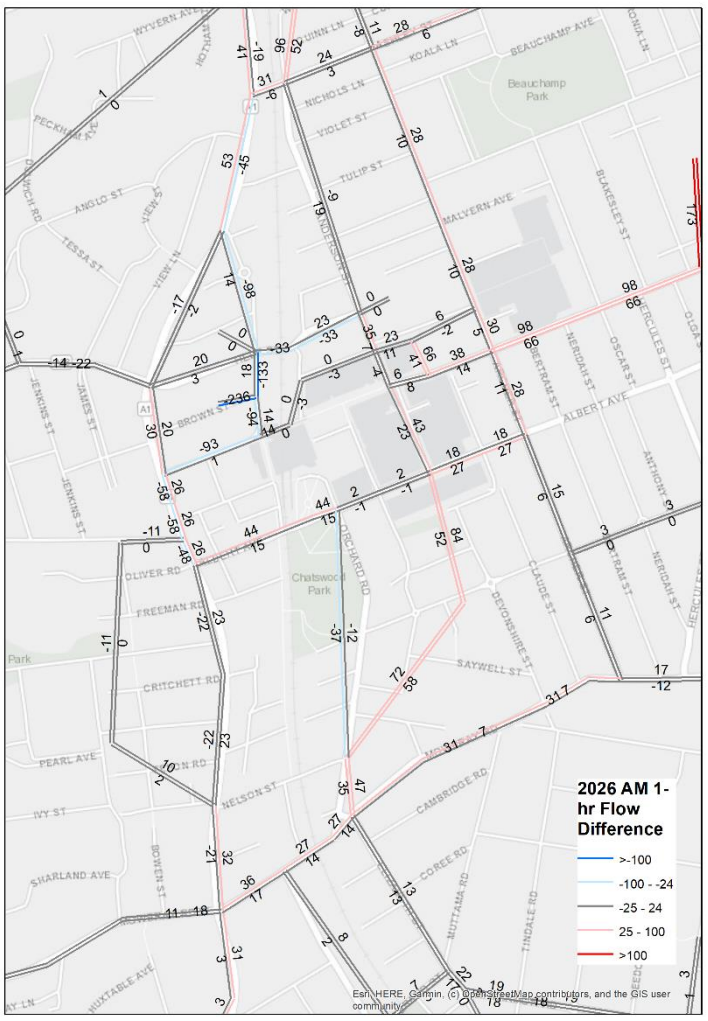

Figure 16: 2026 Traffic flows difference plot

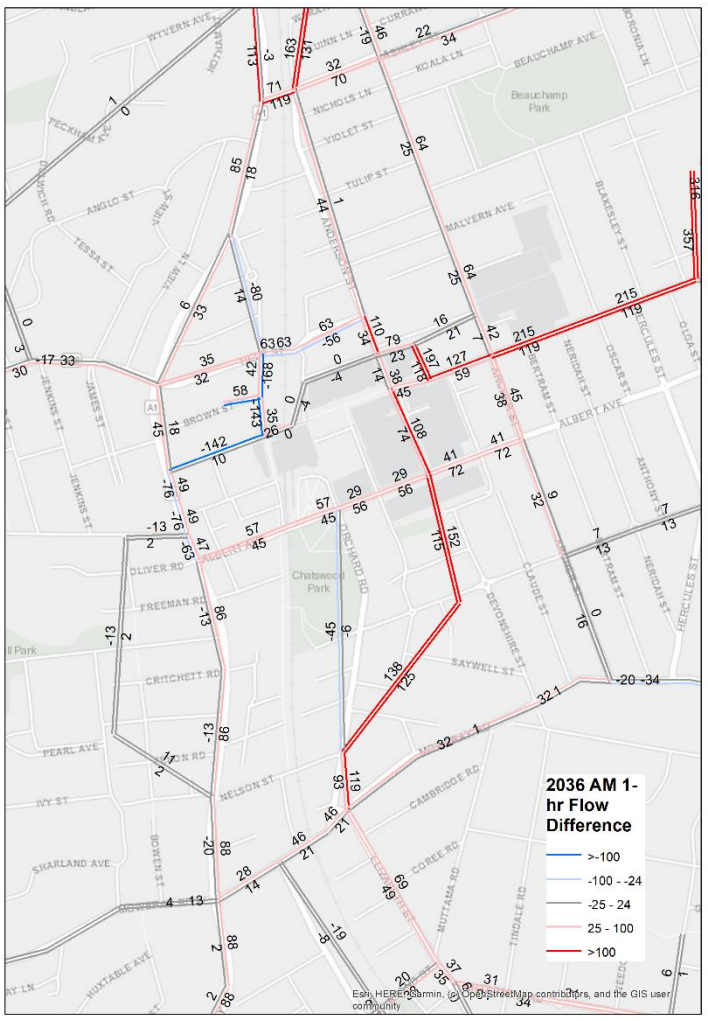

Figure 17: 2036 Traffic flows difference plot

Comparing the scenarios in 2026 and 2036 indicates there are only minor changes to the vehicle flows on the arterial road network such as the Pacific Highway and Mowbray Road. What is more apparent is that the loading of population and employment within the precinct has had varying impacts on the internal streets. The uplift scenarios have weighted more population and employment onto the eastern side of the precinct which has led to increased flows on roads to the east of the Chatswood CBD, such as Victoria Avenue.

6.4.2 Link utilisation

As an indicator of congestion, the volumes were compared to the capacity of each link to develop a value for volume / capacity. The results have been aggregated into the colour bandings presented in Table 19 to give an approximate measure of Level of Service on the network. We note that the TfNSW strategic models are only being used as a comparison tool to compare the scenarios and actual utilisations may not be representative of traffic conditions on these links. As many existing roads are not included in the STFM network the links may not be representative of the capacity of the overall street network.

Table 19: Colour bandings for volume / capacity

LoS		Volume / Capacity range	Label
A		0.00 – 0.50	Significantly under capacity
B			
C		0.50 – 0.75	Under Capacity
D		0.75 – 0.90	Approaching capacity
E		0.90 – 1.00	At capacity
		>1.00	Over capacity

From reviewing the road network utilisation results, it was apparent that the Pacific Highway showed maximum utilisations of 80-90% on most sections. We note that the existing traffic conditions on this section of road would suggest in practice the utilisations may be higher than the model is predicting particularly in the southbound direction in the AM peak. The model results presented in this section have only been used to compare base and uplift scenarios to assess the relative change.

The results of this analysis for both 2026 scenarios are presented in Figure 18 and Figure 19.

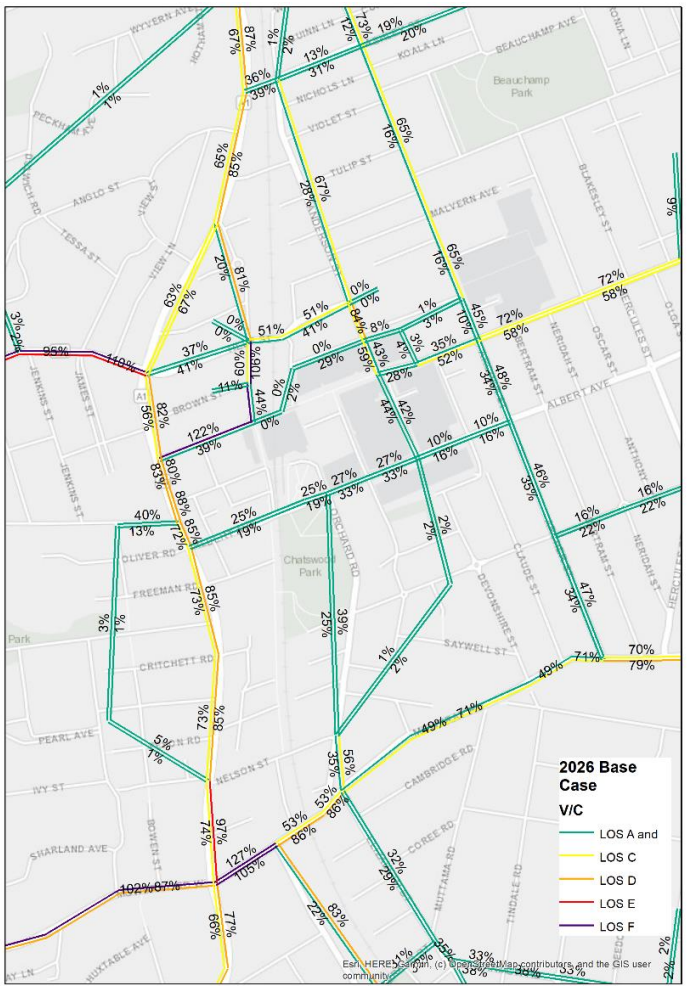

Figure 18: 2026 Base scenario traffic network utilisation

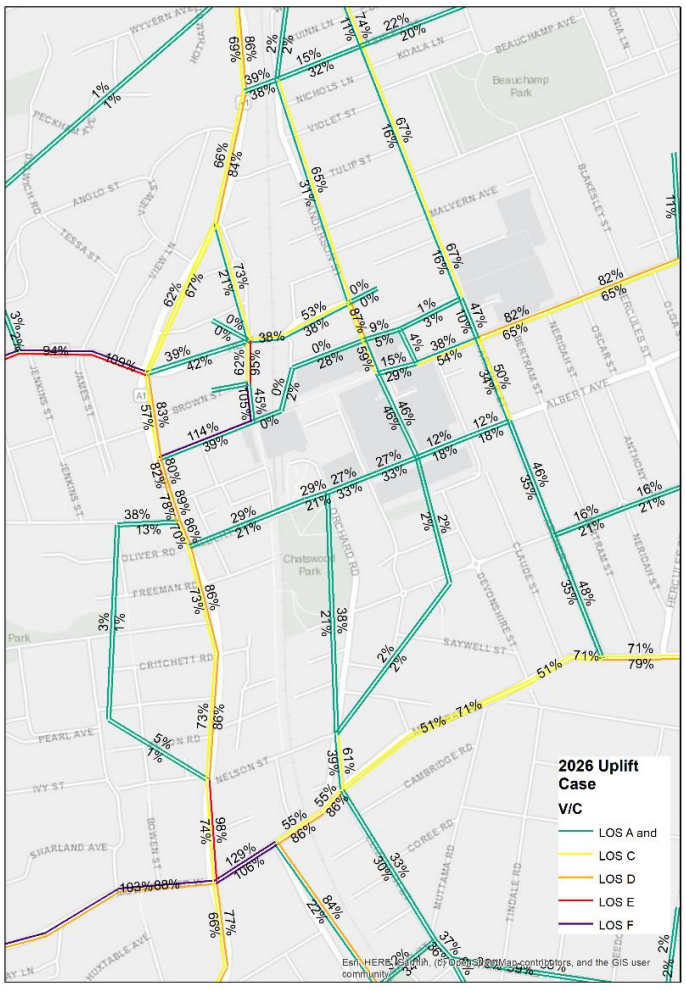

Figure 19: 2026 Uplift scenario traffic network utilisation

The 2026 utilisation analysis indicates that most links are operating with a LoS C or better. Given the difference plots above showed only small changes in traffic flows on the arterial road network utilisations on these links are also similar. It is apparent in the uplift scenario where traffic was higher on links such as Victoria Avenue that the utilisation is higher than the base scenario. Generally internal links within the CBD have acceptable Levels of Service.

The results of this analysis for both 2036 scenarios are presented in Figure 20 and Figure 21.

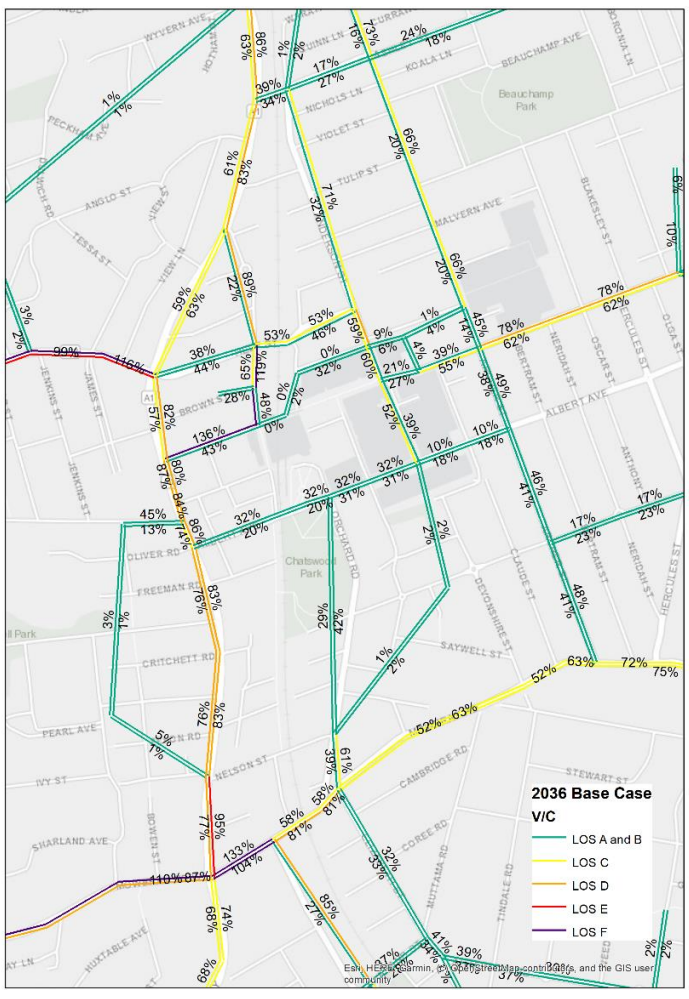

Figure 20: 2036 Base scenario traffic network utilisation

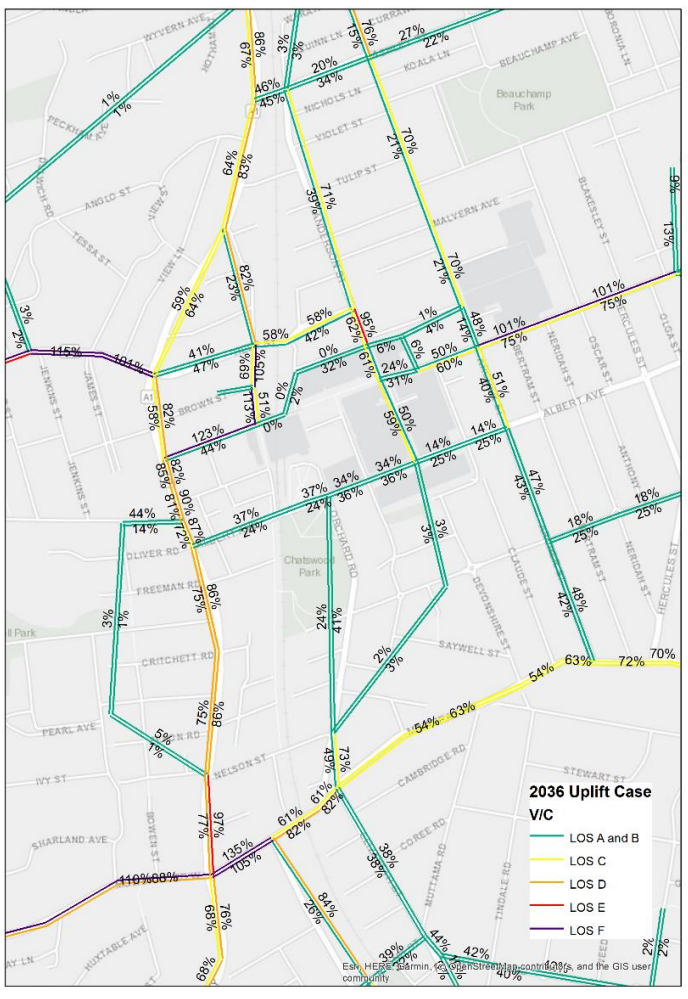

Figure 21: 20236 Uplift scenario traffic network utilisation

2036 analysis shows similar trends to the 2026 outputs, this is expected given Section 5.1 indicated overall vehicle volumes in these years are comparable. When comparing the base and uplift scenarios there are minimal differences on roads external to the precinct. However, the eastern side of the precinct is more congested in the uplift scenario which is likely related to the varying distribution of population and jobs. In 2036, it indicates that loading of the eastern side of the precinct could lead to Victoria Avenue becoming congested. As this is a key link within the precinct that serves a range of functions this should be explored in more detail when approving Develop Applications within the precinct.

7 Next steps

This section includes a summation of the findings of the study and recommendations to support the implementation of the CCPUDS.

7.1 Summary

The following has been identified from the assessment of the horizon years:

- Travel demand in Chatswood will increase significantly over the next 20 years relating to growth in population and employment;
- Sydney Metro is a key driver for travel patterns in future years leading to increased public transport mode shares and a significant uplift in the number of passengers using Chatswood Interchange;
- A range of bus services are heavily utilised in future years and further consideration will be required to ensure these continue to function efficiently in the future;
- Despite mode shift towards public transport private vehicle trips will increase in the horizon years, however, results suggest the road network has capacity to accommodate the uplift;
- Minimal differences were observed between the base and uplift scenarios on the public transport network;
- Differences between the base and uplift scenarios on the road network were predominantly on the internal road network within the CBD and this is likely linked to the varying distributions of population and employment across the precinct;
- Base and uplift scenarios had similar impacts on the surrounding arterial roads such as the Pacific Highway and Mowbray Road; and
- The overall results suggest the WCC CCPUDS is likely to have impacts on the transport network which are similar in magnitude to the TfNSW forecasts.

These findings conclude that the CCPUDS will have an impact in the same order of magnitude as the current TfNSW forecasts and we expect the future transport network will be able to accommodate this demand.

7.2 Recommendations

To address the endorsement letter received from the Department of Planning, Industry and Environment on 9 July 2020, recommendations have been developed. These should be included in the finalised CCPUDS and can be implemented as the strategy is implemented over the next 20 years. Each recommendation has been linked to a Strategic Direction in the WCC Integrated Transport Strategy.

Walking and Cycling

1. Further consideration for supporting and integrating bicycle transport including bicycle infrastructure and facilities within the CBD precinct including opportunities to form links to the Principle Bike Network and harness the potential of micromobility as this technology continues to develop (ITS Strategic Direction 1).
2. Further enhance provision of end of trip facilities in the CBD. This could include adjustment to end of trip facility requirements for new developments in the precinct to support investment in future cycling infrastructure and encourage mode shift (ITS Strategic Direction 5).

Land use and Public Realm

3. A local place plan for the Chatswood CBD. This should adopt the Movement and Place approach using guidance in the recently released Practitioners Guide to Movement and Place. Focus should be given to multi-function corridors such as Victoria Avenue and Anderson Street (ITS Strategic Direction 3).
4. Undertake further analysis of key corridors (such as Victoria Avenue and Anderson Street) to understand how road space allocation can be adjusted to align with future aspirations and where future development can support the vision for these corridors (ITS Strategic Direction 3).

Public transport

5. Improve understanding of the increased passenger volumes expected to use Chatswood Station due to the completion of Sydney Metro City and South West, and Rapid Bus Transit (Northern beaches to Chatswood), and how this will impact the public realm beyond the confines of the Station. This would include measures to harness the opportunities created by increased pedestrian traffic for surrounding land uses and enhancing place in the vicinity of the Station (ITS Strategic Direction 1 and 2).
6. This investigation noted some potential capacity issues on bus services within the CBD. A review of bus services connecting to Chatswood should be undertaken. This should consider future growth forecasts, supporting Sydney Metro and opportunities for technological innovation. This would need to be conducted in conjunction with or led by TfNSW (ITS Strategic Direction 2).
7. In collaboration with or supporting TfNSW, assess the capacity of Chatswood Interchange and understand how the layout could be optimised to support growth in public transport usage and enhance connectivity to sustainable modes. This may need to incorporate future requirements relating to the F-line service or increased service frequencies as part of the role out of rapid services and/or future growth (ITS Strategic Direction 2).

Travel Demand Management

8. Build upon the Travel Demand Management Strategy in the CCPUDS to develop a suite of short, medium and long-term measures to support the future aspirations of the precinct and sustainable travel patterns. These

would align with Travel Demand Management guidance provided by the NSW Government which can be found online (ITS Strategic Direction 1).

Road network and parking

9. Consider speed limit reductions on corridors with a higher place focus to support human centred design, encourage street activity and enable safe crossing movements (ITS Strategic Direction 3).
10. Assess traffic movements within the precinct to identify key routes and develop measures to adjust major traffic flows to avoid key corridors (such as Victoria Avenue and Anderson Street) improving place in the heart of the precinct (ITS Strategic Direction 4).
11. Formulate parking innovations to address parking issues in the precinct with a focus on encouraging the use of off-street parking. This may include a review of parking charges, implementation of expanded car share schemes and parking guidance systems (which would need to be cognisant of the aim to re-route traffic to avoid certain corridors). This could be developed as a Parking Management Plan for the precinct (ITS Strategic Direction 4).
12. Consider car share and on-demand provisions throughout the precinct and whether these are suitable for forecast demand given the increased popularity of ridesharing services (ITS Strategic Direction 4).
13. Undertake a review of parking rates that apply to developments within the precinct to support the Travel Demand Management approach and encourage shift to sustainable modes (ITS Strategic Direction 5).

Loading and servicing

14. Review on street loading and servicing to optimise these operations and reduce the impact on street environments within the precinct. This would require more detailed interrogation along key corridors (such as Victoria Avenue and Anderson street) where on street servicing can be integral to the function of shop front retail (ITS Strategic Direction 4).
15. Encourage loading and servicing for new development on-site within basements enabling vehicles to enter / exit in a forward direction to again optimise these operations and reduce the impact on street environments (ITS Strategic Direction 4).

Appendix A

Land Use Scenarios Technical Note

File Note

ARUP

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Project title	Chatswood CBD Strategic Transport Study	Job number	271844
cc	Norma Shankie-Williams Craig O'Brien Ian Arnott Mark Ozinga Billy Yung	File reference	Issue 3
Prepared by	Sam Oswald	Date	18 March 2020
Subject	Future Growth Scenario Development		

Purpose of Note

Arup has been engaged to assess the potential impact of the proposed population and employment growth outlined in the Chatswood CBD Planning and Urban Design Strategy (CCPUDS) and the draft Housing Strategy produced by Willoughby City Council (WCC).

A methodology for the study was developed in consultation with local developers, WCC and Transport for NSW (TfNSW).

This note will summarise the process undertaken to develop appropriate growth scenarios including population and employment forecasts for the agreed horizon years (2026 and 2036)[1]. So, they can be used in the TfNSW strategic modelling package.

[1] WCC confirmed these horizon years aligned with their future growth plans in February 2020

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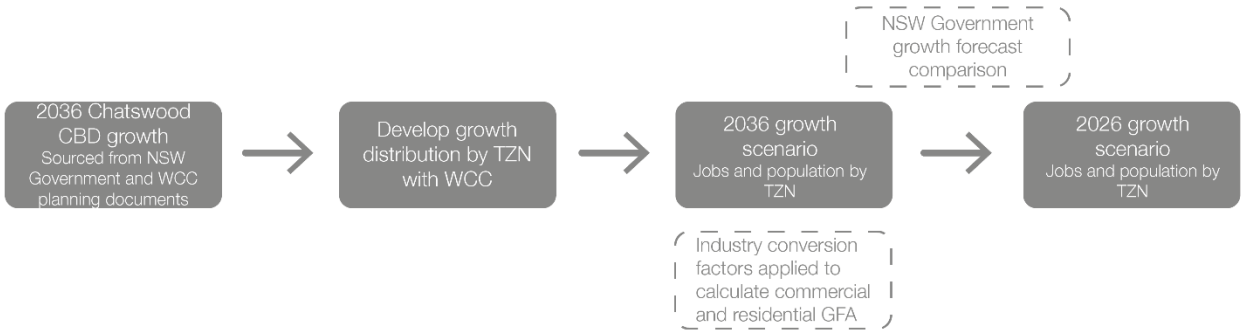
Methodology

The methodology applied the following process to develop the future growth scenarios for 2026 and 2036.



Willoughby City Council Growth Plans

Willoughby City Council's vision for the future of the Chatswood CBD has been outlined in the CCPUDS and the draft Housing Strategy. Both strategies, build upon the foundation developed by the Greater Sydney Commission (GSC) in the North District Plan.

The growth in dwellings and jobs for Chatswood CBD, derived from WCC's planning documents, is presented in Table 1 and is the starting point for our methodology. The uplift in residential dwellings is the expected yield if all residential floorspace in the CCPUDS is delivered.

Table 1: Chatswood CBD future growth

	2016	**Target increase**	**2036**
Jobs	24,700	8,300	33,000
Jobs (office)	14,000	5,500*	21,800*
Dwellings	4,488	5,000	9,488

Figures extracted from NSW Government and WCC planning documents

*WCC's aspiration for the future proportion of office jobs is 66%

Defining Precinct boundaries

The TfNSW strategic models which, will be used to investigate the potential transport impact of the CCPUDS, use Travel Zones for distributing population and employment data. We have therefore identified the travel zones which lie within the Chatswood CBD study area, as they will be impacted by the growth scenarios. These zones are presented in Figure 1.

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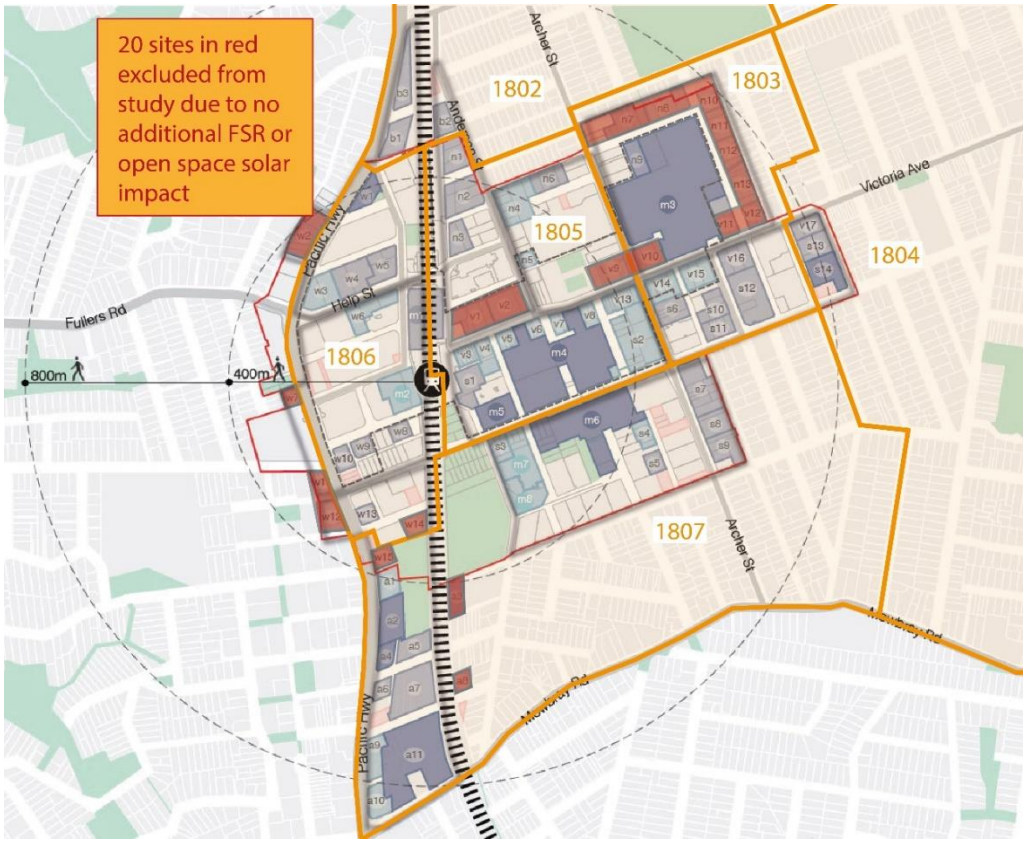

Figure 1: Travel Zones within Chatswood CBD study area

This indicates that any growth in the Chatswood CBD precinct would likely impact upon the following Travel Zones:

- 1802
- 1803
- 1805
- 1806
- 1807

Any impact on Travel Zone 1804 will be included in 1803 as part of this study.

Growth Distributions within Travel Zones

The context of the precinct area within each Travel Zone was considered and potential development sites assessed considering the land use controls in the mixed use zones (Residential FSR 5:1, Commercial FSR 1:1)[2]. Through this analysis and consultation with WCC an estimation of the distribution for future growth in the precinct was developed. This distribution for the future growth by Travel Zone is presented in Table 2 (overleaf).

[2] These floor space ratios were tested in a study conducted by SGS in February 2020 and endorsed by WCC

Table 2: Growth distribution by Travel Zone

Travel Zone	Job distribution (%)	Dwelling distribution (%)
1802	10	10
1803	30	30
1805	20	25
1806	15	15
1807	25	20

This distribution has been applied to the growth from 2016 to 2036 (Table 1). To align the growth scenarios with inputs required for the TfNSW Strategic models. The number of dwellings were converted to population values using information on average household size provided in the WCC draft Housing Strategy, as outlined in Table 3.

Table 3: WCC draft Housing Strategy

Year	Average household size
2016	2.6
2026	2.59
2036	2.53

Conversion into Land Use Area

Although not required for the TfNSW Strategic models to add some context in terms of expected land use uplift. Both future growth scenarios were converted to commercial and residential Gross Floor Area (GFA) using the following conversion factors as outlined in the CCPUDS:

- Each job would require approximately 20m² of Commercial GFA.
- Each dwelling would have an average unit size of 90m².

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2036 Growth Scenario by Travel Zone

Applying the estimated distribution to the future growth in 2036 is presented in Table 4. This forms the 2036 growth scenario.

Table 4: 2036 land use, population and employment scenario by TZN

Travel Zone	Commercial		Residential	
	GFA (m^2)	Jobs	GFA (m^2)	Population
1802	20,000	1,000	92,500	2,600
1803	118,000	5,900	153,000	4,300
1805	182,000	9,100	188,500	5,300
1806	280,000	14,000	224,100	6,300
1807	62,000	3,100	195,700	5,500
TOTAL	**662,000**	**33,100**	**853,800**	**24,000**

Figures are subject to rounding

We note that the population and employment forecasts for the 2036 Base case scenario will be dictated by the current forecasts within the TfNSW strategic modelling suite.

2026 Growth Scenario by Travel Zone

Growth figures were not provided for 2026 in either the CCPUDS or the draft Housing Strategy.

To develop the 2026 scenario, population and employment forecasts from the NSW Government were analysed for the relevant Travel Zones. This analysis is presented in Table 5.

Table 5: NSW Government population and employment forecasts

Year	Travel Zones					Total	Uplift
	1802	1803	1805	1806	1807		
Population							
2016	1,562	747	2,530	5,095	3,552	13,486	-
2026	1,655	1,112	2,923	5,256	3,756	14,711	9%
2036	1,738	1,410	3,393	5,629	4,001	16,171	20%
Employment							
2016	164	4,403	6,902	13,440	1,039	25,948	-
2026	171	4,564	8,030	15,580	1,159	29,504	14%
2036	182	4,937	8,810	16,990	1,259	32,178	24%

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By comparing the forecasts for each year, we factored the predicted growth to develop a 2026 scenario. The 2026 growth scenario is outlined in Table 6.

Table 6: 2026 land use, population and employment scenario by TZN

Travel Zone	Commercial		Residential	
	GFA (m^2)	Jobs	GFA (m^2)	Population
1802	14,000	700	66,000	1,900
1803	102,000	5,100	79,900	2,300
1805	160,000	8,000	125,100	3,600
1806	270,000	13,500	184,200	5,300
1807	44,000	2,200	145,900	4,200
TOTAL	**590,000**	**29,500**	**601,100**	**17,300**

Figures are subject to rounding

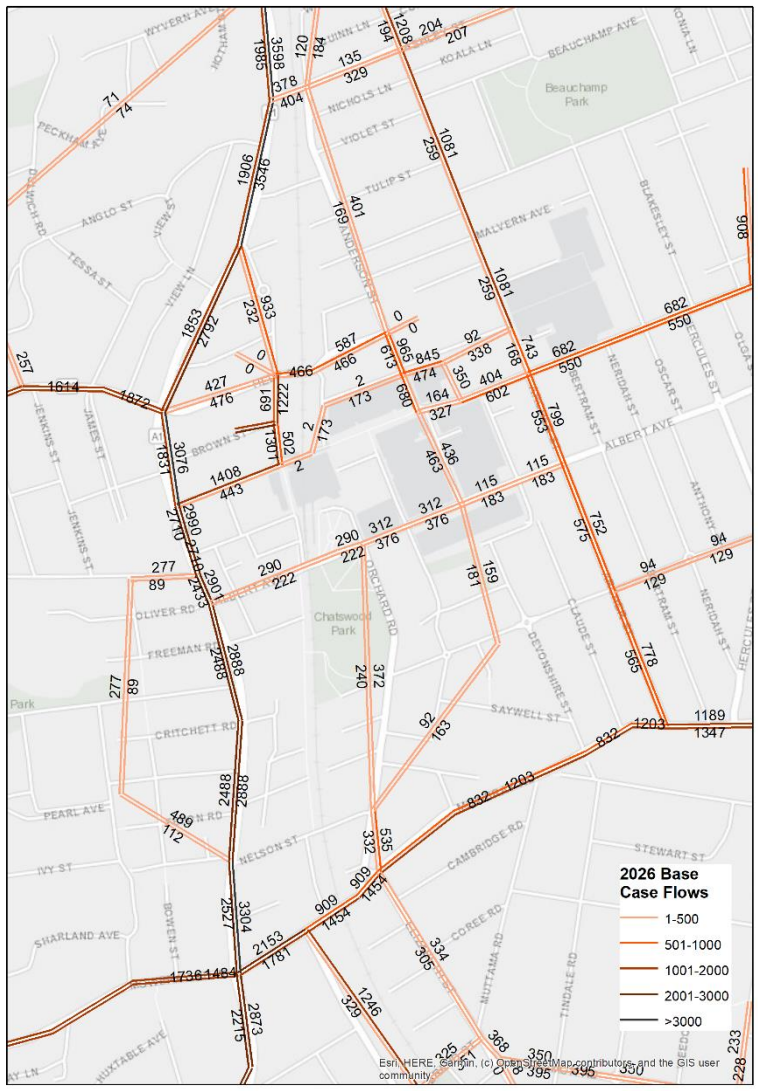
We note that the population and employment forecasts for the 2026 Base case scenario will be dictated by the current forecasts within the TfNSW strategic modelling suite.

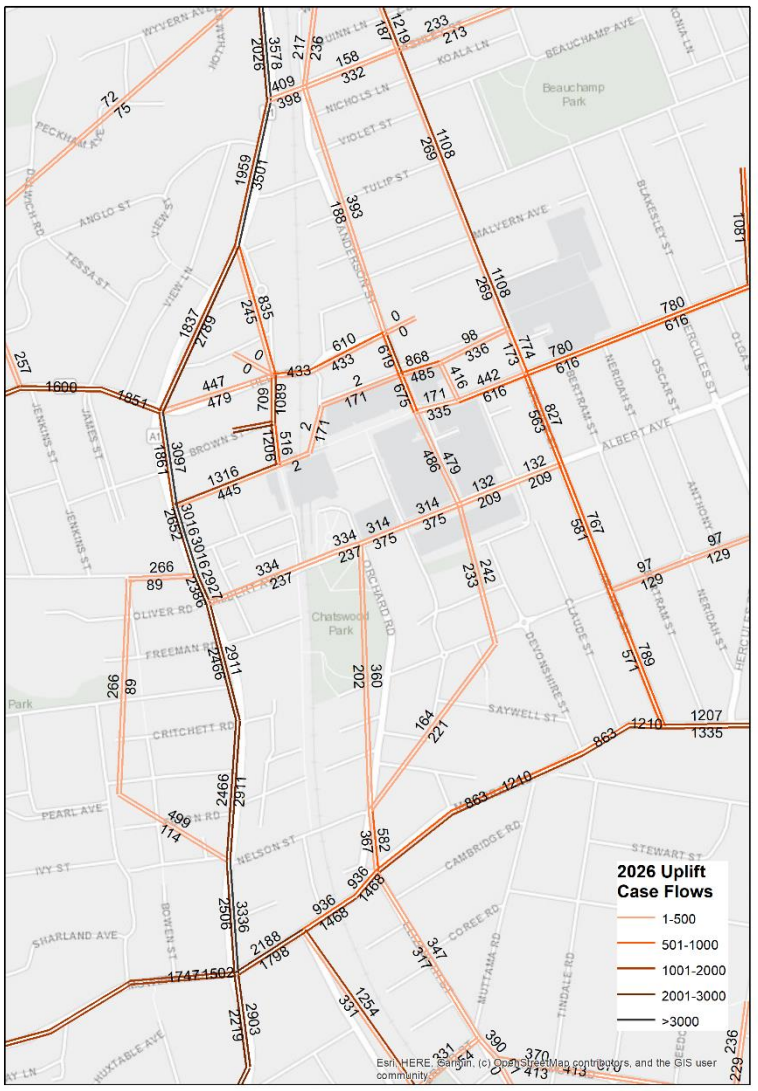
DOCUMENT CHECKING (not mandatory for File Note)

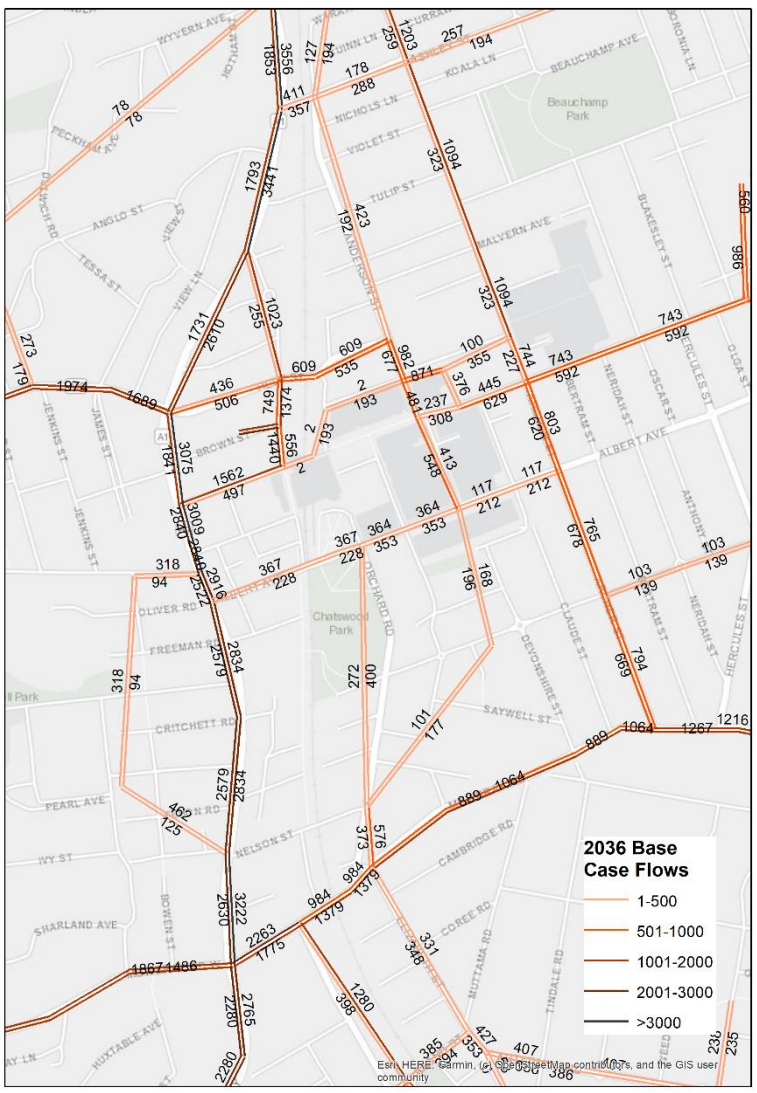
	Prepared by	Checked by	Approved by
Name	Sam Oswald	Ian Brocklehurst	
Signature			

Appendix B

Road Network Volume Plots


2026 Base Case Flows
1-500
501-1000
1001-2000
2001-3000
>3000
Beauchamp Park
Chatswood Park
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community


2026 Uplift Case Flows
1-500
501-1000
1001-2000
2001-3000
>3000
Beauchamp Park
Chatswood Park
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community


2036 Base Case Flows
1-500
501-1000
1001-2000
2001-3000
>3000
Beauchamp Park
Chatswood Park
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

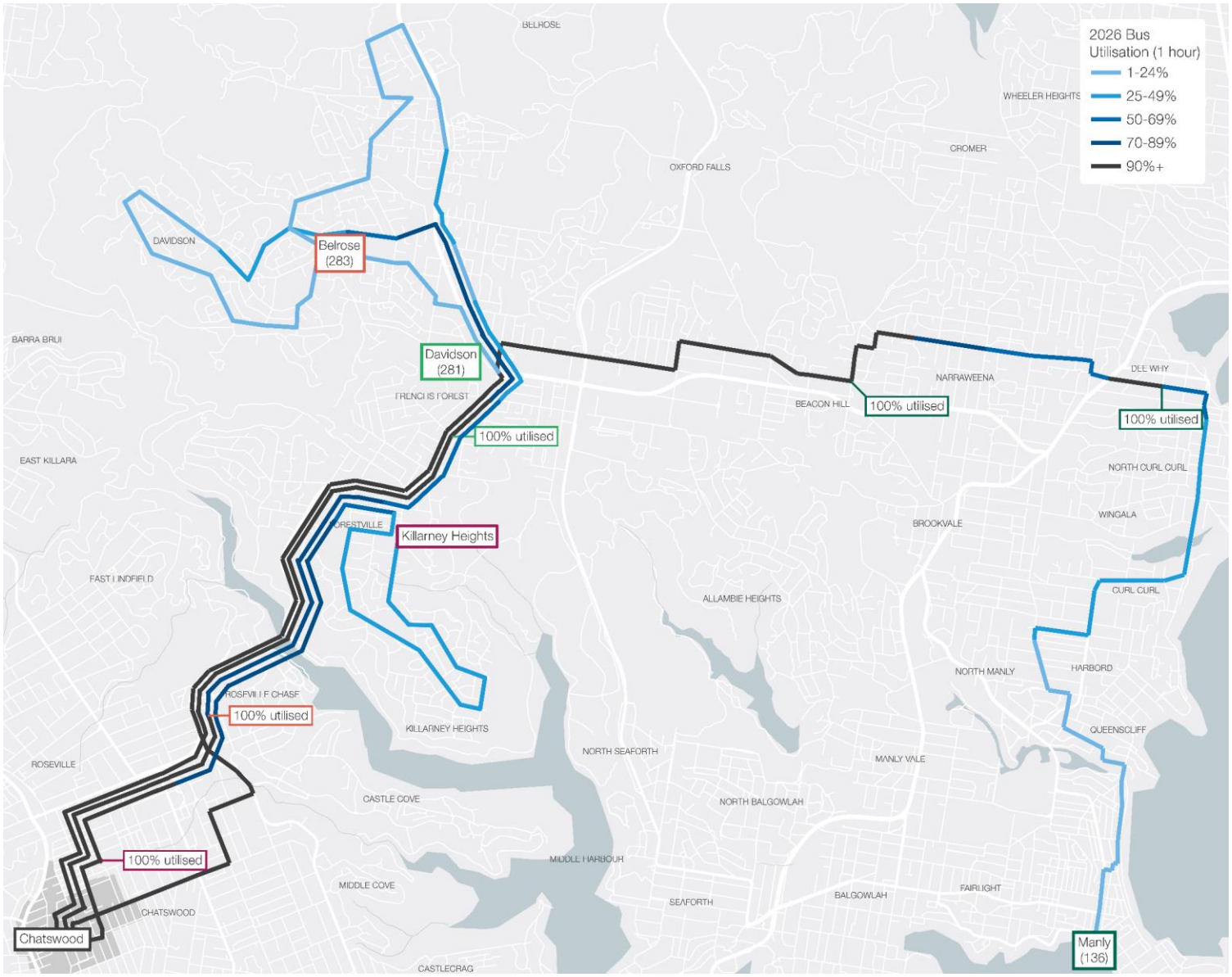

2036 Uplift Case Flows
1-500
501-1000
1001-2000
2001-3000
>3000
Beauchamp Park
Chatswood Park
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community

Appendix C

Bus Service Utilisations

Bus Route	Description	Direction	Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Utilisation	Uplift Utilisation
136	Chatswood to Manly	Outbound	6	190	200	49%	52%
136	Manly to Chatswood	Inbound	6	490	490	128%	128%
530	Burwood to Chatswood	Inbound	11	280	270	44%	42%
530	Chatswood to Burwood	Outbound	11	290	300	45%	47%
M40	Bondi Junction to Chatswood	Inbound	7	190	200	46%	49%
M40	Chatswood to Bondi Junction	Outbound	6	270	290	79%	85%
194	St Ives Chase to City QVB	Inbound	5	160	160	53%	53%
278	Killarney Heights to Chatswood	Inbound	2	140	140	103%	103%
280	Chatswood to Warringah Mall	Outbound	7	350	360	85%	88%
280	Warringah Mall to Chatswood	Inbound	2	120	120	88%	88%
281	Davidson to Chatswood	Inbound	2	210	210	154%	154%
283	Belrose to Chatswood	Inbound	2	170	170	124%	124%

Bus Route	Description	Direction	Frequency (1-hr)	Base Volume (1-hr)	Uplift Volume (1-hr)	Base Utilisation	Uplift Utilisation
136	Chatswood to Manly	Outbound	7	220	230	50%	53%
136	Manly to Chatswood	Inbound	7	530	530	121%	121%
530	Burwood to Chatswood	Inbound	12	290	280	40%	38%
530	Chatswood to Burwood	Outbound	12	320	340	44%	47%
M40	Bondi Junction to Chatswood	Inbound	8	210	250	45%	54%
M40	Chatswood to Bondi Junction	Outbound	6	330	380	85%	98%
194	St Ives Chase to City QVB	Inbound	6	190	200	56%	59%
278	Killarney Heights to Chatswood	Inbound	3	160	160	103%	103%
280	Chatswood to Warringah Mall	Outbound	8	400	420	86%	90%
280	Warringah Mall to Chatswood	Inbound	3	140	140	90%	90%
281	Davidson to Chatswood	Inbound	3	240	250	154%	161%
283	Belrose to Chatswood	Inbound	3	200	200	129%	129%


2026 Bus Utilisation (1 hour)
1-24%
25-49%
50-69%
70-89%
90%+
Belrose (283)
Davidson (281)
Killarney Heights
Chatswood
Manly (136)
100% utilised
100% utilised
100% utilised
100% utilised
BELROSE
DAVIDSON
OXFORD FALLS
WHEELER HEIGHTS
CROMER
BARRA BRUI
FRENCHS FOREST
EAST KILLARA
BEACON HILL
NARRAWEENA
DEE WHY
NORTH CURL CURL
WINGALA
BROOKVALE
CURL CURL
HARBORD
NORTH MANLY
QUEENSCLIFF
MANLY VALE
FAIRLIGHT
ALLAMBIE HEIGHTS
KILLARNEY HEIGHTS
NORTH SEAFORTH
NORTH BALGOWLAH
ROSEVILLE
CASTLE COVE
MIDDLE HARBOUR
MIDDLE COVE
CHATSWOOD
SEAFORTH
BALGOWLAH
CASTLECRAG