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NSW GOVERNMENT

M4-M5 Link

Environmental Impact Statement

August 2017

Appendices B to H

Volume 2B

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Volume 2B

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Appendix B

Secretary's Environmental Assessment Requirements checklist

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Secretary’s Environmental Assessment Requirements Checklist

The Secretary of the NSW Department of Planning and Environment issued Secretary’s Environmental Assessment Requirements (SEARs) for the M4-M5 Link project (the project) on 3 March 2016. The SEARs were revised on 9 November 2016 and further revised on 3 May 2017. The following tables show where the revised SEARs have been addressed throughout the Environmental Impact Statement (EIS).

General SEARs

Desired performance outcome	Requirement	Where addressed in the EIS
1. Environmental Impact Assessment Process The process for assessment of the proposal is transparent, balanced, well focussed and legal.	1. The Environmental Impact Statement (EIS) must be prepared in accordance with Part 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation).	**Chapter 2** (Assessment process)
	2. It is the Proponent’s responsibility to determine whether the project needs to be referred to the Commonwealth Department of the Environment for an approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Proponent must contact the Commonwealth Department of the Environment immediately if it is determined that an approval is required under the EPBC Act, as supplementary environmental assessment requirements may need to be issued to ensure a streamlined assessment under the Bilateral agreement can be achieved.	**Chapter 2** (Assessment process); **Chapter 18** (Biodiversity)
	3. Where the project requires approval under the EPBC Act and is being assessed under the Bilateral Agreement the EIS should address:	**Chapter 2** (Assessment process)
	(a) consideration of any Protected Matters that may be impacted by the development where the Commonwealth Minister has determined that the proposal is a Controlled Action;	
	(b) identification and assessment of those Protected Matters that are likely to be significantly impacted;	
	(c) details of how significant impacts to Protected Matters have been	

Desired performance outcome	Requirement	Where addressed in the EIS
	avoided, mitigated and, if necessary, offset; and	
	(d) consideration of, and reference to, any relevant conservation advices, recovery plans and threat abatement plans.	
	4. The onus is on the Proponent to ensure legislative requirements relevant to the project are met.	
2. Environmental Impact Statement	1. The EIS must include, but not necessarily be limited to, the following:	
	(a) an executive summary;	**Executive Summary**
The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	(b) a description of the project and all components and activities (including ancillary components and activities) required to construct and operate it, including: - the proposed route; - design of the tunnels, interchanges (inclusive of tunnel portals and entry and exit ramps), and connections to Stage 1 and Stage 2 of WestConnex and other proposals (such as the Western Harbour Tunnel) and road user, pedestrian and cyclist facilities, and lighting; - surface road upgrade works, including road widening, intersection treatment and grade separation works, property access, parking, pedestrian and cyclist facilities (including appropriate locations for overbridges) and public transport facilities; - ancillary infrastructure and operational facilities, such as operational and maintenance facilities, ventilation structures and systems, and fire and emergency services and infrastructure for the proposal, including (if required) additional infrastructure (such as tolling and ventilation infrastructure) for the M4 East, M5 Motorway and future Western Harbour Tunnel; - location and operational requirements of construction ancillary facilities and access; - land use changes as a result of the proposal and the acquisition of privately owned, Council and Crown lands, and impacts to Council and Crown lands; and	**Chapter 5** (Project description); **Chapter 6** (Construction work); **Chapter 8** (Traffic and transport); **Chapter 12** (Land use and property)

Desired performance outcome	Requirement	Where addressed in the EIS
	- the relationship and/or integration of the project with existing and proposed[1] public and freight transport services;	
	(c) a statement of the objective(s) of the project, including how it meets the objectives of the overall WestConnex program;	**Chapter 3** (Strategic context and project need)
	(d) a summary of the strategic need for the project with regard to its State significance and relevant State Government policy;	**Chapter 3** (Strategic context and project need)
	(e) an analysis of any feasible alternatives to the project[2];	**Chapter 4** (Project development and alternatives)
	(f) a description of feasible options within the project[3], including: - alternative methods considered for the construction of the project, including the tunnels; and - staging of the proposal and the broader WestConnex scheme;	**Chapter 4** (Project development and alternatives)
	(g) a description of how alternatives to and options within the project were analysed to inform the selection of the preferred alternative / option. The description must contain sufficient detail to enable an understanding of why the preferred alternative to, and options(s) within, the project were selected, including: - details of the short-listed route and tunnel options considered, and the criteria that was considered in the selection of the preferred route and tunnel design; - the alternative tunnel design and ventilation options considered to meet the air quality criteria for the proposal; - need for construction facilities and sites; and a justification for the preferred proposal taking into consideration the	**Chapter 4** (Project development and alternatives); **Chapter 30** (Project justification and conclusion)

[1] Proposed – as identified in relevant State strategies and the like.
[2] Alternatives to a project are different projects which would achieve the same project objective(s) including the consequences of not carrying out the project. For example, alternatives to a road project may be a rail project in the same area and alternate routes for the road, or a combination of these alternatives.
[3] Options within the project are variations of the same project. For example, options within a road project could be design of an intersection; the location or design of a bridge; locations for a ventilation outlet.

Desired performance outcome	Requirement	Where addressed in the EIS
	objects of the *Environmental Planning and Assessment Act 1979* (EP&A Act);	
	(h) a concise description of the general biophysical and socio-economic environment that is likely to be impacted by the project (including offsite impacts). Elements of the environment that are not likely to be affected by the project do not need to be described;	**Chapter 2** (Assessment process); **Chapters 8-23**
	(i) a demonstration of how the project design has been developed to avoid or minimise likely adverse impacts;	**Chapter 4** (Project development and alternatives)
	(j) the identification and assessment of key issues as provided in the 'Assessment of Key Issues' performance outcome;	**Chapter 2** (Assessment process); **Chapters 8-27**
	(k) a statement of the outcome(s) the Proponent will achieve for each key issue;	**Chapter 2** (Assessment process); **Chapter 29** (Summary of environmental management measures); **Appendix A** (Project synthesis)
	(l) measures to avoid, minimise or offset impacts must be linked to the impact(s) they treat, so it is clear which measures will be applied to each impact;	**Chapter 29** (Summary of environmental management measures); **Appendix A** (Project synthesis)
	(m) consideration of the interactions between mitigation measures, between impacts and between measures and impacts;[4]	**Chapter 29** (Summary of environmental management measures)
	(n) identification of other environmental impacts (such as protective and sensitive lands, sedimentation and erosion and impacts to water front land) and proposed measures for managing and/or mitigating the level of impact;	**Chapters 8-26** of the EIS
	(o) an assessment of the cumulative impacts of the project taking into	**Chapter 26** (Cumulative impacts);

[4] Measures proposed to avoid or minimise one impact may cause an unintended impact on another issue. Therefore these impacts and their interactions need to be analysed and resolved where possible.

Desired performance outcome	Requirement	Where addressed in the EIS
	account other stages of WestConnex, the proposed Western Harbour Tunnel, projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed;	**Appendix C** (Cumulative impact assessment methodology)
	(p) statutory context of the project as a whole, including: - how the project meets the provisions of the EP&A Act and EP&A Regulation; and - a list of any approvals that must be obtained under any other Act or law before the project may lawfully be carried out;	**Chapter 2** (Assessment process); **Chapter 30** (Project justification and conclusion); **Appendix D** (Environmental Planning and Assessment Regulation 2000 (NSW) requirements)
	(q) a chapter that synthesises the environmental impact assessment and provides: - a succinct but full description of the project for which approval is sought; - a description of any uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved in the next stages of the project; - a compilation of the impacts of the project that have not been avoided; - a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts; - a compilation of the outcome(s) the proponent will achieve; and - the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts; and	**Appendix A** (Project synthesis)
	(r) relevant project plans, drawings, diagrams in an electronic format that enables integration with mapping and other technical software.	Throughout the EIS
	2. The EIS must only include data and analysis that is reasonably needed to	Throughout the EIS

Desired performance outcome	Requirement	Where addressed in the EIS
	make a decision on the proposal. Relevant information must be succinctly summarised in the EIS and included in full in appendices. Irrelevant, conflicting or duplicated information must be avoided.	
3. Assessment of Key Issues* Key issue impacts are assessed objectively and thoroughly to provide confidence that the project will be constructed and operated within acceptable levels of impact. * Key issues are nominated by the Proponent in the CSSI project application and by the Department in the SEARs. Key issues need to be reviewed throughout the preparation of the EIS to ensure any new key issues that emerge are captured. The key issues identified in this document are not exhaustive but are key	1. The level of assessment of likely impacts must be proportionate to the significance of, or degree of impact on, the issue, within the context of the proposal location and the surrounding environment. The level of assessment must be commensurate to the degree of impact and sufficient to ensure that the Department and other government agencies are able to understand and assess impacts.	**Chapters 8-27** of the EIS
	2. For each key issue the Proponent must:	
	(a) describe the biophysical and socio-economic environment, as far as it is relevant to that issue, including adequate baseline data, in terms of temporal, spatial and parameters monitored;	
	(b) describe the legislative and policy context, as far as it is relevant to the issue;	
	(c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence of the impact (comprehensive risk assessment), and the cumulative impacts of: (i) concurrent project construction activities; and (ii) proposed and approved projects (where information is available at the time of writing);	
	(d) demonstrate how potential impacts have been avoided (through design, or construction or operation methodologies);	
	(e) detail how likely impacts that have not been avoided through design will be minimised, and the predicted effectiveness of these measures (against performance criteria where relevant); and	

Desired performance outcome	Requirement	Where addressed in the EIS
issues common to most CSSI projects.	(f) detail how any residual impacts will be managed or offset, and the approach and effectiveness of these measures.	**Chapter 28** (Environmental risk analysis)
	3. Where multiple reasonable and feasible options to avoid or minimise impacts are available, they must be identified and considered and the proposed measure justified taking into account the public interest.	**Chapter 4** (Project development and alternatives); **Chapter 5** (Project description)
4. Consultation The project is developed with meaningful and effective engagement during project design and delivery.	1. The project must be informed by consultation, including with relevant local, State and Commonwealth government agencies, infrastructure and service providers, special interest groups (including Local Aboriginal Land Councils, Aboriginal stakeholders, and pedestrian and bicycle user groups), affected landowners, businesses and the community.	**Chapter 7** (Consultation); **Appendix G** (Draft Community Consultation Framework)
	2. The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received.	
	3. The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.	

Key issue SEARs

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
1. Transport and Traffic Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport)
	(a) a considered approach to route identification and scheduling of transport movements, particularly outside standard construction hours;	
	(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	
	(c) construction worker parking;	
	(d) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	
	(e) access constraints and impacts on public transport, pedestrians and cyclists;	
	(f) the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network associated with construction of the project. Where the closure, diversion or reconfiguration are temporary, provide an estimate of the duration of the altered access arrangements; and	
	(g) the cumulative traffic impacts of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex.	**Chapter 8** (Traffic and transport); **Chapter 26** (Cumulative impacts); **Appendix H** (Technical working paper: Traffic and transport)
	2. The Proponent must model and/or assess the operational transport impacts of the project including, but not necessarily limited to:	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	(a) forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the project and the surrounding road, cycle and public transport network, including potential shifts of traffic movements on alternate routes outside the proposal area (such as toll avoidance) and impact of permanent street closures directly attributable to the SSI;	and transport)
	(b) travel time analysis;	
	(c) performance of key interchanges and intersections by undertaking a level of service analysis at key locations, for peak periods;	
	(d) wider transport interactions (local and regional roads, cycling, public and freight transport), taking into account the Sydney City Centre Access Strategy, planned future urban release areas such as the Bays Precinct and planned future port activities and uses;	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport); **Appendix N** (Technical working paper: Active transport strategy)
	(e) the redistribution of traffic and impacts on traffic volumes and levels of service on the road network resulting from changes to the design of the M4-M5 Link as modelled in the traffic assessments for the M4 East and New M5 projects;	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport)
	(f) induced traffic and operational implications for existing and proposed public transport (particularly with respect to strategic bus corridors and bus routes and permanent closure/relocation of bus stops) and consideration of opportunities to improve public transport;	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport)
	(g) impacts on cyclists and pedestrian access and safety, including on known routes and future proposals such as along Lilyfield Road;	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport); **Appendix N** (Technical working paper: Active transport strategy)
	(h) opportunities to integrate cycling and pedestrian elements with	**Chapter 8** (Traffic and transport);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	surrounding networks and within the project; and	**Appendix H** (Technical working paper: Traffic and transport); **Appendix N** (Technical working paper: Active transport strategy)
	(i) property and business access and on street parking.	**Chapter 8** (Traffic and transport); **Appendix H** (Technical working paper: Traffic and transport); **Appendix P** (Technical working paper: Social and economic)
	The assessment must provide an explanation for the scope of the modelled area, including justification of the nominated boundaries.	**Chapter 8** (Traffic and transport); Appendix H (Technical working paper: Traffic and transport)
2. Air Quality The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	1. The Proponent must undertake an air quality impact assessment (AQIA) for construction and operation of the project in accordance with the current guidelines.	**Chapter 9** (Air quality); **Appendix I** (Technical working paper: Air quality)
	2. The Proponent must ensure the AQIA also includes the following:	
	(a) demonstrated ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations Act 1997* and the *Protection of the Environment Operations (Clean Air) Regulation 2010*;	**Chapter 9** (Air quality); **Appendix I** (Technical working paper: Air quality)
	(b) the identification of all potential sources of air pollution and an assessment of potential emissions of PM_{10}, $PM_{2.5}$, CO, NO_2 and other nitrogen oxides and volatile organic compounds (e.g. BTEX);	
	(c) consider the impacts from the dispersal of these air pollutants on the ambient air quality along the proposal route, proposed ventilation outlets and portals, surface roads, ramps and interchanges and the alternative surface road network;	
	(d) assessment of worst-case scenarios for in-tunnel and ambient air quality,	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	including a range of potential ventilation scenarios and range of traffic scenarios, including worst-case design maximum traffic flow scenario (variable speed) and worst-case breakdown scenario, and discussion of the likely occurrence of each;	
	(e) details of the proposed tunnel design and mitigation measures to address in-tunnel air quality and the air quality in the vicinity of portals and any mechanical ventilation systems (ie ventilation outlets and air inlets) including details of proposed air quality monitoring (including frequency and criteria);	
	(f) a demonstration of how the project and ventilation design ensures that concentrations of air emissions meet NSW, national and international best practice for in-tunnel and ambient air quality, and taking into consideration the approved criteria for the M4 East project, New M5 project and the In-Tunnel Air Quality (Nitrogen Dioxide) Policy;	
	(g) consideration of any advice from the Advisory Committee on Tunnel Air Quality on the project, particularly in relation to assessment methodology;	
	(h) details of any emergency ventilation systems, such as air intake/exhaust outlets, including protocols for the operation of these systems in emergency situations, potential emission of air pollutants and their dispersal, and safety procedures;	**Chapter 5** (Project description); **Appendix I** (Technical working paper: Air quality)
	(i) details of in-tunnel air quality control measures considered, including air filtration, and justification of the proposed measures;	**Chapter 9** (Air quality); **Appendix I** (Technical working paper: Air quality)
	(j) details of the proposed mitigation measures to prevent the generation and emission of dust (particulate matter and TSP) and air pollutants (including odours) during the construction of the proposal, particularly in relation to ancillary facilities (such as concrete batching plants), the use of mobile plant, stockpiles and the processing and movement of spoil; and	**Chapter 9** (Air quality); **Appendix I** (Technical working paper: Air quality)

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	(k) a cumulative assessment of the in-tunnel, local and regional air quality due to the operation of and potential continuous travel through the M4 East and New M5 Motorways and surface roads.	**Chapter 9** (Air quality); **Chapter 26** (Cumulative impacts); **Appendix I** (Technical working paper: Air quality)
3. Health and Safety The project avoids or minimises any adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety.	1. The Proponent must assess the potential health impacts of the project, in accordance with the current guidelines.	**Chapter 11** (Human health risk); **Appendix K** (Technical working paper: Human health risk assessment)
	2. The assessment must:	
	(a) describe how the design of the proposal minimises adverse health impacts;	
	(b) assess human health impacts from the operation and use of the tunnel under a range of conditions, including worst case operating conditions and the full length of all tunnels in the WestConnex scheme;	
	(c) human health risks and costs associated with the proposal, including those associated with air quality, noise and vibration, and social impacts on the adjacent and surrounding areas during the construction and operation of the proposal;	
	(d) include both incremental changes in exposure from existing background pollutant levels and the cumulative impacts of project specific and existing pollutant levels at the location of the receivers (including public open space areas);	**Chapter 11** (Human health risk); **Chapter 26** (Cumulative impacts); **Appendix K** (Technical working paper: Human health risk assessment)
	(e) assess the likely risks of the project to public safety, paying particular attention to pedestrian safety, subsidence risks, bushfire risks and the handling and use of dangerous goods; and	**Chapter 8** (Traffic and transport); **Chapter 11** (Human health risk); **Chapter 12** (Land use and property); **Chapter 19** (Groundwater); **Chapter 25** (Hazard and risk); **Chapter 29** (Summary of environmental management measures); **Appendix H** (Technical working paper: Traffic

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
		and transport); **Appendix K** (Technical working paper: Human health risk assessment)
	(f) include a cumulative human health impact assessment inclusive of in-tunnel, local and regional impacts due to the operation of and potential continuous travel through the M4 East and New M5 Motorways and surface roads.	**Chapter 11** (Human health risk); **Chapter 26** (Cumulative impacts); **Appendix K** (Technical working paper: Human health risk assessment)
4. Noise and Vibration - Amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	1. The Proponent must assess construction and operational noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must address the redistribution of traffic and include consideration of impacts to sensitive receivers (on affected floors of residential buildings), include consideration of sleep disturbance and, as relevant, the characteristics of noise and vibration (for example, low frequency noise).	**Chapter 10** (Noise and vibration); **Appendix J** (Technical working paper: Noise and vibration)
	2. An assessment of construction noise and vibration impacts which must address:	
	(a) the nature of construction activities (including transport, tonal or impulsive noise-generating works and the removal of operational noise barriers, as relevant);	
	(b) the intensity and duration of noise and vibration impacts (both air and ground-borne);	
	(c) the nature, sensitivity and impact to receivers;	
	(d) the need to balance timely conclusion of noise and vibration-generating works with periods of receiver respite, and other factors that may influence the timing and duration of construction activities (such as traffic management);	
	(e) the potential for works outside standard construction hours, including	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	estimated duration and timing, predicted levels, exceedances and number of potentially affected receivers and justification for the activity in terms of the Interim Construction Noise Guideline (DECCW, 2009);	
	(f) potential noise and vibration mitigation measures, including timing of implementation;	
	(g) figures illustrating the existing and predicted noise levels;	
	(h) a cumulative noise and vibration assessment inclusive of impacts from the project (including concurrent project construction activities); and	**Chapter 10** (Noise and vibration); **Chapter 26** (Cumulative impacts); **Appendix J** (Technical working paper: Noise and vibration)
	(i) a cumulative noise and vibration assessment of the impacts from the project and the construction of other key infrastructure projects including, but not limited to, the New M5 and M4 East.	
	3. The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required.	**Chapter 10** (Noise and vibration); **Appendix J** (Technical working paper: Noise and vibration)

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
5. Noise and Vibration - Structural Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Increases in noise emissions and vibration affecting environmental heritage as defined in the *Heritage Act 1977* during operation of the project are effectively managed.	1. The Proponent must assess construction and operation noise and vibration impacts in accordance with relevant NSW noise and vibration guidelines. The assessment must include consideration of impacts to the structural integrity and heritage significance of items (including Aboriginal places and items of environmental heritage).	**Chapter 10** (Noise and vibration); **Chapter 20** (Non-Aboriginal heritage); **Appendix J** (Technical working paper: Noise and vibration); **Appendix U (**Technical working paper: Non-Aboriginal heritage)
	2. The Proponent must demonstrate that blast impacts are capable of complying with the current guidelines, if blasting is required.	**Chapter 10** (Noise and vibration); **Appendix J** (Technical working paper: Noise and vibration)
6. Biodiversity The project design considers all feasible measures to avoid and minimise impacts	1. The Proponent must assess biodiversity impacts in accordance with the current guidelines including the Framework for Biodiversity Assessment (FBA) and be carried out by a person accredited in accordance with section 142B(1)(c) of the *Threatened Species Conservation Act, 1995*.	**Chapter 18** (Biodiversity); **Appendix S** (Technical working paper: Biodiversity)
	2. The Proponent must assess any impacts on biodiversity values not covered	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	by the FBA. Impacts on species, populations and ecological communities that will require further consideration and provision of information specified in section 9.2 of the FBA include any identified through consultation with the OEH. Species specific surveys shall be undertaken for those species and in accordance with the survey requirements specified by the OEH. The Proponent must identify whether the project as a whole, or any component of the project, would be classified as a Key Threatening Process (KTP) in accordance with the listings in the *Threatened Species Conservation Act 1995* (TSC Act), *Fisheries Management Act 1994* (FM Act) and *Environmental Protection and Biodiversity Conservation Act 2000* (EPBC Act).	
	3. The Proponent must assess any impacts to trees within the project area. Impacts should be minimised; following the hierarchy of avoid, minimise and mitigate impacts to trees.	
7. Urban Design The project design complements the visual amenity, character and quality of the surrounding environment. The project contributes to the accessibility and connectivity of communities.	1. The Proponent must:	
	(a) identify the urban design and landscaping aspects of the project and its components to enhance the appearance of ventilation outlets, interchanges, potential connections to the Bays Precinct and transport linkages, tunnel portals, bridges, noise walls, ancillary buildings, and any additional surface infrastructure, 'cut and cover' arrangements;	**Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design)
	(b) identify measures aimed at improving 'north-south' connectivity between Balmain/Rozelle and Sydney Harbour;	**Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design); **Appendix N** (Technical working paper: Active transport strategy)
	(c) identify measures aimed at preserving the 'east-west' connectivity between White Bay and the Rozelle Rail Yards;	
	(d) consider resulting residual land treatments, and demonstrate how the proposed hard and soft urban design elements of the proposal would be consistent with the existing and desired future character of the area	**Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design)

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	traversed or affected by the proposal;	
	(e) identify opportunities to utilise surplus or residual land, particularly for the provision of community space (passive and recreational) and utilise key structures (such as ventilation outlets) for multiple uses i.e. integration with other structures;	**Chapter 12** (Land use and property); **Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design)
	(f) evaluate the visual impacts and urban design aspects of the proposal and its components (such as the ventilation outlets and interchanges) on surrounding areas, taking into consideration the urban and landscape design of the M4 East and New M5 Motorways and WestConnex Urban Design Corridor Framework;	**Chapter 13** (Urban design and visual amenity); **Chapter 26** (Cumulative impacts); **Appendix L** (Technical working paper: Urban design); **Appendix O** (Technical working paper: Landscape and visual impact)
	(g) explore the use of Crime Prevention Through Environmental Design (CPTED) principles during the design development process, including natural surveillance, lighting, walkways, signage and landscape;	**Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design)
	(h) identify urban design strategies and opportunities to enhance healthy, cohesive and inclusive communities; and	
	(i) describe urban design and landscape mitigation measures, having regard to the urban design and landscape objectives for the proposal.	**Chapter 13** (Urban design and visual amenity); **Chapter 29** (Summary of environmental management measures); **Appendix L** (Technical working paper: Urban design); **Appendix O** (Technical working paper: Landscape and visual amenity)
8. Visual Amenity The project minimises adverse impacts on the visual amenity of the built and natural environment (including public open space) and capitalises on	1. The Proponent must assess the visual impact of the project and any ancillary infrastructure on:	
	(a) views and vistas;	**Chapter 13** (Urban design and visual amenity); **Appendix O** (Technical working paper: Landscape and visual impact)
	(b) streetscapes, key sites and buildings;	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
opportunities to improve visual amenity.	(c) heritage conservation areas and heritage items including Aboriginal places and environmental heritage; and	**Chapter 13** (Urban design and visual amenity); **Appendix O** (Technical working paper: Landscape and visual impact); **Appendix U** (Technical working paper: Non-Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
	(d) the local community (including view loss and overshadowing).	**Chapter 13** (Urban design and visual amenity); **Appendix M** (Shadow diagrams and overshadowing); **Appendix O** (Technical working paper: Landscape and visual impact); **Appendix P** (Technical working paper: Social and economic)
	2. The Proponent must provide artist impressions and perspective drawings of the project from a variety of locations along and adjacent to the route to illustrate how the project has responded to the visual impact through urban design and landscaping.	
9. Socio-economic, Land Use and Property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses,	1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative ongoing impacts of the proposal).	**Chapter 14** (Social and economic) **Chapter 26** (Cumulative impacts); **Appendix P** (Technical working paper: Social and economic)
	2. The Proponent must assess impacts from construction and operation on potentially affected property (including Crown lands), businesses, recreational users and land and water users, including property acquisitions/adjustments, access amenity, relevant statutory rights, and community severance and barrier impacts resulting from the project.	**Chapter 12** (Land use and property); **Chapter 14** (Social and economic); **Appendix P** (Technical working paper: Social and economic)
	3. The Proponent must identify opportunities for local centre street revitalisation improvements, pedestrian and cyclist access and connectivity and provision of community and social facilities	**Chapter 12** (Land use and property); **Chapter 13** (Urban design and visual amenity); **Chapter 14** (Social and economic); **Appendix L** (Technical working paper: Urban design); **Appendix N** (Technical working paper: Active

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.		transport strategy)
	4. The design and siting of project elements should be located in such a way that functional, contiguous areas of residual land are maximised. The design and siting must consider appropriate land use interfaces (i.e. White Bay) and the social and economic impacts of proposed land uses against alternate land uses.	**Chapter 12** (Land use and property); **Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design); **Appendix P** (Technical working paper: Social and economic)
	5. Where air quality allows, residual land must be designed to positively contribute to additional community uses, public recreation uses and/or affordable or social housing. Passively landscaped areas should not be the default use for residual land.	**Chapter 12** (Land use and property); **Chapter 13** (Urban design and visual amenity); **Appendix L** (Technical working paper: Urban design)
	6. The Proponent must assess potential impacts on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities.	**Chapter 6** (Construction work); **Chapter 12** (Land use and property); **Chapter 14** (Social and economic); **Chapter 25** (Hazard and risk); **Appendix F** (Utilities Management Strategy)
	7. Where the project is predicted to affect trunk utilities, the Proponent must undertake a utilities management strategy. The strategy must identify proposed management strategies, including relocations or adjustment of the utilities, and their estimated timing and duration. This strategy must be developed in consultation with the relevant utility owners or providers.	**Chapter 7** (Consultation); **Chapter 12** (Land use and property); **Chapter 25** (Hazard and risk); **Appendix F** (Utilities Management Strategy)
	8. A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the draft Framework include, but are not limited to:	**Chapter 7** (Consultation); **Appendix G** (Draft community consultation framework)

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	(a) traffic management (including property access, pedestrian access);	
	(b) landscaping/urban design matters;	
	(c) construction activities including out of hours work; and	
	(d) noise and vibration mitigation and management.	
10. Water - Hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not	1. The Proponent must describe (and map) the existing hydrological regime for any surface and groundwater resource (including reliance by users and for ecological purposes) likely to be impacted by the project, including stream orders, as per the FBA.	**Chapter 15** (Soil and water quality); **Chapter 17** (Flooding and drainage); **Chapter 18** (Biodiversity); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	2. The Proponent must prepare a detailed water balance for ground and surface water including the proposed intake and discharge locations, volume, frequency and duration for both the construction and operational phases of the project.	**Chapter 17** (Flooding and drainage); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	3. The Proponent must assess (and model if appropriate) the impact of the construction and operation of the project and any ancillary facilities (both built elements and discharges) on surface and groundwater hydrology in accordance with the current guidelines, including:	
	(a) natural processes within rivers, wetlands, estuaries, marine waters and floodplains that affect the health of the fluvial, riparian, estuarine or marine system and landscape health (such as modified discharge volumes, durations and velocities), aquatic connectivity and access to habitat for spawning and refuge;	**Chapter 15** (Soil and water quality); **Chapter 17** (Flooding and drainage); **Chapter 18** (Biodiversity); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
achieved). Sustainable use of water resources.		**Appendix S** (Technical working paper: Biodiversity); **Appendix T** (Technical working paper: Groundwater)
	(b) impacts from any permanent and temporary interruption of groundwater flow, including the extent of drawdown, barriers to flows, implications for groundwater dependent surface flows, ecosystems and species, groundwater users and the potential for settlement;	**Chapter 18** (Biodiversity); **Chapter 19** (Groundwater); **Appendix S** (Technical working paper: Biodiversity); **Appendix T** (Technical working paper: Groundwater)
	(c) changes to environmental water availability and flows, both regulated/licensed and unregulated/rules-based sources;	**Chapter 17** (Flooding and drainage); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	(d) direct or indirect increases in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses;	**Chapter 15** (Soil and water quality); **Chapter 18** (Biodiversity); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix S** (Technical working paper: Biodiversity)
	(e) minimising the effects of proposed stormwater and wastewater management during construction and operation on natural hydrological attributes (such as volumes, flow rates, management methods and re-use options) and on the conveyance capacity of existing stormwater systems where discharges are proposed through such systems; and	**Chapter 17** (Flooding and drainage); **Appendix Q** (Technical working paper: Surface water and flooding)
	(f) water take (direct or passive) from all surface and groundwater sources with estimates of annual volumes during construction and operation.	**Chapter 6** (Construction work); **Chapter 17** (Flooding and drainage); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper:

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
		Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	4. The Proponent must identify any requirements for baseline monitoring of hydrological attributes.	**Chapter 15** (Soil and water quality); **Chapter 17** (Flooding and drainage); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding)
	5. The assessment must include details of proposed surface and groundwater monitoring.	**Chapter 15** (Soil and water quality); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	6. The proposed tunnels should be designed to prevent drainage of alluvium in the paleochannels.	**Chapter 19** (Groundwater); **Appendix T** (Technical working paper: Groundwater)
11. Water - Quality The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being	1. The Proponent must:	
	(a) state the ambient NSW Water Quality Objectives (NSW WQO) and environmental values for the receiving waters relevant to the project, including the indicators and associated trigger values or criteria for the identified environmental values;	**Chapter 15** (Soil and water quality); **Appendix Q** (Technical working paper: Surface water and flooding)
	(b) identify and estimate the quality and quantity of all pollutants that may be introduced into the water cycle by source and discharge point and describe the nature and degree of impact that any discharge(s) may have on the receiving environment, including consideration of all pollutants that pose a risk of non-trivial harm to human health and the environment;	**Chapter 15** (Soil and water quality); **Chapter 16** (Contamination); **Appendix K** (Human health risk assessment); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix R** (Technical working paper: Contamination)
	(c) identify the rainfall event that the water quality protection measures will be	**Chapter 15** (Soil and water quality);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	designed to cope with;	**Appendix Q** (Technical working paper: Surface water and flooding)
	(d) assess the significance of any identified impacts including consideration of the relevant ambient water quality outcomes;	
	(e) demonstrate how construction and operation of the project will, to the extent that the project can influence, ensure that:	
	- where the NSW WQOs for receiving waters are currently being met they will continue to be protected; and	
	- where the NSW WQOs are not currently being met, activities will not worsen water quality and, where reasonably practicable, work toward their achievement over time;	
	(f) justify, if required, why the WQOs cannot be maintained or achieved over time;	
	(g) demonstrate that all practical measures to avoid or minimise water pollution and protect human health and the environment from harm are investigated and implemented;	**Chapter 11** (Human health risk); **Chapter 15** (Soil and water quality); **Chapter 28** (Environmental risk analysis); **Appendix K** (Technical working paper: Human health risk assessment); **Appendix Q** (Technical working paper: Surface water and flooding)
	(h) identify sensitive receiving environments (which may include estuarine and marine waters downstream) and develop a strategy to avoid or minimise impacts on these environments; and	**Chapter 15** (Soil and water quality); **Chapter 18** (Biodiversity); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix S** (Technical working paper: Biodiversity)
	(i) identify proposed monitoring locations, monitoring frequency and indicators of surface and groundwater quality.	**Chapter 15** (Soil and water quality); **Chapter 19** (Groundwater);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
		Appendix Q (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	2. The assessment should consider the results of any current water quality studies, as available, in the project catchment.	**Chapter 15** (Soil and water quality); **Appendix Q** (Technical working paper: Surface water and flooding)
12. Flooding The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	1. The Proponent must assess and (model where required) the impacts on flood behaviour during construction and operation for a full range of flood events up to the probable maximum flood (taking into account sea level rise and storm intensity due to climate change) including:	**Chapter 17** (Flooding and drainage); **Chapter 24** (Climate change risk and adaption); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix X** (Climate change risk assessment framework)
	(a) how the tunnel entries and cut-and-cover sections of the tunnels would be protected from flooding during construction works;	**Chapter 5** (Project description); **Chapter 17** (Flooding and drainage); **Chapter 25** (Hazard and risk); **Appendix Q** (Technical working paper: Surface water and flooding)
	(b) any detrimental increases in the potential flood affectation of the project infrastructure and other properties, assets and infrastructure;	**Chapter 17** (Flooding and drainage); **Chapter 28** (Environmental risk analysis); **Appendix Q** (Technical working paper: Surface water and flooding)
	(c) consistency (or inconsistency) with applicable Council floodplain risk management plans;	
	(d) compatibility with the flood hazard of the land;	
	(e) compatibility with the hydraulic functions of flow conveyance in flood ways and storage areas of the land;	
	(f) whether there will be adverse effect to beneficial inundation of the floodplain environment, on, or adjacent to or downstream of the site;	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	(g) downstream velocity and scour potential;	**Chapter 15** (Soil and water quality); **Chapter 17** (Flooding and drainage); **Appendix Q** (Technical working paper: Surface water and flooding)
	(h) impacts the development may have upon existing community emergency management arrangements for flooding. These matters must be discussed with the State Emergency Services and Council;	**Chapter 7** (Consultation); **Chapter 17** (Flooding and drainage); **Appendix Q** (Technical working paper: Surface water and flooding)
	(i) any impacts the development may have on the social and economic costs to the community as consequence of flooding;	**Chapter 17** (Flooding and drainage); **Appendix Q** (Technical working paper: Surface water and flooding)
	(j) whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses; and	**Chapter 15** (Soil and water quality); **Chapter 17** (Flooding and drainage); **Chapter 18** (Biodiversity); **Appendix S** (Technical working paper: Biodiversity); **Appendix Q** (Technical working paper: Surface water and flooding)
	(k) any mitigation measures required to offset potential flood risks attributable to the project.	**Chapter 17** (Flooding and drainage); **Chapter 28** (Environmental risk analysis); **Appendix Q** (Technical working paper: Surface water and flooding)
	2. The assessment should take into consideration any flood studies undertaken by local government councils, as available.	**Chapter 17** (Flooding and drainage); **Appendix Q** (Technical working paper: Surface water and flooding)
13. Soils The environmental values of land, including soils,	1. The Proponent must verify the risk of acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Risk Map) within the area likely to be impacted by, the project.	**Chapter 15** (Soil and water quality); **Chapter 16** (Contamination); **Chapter 25** (Hazard and risk); **Appendix R** (Technical working paper: Contamination)

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.	2. The Proponent must assess the impact of the project on acid sulfate soils (including impacts of acidic runoff offsite) in accordance with the current guidelines and detail the mitigation measures proposed to minimise potential impacts.	**Chapter 15** (Soil and water quality); **Chapter 16** (Contamination); **Chapter 25** (Hazard and risk); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix R** (Technical working paper: Contamination)
	3. The Proponent must assess whether the land is likely to be contaminated and identify if remediation of the land is required, having regard to the ecological and human health risks posed by the contamination in the context of past, existing and likely (or potential) future land uses. Where assessment and/or remediation is required, the Proponent must document how the assessment and/or remediation would be undertaken in accordance with current guidelines.	**Chapter 16** (Contamination); **Chapter 25** (Hazard and risk); **Appendix K** (Technical working paper: Human health risk assessment); **Appendix R** (Technical working paper: Contamination)
	4. The Proponent must assess whether salinity is likely to be an issue and if so, determine the presence, extent and severity of soil salinity within the project area.	**Chapter 15** (Soil and water quality); **Chapter 19** (Groundwater); **Appendix T** (Technical working paper: Groundwater)
	5. The Proponent must assess the impacts of the project on soil salinity and how it may affect groundwater resources and hydrology.	**Chapter 15** (Soil and water quality); **Chapter 19** (Groundwater); **Appendix Q** (Technical working paper: Surface water and flooding); **Appendix T** (Technical working paper: Groundwater)
	6. The Proponent must assess the impacts on soil and land resources (including erosion risk or hazard). Particular attention must be given to soil erosion and sediment transport consistent with the practices and principles in the current guidelines.	**Chapter 15** (Soil and water quality); **Appendix Q** (Technical working paper: Surface water and flooding)
	7. The Proponent must assess the impact of any disturbance of contaminated groundwater and the tunnels should be carefully designed so as to not exacerbate mobilisation of contaminated groundwater and/or prevent	**Chapter 16** (Contamination); **Chapter 19** (Groundwater); **Appendix R** (Technical working paper:

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	contaminated groundwater flow.	Contamination); **Appendix T** (Technical working paper: Groundwater)
14. Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.	1. The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of listed heritage items inclusive of:	**Chapter 20** (Non-Aboriginal heritage); **Chapter 21** (Aboriginal heritage); **Chapter 26** (Cumulative impacts); **Appendix U** (Technical working paper: Non-Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
	(a) Aboriginal places and objects, as defined under the *National Parks and Wildlife Act 1974* and in accordance with the principles and methods of assessment identified in the current guidelines;	**Chapter 21** (Aboriginal heritage); **Appendix V** (Technical working paper: Non-Aboriginal heritage)
	(b) Aboriginal places of heritage significance, as defined in the Standard Instrument – Principal Local Environmental Plan;	
	(c) environmental heritage, as defined under the *Heritage Act 1977* (including potential items of heritage value, conservation areas, built heritage landscapes and archaeology);	**Chapter 20** (Non-Aboriginal heritage); **Chapter 21** (Aboriginal heritage); **Appendix U** (Technical working paper: Non-Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
	(d) items listed on the National and World Heritage lists; and	
	(e) heritage items and conservation areas identified in local and regional planning environmental instruments covering the project area.	
	2. Where impacts to State or locally significant heritage items are identified, the assessment must: (a) include a significance assessment and statement of heritage impact for all heritage items (including any unlisted places that are assessed of heritage value;	
	(b) provide a discussion of alternative locations and design options that have	**Chapter 20** (Non-Aboriginal heritage);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	been considered to reduce heritage impacts;	**Chapter 21** (Aboriginal heritage); **Appendix U** (Technical working paper: Non-Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
	(c) in areas identified as having potential archaeological significance, undertake a comprehensive archaeological assessment in line with heritage Council guidelines which includes a methodology and research design to assess the impact of the works on the potential archaeological resource and to guide physical archaeological test excavations and include the results of these excavations;	**Chapter 20** (Non-Aboriginal heritage); **Appendix U** (Technical working paper: Non-Aboriginal heritage)
	(d) consider impacts to the item of significance caused by, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, increased traffic, visual amenity, landscape and vistas, curtilage, subsidence and architectural noise treatment (as relevant);	
	(e) provide a comparative analysis to inform the rarity and representative value of any heritage places proposed for demolition;	
	(f) outline measures to avoid and minimise those impacts in accordance with the current guidelines; and	
	(g) be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria).	
	3. Where archaeological investigations of Aboriginal objects are proposed these must be conducted by a suitably qualified archaeologist, in accordance with section 1.6 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW 2010).	**Chapter 21** (Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
	4. Where impacts to Aboriginal objects and/or places are proposed, consultation	**Chapter 7** (Consultation);

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	must be undertaken with Aboriginal people in accordance with the current guidelines.	**Chapter 21** (Aboriginal heritage); **Appendix V** (Technical working paper: Aboriginal heritage)
15. Sustainability The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	1. The Proponent must assess the sustainability of the project in accordance with the Infrastructure Sustainability Council of Australia (ISCA) *Infrastructure Sustainability Rating Tool* and recommend an appropriate target rating for the project.	**Chapter 27** (Sustainability)
	2. The Proponent must assess the project against the current guidelines including targets and strategies to improve Government efficiency in use of water, energy and transport.	**Chapter 23** (Resource use and waste minimisation); **Chapter 27** (Sustainability)
16. Waste All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	1. The Proponent must assess predicted waste generated from the project during construction and operation, including:	**Chapter 23** (Resource use and waste minimisation); **Chapter 27** (Sustainability)
	a) classification of the waste in accordance with the current guidelines;	
	b) estimates / details of the quantity of each classification of waste to be generated during the construction of the project, including bulk earthworks and spoil balance;	
	c) handling of waste including measures to facilitate segregation and prevent cross contamination;	
	d) management of waste including estimated location and volume of stockpiles;	
	e) waste minimisation and reuse;	
	f) lawful disposal or recycling locations for each type of waste; and	
	g) contingencies for the above, including managing unexpected waste volumes.	

Key issue and desired performance outcome	Requirement (specific assessment requirements in addition to the general requirement above)	Where addressed in the EIS
	2. The Proponent must assess potential environmental impacts from the excavation, handling, storage on site and transport of the waste particularly with relation to sediment/leachate control, noise and dust.	**Chapter 8** (Traffic and transport); **Chapter 9** (Air quality); **Chapter 10** (Noise and vibration); **Chapter 16** (Contamination); **Chapter 23** (Resource use and waste minimisation); **Appendix I** (Technical working paper: Air quality); **Appendix J** (Technical working paper: Noise and vibration); **Appendix Q** (Technical working paper: Surface water and flooding)
17. Climate Change Risk The project is designed, constructed and operated to be resilient to the future impacts of climate change.	1. The Proponent must assess the risk and vulnerability of the project to climate change in accordance with the current guidelines.	**Chapter 24** (Climate change risk and adaptation); **Appendix X** (Climate change risk assessment framework)
	2. The Proponent must quantify specific climate change risks with reference to the NSW Government's climate projections at 10 km resolution (or lesser resolution if 10 km projections are not available) and incorporate specific adaptation actions in the design.	
18. Hazards	1. The Proponent must describe the process for assessing the risk of emissions from ventilation facilities on aircraft operations taking into consideration the requirements of the *Airports Act 1996* (Commonwealth) and the *Airport Regulations 1997*.	**Chapter 25** (Hazard and risk); **Appendix I** (Technical working paper: Air quality)

Appendix C

Cumulative impact assessment methodology

WestConnex

Roads and Maritime Services

WestConnex M4-M5 Link

Cumulative impact assessment methodology

August 2017

Client: Roads and Maritime Services

ABN: 76 236 371 088

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1 Assessment methodology

1.1 Introduction

The Secretary of the NSW Department of Planning and Environment (DP&E) has issued a set of environmental assessment requirements for the project. These are referred to as Secretary's Environmental Assessment Requirements (SEARs). **Table 1-1** sets out these requirements and the desired performance outcomes that relate to the cumulative impacts associated with the project, and identifies where they have been addressed in this environmental impact statement (EIS).

Table 1-1 SEARs – cumulative impacts

Desired performance outcome	SEARs	Where addressed in the EIS
2. Environmental Impact Statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	1. The EIS must include, but not necessarily be limited to, the following: (o) an assessment of the cumulative impacts of the project taking into account other stages of WestConnex, the proposed Western Harbour Tunnel, projects that have been approved but where construction has not commenced, projects that have commenced construction, and projects that have recently been completed;	This document outlines the methodology for the cumulative impact assessment for the project. Cumulative impacts are assessed in detail in the relevant technical working papers and appendices, including **Appendix H** (Traffic and transport), **Appendix I** (Air quality), **Appendix J** (Noise and vibration), **Appendix K** (Human health risk assessment), **Appendix O** (Landscape and visual impact), **Appendix P** (Social and economic), **Appendix Q** (Surface water and flooding), **Appendix S** (Biodiversity), **Appendix T** (Groundwater), **Appendix U** (Non-Aboriginal heritage), **Appendix V** (Aboriginal heritage) and **Appendix W** (Detailed greenhouse gas calculations) of the EIS.
3. Assessment of Key Issues Key issue impacts are assessed objectively and thoroughly to provide confidence that the project will be constructed and operated within acceptable levels of impact.	2. For each key issue the Proponent must: (c) identify, describe and quantify (if possible) the impacts associated with the issue, including the likelihood and consequence of the impact (comprehensive risk assessment), and the cumulative impacts of: (i) concurrent project construction activities; and (ii) proposed and approved projects (where information is available at the time of writing)	The environmental risk analysis for the project is outlined in **Chapter 28** (Environmental risk analysis) of the EIS. A description of concurrent project activities is provided in **Chapter 26** (Cumulative impacts) of the EIS. A list of projects included in the cumulative assessment is provided in **Table 1-3**.
1. Transport and Traffic Network connectivity, safety and efficiency of the transport system in	1. The Proponent must assess construction transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	Cumulative construction traffic and transport impacts are discussed in **Chapter 26** (Cumulative impacts) and in **Appendix H** (Technical working

Desired performance outcome	SEARs	Where addressed in the EIS
the vicinity of the project are managed to minimise impacts. The safety of transport system customers is maintained. Impacts on network capacity and the level of service are effectively managed. Works are compatible with existing infrastructure and future transport corridors.	(g) the cumulative traffic impacts of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex.	paper: Traffic and transport) of the EIS.
2. Air Quality The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	2. The Proponent must ensure the AQIA also includes the following: (k) a cumulative assessment of the in tunnel, local and regional air quality due to the operation of and potential continuous travel through the M4 East and New M5 Motorways and surface roads.	Cumulative air quality impacts are discussed in **Chapter 9** (Air quality),Chapter **26** (Cumulative impacts) and in **Appendix I** (Technical working paper: Air quality) of the EIS.
3. Health and Safety The project avoids or minimises any adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety.	2. The assessment must: (d) include both incremental changes in exposure from existing background pollutant levels and the cumulative impacts of project specific and existing pollutant levels at the location of the receivers (including public open space areas); (f) include a cumulative human health impact assessment inclusive of in-tunnel, local and regional impacts due to the operation of and potential continuous travel through the M4 East and New M5 Motorways and surface roads.	Cumulative human health impacts are discussed in **Chapter 11** (Human health risk), **Chapter 26** (Cumulative impacts) and in **Appendix K** (Technical working paper: Human health risk assessment) of the EIS.
4. Noise and Vibration – Amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. Increases in noise emissions and vibration affecting nearby properties and other	2. An assessment of construction noise and vibration impacts which must address: (h) a cumulative noise and vibration assessment inclusive of impacts from the project (including concurrent project construction activities); and (i) a cumulative noise and vibration assessment of the impacts from the project and the construction of other key infrastructure projects including, but not limited to, the New M5 and M4 East.	Cumulative construction noise and vibration impacts are discussed in **Chapter 26** (Cumulative impacts) and in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

Desired performance outcome	SEARs	Where addressed in the EIS
sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.		
7. Urban Design The project design complements the visual amenity, character and quality of the surrounding environment. The project contributes to the accessibility and connectivity of communities.	(f) evaluate the visual impacts and urban design aspects of the proposal and its components (such as the ventilation outlets and interchanges) on surrounding areas, taking into consideration the urban and landscape design of the M4 East and New M5 Motorways and WestConnex Urban Design Corridor Framework;	Cumulative landscape character and visual impacts are discussed in **Chapter 26** (Cumulative impacts) and in **Appendix O** (Technical working paper: Landscape and visual impact) of the EIS.
9. Socio-economic, Land Use and Property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	1. The Proponent must assess social and economic impacts (of all phases of the project) in accordance with the current guidelines (including cumulative ongoing impacts of the proposal).	Cumulative social and economic impacts are discussed in **Chapter 26** (Cumulative impacts) and in **Appendix P** (Technical working paper: Social and economic) of the EIS.
14. Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the	1. The Proponent must identify and assess any direct and/or indirect impacts (including cumulative impacts) to the heritage significance of listed heritage items	Cumulative non-Aboriginal and Aboriginal heritage impacts are discussed in **Chapter 26** (Cumulative impacts) and in **Appendix U** (Technical working paper: Non-Aboriginal heritage) and **Appendix V** (Technical working paper: Aboriginal heritage) of the EIS.

Desired performance outcome	SEARs	Where addressed in the EIS
greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.		

There are currently no NSW or Australian Government guidelines on undertaking cumulative impact assessments. Therefore, the cumulative impact assessment in this EIS is based on the broad requirements set out in the SEARs for the project.

This section includes a description of how projects were initially identified for consideration by explaining the screening criteria applied in determining whether the projects should be assessed for cumulative impacts. It also includes summary tables of the projects that were excluded from the assessment and the projects included as well as an overview of the type of assessment undertaken for the relevant cumulative impacts. A summary of the assessment of cumulative impacts is provided in **Chapter 26** (Cumulative impacts) of the EIS.

1.1.1 Identification of other projects

An initial list of projects for potential inclusion in the cumulative impact assessment was identified from the following sources:

- Previous WestConnex projects (with information sourced from the previous EIS documents and post-approval management plans (where available))
- Rozelle Rail Yards Site Management Works Review of Environmental Factors (Roads and Maritime 2016) and Submissions Report (Roads and Maritime 2017)
- Known NSW Roads and Maritime Services (Roads and Maritime) and other transport infrastructure projects in proximity to the project, including proposed projects that interface with the project
- Consultation with government agencies (including DP&E)
- A review of the DP&E's Major Projects website
- A review of council and other government agency websites (such as UrbanGrowth NSW, Transport for NSW and Sydney Water)
- State media releases relating to major projects (since the planning process for the project commenced).

Only projects considered to be of ‘material’ scale in the vicinity of the M4-M5 Link were included on the list of projects to be screened. The materiality threshold for this cumulative impact assessment is defined as projects listed on the DP&E's Major Projects website as State significant development, State significant infrastructure and known project proposals of a relevant scale or resultant impact that involve activities that could result in a cumulative impact, including proposed projects that interface with the project.

These projects were classified according to their status, ie whether the project is:

- Recently completed
- Under construction, and/or likely to be under construction at the time that the M4-M5 Link construction commences
- Approved, but construction has yet to commence

- Under statutory environmental impact assessment (such as a Review of Environmental Factors or an EIS)
- A future strategic government project that has yet to be subject to statutory environmental impact assessment but interfaces with the M4-M5 Link project. This refers to related Roads and Maritime projects and projects that at minimum have a Business Case or strategy/plan document published in the public domain.

The list of projects identified can be broadly categorised as:

- **The WestConnex program of works**: This category includes the approved WestConnex projects of King Georges Road Interchange Upgrade and M4 Widening (completed construction and open to traffic) and the M4 East and New M5 (currently under construction).
- **Related Roads and Maritime projects**: This category includes other Roads and Maritime projects that may interact with, be constructed, or operate within the vicinity of the M4-M5 Link project, such as the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and F6 Extension projects. As these projects are in the early planning stages, only limited information is available to inform a cumulative impact assessment in this EIS. As such, a cumulative impact assessment has only been undertaken for key issues such as traffic, noise and vibration, air quality and human health risk
- **Other transport infrastructure projects**: This category includes public transport infrastructure such as light rail, metro and rapid transit projects such as the Sydney Metro City and Southwest, the Sydney central business district (CBD) and South East Light Rail and proposed on-street rapid transit along Parramatta Road between Burwood and the Sydney CBD
- **Other projects or strategic developments**: This category primarily includes urban development, other infrastructure and active transport projects. A number of the urban development projects are strategic in nature (ie are conceptual or in the early stages of planning), with limited detail available on specific impacts or timing of the various components. This includes, for example, The Bays Precinct transformation and the Parramatta Road corridor urban transformation, which are both in the early stages of strategic assessment, land use planning and consultation. These strategic developments do have population growth and changes in land use associated with them, which are linked to traffic movements on roads within or in proximity to the project.

Land use projections for these and other strategic development projects such as around Green Square and Mascot have been included in the WestConnex Road Traffic Model (WRTM) version 2.3, which has informed the traffic modelling for the M4-M5 Link project, including the consideration of cumulative traffic and transport impacts.

A description of these projects is included in **Table 1-3**.

1.1.2 Screening criteria

Following the identification of potentially relevant projects (refer to **Chapter 26** (Cumulative impacts)) the following criteria were applied to determine whether each project or strategic development should be included in the cumulative impact assessment or not.

- **Spatial relevance:** A project was considered to be spatially relevant where that project overlapped or was adjacent or proximal to the M4-M5 Link project footprint
  - A project was considered to be adjacent to the M4-M5 Link project where it was within 500 metres of the M4-M5 Link project footprint
  - A project was considered to be proximal to the M4-M5 Link project where it was within two kilometres of construction sites or within 10 kilometres of the M4-M5 Link project footprint
- **Temporal relevance:** A project was considered to be temporally relevant where the expected timing of the construction or operation of a project would be concurrent (ie overlap) with the timing of the construction or operation of the M4-M5 Link project

- **Publicly available information:** Projects under consideration must have publicly-available information (at the time of preparing this EIS), with an adequate level of detail. If a potential future project was known, but there was insufficient public data available to allow a qualitative assessment of the potential cumulative impacts, it was not able to be included in the cumulative impact assessment.

All of the above criteria were applied in determining whether a project would be included in the cumulative impact assessment. However, exceptions were made for strategic transport infrastructure or master plan projects that did not meet all the criteria. They were still included in the cumulative impact assessment due to their inclusion in the WRTM version 2.3, and therefore the operational traffic modelling for the project. These projects include the Western Sydney Airport and the Central to Eveleigh Urban Transformation and Transport Program.

1.2 Project screening

Based on the application of the screening criteria discussed in **section 1.1.2**, **Table 1-2** provides a list of projects that were considered, but not assessed in the cumulative impact assessment including the justification for why they were not included. **Table 1-3** provides a description of the projects included in the cumulative impact assessment.

Table 1-2 Projects considered but not assessed in the cumulative impact assessment

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
King Street Gateway	King Street Gateway is a future strategic government project at the intersection of the Princes Highway, King Street and Sydney Park Road at Newtown. The project works are aimed at protecting the amenity of King Street and may include: · Refining treatments to and rationalisation of road space · Limiting through-traffic · Improving pedestrian safety and access to Sydney Park. Roads and Maritime is committed to working with City of Sydney and Inner West councils to develop and implement the concept for the King Street Gateway. When finalised, the King Street Gateway concept is aimed at delivering improvements along the Princes Highway, and may also include potential amendments to restrict some turning movements at the intersection of May Street and Mitchell Road, to minimise the use of local roads and further protect the amenity of King Street.	WestConnex New M5 Submissions and Preferred Infrastructure Report (AECOM 2016).	· Overlaps with the M4-M5 Link mainline tunnel footprint · Potential construction time period overlap with the M4-M5 Link project (however the program is unknown at this stage) · Traffic implications on the road network around the M4-M5 Link.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.
Alexandria to Moore Park Connectivity Upgrade	Roads and Maritime is investigating key intersection improvements to reduce travel time, improve connectivity and support urban renewal on the southern outskirts of the Sydney CBD. The Alexandria to Moore Park connectivity upgrade includes improvements at critical intersections and pinch points in the inner city suburbs of Alexandria, Waterloo and Moore	· Alexandria to Moore Park Connectivity Upgrade - Project Updates (Roads and Maritime December 2016 and June 2017) · Alexandria to Moore Park Connectivity	The project footprint at the Euston Road intersection with Maddox Street is in proximity (less than one kilometre) from the M4-M5 Link footprint at the St Peters interchange and directly connects to the WestConnex New M5	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
	Park and can be divided into three areas: · Euston Road (at Maddox Street) at Alexandria to McEvoy Street (at Young Street) at Waterloo · McEvoy Street (at Young Street) to Lachlan Street and South Dowling Street at Waterloo · Anzac Parade, Alison Road and Dacey Avenue at Moore Park. A concept design and review of environmental factors (REF) is due to be displayed for community and stakeholder feedback in the second half of 2017.	Upgrade - Questions and Answers (Roads and Maritime June 2017) · Alexandria to Moore Park Connectivity Upgrade - Community Consultation Report (Roads and Maritime April 2017) · Roads and Maritime website: http://www.rms.nsw.gov.au/projects/sydney-inner/alexandria-moore-park-connectivity-upgrade/index.html.	project at this intersection.	
Parramatta Road Bus Rapid Transit and future Light Rail	Parramatta Road is identified in State policy documents (detailed in **Chapter 4** (Project development and alternatives)) as one of Sydney's key growth corridors to investigate for a rapid transit system, either bus or light rail. The Parramatta Road Corridor on-street rapid transit route, from Burwood train station to the Sydney CBD, would service the five precincts of Burwood-Concord, Kings Bay, Taverners Hill, Leichhardt and Camperdown. It is expected that public transport journeys would become faster and more reliable through the operation of higher-frequency and capacity services, additional on-road transit priority and the provision of high-quality and accessible transit 'superstops'. The *Parramatta Road Corridor Urban*	· State Infrastructure Strategy (Infrastructure NSW 2014) · Sydney's Bus Future - Simpler, faster, better bus services (Transport for NSW December 2013) · Parramatta Road Corridor Urban Transformation Strategy (UrbanGrowth NSW 2016) · Parramatta Road Corridor Urban Transformation Implementation Plan 2016-2023	The M4-M5 Link will provide reductions in traffic along sections of Parramatta road thereby enabling public transport improvements on this corridor. One of the proposed bus rapid superstops is planned for Parramatta Road at the intersection with Pyrmont Bridge Road, which is adjacent to the M4-M5 Link Pyrmont Bridge Road tunnel site. Changes to traffic conditions as a result of a new rapid transit system	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
	Transformation Strategy (UrbanGrowth NSW 2016) describes a rapid bus solution from Burwood to the Sydney CBD in its 2016–2023 implementation plan. Local councils and state agencies would have a role in implementing the Strategy.	(UrbanGrowth NSW 2016).	would also potentially impact on communities impacted by the M4-M5 Link project. There is a potential for construction periods to overlap.	
Sydney Metro West	The NSW Government has announced a new metro railway line linking the Parramatta and Sydney CBDs, and communities along the way. The proponent for the project is Transport for NSW. The new railway line is expected to be built largely underground and operational after 2025. The metro line would service four key precincts including Parramatta, Sydney Olympic Park, The Bays Precinct and the Sydney CBD. Sydney Metro West would work together with the existing T1 Western Line to service the growing needs of Western Sydney, by doubling the rail capacity of the Parramatta to Sydney corridor. The project is in the early planning stages with a preferred alignment to be announced in late 2018.	· Sydney Metro West - Project Overview (Transport for NSW 2017) (https://www.sydneymetro.info/west/project-overview).	The project is in spatial proximity to the M4-M5 Link around The Bays Precinct.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.
Inner West Greenway	The Inner West Greenway is an open space/active and mixed transport corridor, connecting the Parramatta River at Iron Cove with the Cooks River in the south at Earlwood. It follows the Inner West light rail corridor and provides connections to Leichhardt, Haberfield, Summer Hill, Petersham, Lewisham, Dulwich Hill, Hurlstone Park and Earlwood.	· GreenWay Missing Links Report (GreenWay Missing Links Working Group October 2015) (http://www.greenway.org.au/).	Spatial overlap above the M4-M5 Link mainline tunnel alignment at Haberfield and Leichhardt near Hawthorne Canal and also adjacent to the Darley Road civil and tunnel site.	· Design of the missing links of the project in early stages · Insufficient public information available · Impacts and the timing of the missing links of the project are not yet

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
	Funding has been allocated to continue developing the corridor, to complete the missing links (eg between the Leichhardt North light rail stop and Hawthorne Canal and from Marion Street to Parramatta Road). The Greenway trail is expected to be completed by 2020.		Potential for construction of the missing links in and around the project footprint to occur at the same time as construction for the M4-M5 Link.	known.
The Green Grid	The primary aim of the Green Grid is to conserve, improve and expand Sydney's strategic network of open spaces. Connecting town centres integrating public transport and connecting the residents, workers and visitors of Sydney with a diversity of open space, sports facilities and recreational experiences.	· The Green Grid – Creating Sydney's open space network (NSW Government Architect's Office) · A Plan for Growing Sydney (NSW Government 2014).	It is possible that the Green Grid project may spatially overlap with some parts of the M4-M5 Link footprint. The 'central region' of the Green Grid includes the area at Alexandria Canal, which is close to the St Peters interchange.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.
Johnstons Creek naturalisation	Sydney Water is investigating opportunities to naturalise a 600 metre section of Johnstons Creek at Bicentennial Park, Annandale, as it is in need of repair. This work would help maintain the stormwater system and protect the local environment. The work would involve replacing the concrete walls with natural looking banks made of rocks and native plants. A concept design for the project was released in December 2016. There is no indicative timing for this work.	· Waterway rehabilitation - Johnstons Creek - Community Update (Sydney Water November 2016) · Johnstons Creek Parklands Master Plan (City of Sydney 2013) · Early Concept Designs (Sydney Water December 2016).	The naturalisation project does not interact directly with the M4-M5 project footprint but at its closest point is within 500 metres of the project footprint at the intersection of The Crescent and City West Link.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.
Lilyfield Road Regional Bike Route	Inner West Council is proposing a new cycleway that would be separated from Lilyfield Road traffic lanes. This will make it safer for	· Leichhardt Municipal Council – 2016 Leichhardt Bike Plan	Spatial overlap along Lilyfield Road and Victoria Road near the Rozelle	· Design of the project in early stages · Insufficient public

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
Separated Cycleway	pedestrians and cyclists and improve connections to local areas, while promoting the use of active and public transport. This project aims to: · Improve local bike routes · Improve accessibility for our community · Make the roads more bike friendly and safe · Encourage local residents to cycle · Promote health and wellbeing. The project is currently under review following community consultation. Draft concept plans are currently being prepared and will be placed on public exhibition.	(GTA Consultants on behalf of Leichhardt Municipal Council October 2015) · Making it safer and easier to ride a bike - Lilyfield Road, Lilyfield (Factsheet Inner West Council).	Rail Yards.	information available · Impacts and the timing of the project are not yet known.
Superyacht Marina	Redevelopment of the Sydney Superyacht Marina at Rozelle to create a commercial marine hub, providing berthing for a range of vessels, commercial space supporting marine uses, a yacht club and associated restaurants and café.	http://superyachtmarina.com.au/.	Proximal to the Rozelle Rail Yards.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.
CBD Metro	The CBD Metro comprises a seven kilometre underground railway within twin tunnels, each about six metres in diameter. It would traverse the Inner West local government area (LGA). It was designed to enable a future extension to Westmead from Central Station and extensions to the northwest from Rozelle. New stations were proposed at Central, Town Hall Square, Martin Place, Barangaroo–Wynyard, Pyrmont and Rozelle, with infrastructure at White Bay for a future station. Two alternatives for the eastern entrance at	Sydney Metro - Annual Report (NSW Government 2009).	Spatial overlap at Rozelle where a new station and stabling facility were proposed. The station would be located beneath Victoria Road, near the corner of Darling Road and in proximity to the proposed Iron Cove Link.	· Temporal relevance not determined · Although the design has considered the protected corridor, there is currently no government commitment to proceed.

Project name	Brief project description	Information source	Potential interaction with the M4-M5 Link	Justification for exclusion
	Pyrmont Station were designed. A stabling facility and maintenance depot was also proposed at the Rozelle Rail Yards. While the project corridor was approved in 2010, the NSW Government announced in February 2010 that the project did not form part of the strategic transport plan for Sydney and would consequently not be constructed. The corridor remains a preserved corridor under the State Environmental Planning Policy (Infrastructure) 2007.			
Cooks Cove precinct redevelopment – Stage 1: Southern Precinct	The Cooks Cove precinct is located at Arncliffe, about 10 kilometres south of the Sydney CBD in close proximity to Sydney Airport and Port Botany. It is bordered by Marsh Street to the north and west and Cooks River to the east. The proposed redevelopment of the Southern Precinct would involve: · Relocation of the Kogarah Golf Course and golf club · Creation of new cycling and pedestrian corridors · Creation of new pocket parks and enhancements to existing parks · Improvements to existing wetlands and creation of additional habitat · Remediation of contaminated land · Upgrades to operational infrastructure within the state heritage listed Arncliffe Market Gardens. Results of submission are expected mid-2017.	· Cooks Cove – Planning Report (NSW Government November 2016) http://www.cookcoveprecinct.com.au/ · Cooks Cove – Indicative Development Proposal – Kogarah Golf Course Relocation (John Boyd Properties April 2016).	Spatial – the Cooks Cove Southern Precinct is located around three kilometres from the St Peters interchange.	· Design of the project in early stages · Insufficient public information available · Impacts and the timing of the project are not yet known.

Table 1-3 Projects included in the cumulative impact assessment

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
WestConnex program of works					
King Georges Road Interchange Upgrade	Upgrade of the King Georges Road Interchange between the M5 West Motorway and the M5 East Motorway at Beverly Hills, in preparation for the New M5 project. Construction commenced in July 2015 and the road was opened to traffic in December 2016.	Recently completed.	Proximal – the road alignment is within 10 kilometres of the St Peters interchange.	Operational overlap and within the WestConnex program of works.	· Traffic and transport.
M4 Widening	Widening of around eight kilometres of the existing M4 Motorway from Parramatta to Homebush from three to four lanes in each direction. Construction commenced in March 2015 and the road was opened to traffic in July 2017.	Recently completed.	Proximal – the road widening is within 10 kilometres of the Wattle Street interchange at Haberfield.	Operational overlap and within the WestConnex program of works.	· Traffic and transport.
M4 East	Extending the M4 Motorway in twin tunnels between Homebush and Haberfield via Concord, with three lanes in each direction. Construction commenced in March 2016. The project is expected to be completed and open to traffic in 2019. Includes provision for the future connection to M4-M5 Link at Haberfield.	Under construction.	Overlaps – the project overlaps with the M4-M5 Link project footprint at the Wattle Street interchange, Wattle Street civil and tunnel site, Haberfield civil and tunnel site (including the Parramatta Road ventilation facility) and the Northcote Street civil site.	Construction overlap may be up to 12 months. Operation overlap. This project is also within the WestConnex program of works.	· All key issues for the EIS.
New M5	Duplication of the M5 East from King Georges Road in Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters. The St Peters interchange allows for connections to the proposed future Sydney Gateway project and an underground connection to the M4-M5 Link. The New M5 tunnels also include provision for a future	Under construction.	Overlaps – the project overlaps with the M4-M5 Link project footprint at the St Peters interchange and the Campbell Road civil and tunnel site.	Construction is expected to overlap for around 24 months. Operation overlap. This project is also within the	· All key issues for the EIS.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	connection to the proposed future F6 Extension. Local streets and intersections around the St Peters interchange are also being upgraded to ensure safe and efficient connections for the New M5. Construction commenced in July 2016. The project is expected to be completed and open to traffic in 2020.			WestConnex program of works.	
Related Roads and Maritime projects					
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct. The project is undergoing concept development and would be subject to separate planning approval. For the purposes of this cumulative impact assessment, the Sydney Gateway project is conservatively assumed to be operational by 2023.	Future strategic government project.	Adjacent – the road alignment would connect to the St Peters interchange (the rail component of the Sydney Gateway project has not been considered).	For the purposes of this EIS, both projects are being assessed as being under construction concurrently for at least some of the time.	· Traffic and transport · Noise and vibration · Air quality · Human health risk.
Western Harbour Tunnel and Beaches Link	**Western Harbour Tunnel** Tunnels connecting to the M4-M5 Link at the Rozelle interchange, crossing underneath Sydney Harbour between the Birchgrove and Waverton areas, and connection with the Warringah Freeway at North Sydney. **Beaches Link** Tunnels connecting to the Warringah Freeway, crossing underneath Middle Harbour and connecting with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth	Future strategic government project.	Overlaps – the Western Harbour Tunnel construction and operational footprint overlaps with the M4-M5 Link footprint at the Rozelle interchange including surface works and infrastructure within the Rozelle Rail Yards.	For the purposes of this EIS, both projects are being assessed as being under construction concurrently for at least some of the time.	· Traffic and transport · Noise and vibration · Air quality · Human health risk · Social and economic.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	and Frenchs Forest. This project is undergoing concept development and would be subject to separate planning approval. For the purposes of this cumulative impact assessment, the Western Harbour Tunnel component is conservatively assumed to be operational by 2023, but construction may continue after the expected opening year of the M4-M5 Link project. For the purposes of this cumulative impact assessment, the Beaches Link component is conservatively assumed to be operational by 2033.				
F6 Extension	A proposed future motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor. This project is subject to separate environmental assessment and approval. For the purposes of this cumulative impact assessment, the F6 Extension is conservatively assumed to be operational by 2033.	Future strategic government project.	Proximal – the road alignment is within around five kilometres of the St Peters interchange.	Operational overlap.	· Traffic and transport · Noise and vibration · Air quality · Human health risk · Social and economic.
Other transport projects					
Sydney Metro City and Southwest	The project comprises two stages: Stage 1: Chatswood to Sydenham Stage 2: Sydenham to Bankstown. The metro line would be around 16 kilometres long (of which around 15 kilometres is located in underground rail tunnels) and includes seven new stations and 11 replacement stations (superseding heavy rail between Sydenham and Bankstown). Key features of Stage 1 relevant to the M4-M5 Link project include:	Stage 1 was approved in January 2017. Stage 2 under assessment.	Overlaps – the Sydney Metro Rail runnels overlap with the M4-M5 Link Motorway tunnels in the Newtown area north of the St Peters interchange. A construction compound for the metro project at Sydney Steel Road (the Marrickville dive site) is less than one kilometre from the St Peters interchange.	Construction and operational overlap.	· Traffic and transport · Noise and vibration · Air quality · Human health risk · Social and economic · Groundwater.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	A dive structure (about 400 metres in length) and tunnel portal north of Sydenham Station and south of Bedwin Road, Marrickville – referred to as the Marrickville dive site in this EIS A services facility (for traction power supply and an operational water treatment plant) adjacent to the dive structure. Early works on Stage 1 would start in 2017. Testing and commissioning of the project would be completed by late 2024. Services on Stage 1 of Sydney Metro City and Southwest are expected to start in 2024.				
CBD and South East Light Rail – Rozelle maintenance depot	The CBD and South East Light Rail includes 20 light rail stops, a pedestrian zone on George Street (between Hunter and Bathurst streets), around 12 substations to provide power for the light rail vehicles, a light rail vehicle stabling facility in Randwick and a maintenance depot at Rozelle. Preparatory work for the depot, adjacent to Lilyfield Road and Catherine Street, began in April 2016 with site establishment and demolition work. When complete, the new facility would be used by light rail drivers as well as maintenance facility operators to repair and service light rail vehicles. Works are scheduled to finish by Q1-2018.	Under construction.	Adjacent – The Rozelle maintenance depot is immediately west of the Rozelle Rail Yards.	Construction and operational overlap.	· Traffic and transport · Noise and vibration · Flooding and drainage · Aboriginal heritage · Non-Aboriginal heritage · Biodiversity · Visual amenity.
Other projects and strategic developments					
Rozelle Rail Yards Site Management	Roads and Maritime would be responsible for removing existing rail and rail related infrastructure from the Rozelle Rail Yards and	Under construction.	Overlaps – the site management works at the Rozelle Rail Yards overlap	Operation overlap.	· Contamination · Flooding and

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
Works	managing existing issues at the site such as waste and noxious weeds. Works are expected to commence in the second half of 2017 and take up to 12 months to complete.		with the M4-M5 Link footprint at the Rozelle interchange, but the site management works will be completed prior to M4-M5 Link works commencing.		drainage · Visual amenity · Biodiversity · Aboriginal heritage · Non-Aboriginal heritage · Noise and vibration · Air quality.
Parramatta Road Corridor Urban Transformation Strategy	The strategy is the NSW Government's 30 year plan setting out how the Parramatta Road Corridor will grow and bring new life to local communities living and working along the corridor. The corridor spans 20 kilometres from Granville to Camperdown and includes eight identified urban renewal precincts including the Taverners Hill, Leichhardt and Camperdown precincts. The Strategy identifies the 'Camperdown Triangle' at the intersection of Parramatta Road, Pyrmont Bridge Road and Mallett Street as a potential biomedical hub. One of the key actions for the Camperdown Precinct is to prioritise land use for biotechnology and employment uses that support the growth of the nearby institutions, such as RPA Hospital and Sydney University Plans for the Camperdown Precinct also include reinforcing active transport over private vehicle movements and improving high-capacity public transport connections along Parramatta Road to the Sydney CBD. The Strategy identifies a public transport 'super stop' at the intersection of Pyrmont Bridge Road and Parramatta Road.	Future strategic government project.	Overlaps – the Pyrmont Bridge Road civil and tunnel site for the project occupies part of the 'Camperdown triangle' identified in the Strategy.	Operational overlap.	· Traffic and transport · Land use · Social and economic · Visual amenity.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
Bays Precinct Transformation Plan	*The Bays Precinct Urban Transformation Plan* (UrbanGrowth NSW 2015) establishes the strategy for how The Bays Precinct would be developed over 20 years for residential, employment, entertainment and open space uses. The Bays Precinct, located about two kilometres west of the Sydney CBD, encompasses the areas surrounding Blackwattle Bay, Rozelle Bay and White Bay. The Bays Precinct comprises eight precincts, including the former Rozelle Rail Yards, White Bay Power Station, White Bay, and Rozelle Bay and Bays Waterways. The Transformation Plan offers the opportunity to transform 95 hectares of largely government-owned, harbour-front land and 94 hectares of waterways for the economic, cultural and social benefit of Sydney and the state. The vision for the Rozelle Rail Yards, as outlined in the Plan, was superseded by the NSW Government announcement in July 2016 that the site would be used for the M4-M5 Link. Preliminary investigation and consultation is underway for the development of the White Bay Power Station site, led by UrbanGrowth NSW. This site is identified as a high priority development site.	Future strategic government project.	Adjacent – M4-M5 Link activities such as surface road improvements at Victoria Road and Anzac Bridge approach as well as development on part of the former Rozelle Rail Yards (for the Rozelle interchange) would be immediately adjacent to the White Bay Power Station site. Overlaps – the M4-M5 Link intends to use the Rozelle Rail Yards, which is an identified precinct in the Plan – it is expected that use of this site would be complementary to the Plan as far as possible. The M4-M5 Link also intends to discharge treated water into Rozelle Bay.	Operational overlap.	· Traffic and transport · Land use · Social and economic · Visual amenity.
Western Sydney Airport	The Australian Government has announced that Badgerys Creek will be the site for the Western Sydney Airport. The Government is committed to ongoing investment in the western Sydney region, where the new airport will be a major generator of	Approved.	Although the footprint of the proposed airport is not spatially relevant to the M4-M5 Link, this project has been included by exception).	Operational overlap.	· Traffic and transport · Air quality · Noise and vibration · Human health risk.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	economic activity providing employment opportunities closer to where people in Western Sydney live. The airport will be a single runway, catering for 10 million passengers a year, five years after opening, with a second runway planned for 2050.				· Resource waste and waste minimisation.
Mascot Station Town Centre Precinct Masterplan	The Mascot Station Town Centre Precinct is a key centre in planning and urban development in the City of Bayside LGA and is nominated as a growth centre in state and local planning strategies. The scope includes transport measures, public open space and desirable built form outcomes. The Masterplan balances land uses by providing residential and employment uses that capitalise on accessibility to public transport and open space.	Future strategic government project.	Proximal – the Mascot town centre precinct is located around one kilometre from the St Peters interchange.	Operational overlap.	· Traffic and transport · Air quality · Noise and vibration · Human health risk.
Green Square Town Centre Project	Green Square Town Centre would rejuvenate former industrial precincts, with a vision for a vibrant place where people can live, work and enjoy both during the day and at night. It would include entertainment, cultural and community features and activities. The project would include community facilities including a library, plaza, open space and aquatic centre.	Under construction.	Proximal – the Green Square Town Centre urban development at the station on Bourke Street is around one kilometre from the St Peters interchange.	Operational overlap.	· Traffic · Air quality · Noise and vibration · Human health risk
Central to Eveleigh Urban Transformation and Transport Program	The transformation of Central to Eveleigh is through three projects that include five precincts of government land. Planning for these precincts would improve local links across the rail corridor, provide more open space, and create new community facilities and places for residents, visitors and workers to enjoy.	Future strategic government project.	Although the footprint of the precincts is not spatially relevant to the M4-M5 Link, this project has been included by exception.	Operational overlap.	· Traffic · Air quality · Noise and vibration · Human health risk.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	The program has the potential to make a contribution to meeting the future needs of Sydney residents and businesses through connecting Sydney's diverse and vibrant communities, strengthening the Global City and making a great place to live.				
Whites Creek naturalisation	Sydney Water is investigating the naturalisation of about 420 metres of Whites Creek about 200 metres west of its outlet at Rozelle Bay in Annandale. The purpose is to devise a restoration plan with a focus on developing naturalising solutions where possible. The early concept design for the naturalisation and/or rehabilitation of this section of Whites Creek involves the removal of deteriorated concrete banks and subsequent rehabilitation and naturalisation. The design and construction timelines for these works are not known. For the purpose of this cumulative impact assessment, it is assumed that works would be completed prior to construction of the M4-M5 Link commencing.	Concept design ready (December 2016).	Overlaps – the M4-M5 Link includes the proposed widening of Whites Creek near The Crescent, consistent with Sydney Water's plans for the portion of Whites Creek to the west. The M4-M5 Link also plans to discharge treated tunnel water into Rozelle Bay.	Operational and construction overlap.	· Flooding and drainage · Water quality · Biodiversity.
Sydney Airport Master Plan	The Master Plan outlines the strategic direction for the development of Sydney Airport over the next 20 years. It includes an assessment of the future needs of airlines and other airport users, a land use zoning plan, forecast changes in the number of airline passengers, flights and the volume of air freight, information about aircraft noise and the plans for dealing with any environmental issues associated with implementing the new master plan. The plan includes a number of projects to	Master Plan approved and some of the projects have commenced.	Proximal – Sydney Airport is within two kilometres of the St Peters interchange.	Construction and operational overlap.	· Traffic and transport · Air quality · Noise and vibration · Human health risk.

Project name	Brief project description	Status	Spatial relevance[1]	Temporal relevance[2]	Relevant technical issues
	significantly improve road traffic capacity in and around the airport over the short and long term. In particular, proposed works to the junctions around the Terminal 2/Terminal 3 precinct, proposed road works within the Terminal 1 precinct and the creation of public transport facilities in both precincts would result in improved traffic flows in and around the airport.				

Notes:

[1] Spatial relevance – overlap means part of the project footprint overlaps with the project footprint of the M4-M5 Link, adjacent means within 500 metres of the M4-M5 Link project footprint and proximal is within 10 kilometres of the M4-M5 Link project footprint.

[2] Temporal relevance – Construction: the construction phase of the project is concurrent with the construction phase of the M4-M5 Link. Operation: the operation phase of the project commences during the construction phase or operational phase of the M4-M5 Link

Appendix D

Environmental Planning and Assessment Regulation 2000 (NSW) checklist

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Appendix D – Environmental Planning and Assessment Regulation 2000 (NSW), Part 3 of Schedule 2 checklist

Part 3 of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW) lists the information required to be included in an environmental impact statement (EIS). **Table D-1** provides a checklist to demonstrate where this information has been included within the EIS for the M4-M5 Link project (the project).

Table D-1 Environmental Planning and Assessment Regulation 2000 (NSW), Part 3, Schedule 2 checklist

Requirement	Where addressed in this EIS
6 Form of the environmental impact statement	
An environmental impact statement must contain the following information:	
(a) The name, address and professional qualifications of the person by whom the statement is prepared,	The name, an address and professional qualification of the person by whom the statement is prepared is provided on the EIS **Certification page**.
(b) The name and address of the responsible person,	The name and address of the responsible person is provided on the EIS **Certification page**.
(c) The address of the land: (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out,	The address of the land to which the EIS relates is provided on the EIS **Certification page** and is more fully described in **Chapter 5** (Project description) and **Chapter 6** (Construction work) of the EIS.
(d) A description of the development, activity or infrastructure to which the statement relates,	A description of the infrastructure to which the EIS relates is provided on the EIS **Certification page** and in more detail in **Chapter 5** (Project description) and **Chapter 6** (Construction work) of the EIS.
(e) An assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule,	An assessment of the environmental impact of the project, dealing with the matters referred to in this Schedule is provided throughout **Chapter 8** to **Chapter 28**, and in **Appendix H** to **Appendix X** of the EIS.
(f) A declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	A declaration has been provided on the EIS **Certification page**, certifying that the EIS: · Has been prepared in accordance with Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW) · Contains all available information relevant to the environmental assessment of the infrastructure to which the EIS relates · Contains information that is neither false nor misleading.

Requirement	Where addressed in this EIS
7 Content of environmental impact statement	
(1) An environmental impact statement must also include each of the following:	
(a) A summary of the environmental impact statement,	A summary of the EIS is provided in the **Executive Summary** and **Appendix A** (Project synthesis) of the EIS.
(b) A statement of the objectives of the development, activity or infrastructure,	The project objectives are outlined in **Chapter 3** (Strategic context and project need) of the EIS. A justification of the project against the project objectives is provided in **Chapter 30** (Project justification and conclusion) of the EIS.
(c) An analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure,	An analysis of feasible alternatives to the project, based on the extent to which each alternative could meet the project objectives has been carried out, including a theoretical base case or 'do nothing/do minimum' alternative. This analysis is provided in **Chapter 4** (Project development and alternatives) of the EIS.
(d) An analysis of the development, activity or infrastructure, including:	An analysis of the project has been provided throughout **Chapter 8** to **Chapter 28**, and in **Appendix H** to **Appendix X** of the EIS.
(i) A full description of the development, activity or infrastructure, and	A description of the project and how it would be constructed is provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work) of the EIS respectively.
(ii) A general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and	A description of the environment likely to be affected by the project, including those aspects likely to be significantly affected is provided throughout **Chapter 5** to **Chapter 28**, and in **Appendix H** to **Appendix X** of the EIS.
(iii) The likely impact on the environment of the development, activity or infrastructure, and	The likely impact of the project on the environment has been provided throughout **Chapter 8** to **Chapter 28**, and in **Appendix H** to **Appendix X** of the EIS.
(iv) A full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and	Recommended environmental management measures proposed to mitigate any adverse effects of the project have been provided throughout **Chapter 8** to **Chapter 28**, and are summarised in **Chapter 29** (Summary of environmental management measures) of the EIS. Environmental management measures are also stated in **Appendix H** to **Appendix X** of the EIS as relevant.
(v) A list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out,	Approvals that must be obtained under any other Act or law before the project is carried out are listed in **Chapter 2** (Assessment process) of the EIS.
(e) A compilation (in a single section of the environmental impact statement) of the measures referred to in item (d) (iv),	A summary of recommended environmental management measures proposed to mitigate any adverse effects of the project is provided in **Chapter 29** (Summary of environmental management

Requirement	Where addressed in this EIS
	measures) of the EIS.
(f) The reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4).	The reasons which justify why the project should be carried out are provided in **Chapter 3** (Strategic context and project need) and **Chapter 30** (Project justification and conclusion) of the EIS. The principles of ecologically sustainable development have been an integral consideration throughout the design of the project. This includes the effective integration of the economic and environmental considerations in the decision making process, as defined by section 6(2) of the *Protection of the Environment Administration Act 1991* (NSW). The four main principles of ecologically sustainable development, as set out in subclause (4) of Schedule 2 Part 3 Section 7 of the Environmental Planning and Assessment Regulation 2000 (NSW), have been considered in the design, construction and operation phases of the project. A detailed description of how these principles have been considered is provided in **Chapter 27** (Sustainability) of the EIS.
(2) Subclause (1) is subject to the environmental assessment requirements that relate to the environmental impact statement.	The SEARs, as issued on 3 March 2016, and revised on 9 November 2016 and further revised on 3 May 2017, have been addressed throughout the EIS.
(3) Subclause (1) does not apply if:	
(a) the Secretary has waived (under clause 3 (9)) the need for an application for environmental assessment requirements in relation to an environmental impact statement in respect of State significant development, and	Not applicable.
(b) the conditions of that waiver specify that the environmental impact statement must instead comply with requirements set out or referred to in those conditions.	Not applicable.
(4) The principles of ecologically sustainable development:	The four main principles of ecologically sustainable development, as set out in subclause (4) of Schedule 2 Part 3 Section 7 of the Environmental Planning and Assessment Regulation 2000 (NSW), have been considered in the design, construction and operation phases of the project. A detailed description of how these principles have been considered is provided in **Chapter 27** (Sustainability) of the EIS.
(a) the *precautionary principle* , namely, that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. In the application of the precautionary principle, public and private decisions should be guided by:	
(i) careful evaluation to avoid, wherever practicable, serious or irreversible	

Requirement	Where addressed in this EIS
damage to the environment, and	
(ii) an assessment of the risk-weighted consequences of various options,	
(b) *inter-generational equity*, namely, that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations,	
(c) *conservation of biological diversity and ecological integrity*, namely, that conservation of biological diversity and ecological integrity should be a fundamental consideration,	
(d) *improved valuation, pricing and incentive mechanisms*, namely, that environmental factors should be included in the valuation of assets and services, such as:	
(i) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement,	
(ii) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,	
(iii) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.	

Appendix E

Geological long-sections

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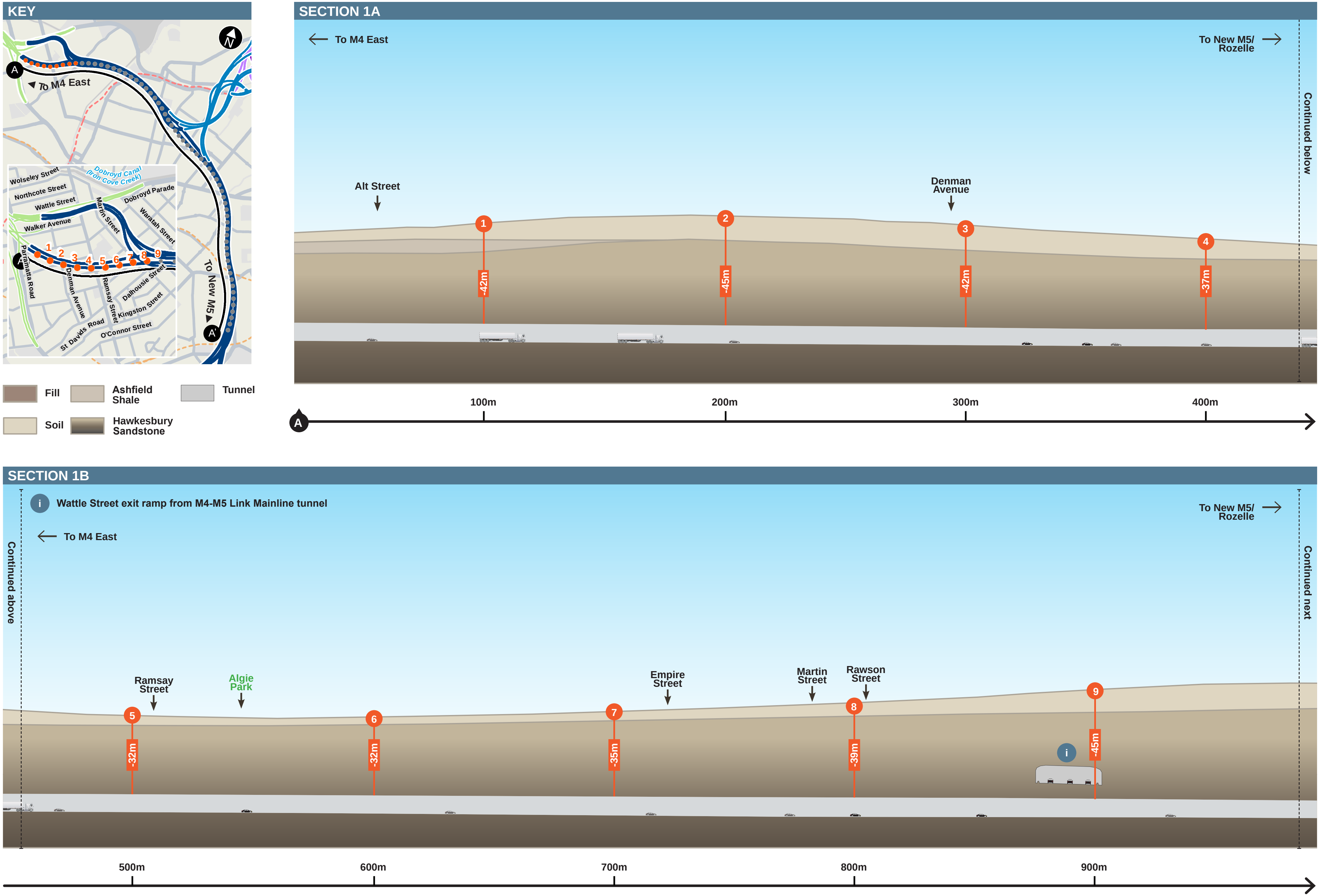


Figure 1 Geological long-section of the Mainline tunnel - Section 1

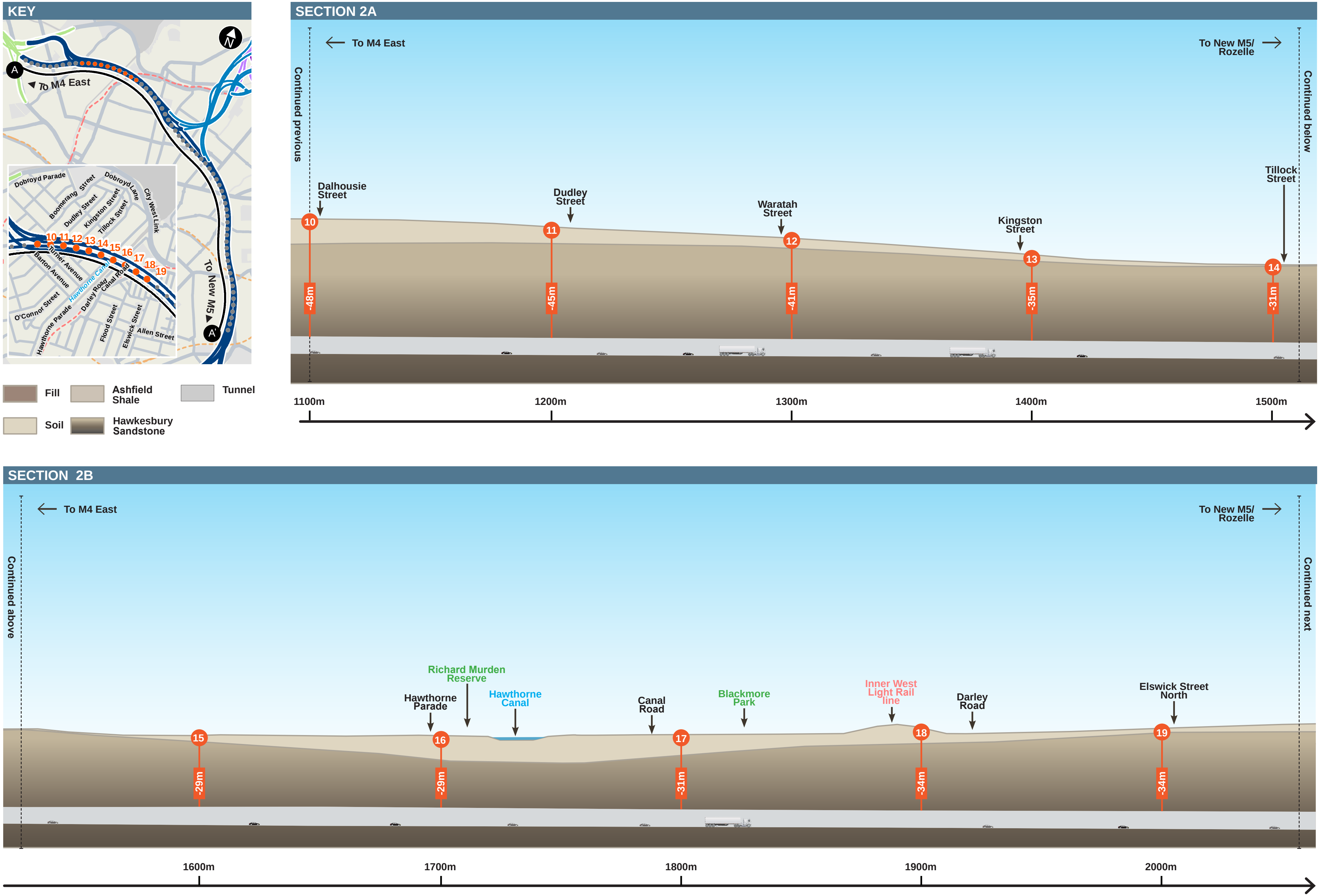
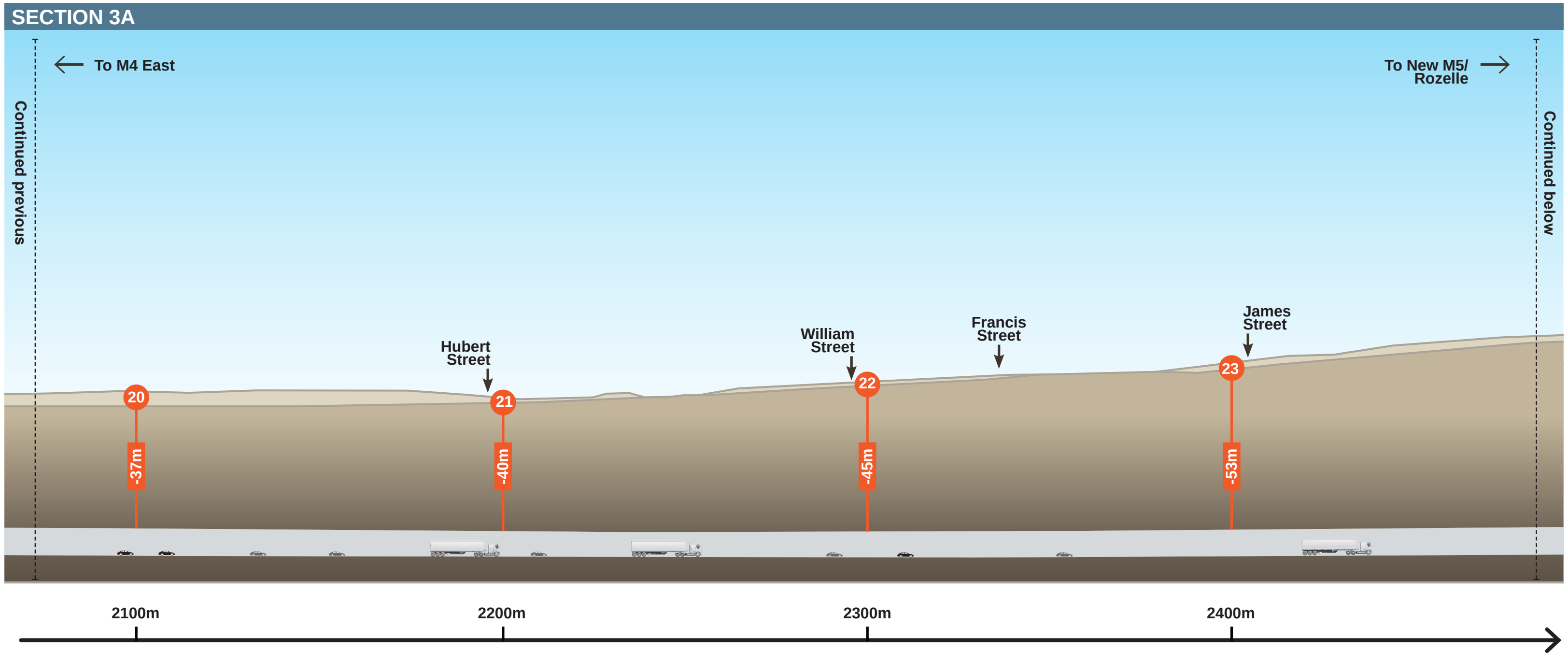


Figure 2 Geological long-section of the Mainline tunnel - Section 2



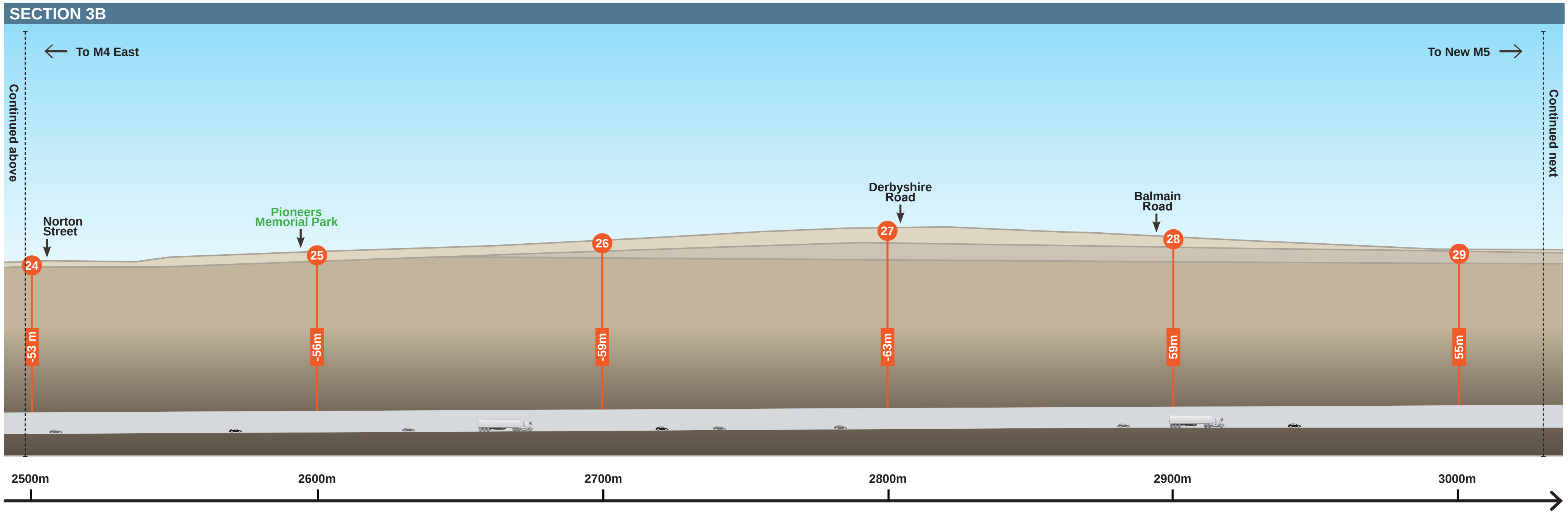
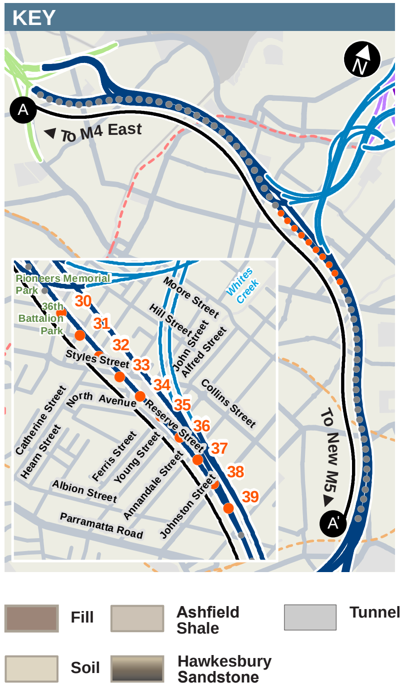
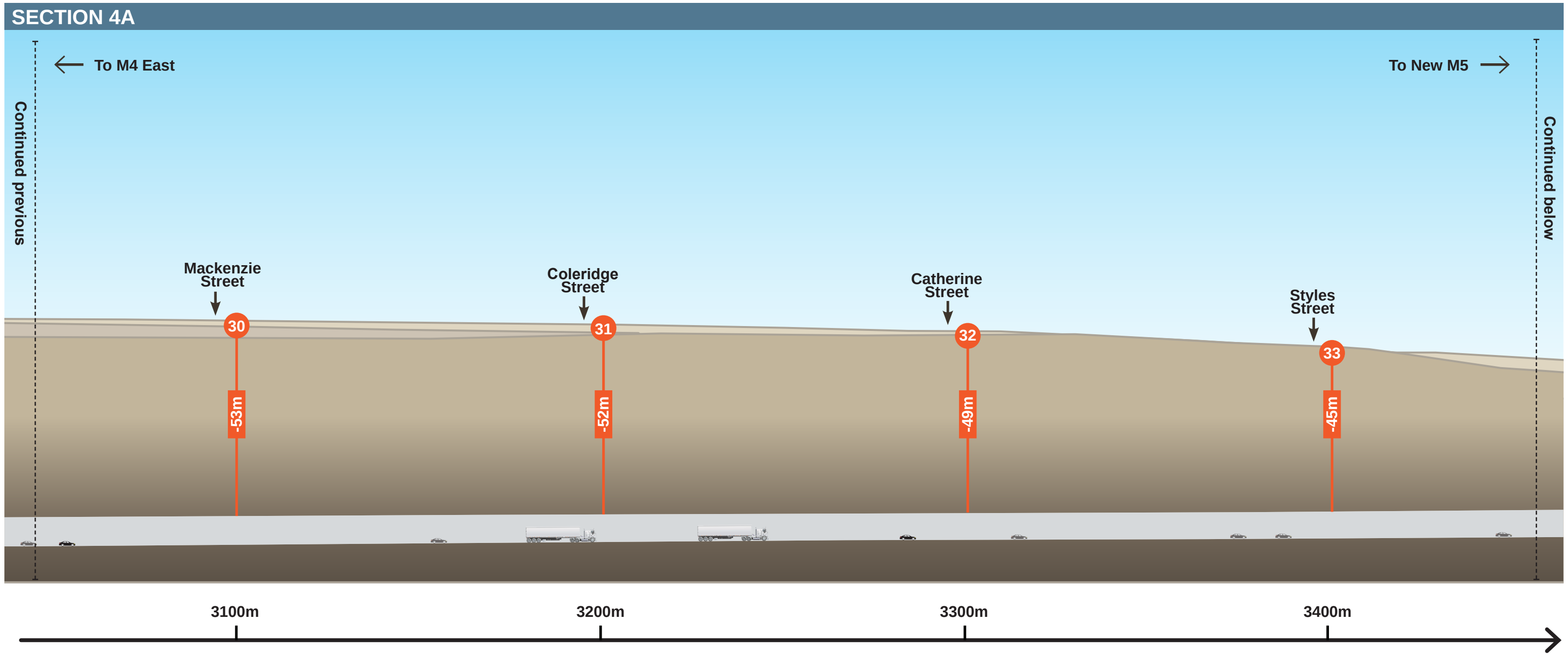


Figure 3 Geological long-section of the Mainline tunnel - Section 3





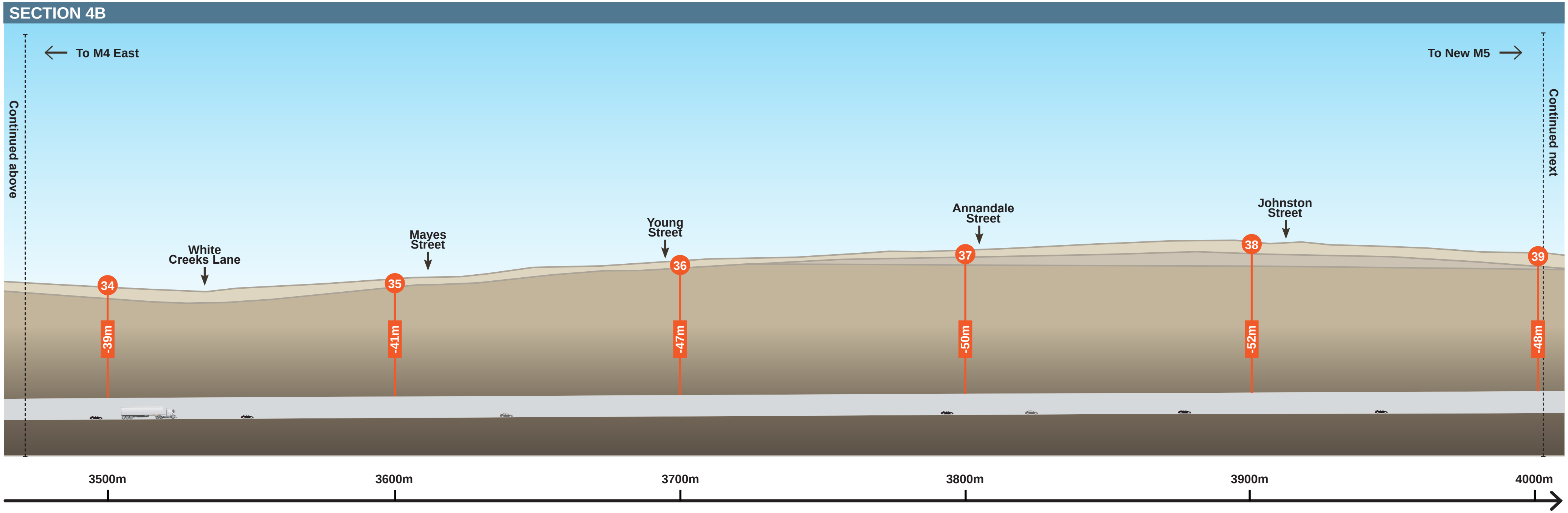


Figure 4 Geological long-section of the Mainline tunnel - Section 4

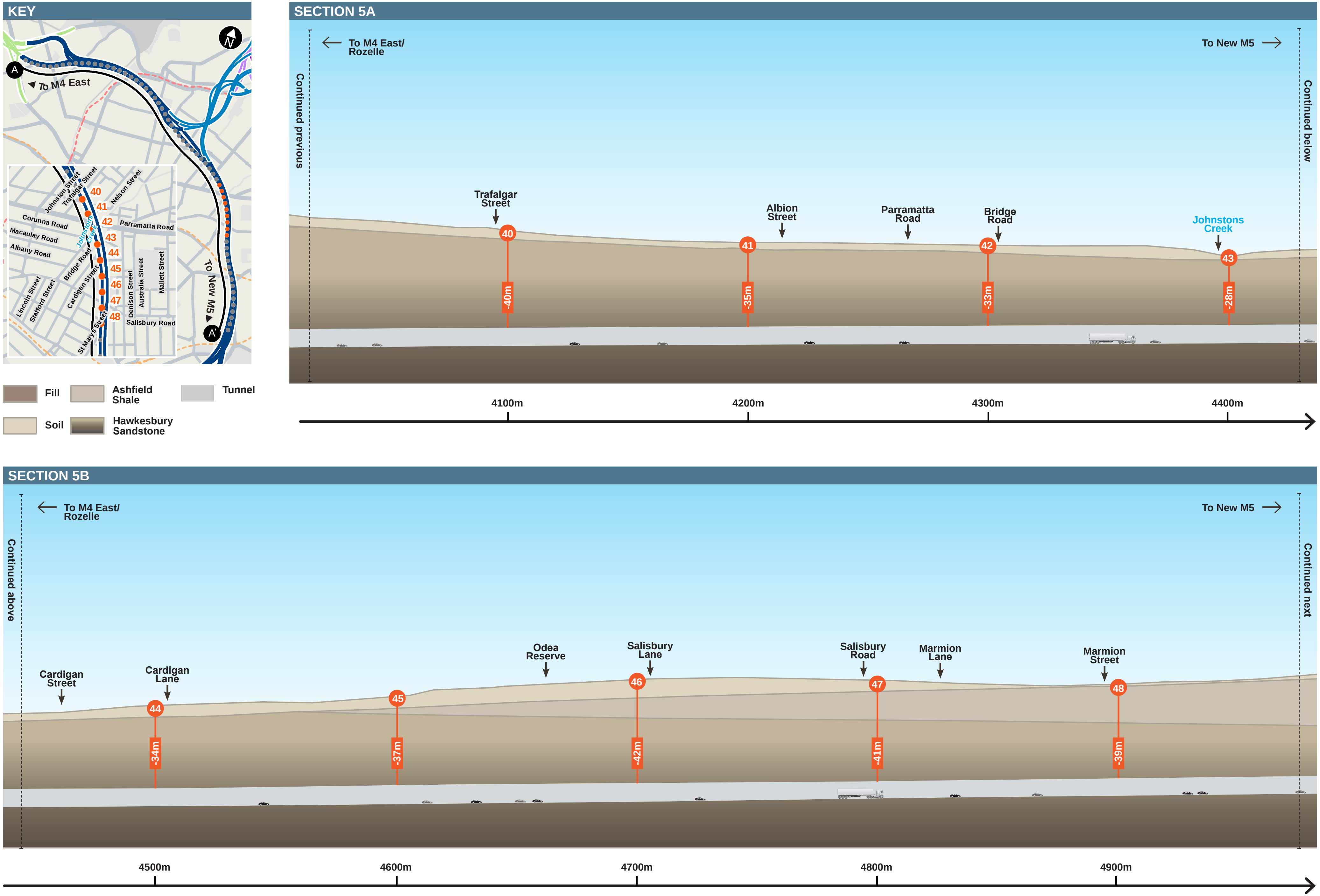
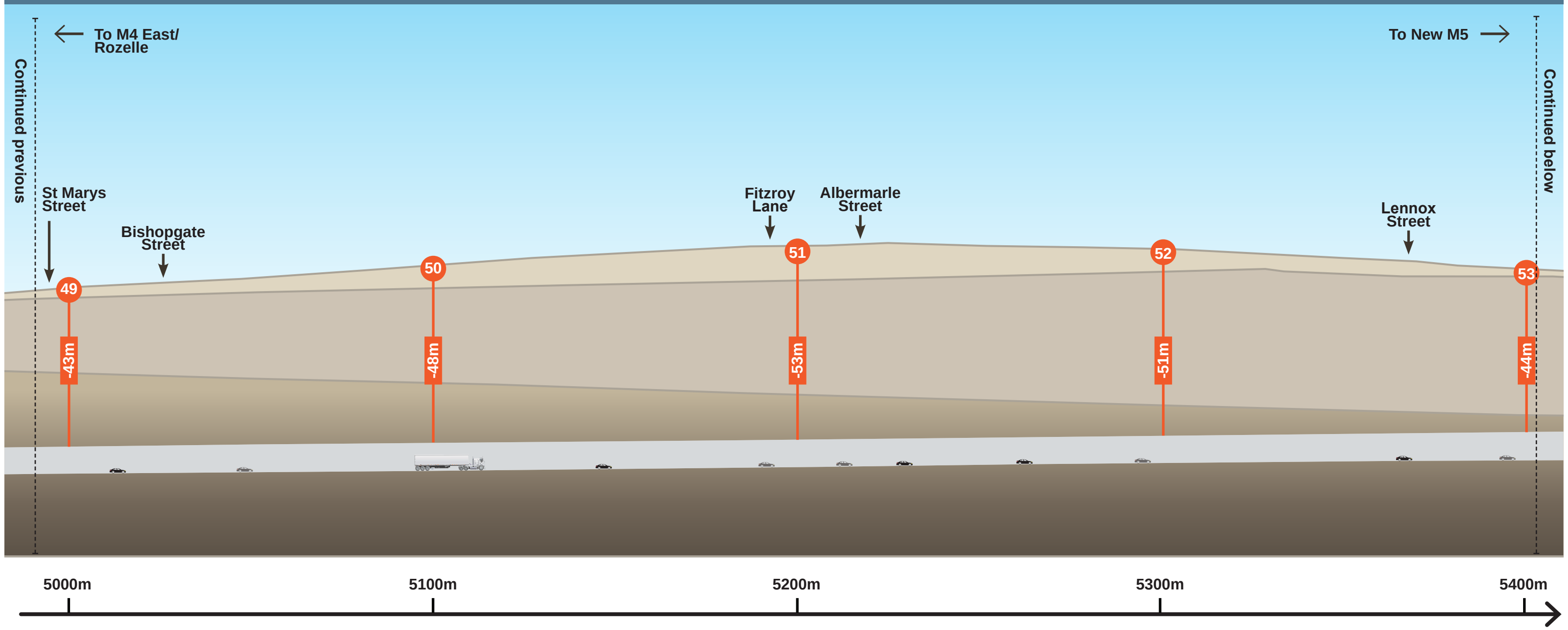


Figure 5 Geological long-section of the Mainline tunnel - Section 5

KEY

SECTION 6A



SECTION 6B

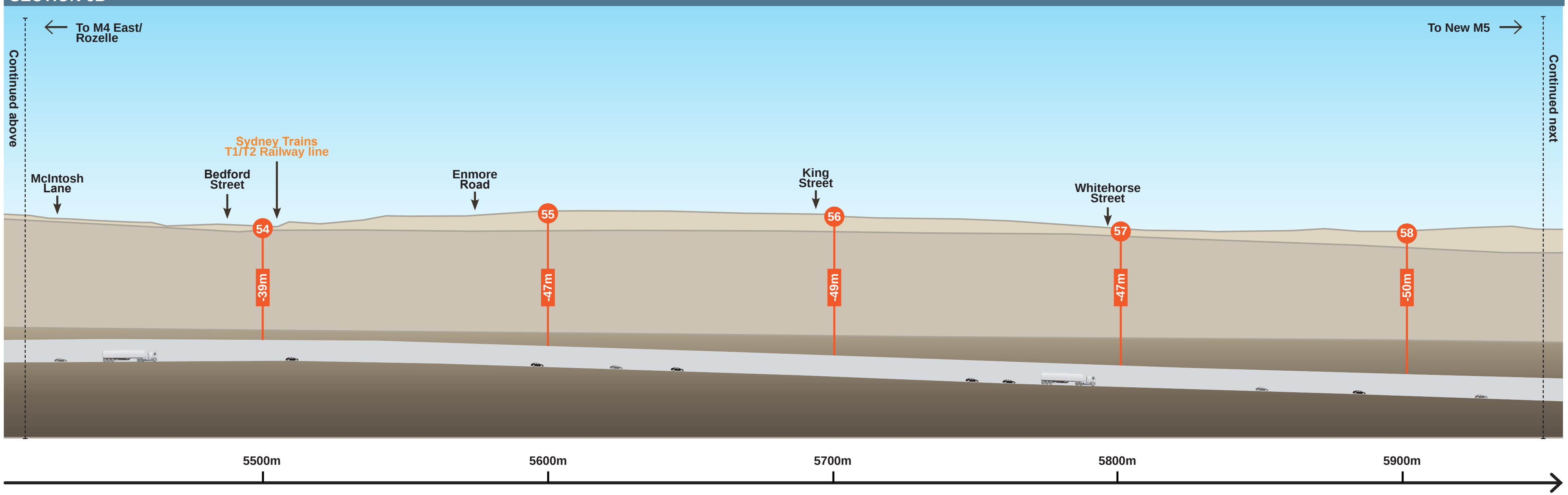


Figure 6 Geological long-section of the Mainline tunnel - Section 6

KEY

SECTION 7

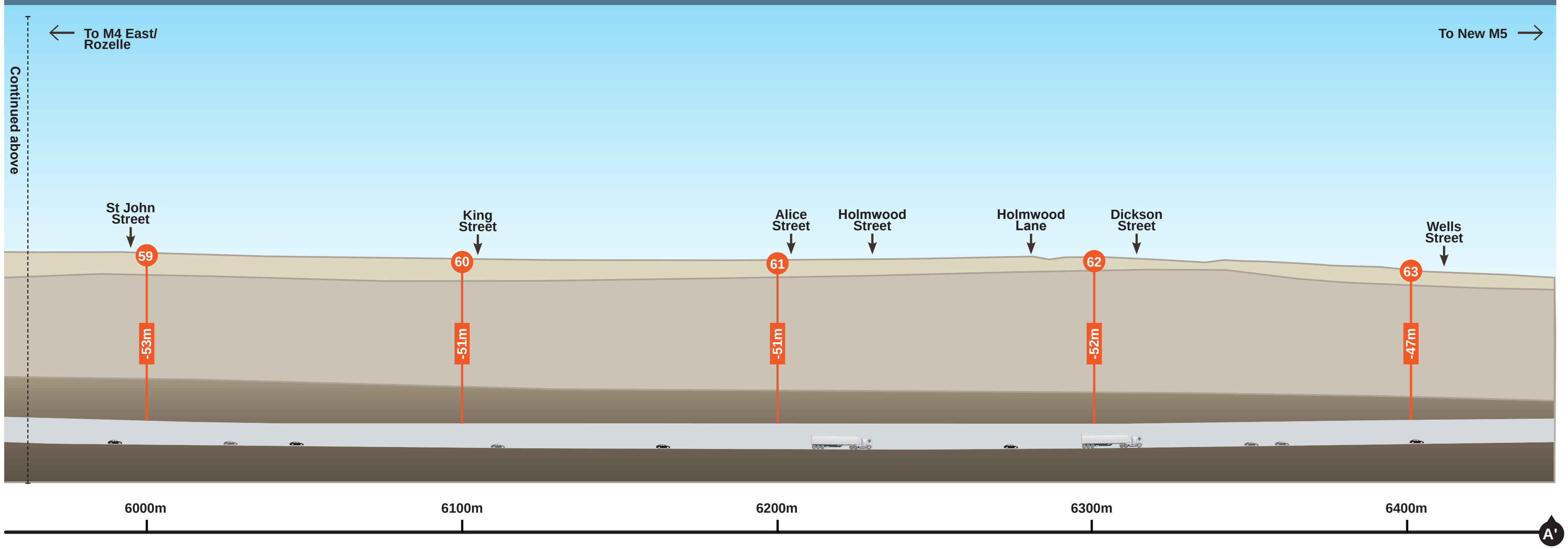


Figure 7 Geological long-section of the Mainline tunnel - Section 7

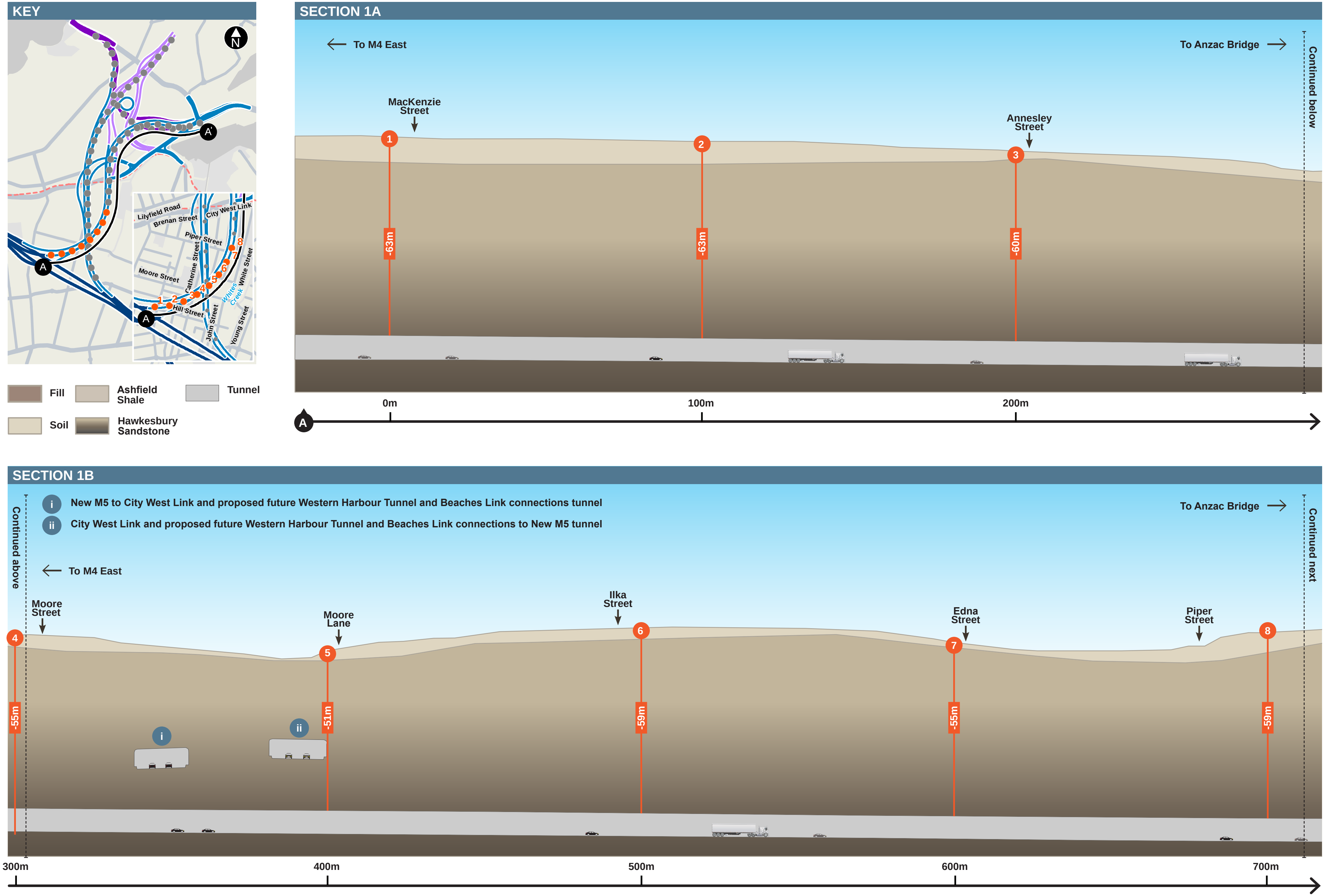
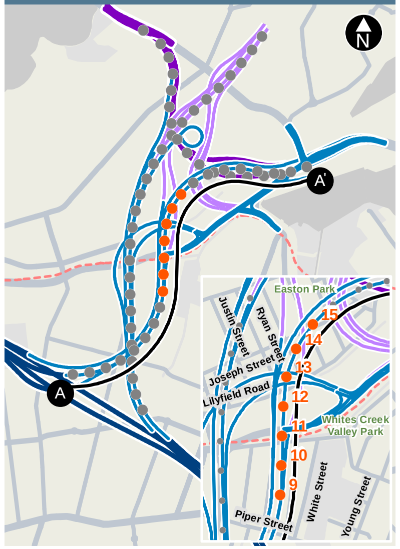


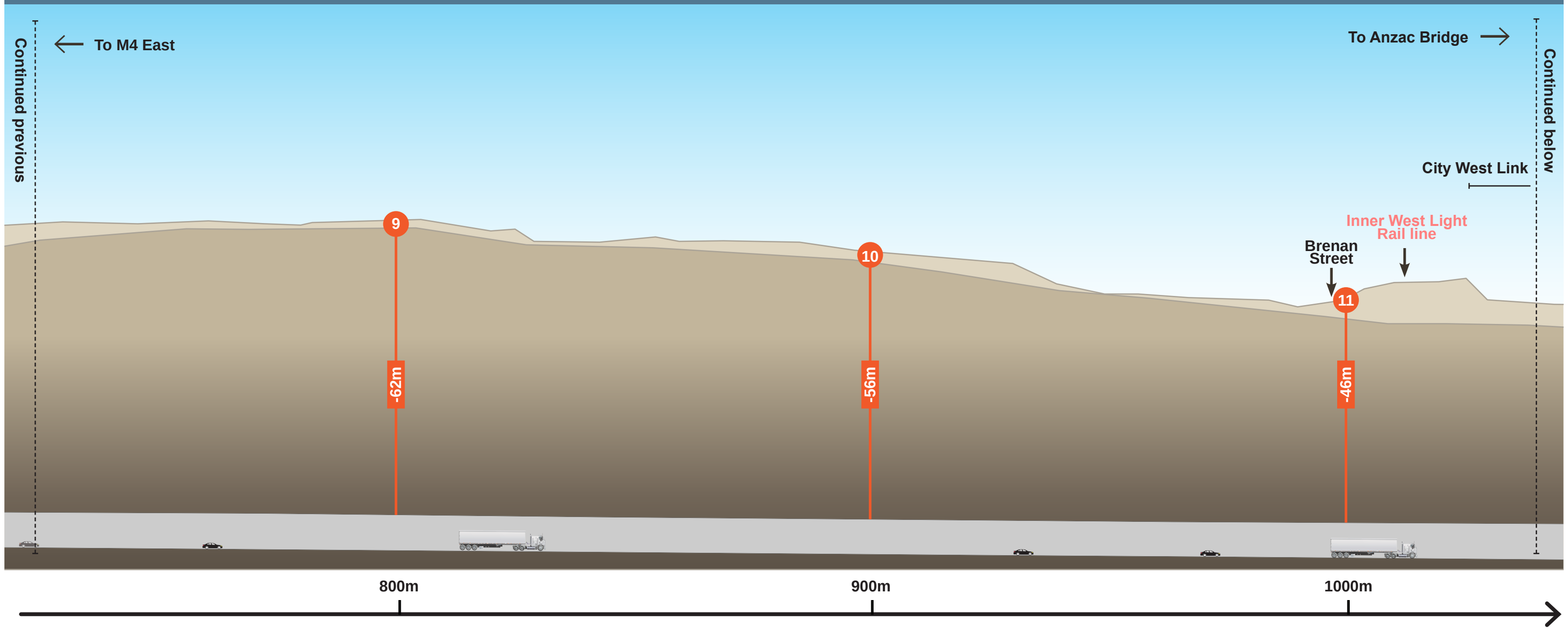
Figure 8 Geological long-section - M4 East to Anzac Bridge - Section 1

KEY



Fill
Ashfield Shale
Tunnel
Soil
Hawkesbury Sandstone

SECTION 2A



SECTION 2B

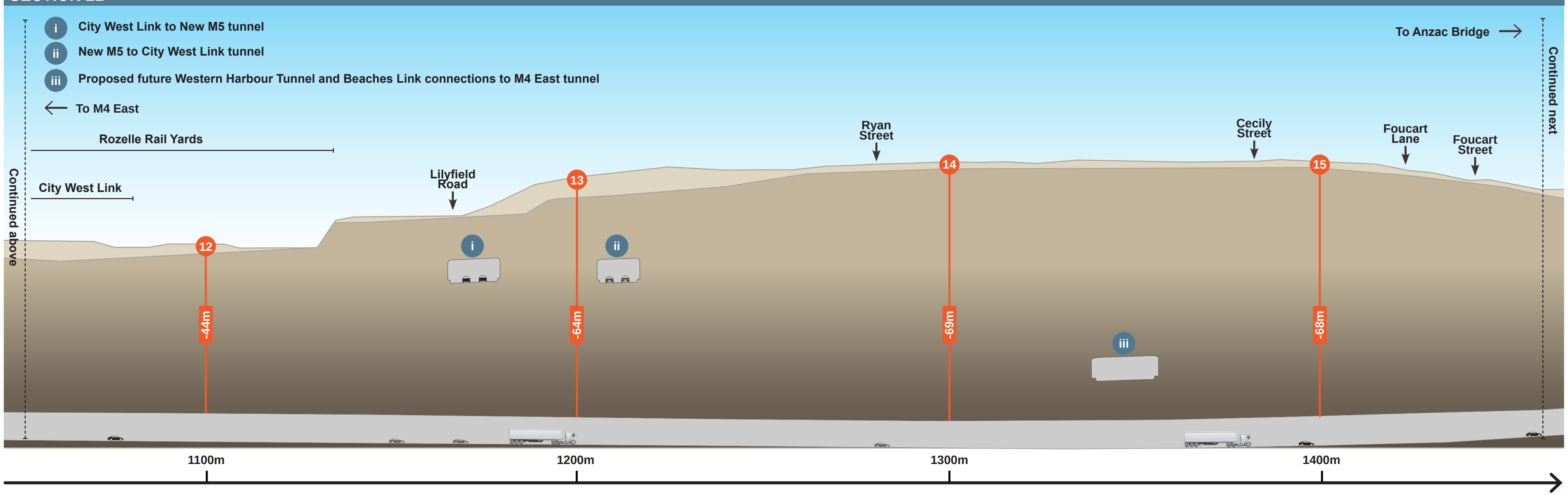


Figure 9 Geological long-section - M4 East to Anzac Bridge - Section 2

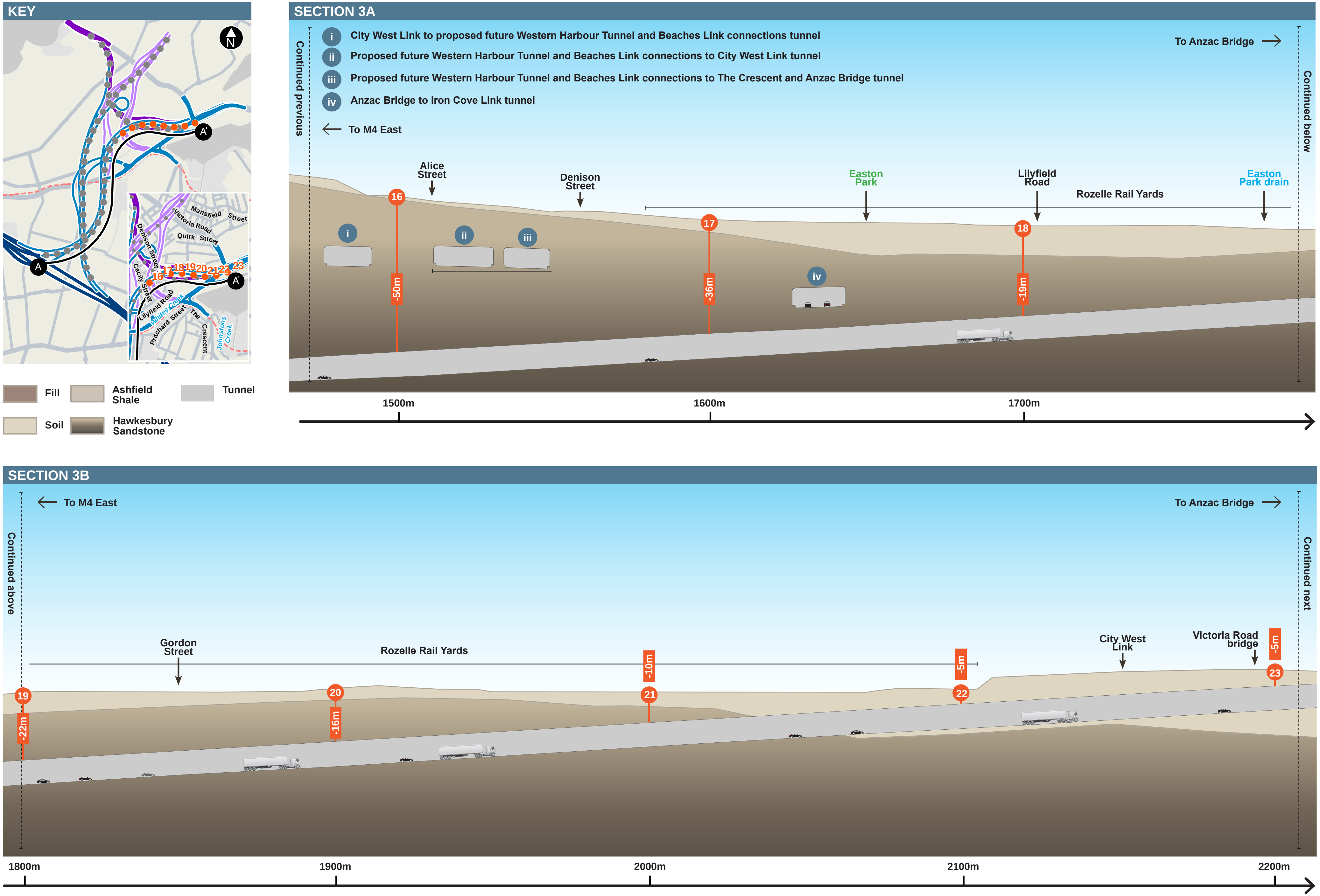
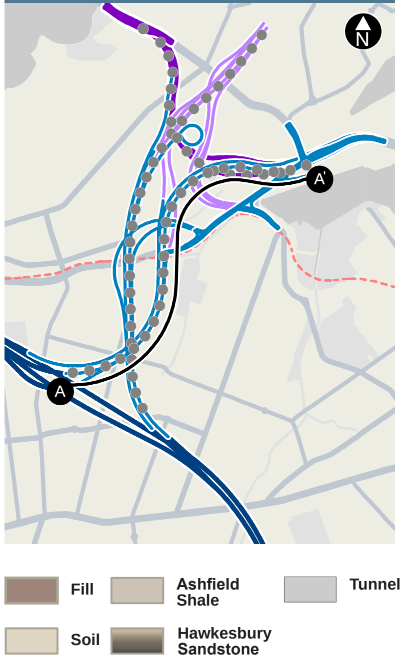


Figure 10 Geological long-section - M4 East to Anzac Bridge - Section 3

KEY



SECTION 4

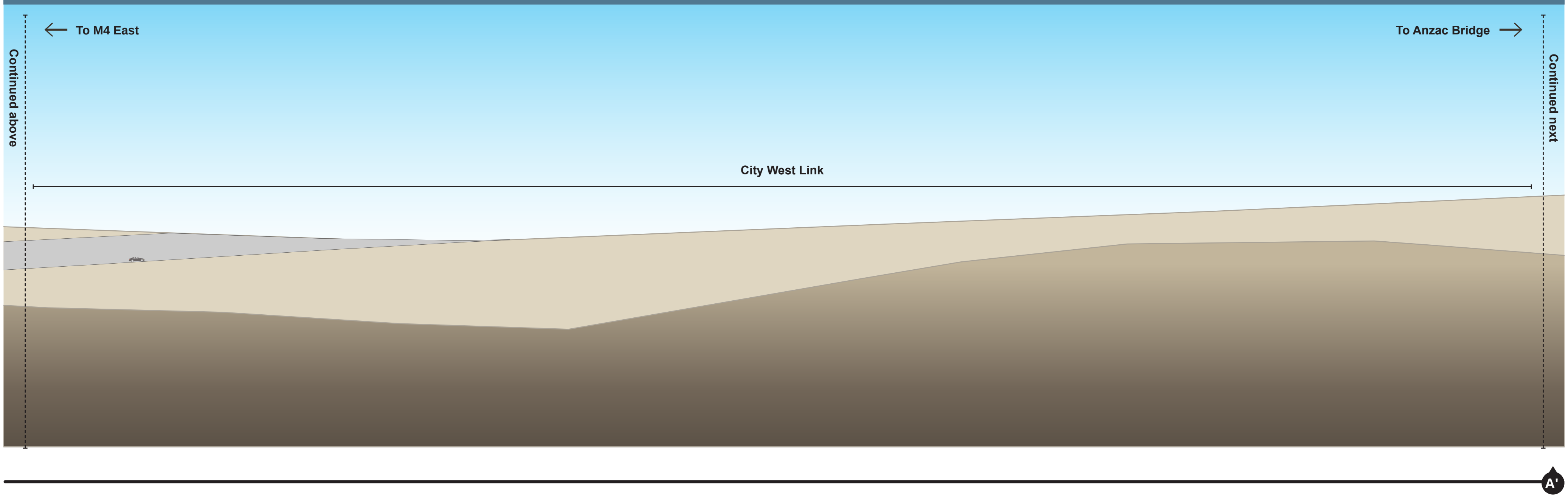
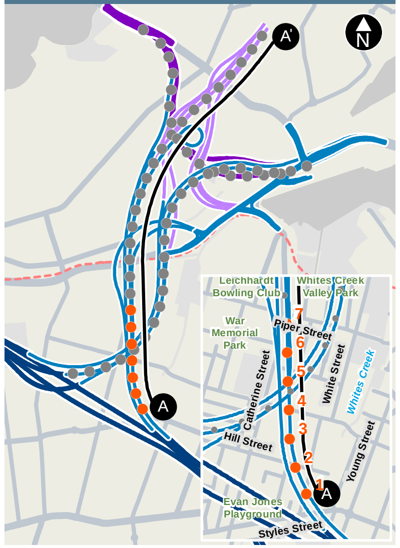


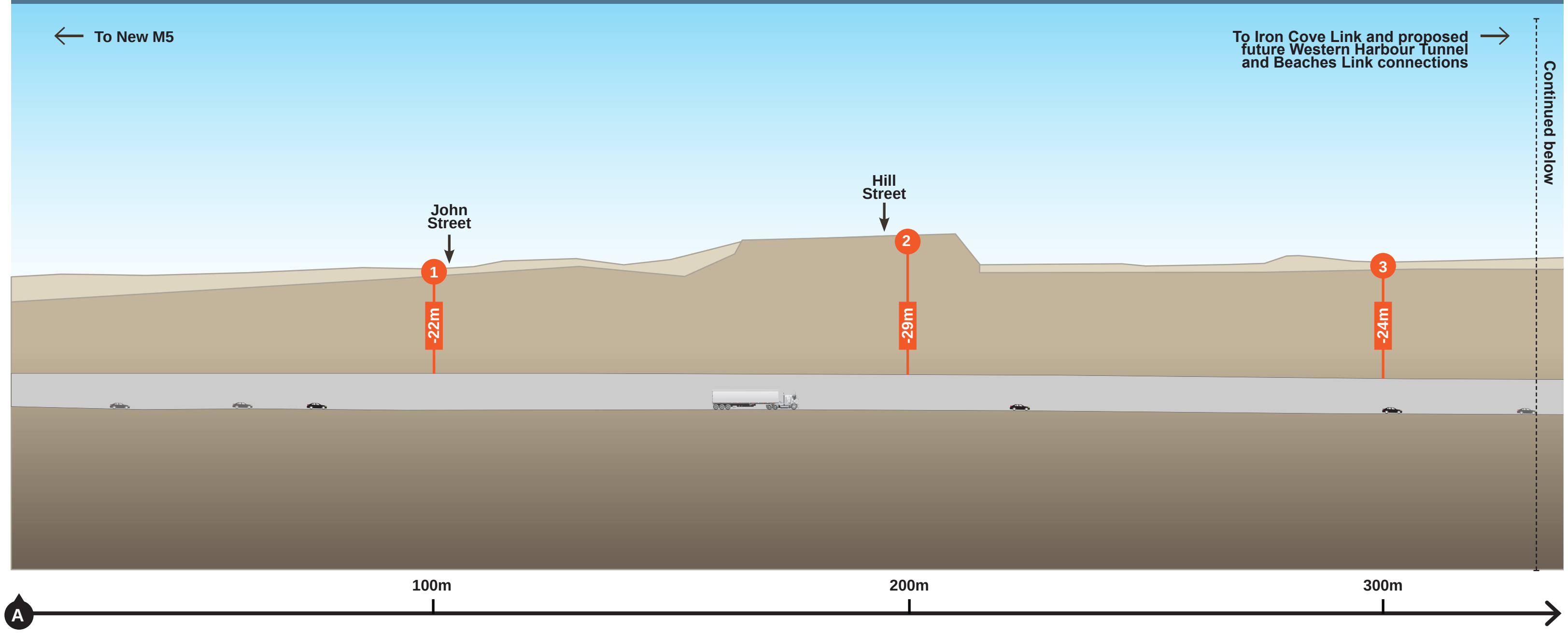
Figure 11 Geological long-section - M4 East to Anzac Bridge - Section 4

KEY



Fill
Ashfield Shale
Tunnel
Soil
Hawkesbury Sandstone

SECTION 1A



SECTION 1B

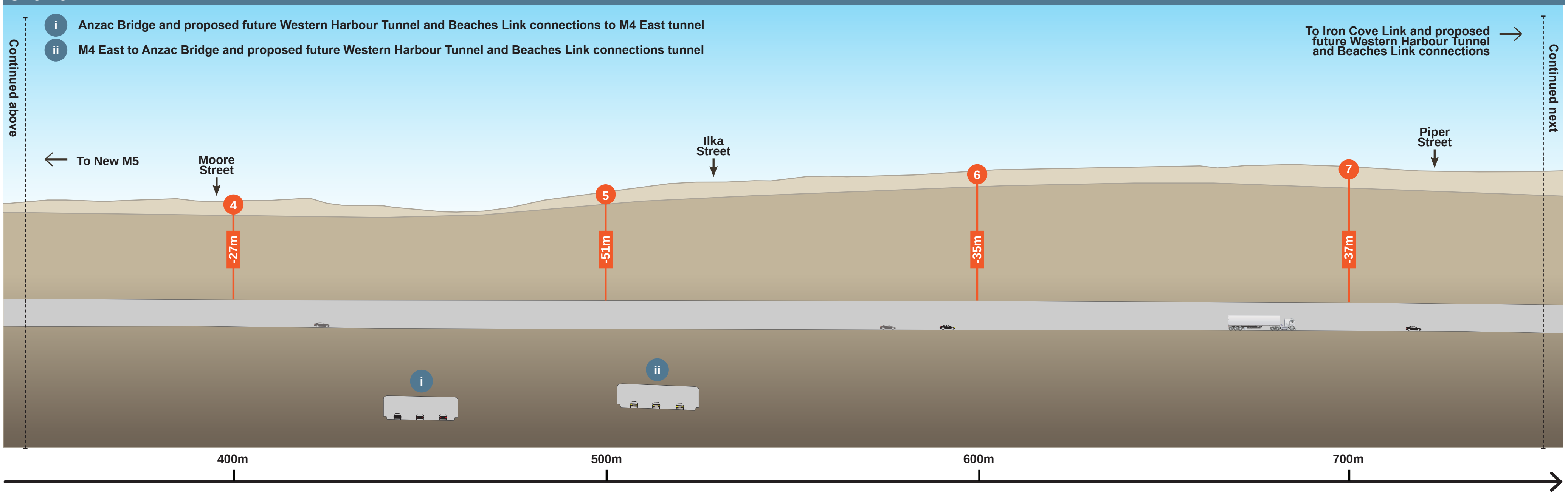


Figure 12 Geological long-section - New M5 to the proposed future Western Harbour Tunnel and Beaches Link connections tunnel extent - Section 1

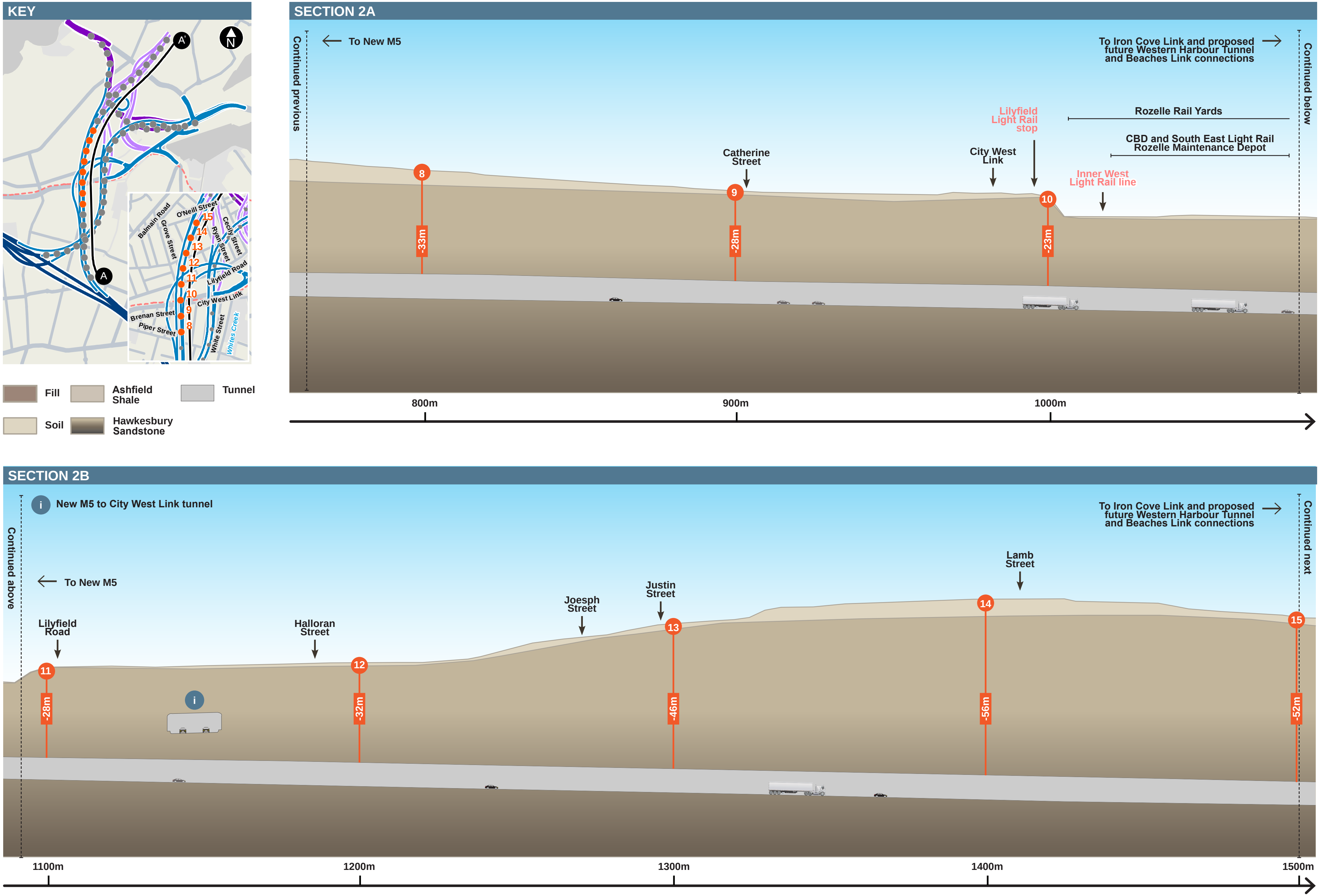


Figure 13 Geological long-section - New M5 to the proposed future Western Harbour Tunnel and Beaches Link connections tunnel extent - Section 2

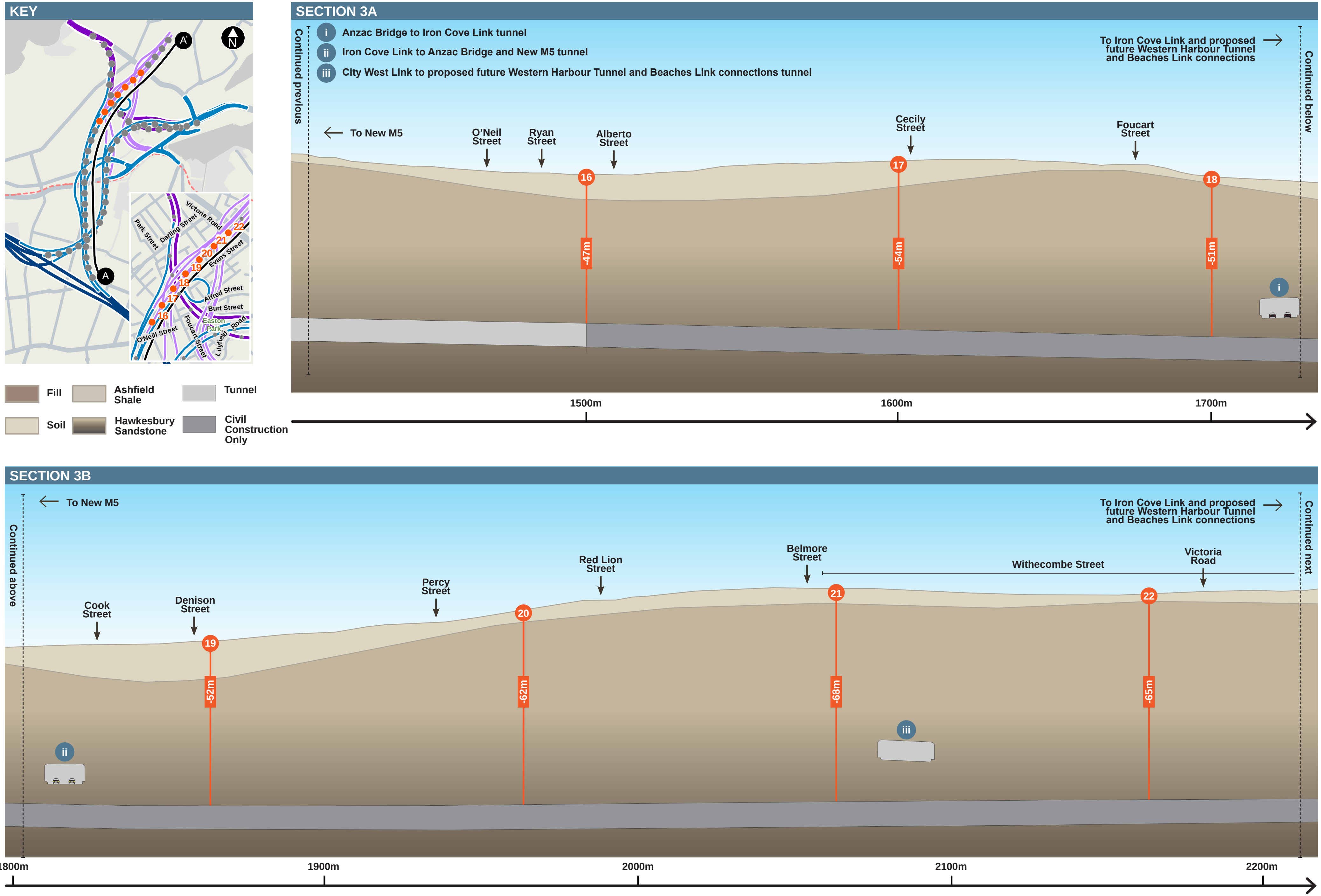


Figure 14 Geological long-section - New M5 to the proposed future Western Harbour Tunnel and Beaches Link connections tunnel extent - Section 3

KEY

SECTION 4

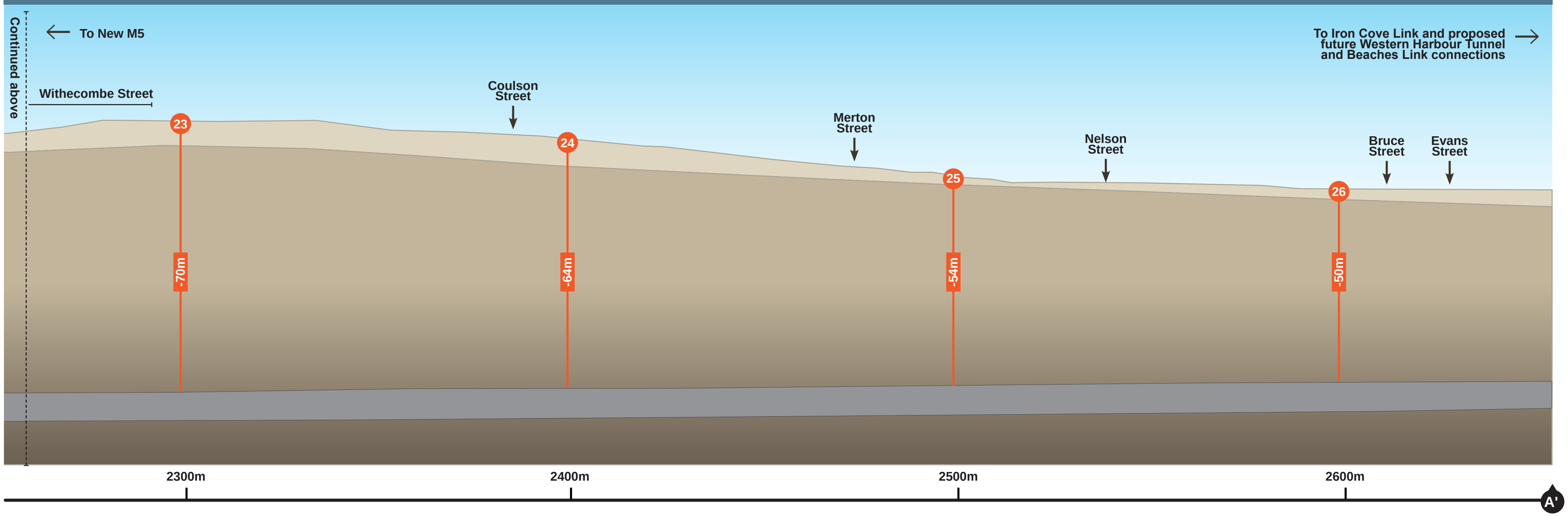


Figure 15 Geological long-section - New M5 to the proposed future Western Harbour Tunnel and Beaches Link connections tunnel extent - Section 4

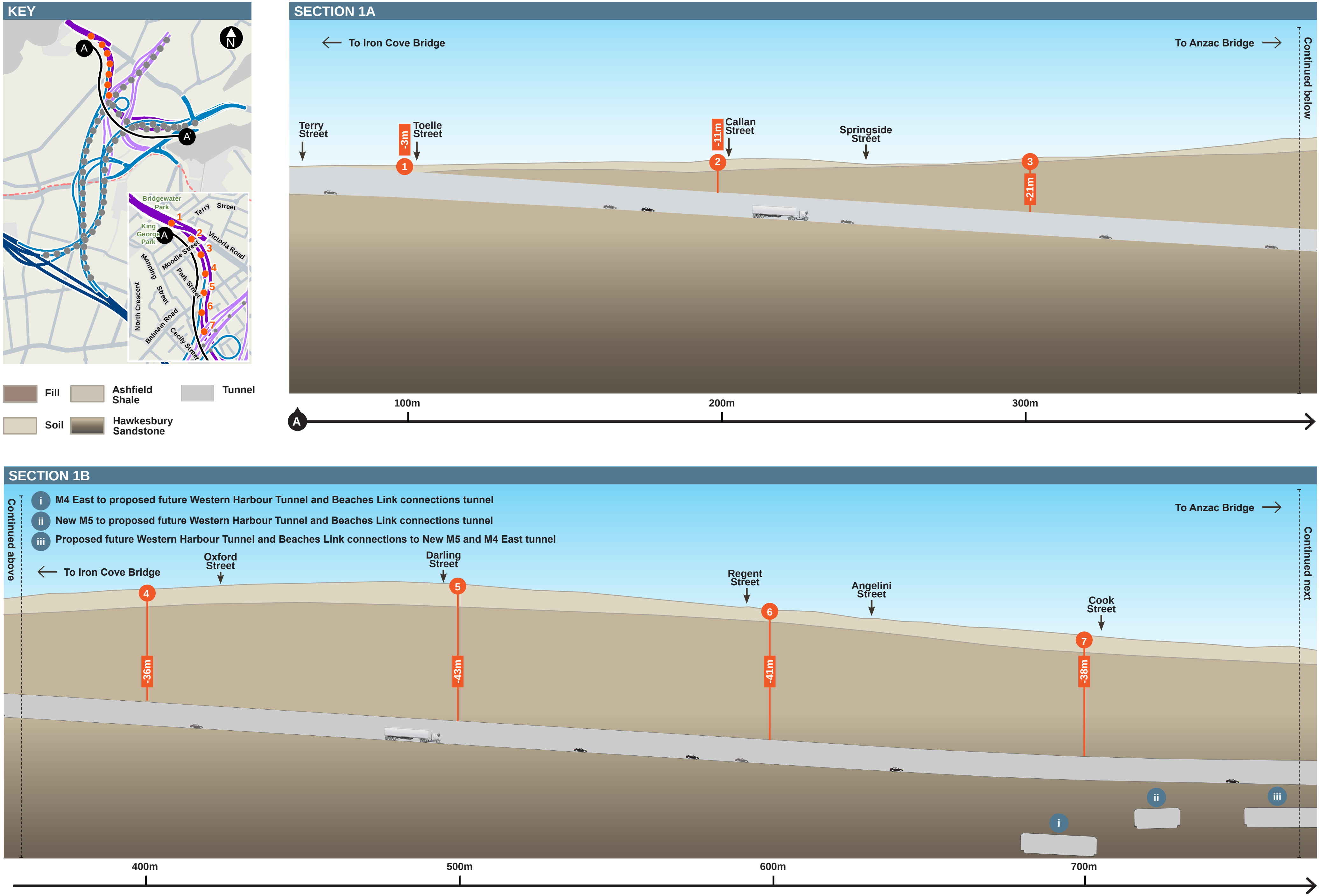


Figure 16 Geological long-section - Iron Cove Link to Anzac Bridge - Section 1

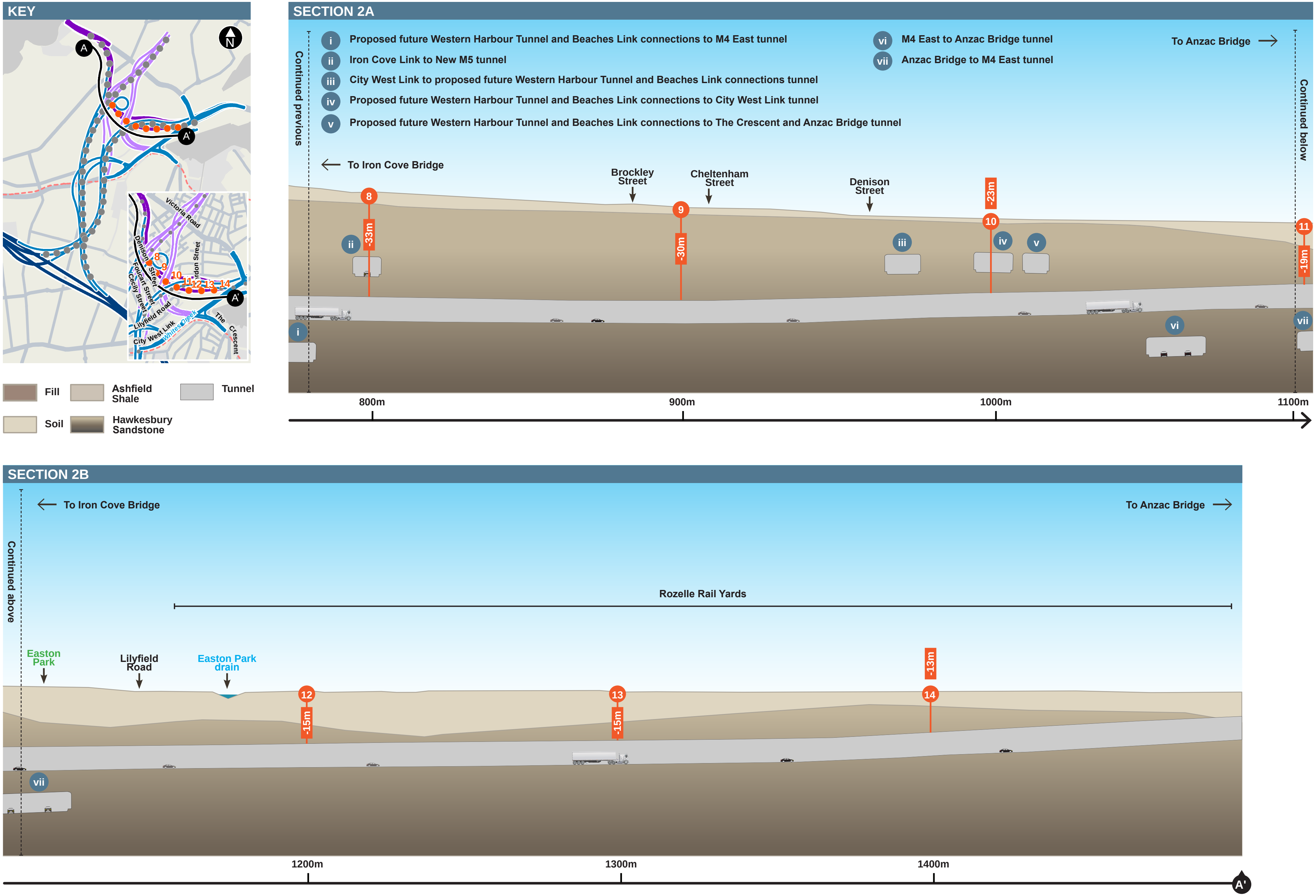


Figure 17 Geological long-section - Iron Cove Link to Anzac Bridge - Section 2

Appendix F

Utilities Management Strategy

WestConnex

Roads and Maritime Services

WestConnex – M4-M5 Link

Utilities Management Strategy

August 2017

Client: Roads and Maritime Services

ABN: 76 236 371 088

Prepared by

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Glossary of terms and abbreviations

Term	Meaning
A	
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions associated with past and present day Aboriginal communities
Acid sulfate soils	Naturally occurring soils, sediments or organic substrates (eg peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid
AHD	Australian Height Datum (AHD)
AHIMS	Aboriginal Heritage Information Management System A register of NSW Aboriginal heritage information maintained by the NSW Office of Environment and Heritage
Alignment	The geometric layout (eg of a road) in plan (horizontal) and elevation (vertical)
Areas of interest	Areas within and adjacent to the project footprint as defined in the Utilities Management Strategy where utility works are proposed as part of the M4-M5 Link project
Arterial roads	The main or trunk roads of the state road network that carry predominantly through traffic between region
B	
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means
C	
Campbell Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at St Peters
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes
CBD	Central business district
CEMP	Construction Environmental Management Plan A site specific plan developed for the construction phase of the project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that the environmental risks are properly managed
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design
Construction	Includes all physical work required to construct the project
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, pre-cast yards and material stockpiles, laydown areas, parking, maintenance workshops and offices
CSSI	Critical State significant infrastructure
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own
Cut-and-cover	A method of tunnel construction whereby the structure is built in an open excavation and subsequently covered
D	
Darley Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Leichhardt

Term	Meaning
Detailed design	The phase of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m^3/s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (eg metres per second (m/s))
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water
DBYD	Dial-Before-You-Dig
E	
Earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock
EIS	Environmental impact statement
EMF	Electric and magnetic fields
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPL	Environment Protection Licence under the *Protection of the Environment Operations Act 1997* (NSW)
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle
F	
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunami
Feeder	A power line for transmitting electric power from a generation station to a distribution network
G	
GST	Galvanised steel trough
Groundwater	Water that is held in rocks and soil beneath the earth's surface
H	
Haberfield civil and tunnel site/Haberfield civil site	Construction ancillary facilities for the M4-M5 Link project located at Haberfield
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Heritage Act	*Heritage Act 1977* (NSW)
Heritage item	Any place, building or object listed on a statutory heritage register
HV	High voltage
HVCs	High voltage connections
I	
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
Infrastructure SEPP	State Environmental Planning Policy (Infrastructure) 2007 (NSW).
Interchange	A grade separation of two or more roads with one or more interconnecting carriageways
Iron Cove Link	Around one kilometre of twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge
Iron Cove Link civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
J	
K	

Term	Meaning
KGRIU	King Georges Road Interchange Upgrade A component of the WestConnex program of works. Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project
kPa	Kilopascal
kV	Kilovolt
L	
Lane	A portion of the carriageway allotted for the use of a single line of vehicles
LEP	Local environmental plan
M	
M4 East Motorway/project	A component of the WestConnex program of works. Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange
M4 Widening	A component of the WestConnex program of works. Widening of the existing M4 Motorway from Parramatta to Homebush
M4-M5 Link	The project which is the subject of this EIS. A component of the WestConnex program of works
Mainline tunnels	The M4-M5 Link mainline tunnels connecting with the M4 East at Haberfield and the New M5 at St Peters
Motorway	Fast, high volume controlled access roads. May be tolled or untolled
MVA	Mega Volt Amp
N	
New M5 Motorway/project	A component of the WestConnex program of works. Located from Kingsgrove to St Peters (under construction)
NCA	Noise catchment area
Northcote Street civil site	A construction ancillary facility for the M4-M5 Link project located at Haberfield
NSW	New South Wales
NSW EPA	NSW Environment Protection Authority
O	
OOHW	Out-of-hours work
P	
Parramatta Road East civil site	A construction ancillary facility for the M4-M5 Link project at Haberfield
Parramatta Road West civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at Ashfield
Portal	The entry and/or exit to a tunnel
Pre-construction	All work prior to, and in respect of the State significant infrastructure, that is excluded from the definition of construction
Project	A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange
Project footprint	The land required to construct and operate the project. This includes permanent operational infrastructure (including the tunnels), and land required temporarily for construction
Property	Based on ownership, with the potential to contain more than one lot and deposited plan (DP)

Term	Meaning
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is NSW Roads and Maritime Services
Pyrmont Bridge Road tunnel site	A construction ancillary facility for the M4-M5 Link project at Annandale
Q	
R	
RL	Reduced level
Risk	Chance of something happening that will potentially have an undesirable effect. It is measured in terms of consequence and likelihood
ROL	Road Occupancy Licence
Road reserve	A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
Roadheader	A commonly used machine for excavation in sandstone using picks mounted on a rotary cutter head attached to a hydraulically operated boom
Rozelle civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Lilyfield and Rozelle
Rozelle interchange	A new interchange at Lilyfield and Rozelle that would connect the M4-M5 Link mainline tunnels with City West Link, Anzac Bridge, the Iron Cove Link and the proposed future Western Harbour Tunnel and Beaches Link
Rozelle Rail Yards	The Rozelle Rail Yards is bound by City West Link to the south, Lilyfield Road to the north, Balmain Road to the west, and White Bay to the east. Note that the project only occupies part of the Rozelle Rail Yards site
S	
SEARs	Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of the Planning and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW)
Sensitive receiver/receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises)
Settlement	Refers to how ground can move due to the construction of new infrastructure
Shoring	A process for temporarily supporting a building, vessel, structure, or trench with shores (propos) when in danger of collapse or during repairs or alterations
Socio-economic	Involving combination of social and economic matters
Spoil	Surplus excavated material
SSI	State significant infrastructure
STA	State Transit Authority
St Peters interchange	A component of the New M5 project, located at the former Alexandria Landfill site at St Peters. Approved and under construction as part of the New M5 project. Additional construction works proposed as part of the M4-M5 Link project

Term	Meaning
Stub tunnel	Driven tunnels constructed to connect to potential future motorway links
Substation	A set of equipment reducing the high voltage of electrical power transmission to that suitable for supply to consumers
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct
T	
The Crescent civil site	A construction ancillary facility for the M4-M5 Link project located at Annandale
TMC	Traffic Management Centre
U	
URMP	Utilities Relocation Management Plan. The Plan which outlines the environmental management practices and procedures for utility works which are carried out prior to the approval of the Construction Environmental Management Plan
Utility service provider	Includes Telstra, Jemena, Ausgrid, Sydney Trains, Sydney Water and relevant local councils (Inner West Council and City of Sydney Council)
Utility services	Includes communication, gas, electricity, water, sewer and drainage services and associated infrastructure
Utility works	Includes utility installation, relocations and adjustments of utility services. Also includes protection of existing utility services and removal of redundant utility services
V	
Ventilation facility	Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels. May comprise one or more ventilation outlets
Ventilation outlet	The location and structure from which air within a tunnel is expelled
Victoria Road civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
V	voltage
W	
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent)
Wattle Street civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Haberfield
Wattle Street interchange	An interchange to connect Wattle Street (City West Link) with the M4 East and the M4-M5 Link tunnels. Approved and to be constructed as part of the M4 East project, with minor construction works associated with the M4-M5 Link project
W	watts
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest
WestConnex program of works	A program of works that includes the M4 Widening, King Georges Road Interchange Upgrade, M4 East, New M5 and M4-M5 Link projects

1 Introduction

1.1 M4-M5 Link project

1.1.1 Overview

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the WestConnex M4-M5 Link (the project), which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities.

Approval is being sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for the project. A request has been made for the NSW Minister for Planning to specifically declare the project to be State significant infrastructure (SSI) and also critical State significant infrastructure (CSSI). An environmental impact statement (EIS) is therefore required.

1.1.2 Staging and program

It is anticipated the project would be constructed and opened to traffic in two stages (as shown in **Figure 1-1**).

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project
- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

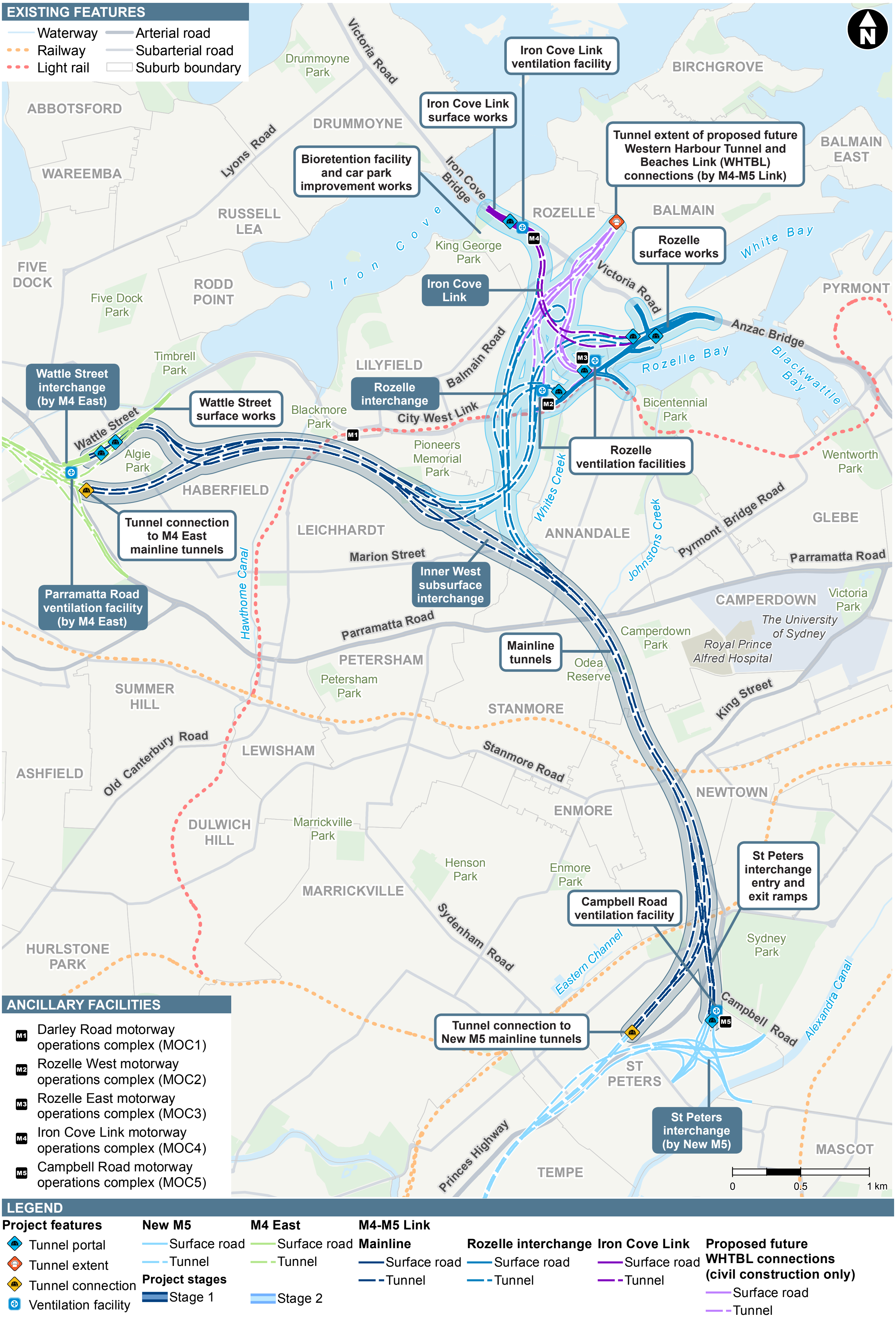


Figure 1-1 Overview of the project

1.1.3 Construction

Twelve construction ancillary facilities are described in this EIS (as listed below). To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS. The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix a (for Option A) or b (for Option B).

The construction ancillary facilities required to support construction of the project include:

- Construction ancillary facilities at Haberfield (Option A), comprising:
  - Wattle Street civil and tunnel site (C1a)
  - Haberfield civil and tunnel site (C2a)
  - Northcote Street civil site (C3a)
- Construction ancillary facilities at Ashfield and Haberfield (Option B), comprising:
  - Parramatta Road West civil and tunnel site (C1b)
  - Haberfield civil site (C2b)
  - Parramatta Road East civil site (C3b)
- Darley Road civil and tunnel site (C4)
- Rozelle civil and tunnel site (C5)
- The Crescent civil site (C6)
- Victoria Road civil site (C7)
- Iron Cove Link civil site (C8)
- Pyrmont Bridge Road tunnel site (C9)
- Campbell Road civil and tunnel site (C10).

The location of the construction ancillary facilities is shown in **Figure 1-2**.

The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design.

Existing utility services would potentially be impacted during construction of the project. These utility services would need to be either avoided or protected during construction, or relocated to a different location within, or in proximity, to the project footprint. In addition, temporary and permanent power supply connections and new drainage infrastructure would be required within and outside of the project footprint to service the construction and operation of the project.

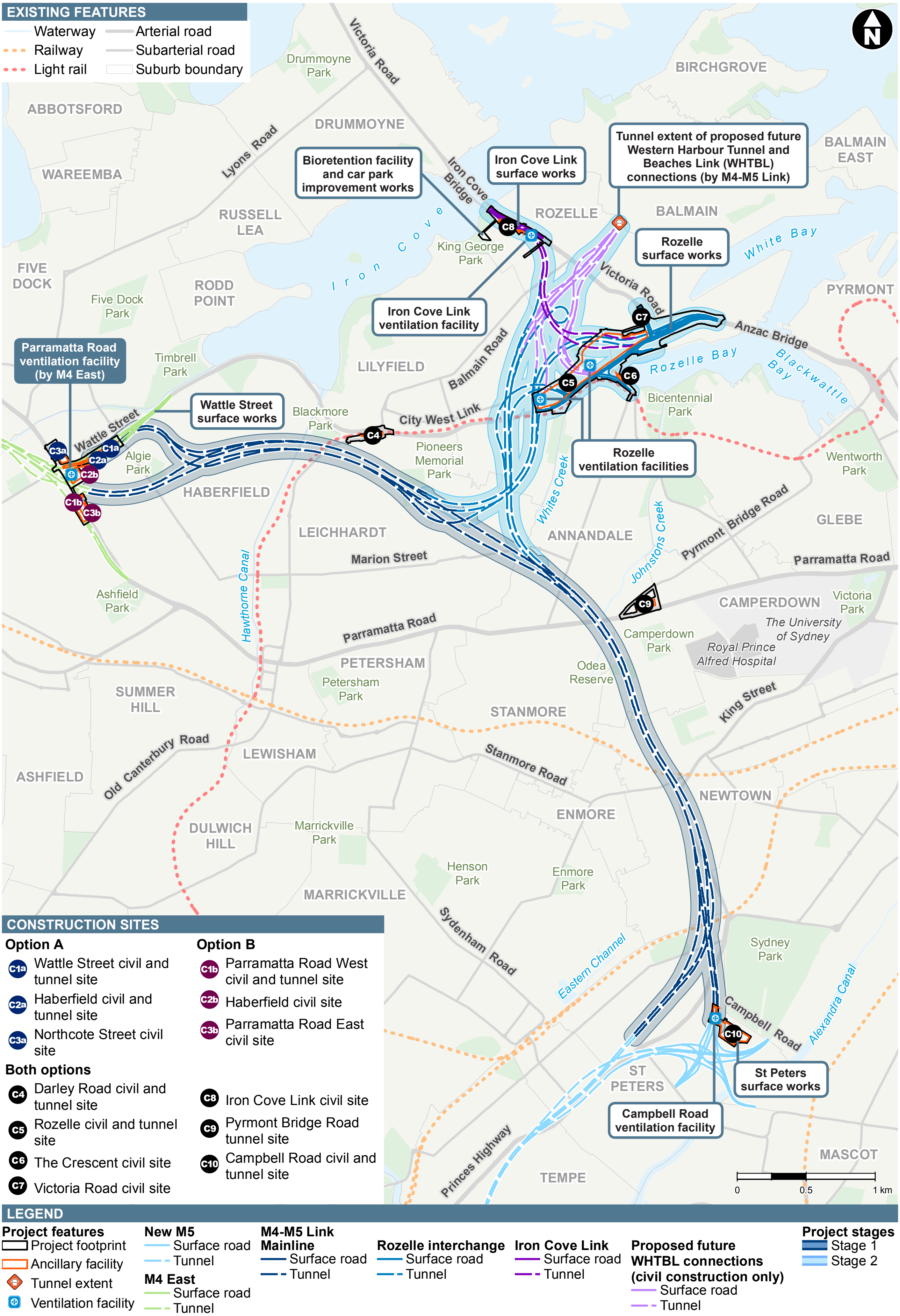


Figure 1-2 Overview of project footprint and ancillary facilities

1.2 WestConnex program of works

The M4-M5 Link is part of the WestConnex program of works. Separate planning applications and assessments have been completed for each of the approved WestConnex projects. Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project.

In addition to linking to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 Extension (via the New M5) projects.

The WestConnex program of works as well as related projects, are shown in **Figure 1-3**.

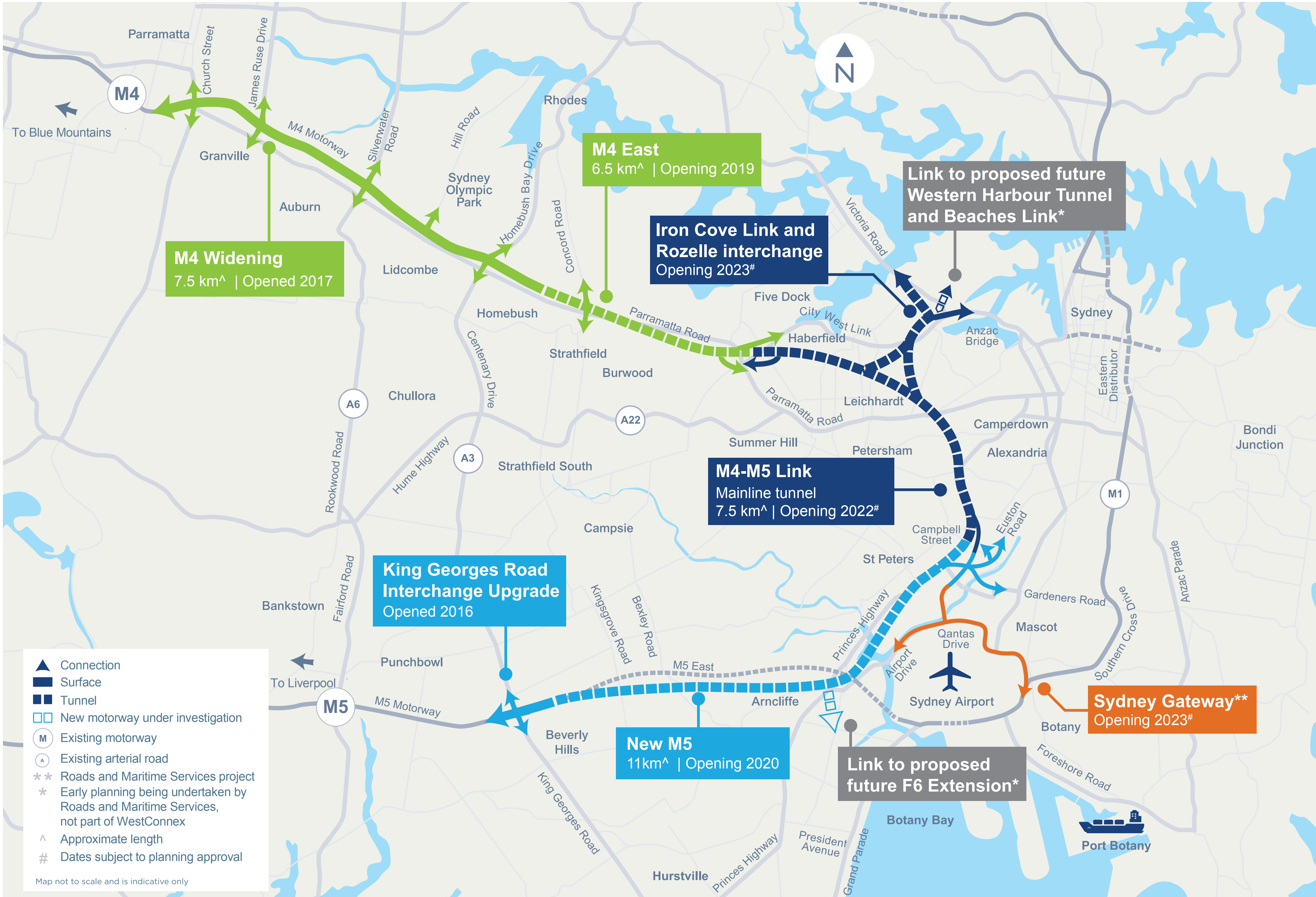


Figure 1-3 Overview of WestConnex and related projects

1.3 Secretary's Environmental Assessment Requirements

In preparing this Utilities Management Strategy, the revised Secretary's Environmental Assessment Requirements (SEARs) issued for the M4-M5 Link project on 3 May 2017 have been addressed. The key matters raised by the SEARs in relation to the potential impacts of the project on utilities and where these issues have been addressed in this Utilities Management Strategy are detailed in **Table 1-1**.

Table 1-1 Relevant SEARs addressed in this report

SEARs	
Socio-economic, Land Use and Property	
Requirement	**Section where addressed in report**
6. The Proponent must assess potential impacts on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities. 7. Where the project is predicted to affect trunk utilities, the Proponent must undertake a utilities management strategy. The strategy must identify proposed management strategies, including relocations or adjustments of the utilities, and their estimated timing and duration. This strategy must be developed in consultation with the relevant utility owners or providers.	Potential impacts on utilities are detailed in **Chapters 3, 4 and 5**. Management strategies are identified in **Chapter 10**. Details of estimated timing and duration of utility works are identified in **section 6.5**. Details of consultation with utility service providers are identified in **section 1.6**.

1.4 Purpose of this strategy

The purposes of this Utilities Management Strategy are:

- To outline the main (trunk) utility works currently proposed as part of the project
- To outline the options currently being considered for the provision of construction power supply and permanent operational power supply for the project
- To outline the options currently being considered for the upgrade of existing drainage infrastructure or provision of new drainage infrastructure for the project
- To provide an overview of how the utility works, including power supply and drainage works would be carried out
- To assess the range of potential environmental impacts associated with utility works, including cumulative impacts
- To identify and assess potential impacts to existing utility assets
- To provide an environmental constraints analysis for areas outside of the project footprint where utility works, such as construction and operational power supply connections, are likely to be required
- To outline a range of mitigation measures which would be applied to minimise the potential environmental impacts
- To outline a process for how utility works that are not assessed as part of the EIS would be managed including requirements for:
  - Obtaining agreements with utility service providers
  - Effective co-ordination of utility adjustment works
  - Consideration of route options where appropriate
  - Undertaking environmental constraints analysis and risk assessment to confirm potential environmental impacts and appropriate management measures

- Stakeholder and community consultation and notification.

The Utilities Management Strategy details the major (trunk) utility works proposed as part of the project as these works have the longest lead times and may potentially result in more substantial environmental and community impacts. This approach is consistent with the requirements of the SEARs.

1.5 Scope of this strategy

This Utilities Management Strategy provides information in relation to:

- Utility installation, protection, relocations, adjustments and new connections (defined as utility works) which are proposed within the project footprint. These utility works have been assessed as part of the EIS and would be subject to a Utilities Relocation Management Plan, if the works are to be carried out prior to approval of a Construction Environmental Management Plan (CEMP), or otherwise would be subject to the CEMP
- Utility works which may be required outside of the project footprint. This Utilities Management Strategy provides information on the type of utility works likely to occur outside of the project footprint, the areas where this work is likely to occur and the framework for how these utility works would be managed. This includes requirements for stakeholder and community consultation, environmental constraints analysis and environmental risk assessment.

The utility services which have been considered in this Strategy include: communications, gas, electricity (including Ausgrid and Sydney Trains infrastructure), water, sewerage and drainage. The Strategy only considers major (trunk) utility services as defined in **section 2.3**. Other minor utility works which do not meet the definition of construction are not considered as part of this Strategy.

The information contained in this Utilities Management Strategy regarding existing utility services and proposed utility works is based on:

- Utility investigations conducted to date
- Preliminary discussions with utility service providers
- The proposed concept design for the project as set out in the EIS.

The information contained in this Strategy is likely to change over time as further investigations are carried out, discussions with utility service providers progress, and as the design of the project and the construction methodology are refined once a contractor has been appointed.

This Utilities Management Strategy establishes a process for managing utility works associated with the project, including arrangements for ongoing stakeholder and community consultation, environmental constraints analysis and environmental risk assessment during the detailed design phase.

This Utilities Management Strategy should be read in conjunction with the M4-M5 Link EIS, in particular the following chapters:

- **Chapter 6** (Construction work)
- **Chapter 12** (Land use and property)
- **Chapter 29** (Summary of environmental management measures).

An overview of the scope of the Utilities Management Strategy is provided in **Figure 1-4**.

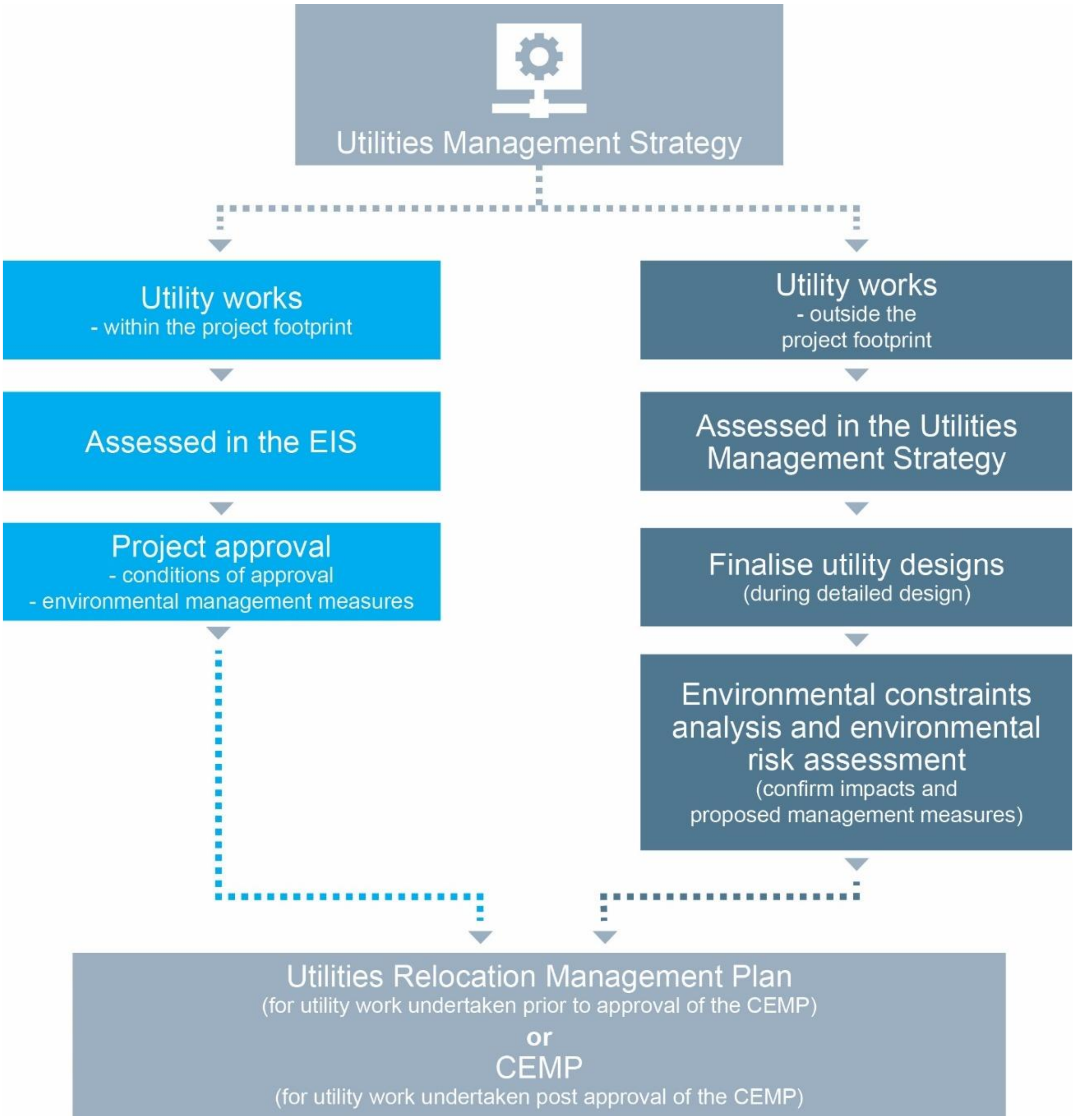


Figure 1-4 Scope of Utilities Management Strategy

1.6 Consultation

Utilities investigations relating to the M4-M5 Link project and preparation of the Utilities Management Strategy has been undertaken in consultation with the following utility service providers:

- Ausgrid
- Sydney Water
- Sydney Trains
- Jemena
- Telstra.

Consultation with utility service providers would continue during the EIS process and during the detailed design and construction phases of the project.

1.7 Relevant legislation

1.7.1 NSW Legislation

Environmental Planning and Assessment Act 1979 (NSW)

Approval is being sought for the M4-M5 Link project under Part 5.1 of the EP&A Act. Clause 4(6) of Schedule 5 to the State Environmental Planning Policy (State and Regional Development) 2011 (NSW) provides that development that is ancillary to the WestConnex program of works, including utilities infrastructure and adjustments to, or relocation of, existing utilities infrastructure is also SSI and CSSI. A request has been made for the NSW Minister for Planning to specifically declare the project to be SSI and also CSSI.

The SEARs for the M4-M5 Link project include requirements relating to assessment of potential impacts of the project on utilities and undertaking a utilities management strategy to address these impacts. The specific SEARs are detailed in **section 1.3** of this Utilities Management Strategy.

State Environmental Planning Policy (Infrastructure) 2007

The aim of State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP) (NSW) is to facilitate the effective delivery of infrastructure across NSW.

The Infrastructure SEPP provides that certain development carried out by or on behalf of a public authority can be carried out without consent or as exempt development as detailed in the following clauses:

- Clauses 41–43 – Electricity transmission or distribution network
- Clauses 53–54 – Gas pipelines
- Clauses 105–107 – Sewage reticulation systems
- Clauses 110–112 – Stormwater management systems
- Clauses 113–116 – Telecommunications and other communication facilities
- Clauses 124–127 – Water supply systems.

The Infrastructure SEPP also outlines requirements for consultation with local councils in relation to development that may impact on:

- Council related infrastructure and services (Clause 13)
- Local heritage (Clause 14)
- Flood liable land (Clause 15).

It also provides for consultation with public authorities in respect to certain types of specified development (Clause 16).

Notwithstanding the above, environmental planning instruments do not apply to SSI or CSSI except that they apply to the declaration of infrastructure as SSI or CSSI (section 115ZF(2) of the EP&A Act). In that regard, the Infrastructure SEPP will not apply to utilities infrastructure that are ancillary to, and carried out as part of, the project.

Other relevant NSW legislation

The following NSW legislation may also be relevant:

- *Protection of the Environment Operations Act 1997* (NSW)
- *Threatened Species Conservation Act 1995* (NSW)
- *National Parks and Wildlife Act 1974* (NSW)
- *Heritage Act 1977* (NSW)
- *Contaminated Land Management Act 1997* (NSW)
- *Fisheries Management Act 1994* (NSW)
- *Water Act 1912* (NSW)
- *Water Management Act 2000* (NSW)
- *Roads Act 1993* (NSW).

1.7.2 Commonwealth legislation

Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC Act) activities that are likely to have a significant impact on matters of national environmental significance (MNES), actions taken on Commonwealth land or by the Commonwealth must be assessed and approved. The EPBC Act identifies MNES as:

- World heritage properties
- National heritage places
- Ramsar wetlands
- Nationally threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth marine environment
- Great Barrier Reef Marine Park
- Nuclear actions
- Protection of water resources from coal seam gas and large coal mining development.

The preliminary assessment of potential environmental constraints in **Chapter 7** indicates that the proposed utility works including power supply connections and drainage infrastructure associated with the M4-M5 Link project are not:

- Likely to have a significant impact on MNES as listed under the EPBC Act
- To be undertaken on Commonwealth land
- To be undertaken by the Commonwealth.

At this stage, based on the currently available information and the assessment undertaken during the EIS development, it seems unlikely that the project would significantly impact on MNES. Therefore it is unlikely that the project would trigger the need to refer the works to the Australian Government Department of the Environment and Energy.

2 Approach to proposed utility works

2.1 Areas of interest

The areas of interest for the proposed utility works are both within and outside the project footprint where services are likely to be directly impacted by the project and where utility works would be required. The majority of the areas of interest are located in the vicinity of the surface works required as part of the project.

Most sections of the tunnels have sufficient depth of cover not to affect existing utility services. However, potential settlement and vibration impacts during construction of the project have been considered in the vicinity of major (trunk) utility services such as the Sydney Water Pressure Tunnel and Sydney Water City Tunnel.

Areas outside of the project footprint may be impacted by utility works, such as the installation of construction power or permanent operational power which are required to support the project. These have also been included in the areas of interest.

2.2 Identifying utility services

2.2.1 Utility investigations to date

Existing utility services (underground and overhead services) have been identified by:

- Dial-Before-You-Dig (DBYD) data searches
- Review of plans and drawings provided by utility service providers
- Site walkovers
- Use of electronic tracing and ground penetrating radar and
- Surface level survey.

Investigations are continuing in consultation with utility service providers to identify the utility services likely to be impacted by the project.

2.2.2 Site management works at Rozelle Rail Yards

Site management works would occur within the Rozelle Rail Yards at Rozelle before the start of project construction works. These works have commenced, with completion planned for 2018. They will be carried out in accordance with a separate assessment process under Part 5 of the EP&A Act.

The site management works would remove rail and rail related infrastructure from the Rozelle Rail Yards site and allow existing issues such as waste and noxious weeds to be appropriately managed. These works would also improve access to surface conditions which would allow for further investigations into the location of utilities and the presence of contamination and waste.

2.3 Major utility services

The Utilities Management Strategy details the major (trunk) utility works proposed as part of the project based on the concept design which is being considered by the EIS. Existing major (trunk) utility services within the areas of interest, identified in consultation with utility service providers include:

- Power (Ausgrid) – high voltage transmission (33kV or greater) and substations
- Sydney Trains – feeders (11kV or greater) and switching stations
- Gas (Jemena) – secondary gas mains (1050 kilopascals (kPa))
- Potable water (Sydney Water) – mains of 300 millimetre diameter or greater
- Sewer (Sydney Water) – rising mains or gravity mains of 300 millimetre or greater
- Telecommunications – multiple fibre optics cables.

During detailed design other major (trunk) utility services that may be impacted by the project may be identified in consultation with utility service providers and these would also be subject to this Strategy.

Major (trunk) utility services have been considered because:

- The investigation, approval and delivery phases potentially require long lead times
- The environmental and community impacts associated with these works are potentially more significant
- The approach is consistent with the requirements of the SEARs.

Other minor utility works which do not meet the definition of construction are not considered as part of this Strategy.

2.4 Treatment approach to utility services

The approach for treating utility services would adopt the following hierarchy:

- Avoid or minimise impacts on utility services where practicable such as by adjusting the project design and construction methodology
- Retain and protect utility services if and where required
- Relocate utilities, including removing utility services and re-laying those services in a designated utility service corridor in a different location within or immediately adjacent to the project footprint where practicable. If a service needs to be relocated outside the project footprint, locations within an existing road reserve or infrastructure corridor would be preferred
- Remove or suitably isolate any redundant utility services as agreed with the appropriate utility service provider.

The approach does not allow for the upgrading of utility services apart from any upgrades required to manage potential impacts arising from the project such as upgrades to drainage infrastructure or power supply connections.

As part of the process, where feasible options exist for relocating utility services these would be identified and evaluated before a preferred option is selected and management measures would be adopted to minimise the potential environmental impacts associated with the works.

All utility works would be carried out in consultation with the relevant utility service provider.

2.5 Utility service corridors

Indicative utility service corridors have been developed for the areas of interest, which are primarily located within the project footprint, but also include areas outside the project footprint. These indicative utility service corridors are shown in **Annexure A**. The corridors are primarily focused on the Rozelle and Iron Cove areas of interest. They have been developed to accommodate multiple utility services in a common corridor where feasible.

During detailed design these indicative corridors could be refined to reflect:

- Ongoing utility investigations and the specific requirements of the utility service providers
- Ongoing refinements to the M4-M5 Link project design
- Outcomes of stakeholder and community consultation
- The requirements of the design and construction contractor (the contractor).

3 Proposed utility works

3.1 Areas of interest

The areas of interest within the project footprint include:

- Wattle Street interchange at Haberfield (M4 East project interface) including the optional construction sites:
  - Option A - the Wattle Street civil and tunnel site (C1a), the Haberfield civil and tunnel site (C2a) and the Northcote Street civil site (C3a)
  - Option B - the Parramatta Road West civil and tunnel site (C1b), the Haberfield civil site (C2b) and the Parramatta Road East civil site (C3b)
- Darley Road civil and tunnel site in Leichhardt (C4)
- Rozelle interchange portals and ramps including the Rozelle civil and tunnel site (C5), The Crescent civil site (C6) and the Victoria Road civil site (C7)
- Iron Cove Link portals and ramps including the Iron Cove Link civil site (C8)
- Pyrmont Bridge Road tunnel site at Annandale (C9)
- St Peters interchange at St Peters (New M5 project interface) including the Campbell Road civil and tunnel site (C10)
- Sections of the mainline tunnels which have the potential to interface with existing major (trunk) utility services.

The proposed utility works in each area of interest within the project footprint are discussed in **sections 3.2** to **3.8**. Proposed utility works in areas of interest outside of the project footprint are discussed in **sections 4.1**, **4.2** and **5.4**.

For some utility works, multiple management options have been identified. Further development of the project design, ongoing investigations, technical requirements and outcomes of consultation with utility service providers would be considered to determine a preferred option. New or revised management options may also be identified in the future during the detailed design phase of the project.

3.2 Wattle Street interchange at Haberfield/Ashfield

Utility works in the area of the Wattle Street interchange area are being undertaken as part of the M4 East project. There are no works proposed as part of the M4-M5 Link project in this area of Haberfield which would impact on existing or M4 East relocated utility services. The vertical alignment of the M4-M5 Link tunnels has been adjusted so that the tunnels are at sufficient depth to avoid existing utility services in this area, including Sydney Water sewer and water mains, council stormwater pipes and Ausgrid transmission cables.

Given the vertical and horizontal separation distances proposed there is unlikely to be settlement or vibration impacts on these utility services. During detailed design, an assessment would be carried out to demonstrate that construction of the M4-M5 Link tunnels would have no adverse settlement or vibration impacts on these services.

The existing utility services in this area are listed in **Table 3-1** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-1 Utilities at Wattle Street interchange, Haberfield

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Sydney Water sewer main	300 mm sewer main	Running southeast from the Sydney Water pumping station in Reg Coady Reserve across Dobroyd Parade and along Martin Street.	Within the project footprint.	Retain and protect (if required).
Sydney Water sewer main	225 mm sewer main	Running southeast from Reg Coady Reserve across Dobroyd Parade and along an existing easement to the north of Martin Street.	Within the project footprint.	Retain and protect (if required).
Sydney Water sewer main	225 mm sewer main	Running southeast across Dobroyd Parade and along an existing easement between Martin Street and Ramsay Street.	Within the project footprint.	Retain and protect (if required).
Sydney Water sewer main	225 mm sewer main	Running along Waratah Street and then south in easement.	Within the project footprint.	Retain and protect (if required).
Sydney Water water main	900 mm water main	From Waratah Street running south along Alt Street.	Within the project footprint.	Retain and protect (if required).
Council major stormwater pipe	1,050 mm diameter	From Dobroyd Canal (Iron Cove Creek) running south across Dobroyd Parade and along an existing easement.	Within the project footprint.	Retain and protect (if required).
Ausgrid transmission cable	132 kV underground transmission cable	Running southeast along Martin Street, across Dobroyd Parade and continuing along Martin Street.	Within the project footprint.	Retain and protect (if required).

All Option A construction sites fall within the construction footprint for the M4 East project and all utility works will be completed as part of that project. No further utility works are required in relation to these sites.

For the two Option B construction sites located on Parramatta Road (C1b and C3b) the existing utility services in this area include Sydney Water sewer and water mains, Telstra communications cables and Ausgrid transmission cables in Parramatta Road, Bland Street and Alt Street. None of these utility services would be directly impacted by the project. These utility services are listed in **Table 3-2** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-2 Utilities at Parramatta Road, Haberfield and Ashfield

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Sydney Water water main	450 mm water main	Running along the western side of Parramatta Road.	Within the project footprint.	Retain and protect (if required).

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Sydney Water sewer main	330 mm and 405 mm sewer main	Running along the northern side of Bland Street to the west and east of Parramatta Road.	Within the footprint.	Retain and protect (if required).
Telstra communications	Underground cables	Running along the eastern side of Parramatta Road.	Within the footprint.	Retain and protect (if required).
Telstra communications	Underground cables	Running along Bland Street to the west and east of Parramatta Road.	Within the footprint.	Retain and protect (if required).
Ausgrid transmission	33 kV underground cable	Running along Parramatta Road, Bland Street and Alt Street.	Within the project footprint.	Retain and protect (if required).

3.3 Leichhardt

3.3.1 Darley Road civil and tunnel site, Leichhardt

Two Sydney Water sewer mains run north/south through the site. One of these sewer mains (225 millimetre diameter) would be relocated to a new utility service corridor along part of the northern boundary of the site, while the other main (150 millimetre diameter) would be retained and protected. There is also a sewer main (150 millimetre diameter) that enters the southeast corner of the site. A small section of this asset would either be retained and protected or relocated to the south along Darley Road outside the construction site boundary.

Along a section of Darley Road and James Street there is a sewer main (450 millimetre diameter) which would potentially be impacted by the proposed construction access tunnel. The sewer main is located seven to nine metres clear of the tunnel roof and therefore the risk of settlement impacts is considered to be negligible. Further discussions would occur with Sydney Water about protection of this asset.

An overhead 33kV Feeder to the 760 Sydney Trains transmission line runs along the northern verge of Darley Road adjacent to the site. This overhead line would be protected during construction. Vehicle access points along Darley Road would be located to avoid pits, manholes and pillars so that asset maintenance is not compromised.

The existing utility services in this area are listed in **Table 3-3** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-3 Utilities at Darley Road, Leichhardt

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Sydney Water sewer main	225 mm diameter sewer main	Running north–south through the central part of the site.	Within the project footprint.	Relocation – sewer main to be relayed within shared utility corridor along part of the northern boundary of the site.
Sydney Water sewer main	150 mm diameter sewer main	Running north–south through the western part of the site.	Within the project footprint.	Retain and protect (if required).
Sydney Water sewer main	150 mm diameter sewer main	Running across the south east corner of the site.	Within the project footprint.	<u>Option 1</u> Retain and protect (if required). <u>Option 2</u> Relocation – sewer main to be relayed to the south along the northern verge of Darley Road.
Sydney Water sewer main	450 mm diameter sewer main	Running north–south along Darley Road and James Street.	Within the project footprint.	Retain and protect (if required).
Ausgrid 33 kV Feeder	Overhead 33 kV Feeder to the 760 Sydney Trains transmission line	Running east/west along Darley Road adjacent to the southern boundary of the site.	Within the project footprint.	Retain and protect (if required).

3.4 Rozelle interchange

The Rozelle interchange (including the civil and tunnel sites (C5 to C7)) covers a broad geographic area and includes some of the most significant project infrastructure and construction activity. This includes surface road works, tunnel ramps and dive structures, cut and cover tunnels, permanent operational infrastructure, drainage channels and wetland. As a result there would be significant impacts on existing utility services in this area which would need to be managed.

Existing utilities in the area of Rozelle interchange include:

- Ausgrid 132 kV and 33 kV transmission feeders
- Sydney Trains electrical feeders and a switching station
- Telstra multi-fibre optic cable trench
- Sydney Water sewer and water mains.

The existing utility services in this area are listed in **Table 3-4** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-4 Utilities at Rozelle interchange

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Electrical – Ausgrid				
90 V and 90 W	132 kV transmission feeders	Feeders run along Lilyfield Road and Burt Street then both run south along Gordon Street and across the Rozelle Rail Yards in an existing easement, then across City West Link and east along James Craig Road.	Part within and part outside the project footprint.	<u>Option 1</u> Retain and protect (if required) across the Rozelle Rail Yards and under City West Link. <u>Option 2</u> Relocation – feeders to be relayed by diverting east along Lilyfield Road, across Victoria Road and along northern side of Anzac Bridge then south under Anzac Bridge to reconnect with James Craig Road[1].
Multiple 33 kV feeders	Multiple feeders from White Bay Power Station (currently disused)	Tunnel running south west from White Bay Power Station under Victoria Road and into the Rozelle Rail Yards.	Part within and part outside the project footprint.	Retain and protect (if required) tunnel section running beneath Victoria Road to maintain Ausgrid access. Relocation – provide new feeder conduits as required by Ausgrid within a new utility service corridor running south through Rozelle Rail Yards and under City West Link, then turning west along the southern side of City West Link and south along the eastern side of The Crescent[1].
Multiple 33 kV feeders	From Easton Park into the Rozelle Rail Yards	Multiple feeders running south under Easton Park and Lilyfield Road into the Rozelle Rail Yards.	Within the project footprint.	<u>Option 1</u> Relocation – feeders to be relayed to run east along the northern boundary of site adjacent to Lilyfield Road and then turn south to run through the Rozelle Rail Yards in new utility service corridors. <u>Option 2</u> Relocation – feeders to be relayed to run west along the north boundary of the site adjacent to Lilyfield Road and then turn south to run across the Rozelle Rail Yards adjacent to the western boundary of the site[1]. Then runs south under City West Link and the light rail corridor before turning east along Railway Parade to reconnect at Bayview Crescent.

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Electrical – Sydney Trains				
Rozelle 33 kV switching station	Inside Rozelle Rail Yards	Within Rozelle Rail Yards immediately to the north of City West Link and near its intersection with The Crescent.	Outside of the project footprint.	Option 1 Reconfiguring of the Sydney Trains network – remove the switching station and construct new feeders outside of the M4-M5 Link project footprint in the Surry Hills area (see **Figure 3-1**). Option 2 Relocation – like for like replacement to a new location either some 450 metres to the south west adjacent to Railway Parade and the light rail corridor or some 200 metres to the north east adjacent to the corner of James Craig Road and City West Link (see **Figure 3-2**).
Feeder 759	33 kV underground bulk supply to Rozelle switching station	Runs south under Easton Park and Lilyfield Road and through the Rozelle Rail Yards to the switching station.	Part within and part outside the project footprint.	Treatment for Feeders 759 and 760. Relocation – feeders relayed to run east along the northern boundary of site adjacent to Lilyfield Road and then turn south to run through the Rozelle Rail Yards and under City West Link in a shared utility service corridor. Then continues south along the eastern side of The Crescent before turning west to run across The Crescent and follows the light rail corridor in a shared galvanised steel trough to tie in with existing overhead connection further to the west.
Feeder 760	33 kV overhead, joint use with Feeder 639	From Rozelle Rail Yards switching station running south to cross City West Link and turning west to the south of City West Link and parallel to the light rail corridor.	Part within and part outside the project footprint.	See Feeder 759 above.

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Feeder 639	11 kV underground and overhead, joint use with Feeder 760	Runs west along James Craig Road then turns north and crosses under Anzac Bridge and then west under Victoria Road and through Rozelle Rail Yard to the switching station. Then south crossing under City West Link and west to the southern side of City West Link and parallel to the light rail corridor.	Part within and part outside the project footprint.	Relocation – feeder relayed to run west along James Craig Road and along the southern side of City West Link then turns to run south along the eastern side of The Crescent. Then turns west across The Crescent and follows the light rail corridor in a galvanised steel trough to tie in with the existing overhead connection further to the west (similar to Feeder 760).
Feeders circuit 766	33 kV underground	Runs north along The Crescent and across City West Link to the switching station within the Rozelle Rail Yards.	Outside the project footprint.	New connection – redirect Feeders 766 and 797 to work in isolation of switching station and remove from the Rozelle Rail Yards completely. Provide new joint in the vicinity of The Crescent and Bayview Crescent or in a location further to the south east to connect the two feeders
Feeder 797	33 kV underground	Runs north along Bayview Crescent, under the light rail corridor and across City West Link then turns east to the switching station within the Rozelle Rail Yards.	Outside the project footprint.	See Feeder 766 above.
Telecommunications				
Major multiple optic fibre trench	A combined communications utility trench (principally Telstra) including 2000 plus fibres in 24 ducts. One of four major links in Sydney. Network connects Melbourne and Brisbane.	Runs south along the eastern verge of Victoria Road to cross under Anzac Bridge. Then turns east to run along the southern side of James Craig Road. Also turns west to run along the southern side of James Craig Road and City West Link before turning south to run along The Crescent.	Part within and part outside of the project footprint.	Relocation – cables to be relayed in new utility service corridor running east adjacent to the White Bay Power Station, then turning south under Anzac Bridge to join existing trench along James Craig Road. Existing trench which runs west to the south of James Craig Road is to be retained. Also relay a short section of trench to the east of James Craig Road.

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Water – Sydney Water				
Water main	300 mm diameter	Runs east crossing under Victoria Road and then south along the eastern verge of Victoria Road and crossing under Anzac Bridge to James Craig Road.	Within the project footprint.	Relocation – main to be relayed with new crossing under Victoria Road and new utility service corridor running east adjacent to White Bay Power Station then turning south across Anzac Bridge to join existing main in James Craig Road. Then relay to the west along the southern side of James Craig Road and City West Link before turning south along the eastern side of The Crescent.
Water main	600 mm diameter	Western verge of Victoria Road at Rozelle.	Within the project footprint.	Relocation – main to be relayed to new utility service corridor in western verge of Victoria Road.
Water mains	450 mm and 500 mm diameter water mains	Run east–west along the southern verge of Lilyfield Road.	Within the project footprint.	Relocation – mains to be relayed in two locations along Lilyfield Road where impacted by proposed cut and cover tunnel construction works.
Wastewater – Sydney Water				
Gravity sewer	150 mm diameter	Running south east from Lilyfield Road through the adjacent Light Rail maintenance depot across the Rozelle Rail Yards and across City West Link.	Within the project footprint.	Retain and protect (if required).
Gravity sewer	150 mm diameter	Running east from Lilyfield Road near Easton Park through part of the Rozelle Rail Yards.	Within the project footprint.	Relocation – sewer to be relayed in new utility service corridor to run east along the northern boundary of site adjacent to Lilyfield Road.
Gravity sewer	150 mm diameter	Running north along the Crescent and then turning west through open space area near Whites Creek to connect with Railway Parade.	Part within and part outside the project footprint.	Relocation – sewer to be relayed from The Crescent in bore under light rail corridor to connect with Bayview Crescent.
Gravity sewer	150 mm diameter	Under Victoria Road and east towards White Bay Power Station.	Within project footprint.	New connection – remove existing sewer main which discharges through the White Bay precinct and install new main running west along Lilyfield Road to reconnect existing properties to sewerage system to the west.

Note:

1 Ausgrid to determine final alignment

Figure 3-1 Sydney Trains - Surry Hills (Option 1)

Figure 3-2 Sydney Trains - Railway Parade, Annandale (Option 2)

3.5 Victoria Road, Iron Cove

Existing utilities in the area of Iron Cove (including the civil site (C8)) include a Jemena secondary gas main, various Ausgrid distribution feeders, Telstra multi-fibre optic cables and Sydney Water sewer and water mains.

A secondary gas main which crosses underneath Victoria Road would be impacted by the project. This main would be relayed along the northern side of Victoria Road and then cross Victoria Road before being relayed west along the southern side of the road to reconnect at Toelle Street.

The Balmain Slopes sewer main crosses under Victoria Road to the west of Terry Street and would be impacted by the project works. The sewer main would be relayed to the east along Victoria Road and then cross Victoria Road and turn east to run under private properties between Springside and Moodie Streets. It then would turn south west along Moodie Street to rejoin the existing sewer.

A separate 225 millimetre diameter sewer main which runs along the south side of Victoria Road between Clubb and Toelle streets would be impacted by the project and would be relayed along the southern boundary of the project footprint.

A major multiple optic fibre trench which runs along the north side of Victoria Road and then crosses under Victoria Road near Byrnes Street would not be impacted by the project. A Sydney Water water-main which runs along the north side of Victoria Road would also not be impacted by the project.

As part of the project, it may also be necessary to relay local electricity, gas and communications services through some of the local streets (Byrnes, Clubb, Toelle, Callan, Manning, McCleer and Springside streets) on the southern side of Victoria Road. This option would be investigated further during detailed design in consultation with relevant utility service providers. This area of interest is shown on **Figure 4-5** and the existing environmental conditions in this area are described in **section 7.6.1**.

The existing utility services in this area are listed in **Table 3-5** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-5 Utilities at Victoria Road, Iron Cove

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Gas – Jemena				
Secondary main	150 mm diameter steel main, 1050 kPa	Crossing under Victoria Road from Terry Street to Toelle Street.	Within the project footprint.	Relocation – main to be relayed from Terry Street to the east along the northern side of Victoria Road then turns south to cross Victoria Road and then west along the southern side of Victoria Road to reconnect at Toelle Street.
Telecommunications				
Major multiple optic fibre trench	A combined communications utility trench including 2000 plus fibres in 24 ducts. One of four major links Sydney. Network connects Melbourne and Brisbane.	Follows northern verge of Victoria Road and runs south to cross the road at Byrnes Street and then travels north west under Iron	Within the project footprint.	Retain and protect (if required).

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
		Cove Bridge.		
Water – Sydney Water				
Water main	250 mm diameter	Northern verge of Victoria Road at Iron Cove.	Within the project footprint.	Retain and protect (if required).
Wastewater – Sydney Water				
Balmain Slopes sub-main trunk sewer	1300 x 1750 mm gravity fed tunnel	Crossing under Victoria Road to the west of Terry Street and Toelle Street.	Within the project footprint.	Relocation – trunk sewer to be relayed to the east along the northern side of Victoria Road and then turns south to cross Victoria Road. Then turns east to run under private properties between Springside and Moodie Streets before turning south west along Moodie Street to rejoin the existing sewer.
Gravity sewer	225 mm diameter	On the southern side of Victoria Road between Clubb and Toelle Streets.	Within the project footprint.	Relocation – sewer main to be relayed a short distance along part of the southern boundary of the site.

3.6 Pyrmont Bridge Road, Annandale

Two Sydney Water sewer mains and one water main are located within the boundary of the proposed Pyrmont Bridge Road tunnel site (C9) including beneath Bignell Lane. These mains would be partly protected and partly relocated to a new service corridor which is to be located to the perimeter of the site.

Underground Telstra optic fibre cables run along the northern verge of Parramatta Road at the frontage of the site. These services would be protected during construction and vehicle access points would be located to avoid pits, manholes and pillars so that maintenance of the cables is not compromised.

The existing utility services in this area are listed in **Table 3-6** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-6 Utilities at Pyrmont Bridge Road, Annandale

Utility service	Description	Existing location	Within or outside the project footprint	Proposed management measures
Sydney Water sewer main	300 and 400 mm diameter sewer main	Running north from Parramatta Road to Bignell Lane through the eastern part of the site, then turns to run west and north along Bignell Lane to connect with Pyrmont Bridge Road.	Within the project footprint.	Option 1 Retain and protect (if required) in utility service corridor along east boundary and along part of Bignell Lane. Then relay in new utility service corridor along part of the eastern, northern and western perimeter of the site. Option 2 Retain and protect existing alignment (if required).
Sydney Water water main	100 mm diameter water main	Running west from Mallet Street along Bignell Lane and then turns north along Bignell Lane to Pyrmont Bridge Road.	Within the project footprint.	Option 1 Retain and protect (if required) in utility service corridor along part of Bignell Lane and then relay in new utility service corridor along the eastern and northern perimeter of the site. Option 2 Retain and protect existing alignment (if required).
Telstra multi-fibre optic cables	Underground multi-fibre cables	Running along the northern verge of Parramatta Road adjacent to the southern boundary of the site.	Within the project footprint.	Retain and protect (if required).

3.7 St Peters interchange

Utility works in the St Peters area (including the civil and tunnel site (C10) are being facilitated by the contractor for the New M5 project.

There are no works proposed as part of the M4-M5 Link project at St Peters which would impact on existing utility services. The vertical alignment of the M4-M5 Link tunnels in the St Peters area would be at sufficient depth to avoid existing utility assets including a Jemena secondary gas main along the northern verge of Campbell Road. This utility service would be protected as part of the New M5 project works and would continue to be protected during construction of the project.

An Ausgrid high voltage (HV) transmission cable along Crown Street would not be impacted given the proposed depth of the M4-M5 Link tunnels below. During detailed design an assessment would be carried out to demonstrate that construction of the M4-M5 Link tunnels would have no adverse settlement or vibration impacts on these services.

The existing utility services in this area are listed in **Table 3-7** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-7 Utilities at St Peters interchange

Utility Service	Description	Existing Location	Within or Outside the Project Footprint	Proposed Management Measures
Jemena secondary gas main	250 mm diameter gas main, 1,050 kPa pressure	Running east–west along northern verge of Campbell Road.	Within the project footprint.	Retain and protect (if required) as part of New M5 project.
Ausgrid 132 kV transmission cable	Underground 132kV HV transmission cable	Running north–south along Crown Street.	Within the project footprint.	Retain and protect (if required).

3.8 Mainline tunnels

3.8.1 Sydney Water utility services

The mainline tunnel alignment crosses key Sydney Water utility services, principally the Pressure Tunnel and the City Tunnel. These deep tunnels supply water to residents of Sydney's eastern and southern suburbs and run from Potts Hill to Waterloo. The Pressure Tunnel is listed on the State Heritage Register and on Sydney Water's Heritage and Conservation Register under section 170 of the *Heritage Act 1977* (NSW) and is of State heritage significance. The City Tunnel is listed on Sydney Water's Heritage and Conservation Register and is of local heritage significance.

The Pressure Tunnel was constructed circa 1930 and is described as having an excavated diameter of 3,800 millimetre and an internal steel lining of 2,480 millimetre diameter and is located at an approximate invert level of Reduced Level (RL)-35 metres Australian Height Datum (AHD). It passes below the proposed alignment of the M4-M5 Link mainline tunnels in the vicinity of Enmore Road and King Street in Newtown. In this location, the base of the M4-M5 Link tunnels is located about 12 metres above the top of the Pressure Tunnel (see **Annexure A**). The closest construction/access shaft for the Pressure Tunnel (shaft 14) is approximately 45 metres from the M4-M5 Link mainline tunnels.

The City Tunnel was constructed circa 1960 and is described as having an excavated diameter of 3,000 millimetre with cement lined steel pipe of 2,100 millimetre diameter and is located at an approximate invert level of RL-15 metres AHD. It passes above the proposed alignment of the M4-M5 Link mainline tunnels in the vicinity of Princes Highway and Alice Street, Newtown. In this location the top of M4-M5 Link tunnels is located about 11 metres below the base of the City Tunnel (refer **Annexure A**).

The existing utility services in this area are listed in **Table 3-8** together with proposed management measures. They are also shown in **Annexure A**.

Table 3-8 Utilities for mainline tunnel

Utility Service	Description	Existing Location	Within or Outside the Project Footprint	Proposed Management Measures
Sydney Water Pressure Tunnel	Excavated diameter of 3,800 mm and an internal steel lining of 2,480 mm diameter. Approximate invert level of RL-35	Running east–west in the vicinity of Enmore Road and King Street, Newtown.	Within the project footprint.	Retain and protect (if required).
Sydney Water City Tunnel	Excavated diameter of 3,000 mm with a cement lined steel pipe of 2,100 mm diameter. Approximate invert level of RL-15	Running east–west in the vicinity of Princes Highway and Alice Street, Newtown.	Within the project footprint.	Retain and protect (if required).

Due to the clearance achieved by the M4-M5 Link alignment relative to the Sydney Water tunnels, and the geological conditions in the areas where these cross over points occur, it is expected the Sydney Water assets would not be adversely impacted. Preliminary settlement assessments have predicted that both of the Sydney Water tunnels would experience minimal movement (see **Chapter 12** (Property and land use) of the EIS). It is expected that the potential vibration and settlement impacts on these utility services would be negligible and can be managed.

Surveys should be undertaken to verify the levels and condition of these Sydney Water assets. A detailed assessment would be carried out in consultation with Sydney Water during the detailed design phase to demonstrate that construction of the M4-M5 Link tunnels would have negligible adverse settlement or vibration impacts on these water tunnels. A settlement monitoring program would also be implemented during construction. An interface agreement would be required with Sydney Water to ensure these utility services are protected during construction including requirements for monitoring of potential vibration and settlement impacts.

3.8.2 Ausgrid electrical infrastructure

Investigations have been undertaken to confirm the location of any existing electrical zone substations adjacent to the tunnel alignment. These substations could potentially have earthing rods infrastructure, possibly up to 30 metres deep.

The tunnel alignment comes within around 20 metres of the Ausgrid substation located in Balmain Road at Leichhardt. The tunnel alignment does not cross directly beneath the substation and at this point the tunnels are located at a depth of about 50 metres below ground level.

Ausgrid has confirmed that the tunnel alignment and depths would not have any adverse impacts on earthing rods associated with existing substations.

4 Proposed power supply

4.1 Construction power supply

4.1.1 Overview

A number of construction sites are proposed along the mainline tunnel alignment and for the Rozelle interchange and Iron Cove Link for construction of the project as detailed in **section 1.1.3**. Major construction power would be required at sites where tunnelling is to be undertaken by roadheaders.

Construction power supply to other construction sites will be arranged by the contractor and are likely to be provided either by local supplies or by generators.

4.1.2 Estimated power demand

The projected estimate of maximum power demands is shown in **Table 4-1**. The maximum power demand has been conservatively calculated to allow contingency for larger or additional roadheaders that may be required to accelerate the construction program. Target power connection dates are indicative only and would be reviewed during detailed design in consultation with Ausgrid.

Table 4-1 Estimate of construction power supply demand

Construction site	Maximum demand (MVA)	Target power connect date
Option A – Wattle Street and Haberfield civil and tunnel sites (C1a and C2a)	10	Q3 2019
Option B – Parramatta Road West civil and tunnel site (C3b)	10	Q4 2018
Darley Road civil and tunnel site (C4)	8	Q3 2018
Rozelle civil and tunnel site (C5)	13	Q4 2018
Pyrmont Bridge Road tunnel site (C9)	10	Q3 2018
Campbell Road civil and tunnel site (C10)	10	Q4 2018

4.1.3 Haberfield/Ashfield

The contractor for the M4 East project has provided a 10 Mega Volt Amp (MVA) construction power supply on the Northcote Street tunnelling site. The connection is provided via two 11 Kilovolt (kV) High Voltage Connections (HVCs) supplied by two cabled connections to the Ausgrid network. It is currently located in an ideal position to service the proposed construction sites at Haberfield.

However, it may not be possible for the M4-M5 Link project to use this supply for construction purposes, as:

- There is uncertainty that the connection would be released by the M4 East contractor by the required date
- The connection capacity has already been reallocated by Ausgrid.

Consequently, an alternative power supply connection is required. The alternative power supply connection is likely to be from the Ausgrid substation located on Croydon Road some distance to the west. The maximum demand of 10 MVA would require two HVCs connected by cables to the Ausgrid 11 kV network.

For both the Option A and Option B construction sites the connection would run from the substation on Croydon Road generally in an easterly and south easterly direction following existing road reserves toward the Parramatta Road West civil and tunnel site with a tee connection to the Wattle Street and Haberfield civil and tunnel sites. The proposed connection would be located outside of the project footprint and therefore would be subject to the environmental constraints analysis and environmental risk assessment process as detailed in **section 9.2**.

An indicative alignment for the connection to serve both sites is shown in **Figure 4-1**. The final alignment would be determined in consultation with Ausgrid during detailed design.

4.1.4 Darley Road, Leichhardt

The location of the proposed supply point for the Darley Road civil and tunnel site (C4) is the Leichhardt substation on Balmain Road opposite the corner of Derbyshire Road some 850 metres to the south east of the construction site.

The maximum demand of 8 MVA would require two HVCs connected by cables to the Ausgrid 11 kV network. The connection would run from the substation on Balmain Road in a north-westerly direction toward the construction site following existing road reserves. The proposed connection would be located outside of the project footprint and therefore would be subject to the environmental constraints analysis and environmental risk assessment process as detailed in **section 9.2**.

An indicative alignment is shown in **Figure 4-2**. The final alignment would be determined in consultation with Ausgrid during detailed design.

4.1.5 Rozelle

The location of the proposed supply point for the Rozelle civil and tunnel site (C5) is the Leichhardt substation on Balmain Road some 1,500 metres to the southwest of the construction site.

The maximum demand of 13 MVA would require two HVCs connected by cables to the Ausgrid 11 kV network. The connection would run from the substation on Balmain Road generally in a north-easterly direction toward the construction site at Rozelle (C5) following existing road reserves. The connection is located outside of the project footprint and therefore would be subject to the environmental constraints analysis and environmental risk assessment process as detailed in **section 9.2**.

An indicative alignment is shown in **Figure 4-3**. The final alignment would be determined in consultation with Ausgrid during detailed design.

4.1.6 Pyrmont Bridge Road, Annandale

The location of the proposed supply point for the Pyrmont Bridge Road tunnel site (C9) is in Layton Street, Annandale some 100 metres to the east of the construction site.

The maximum demand of 10 MVA would require two HVCs connected by cables to the Ausgrid 11 kV network. The connection would run from the substation on Layton Street generally in a westerly direction toward the construction site following existing road reserves. The connection is located outside of the project footprint and therefore would be subject to the environmental constraints analysis and environmental risk assessment process as detailed in **section 9.2**.

An indicative alignment is shown in **Figure 4-4**. The final alignment would be determined in consultation with Ausgrid during detailed design.

4.1.7 Campbell Road, St Peters

The contractor for the New M5 project is required to provide a 10 MVA supply for construction of the M4-M5 Link project. The location of the supply point is on the south side of Albert Street within the M4-M5 Link construction site at Campbell Road (C9). These works do not form part of the M4-M5 Link project.

Figure 4-1 Construction power - Haberfield and Ashfield (Options A and B)

Figure 4-2 Construction power - Darley Road, Leichhardt

Figure 4-3 Construction power - Rozelle

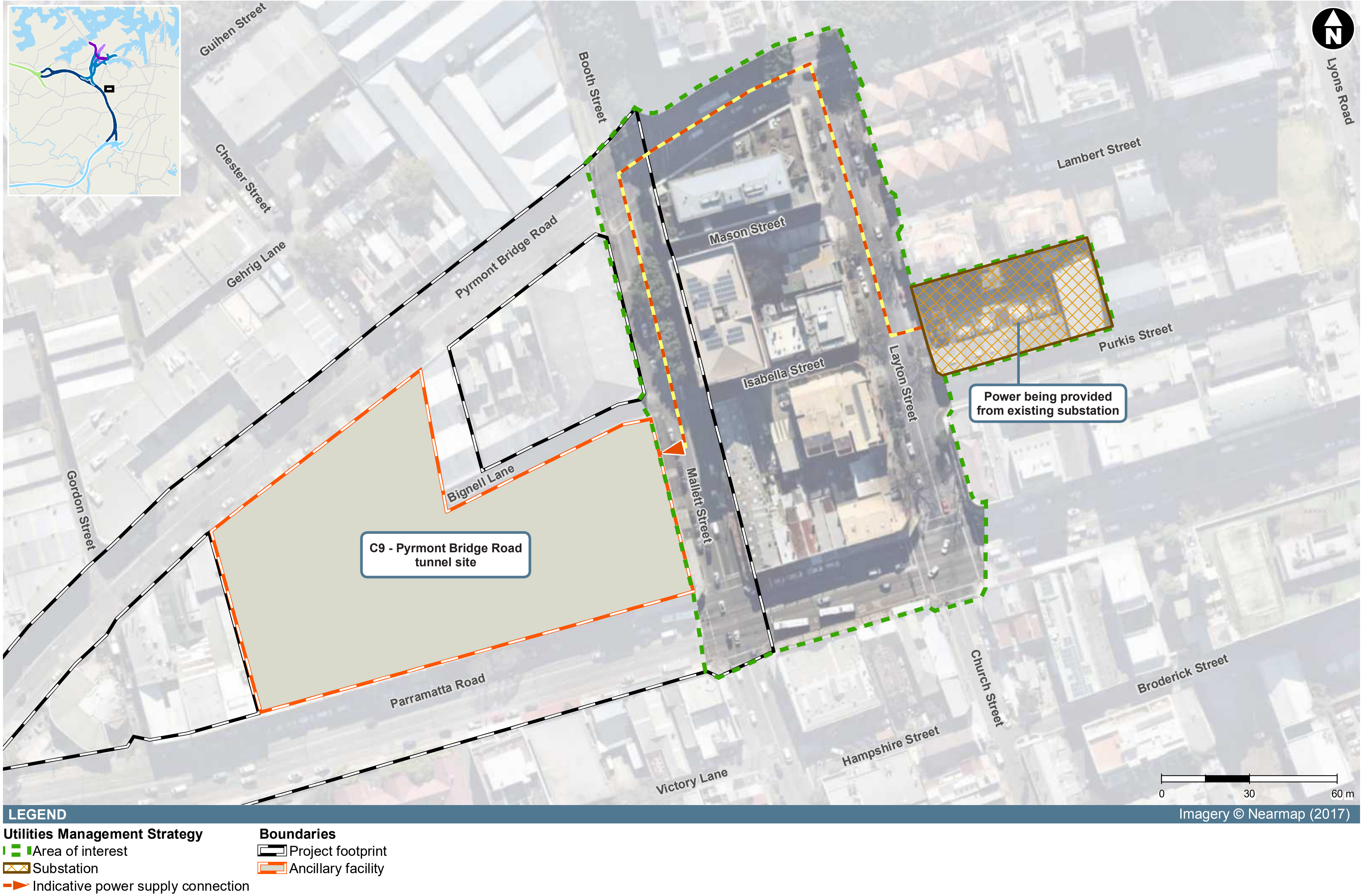


Figure 4-4 Construction power - Pyrmont Bridge Road, Annandale

4.1.8 Summary

Table 4-2 provides a summary of the estimated maximum power demand and supply connection points for each of the proposed tunnel construction sites for the project.

Table 4-2 Construction sites – power demand and supply connections

Construction site	Maximum demand required (MVA)	Ausgrid supply connection point	Approximate distance (metres)[1] to construction site	Within or outside project footprint
Option A - Wattle Street and Haberfield civil and tunnel sites (C1a and C2a)	10	Croydon Road, Croydon	850	Outside the project footprint.
Option B – Parramatta Road West civil and tunnel site (C1b)	10	Croydon Road, Croydon	850	Outside the project footprint.
Darley Road civil and tunnel site (C4)	8	Balmain Road, Leichhardt	850	Outside the project footprint.
Rozelle civil and tunnel site (C5)	13	Balmain Road, Leichhardt	1,500	Outside the project footprint.
Pyrmont Bridge Road tunnel site (C9)	10	Layton Street, Annandale	100	Outside the project footprint.
Campbell Road civil and tunnel site (C10)	10	Connection to be provided within site by New M5 contractor	N/A	N/A

Note:

1 Distance is measured in a straight line between the supply connection point and the construction site.

4.2 Operational power supply

4.2.1 Overview of strategy

The strategy for permanent, operational power supply has considered the following issues:

- The power connection must allow for commissioning of the mainline tunnel independently of, and prior to, the Rozelle interchange and Iron Cove Link
- Mainline tunnel is to be operational in 2022 and commissioned prior to this date
- Rozelle interchange and Iron Cove Link is to be operational in 2023 and commissioned prior to this date
- Power supply must provide full redundancy (effectively two supply units, each capable of powering the operation) and there is to be no inter-dependency between the two redundant supplies, so that power supply would not be interrupted if one unit fails
- The ideal (but not mandatory) location for power supply connection to a long tunnel is as close as possible to the load centre or separate supplies from either end. For the M4-M5 Link project, the main load centres are the ventilation outlets at St Peters, Rozelle and Iron Cove and the evenly spaced jet fans throughout the various tunnel sections.

4.2.2 Estimated power demand

The preliminary estimate of maximum power demands for the M4-M5 Link project is shown in **Table 4-3**.

It has been assumed that operational power for the proposed future Western Harbour Tunnel and Beaches Link project would be supplied separately and as a result no allowance has been included for this project in the estimate of power demand.

Table 4-3 Preliminary estimate of maximum power demand

Project element	MVA
Mainline tunnels	35
Rozelle interchange and Iron Cove Link	30

The maximum power demand for the tunnels is driven predominantly by the ventilation system and particularly for scenarios involving congested traffic conditions or a fire within the tunnels. During normal, free-flowing traffic conditions the power demand for ventilation is significantly reduced by comparison. Therefore much of the power supply capacity remains unused for most of the time.

4.2.3 Power supply connection locations

A bulk power supply can be provided in a single location or two locations and then distributed to the ventilation outlets and jet fans within the tunnels. The Ausgrid transmission voltage is 33 kV and this is the nominated preference for the bulk power supply.

There are two substations best located to provide the bulk power supply connection for the project:

- Alexandria zone substation, at Bourke Road, Alexandria. This substation is currently under construction and is expected to be completed in late 2017
- Rozelle zone substation at Manning Street, Rozelle.

The locations of each zone substation are shown in **Figure 4-5**, **Figure 4-6** and **Figure 4-7**. Upgrade of the zone substations would be required to accommodate the bulk power supply connection for the M4-M5 Link project and these works would be undertaken by Ausgrid.

4.2.4 Options for power supply network connections

Bulk power supply network connection

At this stage, there are three preferred options for the bulk power supply network connection for the project and these options are currently being investigated with Ausgrid:

- Option 1 – connection from Rozelle zone substation only
- Option 2 – connection from Alexandria zone substation only
- Option 3 – connection from Rozelle zone substation (for Rozelle interchange and Iron Cove Link) and Alexandria zone substation (for the mainline tunnels).

Each option is explained in more detail in **Table 4-4**.

Table 4-4 Options for bulk power supply network connection

Option Number	Ausgrid zone substation	Connection to mainline tunnel	Connection to Rozelle interchange and Iron Cove Link	Within or outside the project footprint
1	Manning Street, Rozelle	Dual 33 kV feeders to substation at Darley Road, Leichhardt	Dual 33 kV feeders to substation at Rozelle Rail Yards.	Outside the project footprint.
2	Bourke Road, Alexandria	Dual 33 kV feeders to substation at Campbell Road, St Peters	Additional pair of dual 33 kV feeders to substation at Campbell Road, St Peters and then via the mainline tunnel to Rozelle interchange and Iron Cove Link.	Outside the project footprint.
3	Manning Street, Rozelle	N/A	Sub-option A Dual 33 kV feeders to the tunnel portals at Victoria Road Iron Cove and then via the Iron Cove Link tunnel to a substation at the Rozelle Rail Yards. Sub-option B Dual 33 kV feeders to substation at Rozelle Rail Yards following local roads.	Outside the project footprint.
	Bourke Road, Alexandria	Dual 33 kV feeders to substation at Campbell Road, St Peters	N/A	N/A

At this stage Option 3 is preferred as it provides greater system reliability and accommodates the staged opening of the mainline tunnels and Rozelle interchange/Iron Cove Link.

Feeder connections

For Option 3 there are two sub-options for how 33 kV feeders would connect from the Ausgrid zone substation in Manning Street, Rozelle to the Rozelle Rail Yards. These options are shown in **Figure 4-5** and **Figure 4-6** and include:

- Sub-option A – would be to run the feeders a short distance (about 200 metres) to the north east to the proposed ventilation facility at Victoria Road Iron Cove and then via the Iron Cove Link tunnel to a ventilation facility at the Rozelle Rail Yards
- Sub-option B – would be to run the feeders a longer distance (about 900 metres) to the south east to the ventilation facility at the Rozelle Rail Yards following local roads.

At this stage Sub-option A is preferred given the shorter distance involved and the likely reduced level of environmental and community impact associated with the works.

For Option 3 at Alexandria, the 33 kV feeders would run southwest from the Alexandria zone substation in Bourke Road and then west crossing Alexandria Canal and travelling along Campbell Road to the site (distance of about 1,100 metres). This connection is shown in **Figure 4-7** and would be constructed to supply power to the New M5 project. Additional conduits would be installed by the New M5 project for use by the M4-M5 Link project thereby removing the need for further disturbance.

The dual 33 kV feeders from the Alexandria and Rozelle Zone substations would provide power to high voltage intake substations at Rozelle, Iron Cove and St Peters ventilation facilities and other operational facilities. There would also be underground substations located along the length of the tunnels at spacings of no more than 1,200 metres to supply the ventilation and lighting systems.

Figure 4-5 Permanent power - Iron Cove (Option A)

Figure 4-6 Permanent power - Rozelle (Option B)

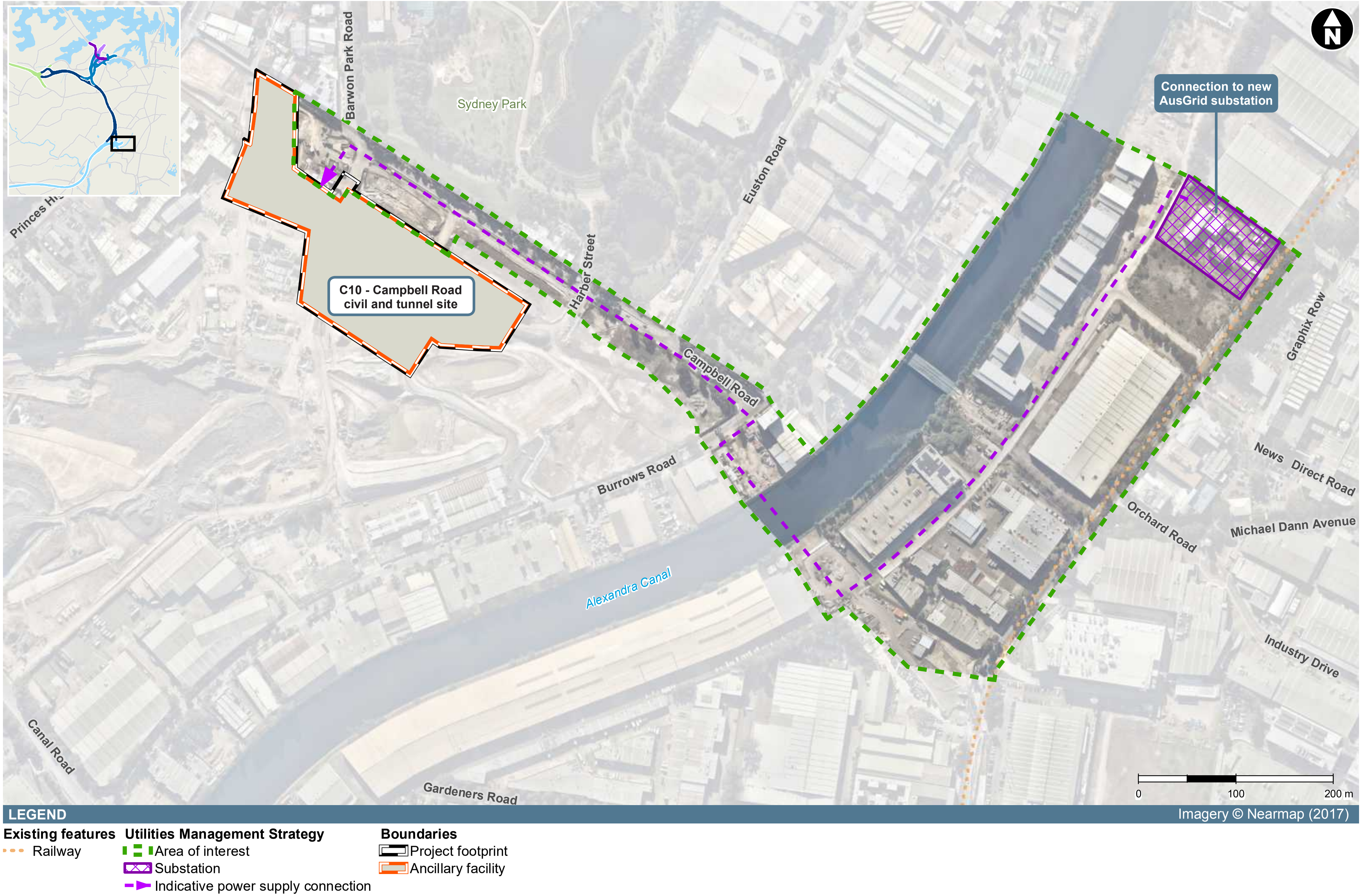


Figure 4-7 Permanent power - St Peters

4.2.5 Relevant considerations

A final decision on the preferred power supply option and feeder route options would be made by the contractor during detailed design in consultation with Ausgrid. A number of issues would be considered in determining the preferred options including:

- Required timeframe for connection and the sequencing of project works
- Capacity of connection
- Redundancy provisions
- Reliability of supply
- Proximity of connection location
- Surface cable route
- Potential for environmental and local community impacts
- Location of existing utility services
- Overall cost.

5 Proposed drainage infrastructure

5.1 Overview

This chapter describes the main permanent drainage infrastructure proposed as part of the M4-M5 Link project. The infrastructure is described under the following work categories:

- Drainage infrastructure proposed within the project footprint, within and adjacent to the Rozelle Rail Yards
- Upgrade of existing road drainage infrastructure within the project footprint
- Drainage works proposed outside of the project footprint.

At this concept design stage of the project, limited information is available about the capacity of the existing drainage infrastructure. This will be investigated further during the detailed design phase and adjustments made to the proposed drainage infrastructure if required.

5.2 Drainage infrastructure within the project footprint

5.2.1 Rozelle Rail Yards

Major drainage works are proposed within and adjacent to the Rozelle Rail Yards including the following elements:

- A new drainage channel (the northern channel) which would run from Lilyfield Road in a southerly direction through the central area of the site and then drains under City West Link via a new drainage box culvert and headwall to Rozelle Bay. This would effectively replace the existing Easton Park drain
- A new drainage channel (the western channel) which would run from the western boundary of the site in an easterly direction parallel to City West Link. In the central part of the site the channel would connect with the northern channel and then drain under City West Link to Rozelle Bay. This would include an adjustment of the northern outlet headwall to be constructed at the CBD and South East Light Rail Rozelle maintenance depot adjacent to the common (western) boundary
- A new drainage channel and bio-retention swale (the eastern channel) which would run from near the eastern boundary in a westerly direction to the northern channel in the central portion of the site and then drain under City West Link to Rozelle Bay
- A water treatment plant which would treat groundwater and surface water that enters the tunnels and then discharge the treated water into the constructed wetland
- A new constructed wetland located in the central portion of the site, which would connect to the northern channel and then drain under City West Link to Rozelle Bay
- Upgrade and widening of the Whites Creek concrete-lined drain along its southern bank in the vicinity of The Crescent to allow for improved conveyance of peak flows to Rozelle Bay. The work would include reshaping the southern bank, naturalisation of the creek and a new outlet to Rozelle Bay.

These works are described and shown in **Chapter 5** (Project description) of the EIS and are all located within the project footprint.

5.2.2 Other drainage infrastructure

Other drainage works are proposed within the project footprint including:

- A new stormwater bioretention facility located within an informal grassed carpark area within King George Park adjacent to Manning Street, Rozelle. This facility would capture and treat surface water run-off from Victoria Road before discharging via an existing outlet to Iron Cove. The carpark area in Manning Street would be redeveloped and the existing capacity (number of spaces) would be maintained
- Upgrade of existing drain in Byrnes Street to capture run-off from Victoria Road and direct it to the new bioretention facility adjacent to Manning Street.

These works are described and shown in **Chapter 5** (Project description) of the EIS and are all located within the project footprint.

5.3 Upgrade of existing road drainage infrastructure

Drainage infrastructure along some existing roads within the M4-M5 Link project footprint would also need to be adjusted or upgraded, including:

- Wattle Street at Haberfield to connect the drainage for the M4-M5 Link tunnel portals to the M4 East drainage system
- Victoria Road at Rozelle to the southeast of Iron Cove Bridge, including the drainage connection between Victoria Road and Warayama Place
- Victoria Road at Rozelle to the north of The Crescent
- Victoria Road at the western approach to Anzac Bridge
- The Crescent to the south of City West Link
- Lilyfield Road generally between Victoria Road and Grove Street to the north of the Rozelle Rail Yards including at the corner of Lilyfield Road and Gordon Street
- James Craig Road near its intersection with The Crescent and further east along James Craig Road on the south side Victoria Road and Anzac Bridge.

5.4 Drainage works outside project footprint

Drainage works proposed outside of the M4-M5 Link project footprint include a number of options that are being considered for managing treated water from the Darley Road water treatment plant. These include:

- Direct discharge to Hawthorne Canal, which would require a pipe to be installed along Canal Road and the construction of a new outlet in the wall of the Hawthorne Canal
- Direct discharge to the existing stormwater pipework in an adjoining road (ie Canal Road), which would require a pipe to be installed to connect to the existing piped drainage and potentially other augmentation of the stormwater drainage network
- Direct discharge into the sewer system located on the site, which would require a Trade Waste Agreement with Sydney Water.

The first two of these options are shown in **Figure 5-1** and would involve work being undertaken in areas outside of the project footprint and therefore would be subject to the environmental constraints analysis and environmental risk assessment process as detailed in **section 9.2**.

Figure 5-1 Water treatment plant discharge - Canal Road, Leichhardt

6 Construction works

6.1 Construction methodology

The construction methodology would vary according to the type of utility service, the scale of the work and the location. However, typically the methodology for constructing an underground utility service may include:

- Establishing temporary construction facilities including storage, laydown and stockpile areas, site offices and amenities
- Securing work areas such as with fencing and hoarding
- Installing pre-construction environmental management controls
- Investigations to confirm location of existing utility services such as potholing and works to protect or relocate services as required
- Removing and managing/protecting vegetation as required
- Saw cutting to remove asphalt or concrete pavement
- Undertaking initial trench excavations and shoring. Note that in some circumstances tunnelling or boring techniques can be used. Launching and receiving sites are required for these techniques
- Stockpiling excavated materials for reuse or removal for off-site disposal
- Preparing sub-grade surface (eg crushed rock) to accommodate utility services
- Laying utility services either as pipes or conduits
- Constructing joint bays and pits
- Pulling feeders through conduits
- Connecting utility services to existing systems
- Testing and commissioning of utility services
- Backfilling trenches and re-instating surface to an appropriate condition
- Removing excess stockpiles, materials and equipment
- Removing or suitably isolating redundant services where practical
- Rehabilitating areas disturbed by works, such as with new topsoil and vegetation
- Site clean-up and decommissioning temporary construction facilities, work areas and environmental management controls.

The work would be carried out in stages and would proceed in a linear manner along the route. The depth and width of excavation would depend on a number of factors such as the type of utility service, local topography, the location of existing services and sub-surface conditions.

6.2 Typical equipment used

The type of equipment that can be used varies according to the type of utility service, the scale of the project and the location. However, typically equipment may include items such as:

- Chainsaws and mulcher/chipper
- Asphalt/concrete cutting saws and rock breaking equipment
- Excavators, bobcats and backhoes
- Boring machine
- Vacuum excavation trucks, super suckers, water tankers and road sweepers
- Horizontal directional drilling and thrust boring rigs

- Piling rig, pole bores and mobile crane
- Power generators and assorted power tools
- Graders, compactors and vibratory rollers
- Concrete agitators and asphalt/concrete pavement laying machine
- Trucks to transport spoil and materials.

6.3 Standard working hours

Construction associated with utility works would typically be undertaken between the following standard hours:

- 7.00 am and 6.00 pm Monday to Friday
- 8.00 am and 1.00 pm on Saturday
- No work on Sunday or public holidays.

6.4 Work required outside of standard working hours

In some instances, works may be required outside of these standard hours. Examples include, but are not limited to, the following:

- Works that are emergency works
- Works that are being carried out on or adjacent to heavily trafficked roads such as Victoria Road, City West Link, The Crescent and Parramatta Road
- Works that affect essential public infrastructure and which could potentially disrupt services to the local community
- Works that involve the delivery of oversize plant or equipment that cannot occur during standard hours
- Works that may shorten the length of the construction phase and thereby benefit the local community
- Works that would not result in exceedances of relevant noise management levels identified in accordance with *Interim Construction Noise Guideline* (NSW EPA, 1999) (ICNG).

In these circumstances works would be undertaken in accordance with an out of hours work (OOHW) protocol and prior notification of the works would be provided to affected residential and business properties. A road occupancy licence (ROL) may be required to support the OOHW, particularly for works that are being carried out on or adjacent to heavily trafficked roads.

6.5 Timing and duration of utility works

Table 6-1 shows the indicative timing and duration of the utility works.

In most areas the utility works would occur over an estimated duration of up to nine months. At Rozelle and Iron Cove where more significant utility works are required, the works would occur over an estimated duration of around 15 months and 24 months respectively.

The duration refers to the overall period during which the utility works would be undertaken. In reality the utility works are likely to be undertaken intermittently during this overall period (not continuously). The overall duration of utility works would be confirmed during detailed design.

Table 6-1 Indicative timing and duration of utility works

Area of interest	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	2018				2019				2020			
Haberfield area (Option A) – Wattle Street civil and tunnel site (C1a) and Haberfield civil and tunnel site (C2a)												
Haberfield area (Option B) – Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)												
Leichhardt area – Darley Road civil and tunnel site (C4)												
Rozelle area – Rozelle civil and tunnel site (C5), The Crescent civil site (C6) and Victoria Road civil site (C7)												
Iron Cove area – Iron Cove civil site (C8)												
Annandale area – Pyrmont Bridge Road tunnel site (C9)												
St Peters area – Campbell Road civil and tunnel site (C10)												

7 Existing environment

7.1 Overview

The information in the following sections (**sections 7.2** to **7.9**) provides a general description of the existing environmental conditions and key constraints in the areas of interest and in particular in the areas that fall outside of the project footprint based primarily on desktop assessment. The descriptions are provided in the context of the utility works including power supply connections and drainage infrastructure that are proposed.

Once further consultation with relevant utility service providers has occurred and a detailed design for the proposed works are confirmed by the contractor then an updated environmental constraints analysis and risk assessment would be undertaken to confirm that the environmental impacts assessed and management measures recommended in this Strategy are appropriate.

7.2 Construction power – Haberfield and Ashfield

As detailed in **section 3.2** there are two options for proposed construction sites at Haberfield and Ashfield – Option A and Option B.

As detailed in **section 4.1.3**, the construction power connection will run from the Ausgrid substation on Croydon Road generally in an easterly and south easterly direction following existing road reserves to service the Parramatta Road West civil and tunnel site with a tee connection to the Wattle Street and Haberfield civil and tunnel sites. The existing environmental conditions in this area of interest are shown in **Figure 7-1** and **Figure 7-2** and described in **Table 7-1**.

Table 7-1 Construction power - Haberfield and Ashfield (Options A and B)

Environmental aspect	Existing conditions
Land use	This area is dominated by commercial development along the Parramatta Road corridor, established residential areas located on either side of the corridor and various open spaces. The area is relatively flat although there is a gentle fall from Parramatta Road in an easterly direction toward Iron Cove. Along this section of Parramatta Road, commercial development lines both sides of the road. To the south-east of Parramatta Road are established residential areas, including local streets such as Church Street, Henry Street, Lucy Street, Knocklayde Street, Page Avenue and Earl Avenue, Alt street and Bland Street. In this area there is an Ausgrid substation on Croydon Road. Key open spaces include Hammond Park at Frederick Street and areas along Dobroyd Canal (Iron Cove Creek) to the east of Parramatta Road. Works associated with the M4 East project are continuing in the area around Parramatta Road and Wattle Street until 2019.
Traffic and transport	Major roads within the investigation area include: · Parramatta Road, which has three lanes of traffic in each direction, operational clearways and is generally congested during peak hours · Wattle Street, which has two lanes of traffic in each direction · Frederick Street and Croydon Road, which both have one lane of traffic in each direction and limited on-street car parking. Other roads within the area of investigation are primarily residential streets with one lane of traffic in each direction, on street parking and footpaths on either side of the road. Bus services operate along Parramatta Road, Frederick Street and John Street.

Environmental aspect	Existing conditions
Non-Aboriginal Heritage	A number of listed non-Aboriginal heritage items are located within the investigation area. The items are listed under the Ashfield LEP or Roads and Maritime's Heritage and the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW) and include: · Roads and Maritime heritage items at 19, 21 and 23 Wattle Street, Haberfield (Roads and Maritime section 170 register) · House at 9 Wattle Street, Haberfield (local significance) · House at 30 Page Avenue, Ashfield (local significance) · Public reserve (Hammond Park) at Frederick Street, Ashfield (local significance) · Houses at 11–11a, 27–29, 31–33, 30–38 Lucy Street, Ashfield (local significance) · Houses at 1 and 43 John Street, Ashfield (local significance) · Houses at 82 and 86 Charlotte Street, Ashfield (local significance) · Houses at 18, 22 and 26 Julia Street, Ashfield (local significance) · Dobroyd Canal (Iron Cove Creek) (local significance) · Commercial building (Bunnings Warehouse) at 476 Parramatta Road (local significance) · Infants Home at 17 Henry Street (local significance). The investigation area also includes the following heritage conservation areas under the Ashfield LEP: · The Ranch Conservation Area to the west of Parramatta Road and north of Frederick Street · Hammond Park Estate Conservation Area to the north of Frederick Street in the vicinity of Hammond Park · Lucy Street Conservation Area to the north of Frederick Street and west of Church Street · Haberfield Heritage Conservation Area east of Parramatta Road and extending both north and south of Wattle Street/Dobroyd Parade.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, sensitive receivers within and adjacent to the investigation area include: · Bupa Aged Care Ashfield at 126–128 Frederick Street, Ashfield · Mini-Skool Early Learning Centre at 195 Croydon Road, Croydon · Robyn Taylor Child Development Centre at 65 Church Street, Croydon · Little VIPs Child Care at 113 Dobroyd Parade, Haberfield · St John’s Anglican Church at 81 Alt Street, Ashfield · St John’s Pre-School at 64 Bland Street, Ashfield · The Infants Home at 17 Henry Street, Ashfield · Haberfield Public School at Bland Street, Haberfield.

Environmental aspect	Existing conditions
Waterways and biodiversity	Dobroyd Canal (Iron Cove Creek) is a concrete lined channel that runs under Parramatta Road and to the east where it drains into Iron Cove. Areas bordering Dobroyd Canal (Iron Cove Creek) are landscaped. Dobroyd Canal (Iron Cove Creek) is located along the northern extent of the investigation area. Vegetation within the investigation area is primarily limited to mature trees of various sizes contained within residential property boundaries. There are a number of mature trees, including significant trees and landscaped vegetation within Hammond Park at Frederick Street.
Geology, soils and contamination	The investigation area includes land classified as Class 5 acid sulphate soils and there are no adjacent Class 1, 2, 3 or 4 lands. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area. Soils landscapes within the investigation area include: · Disturbed terrain soil landscape surrounding Dobroyd Canal (Iron Cove Creek) · Gymea – erosional soil landscape for the majority of the investigation area between Dobroyd Canal (Iron Cove Creek) and Frederick Street/Wattle Street · Blacktown – soil residual landscape for the area beginning at Frederick Street/Wattle Street and extending south. The investigation area consists of the Ashfield Shale (black to dark grey shale and laminate) geological formation. The investigation area does not include any sites identified on the NSW Environment Protection Authority (NSW EPA) Contaminated Lands Register or on the list of NSW Contaminated Sites notified to NSW EPA.
Noise environment	Background noise in this area is dominated by traffic on the major roads in particular Parramatta Road, Wattle Street/Dobroyd Parade and Frederick Street, and construction noise from the M4 East project. The investigation area falls with Noise Catchment Area (NCA) 01 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

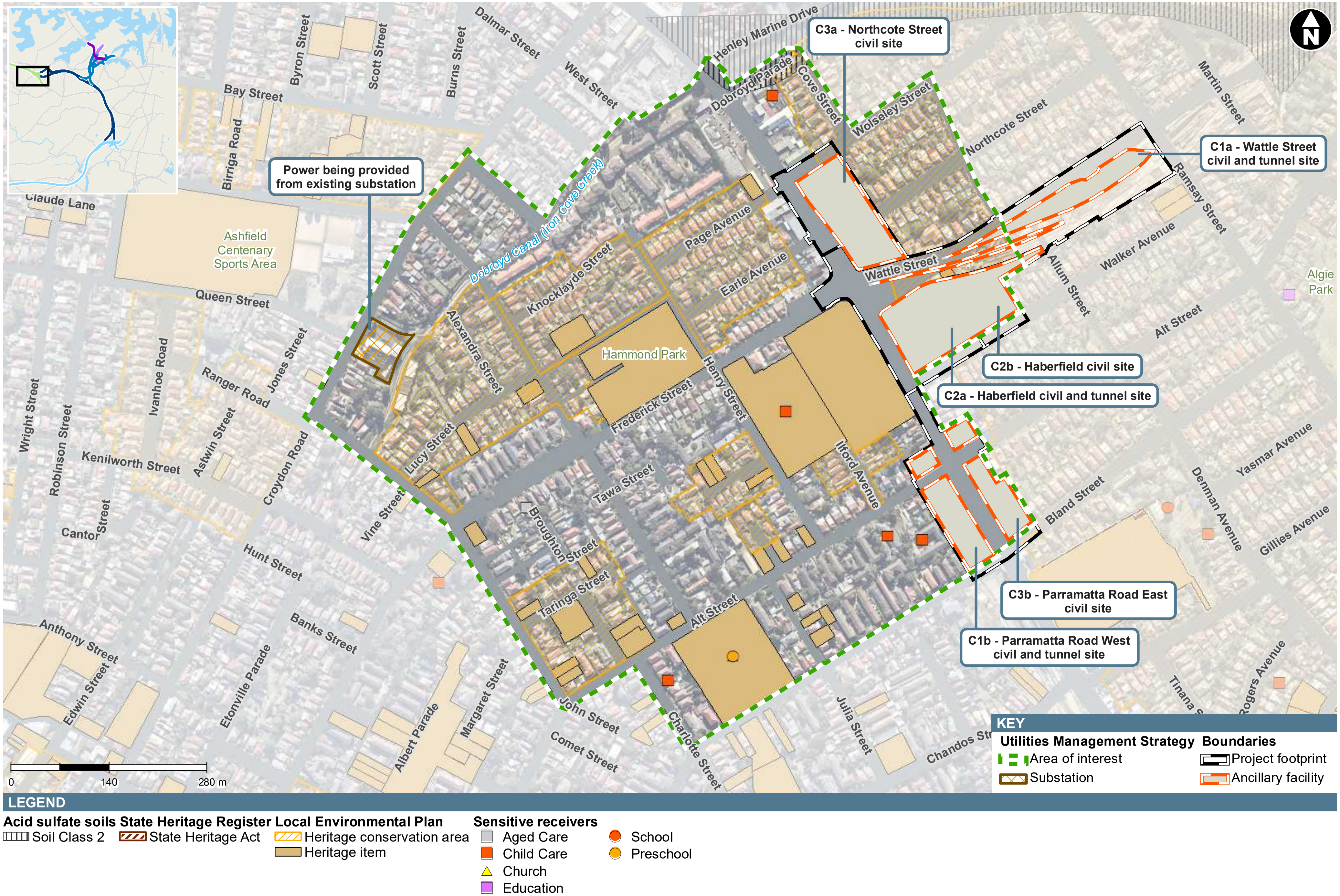


Figure 7-1 Construction power - Haberfield and Ashfield (Options A and B) environmental constraints 1 of 2

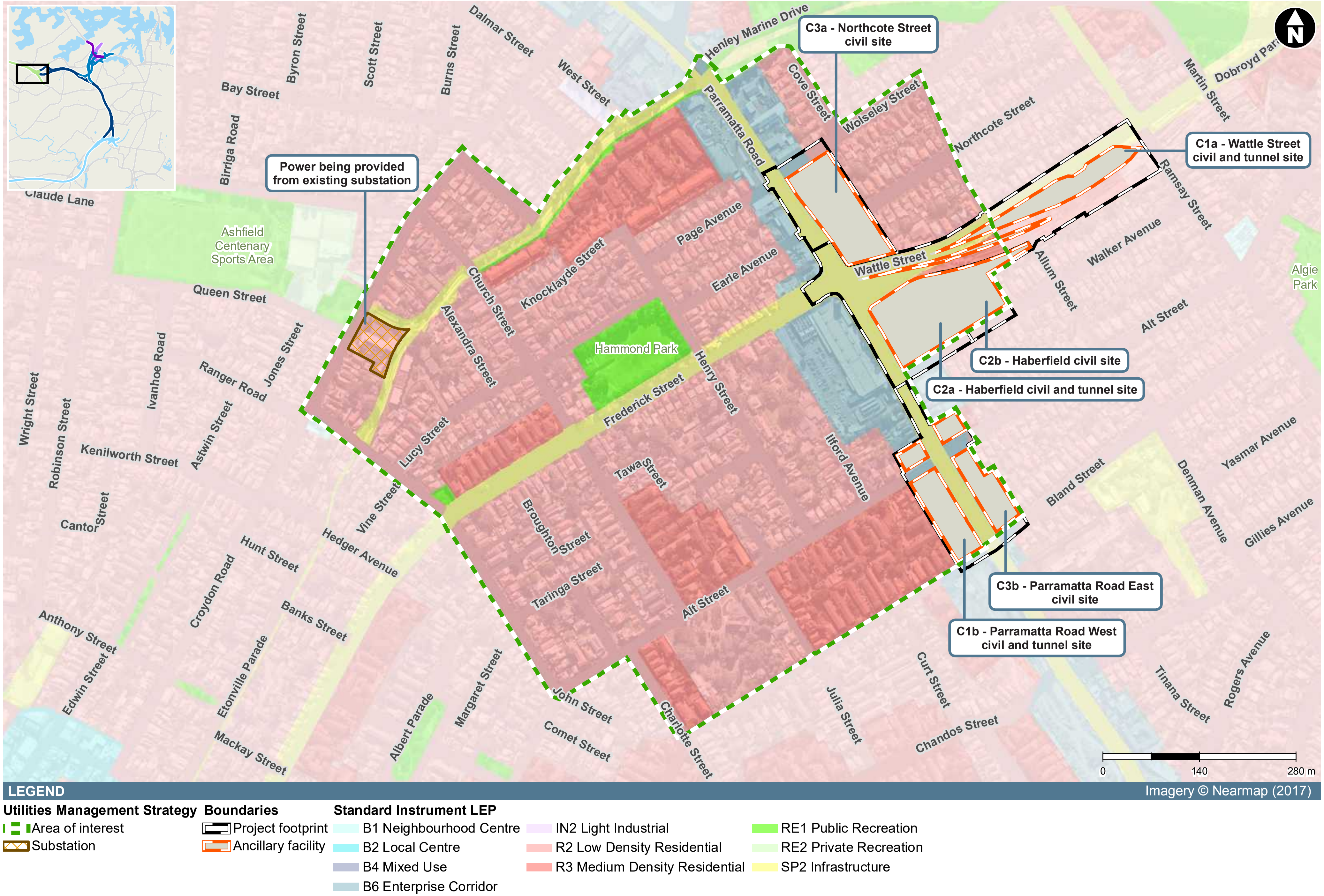


Figure 7-2 Construction power - Haberfield and Ashfield (Options A and B) environmental constraints 2 of 2

7.3 Construction power - Darley Road Leichhardt

As detailed in **section 4.1.4**, the construction power connection will run from the Ausgrid substation on Balmain Road at Leichhardt in a north-westerly direction to the Darley Road civil and tunnel site (C4) following existing road reserves. The existing environmental conditions in this area of interest are shown on **Figure 7-3** and **Figure 7-4** and are described in **Table 7-2**.

Table 7-2 Construction power – Darley Road, Leichhardt

Environmental aspect	Existing conditions
Land use	The Darley Road site is occupied by a commercial building. To the north, the site adjoins the Inner West Light Rail line and the Leichhardt North Light Rail stop and further to the north is City West Link. To the south of the site across Darley Road is an established residential area. Commercial and mixed-use development is located along sections of Norton Street. There is also a small area of industrial/commercial development located on William Street between North Street and Francis Street. Other notable land uses within and adjacent to this area include the Sydney Secondary College Leichhardt and State Transit Authority (STA) bus depot on Balmain Road, Pioneers Memorial Park in Norton Street and Blackmore Park to the north west of Darley Road and the light rail corridor.
Traffic and transport	Major roads within the investigation area include: · City West Link at the north of the investigation area, which is major road with between two to three lanes of traffic in each direction · Darley Road is a collector road with one lane of traffic in each direction and on-street car parking. The signalised intersection of City West Link and Darley Road is quite busy and traffic queues back from this intersection during the morning and afternoon peak periods · Derbyshire Road is a narrow road with one lane of traffic and some provision for on-street parking. Bollards are located along Derbyshire Road adjacent to the Sydney Secondary College Leichhardt and restrict through traffic movements · Norton Street has one lane of traffic in each direction, restricted on-street parking and runs through the Leichardt town centre. Other roads within the area of investigation are primarily residential streets with one lane of traffic in each direction, on-street parking and footpaths on either side of the road. The Leichhardt North Light Rail stop is located to the south of City West Link near the corner of Darley Road. Bus services operate along Norton Street, Derbyshire Road, Balmain Road, Allen Street and Carlisle Street.

Environmental aspect	Existing conditions
Non-Aboriginal Heritage	A number of listed non-Aboriginal heritage items are located within and adjacent to the investigation area. The items are listed under the Leichhardt LEP and the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW) and include: · RailCorp heritage area (Charles Street Rail Bridge) at Charles Street, Leichhardt · Street trees – at Henry Street, Leichhardt (local significance) · Pioneers Memorial Park at Norton Street Leichhardt (local significance) · Former general store, including interiors at 20–22 Forster Street, Leichhardt (local significance) · Leichhardt hotel, including interiors at 1 Short Street, Leichhardt (local significance) · Royal Hotel, including interiors at 156 Norton Street, Leichhardt (local significance) · Charles Street rail bridge which is on the Railcorp section 170 Heritage and Conservation Register (local significance) · The former SRA cable store and traffic office (local significance). The investigation also includes the following heritage conservation areas under the Leichhardt LEP: · Whaleyborough Estate Heritage Conservation Area located between Cromwell Street and Norton Street · Wetherill Estate Heritage Conservation Area located between North Street and Derbyshire Road south of Allen Street · Leichhardt Street/Stanley Street Heritage Conservation Area.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, sensitive receivers within and adjacent to the investigation area include: · Only About Children Leichardt, 215 Elswick Street, Leichhardt · St Columba's Primary School Leichhardt North · Sydney Secondary College Leichhardt on Balmain Road, Leichhardt.
Waterways and biodiversity	There are no waterways within the investigation area. The closest watercourses are located at Hawthorne Canal to the west and Whites Creek to the east. Vegetation within the investigation area is primarily limited to mature street trees of various sizes and vegetation within private properties. There are a number of mature trees located within Pioneers Memorial Park, Blackmore Park, within parts of the Sydney Secondary College Leichhardt and along sections of the light rail corridor. There are heritage listed street trees located within the road reserve at Henry Street, Leichhardt which are identified under the Leichhardt LEP as having local significance.

Environmental aspect	Existing conditions
Geology, soils and contamination	The investigation area includes land classified as Class 5 acid sulphate soils and there are no adjacent Class 1, 2, 3 or 4 lands. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area. Soils landscapes within the investigation area include: · Gymea – erosional soil landscape generally west of Norton Street · Blacktown – residual soil landscape generally east of Norton Street. The investigation area consists of the Ashfield Shale (black to dark grey shale and laminate) geological formation for the area generally east of Francis Street and the geological formation consisting of a lithology of medium to coarse grained quartz sandstone generally west of Francis Street. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register. The State Transit – Leichhardt Depot is located immediately to the east of the investigation area at the corner of Balmain Road and City West Link and is currently listed as 'under assessment' on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	Background noise in the north of the investigation area is dominated by traffic on City West Link. In other areas, background noise is associated with traffic on streets such as Darley Road, Norton Street, Balmain Road and Derbyshire Road. There is also occasional noise associated with the operation of flight paths from Sydney Airport. The investigation area primarily falls with NCAs 12, 13 and 14 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

Figure 7-3 Construction power - Darley Road, Leichhardt environmental constraints 1 of 2

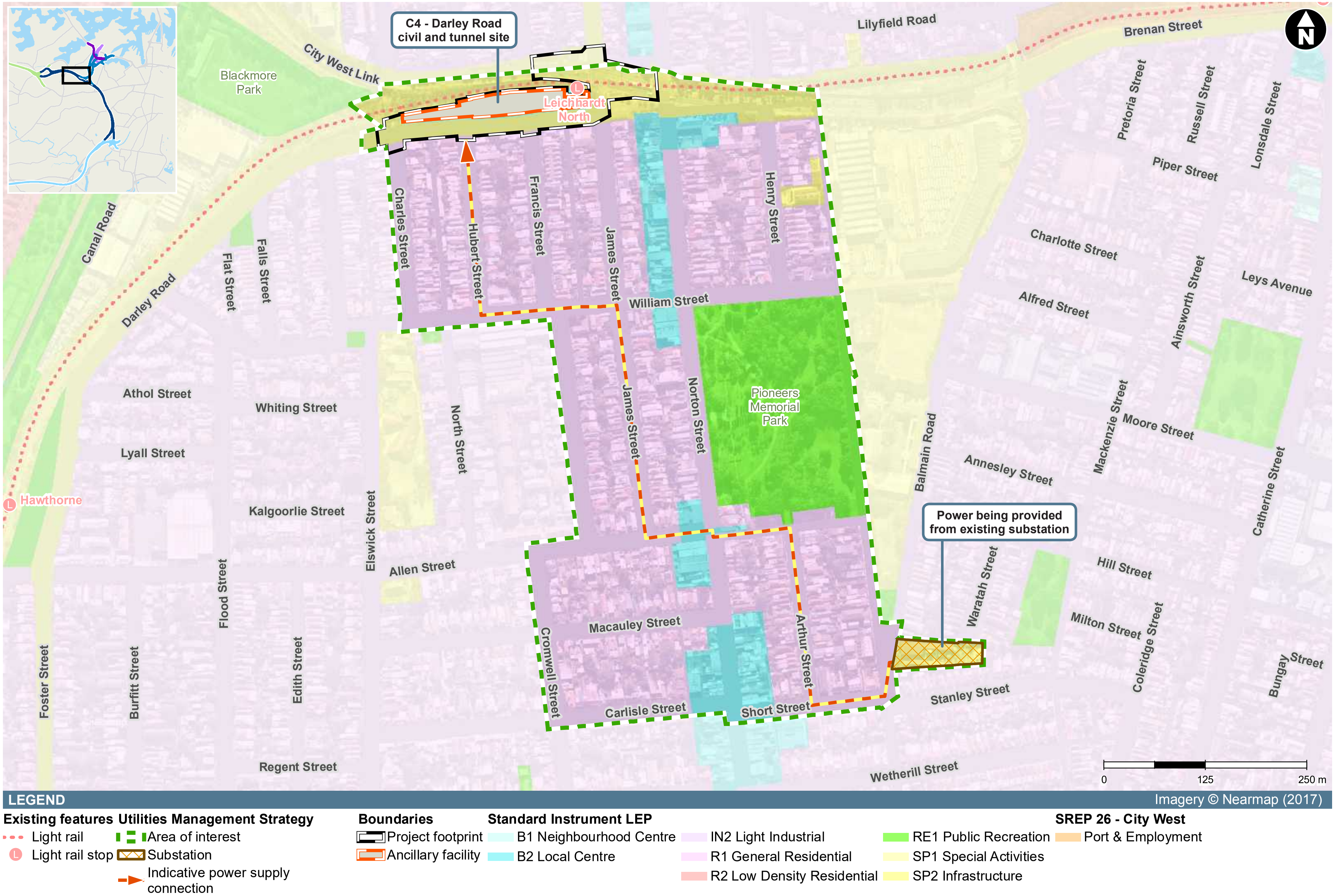


Figure 7-4 Construction power - Darley Road, Leichhardt environmental constraints 2 of 2

7.4 Drainage infrastructure - Canal Road, Leichhardt

As detailed in **section 5.4**, the drainage infrastructure from the Darley Road water treatment plant to Hawthorne Canal will generally follow the existing road reserve along Canal Road. The existing environmental conditions in this area of interest are shown on **Figure 7-5** and **Figure 7-6** and are described in **Table 7-3**.

Table 7-3 Drainage infrastructure – Canal Road, Leichhardt

Environmental aspect	Existing conditions
Land use	Land use within the investigation area generally consists of Blackmore Oval and its amenities, the Inner West Light Rail Corridor and vegetated areas surrounding Blackmore Oval. Land uses surrounding the investigation area include City West Link to the north and the Canal Road arts precinct to the south. Areas of open space within the investigation area include Blackmore Oval and also areas along either side of Hawthorne Canal. Residential areas are located to the south east across the light rail corridor and Darley Road and to the north across City West Link.
Traffic and transport	Roads within and adjacent to the investigation area include: · City West Link at the north of the investigation area, which is major road with two lanes from the west merging into three lanes at James Street to the east · Darley Road, which has one lane of traffic in each direction and on street parking on both sides of the road · Charles Street and Canal Road which run parallel to City West Link and Hawthorne Canal respectively. Both roads have one lane of traffic in each direction and Canal Road has parking areas facing the Hawthorne Canal. The Leichhardt North Light Rail stop is located to the east of the investigation area between City West Link and Darley Road. The Inner West Light Rail line runs east-west in this location within the investigation area.
Non-Aboriginal Heritage	The Hawthorne Canal Stormwater Channel No. 62 located to the west of the investigation area is listed on the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW) The Charles Street Rail Bridge near the intersection of Charles Street and Darley Road is also listed on the RailCorp section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW).
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Based on the desktop assessment, sensitive receivers within and adjacent to the investigation area include recreational users of Blackmore Oval and Billy Kids Kindergarten located to the north of the investigation area at 64 Charles Street, Lilyfield.
Waterways and biodiversity	The Hawthorne Canal is located immediately adjacent to the west of the investigation area. Hawthorne Canal is an artificial stormwater canal that joins the Parramatta River (Iron Cove) to the north. There is also a small wetland area to the north of Blackmore Oval. The area immediately surrounding Blackmore Park is vegetated consisting primarily of grasses and mature trees. This area is most densely vegetated directly to the east of Blackmore Park and around the wetland area. There are groups of mature trees located along Canal Road and Hawthorne Canal.

Environmental aspect	Existing conditions
Geology, soils and contamination	The investigation area includes land primarily classified as Class 2 acid sulphate soils. Acid sulphate soils are likely to be encountered for works below the natural ground surface. Soils landscapes within the investigation generally include the Gymea – erosional soil landscape. The investigation area generally is comprised of the geological formation consisting of a lithology of medium to coarse grained quartz sandstone. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register or the List of NSW contaminated sites notified to NSW EPA.
Noise environment	The background noise environment would be primary influenced by traffic on City West Link and to a lesser extent on Darley Road and by the operation of the light rail line. The investigation area falls with NCA 08 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

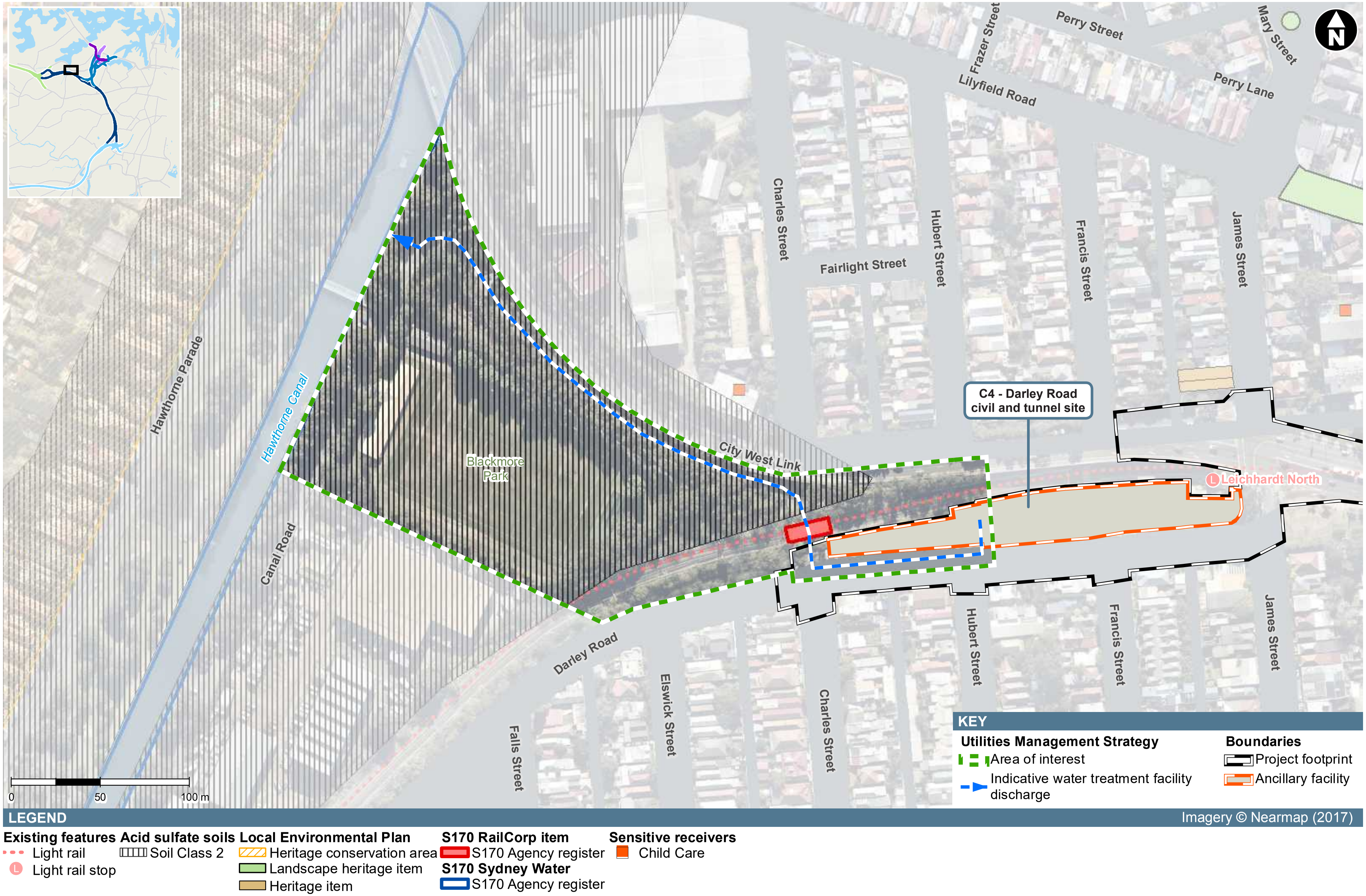


Figure 7-5 Water treatment plant discharge - Canal Road, Leichhardt environmental constraints 1 of 2

Figure 7-6 Water treatment plant discharge - Canal Road, Leichhardt environmental constraints 2 of 2

7.5 Construction power - Rozelle

As detailed in **section 4.1.5**, the construction power connection will run from the Ausgrid substation on Balmain Road at Leichhardt in a north-easterly direction through Lilyfield to the Rozelle civil and tunnel site (C5) following existing road reserves. The existing environmental conditions in this area of interest are shown on **Figure 7-7** and **Figure 7-8** and are described in **Table 7-4**.

Table 7-4 Construction power - Rozelle

Environmental aspect	Existing conditions
Land use	Land uses located between City West Link and Leichardt Road are primarily residential. The STA – Leichhardt Depot and Sydney Secondary College Leichhardt Campus are located west of Balmain Road and south of City West Link and there is a small commercial precinct on Moore Street west of Mackenzie Street. In the north of the investigation area land uses consists of City West Link, the Inner West Light Rail corridor, the Rozelle Rail Yards and residential properties to the north of Lilyfield Road. Areas of open space within the investigation area include: · War Memorial Park at 39–73 Moore Street, Leichhardt · 36th Battalion Park at Mackenzie Street and Hill Street, Leichhardt and · Active recreation area on Balmain Road adjacent to the Sydney Secondary College, Leichhardt.
Traffic and transport	Major roads within the investigation area include: · City West Link at the north of the investigation area, which is a major road with two lanes from the west merging into three lanes at James Street to the east · Balmain Road which has one to two lanes of traffic in each direction, limited on-street parking and is subject to school zone speed limits during school hours · Lilyfield Road has one lane of traffic in each direction, on-street parking and cycle ways · Catherine Street, which has one lane of traffic in each direction, on-street parking and cycle ways. Other roads within the area of investigation are primarily residential streets with one lane of traffic in each direction, on-street parking and footpaths on either side of the road. The STA – Leichhardt Depot is located east of Balmain Road, south of City West Link. Bus services operate along Catherine Street, Balmain Road, Piper Street and Moore Street.

Environmental aspect	Existing conditions
Non-Aboriginal Heritage	A number of listed non-Aboriginal heritage items are located within the investigation area. The items are listed under the Leichhardt LEP, Sydney Regional Environmental Plan No 26 – City West (SREP 26) or the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW)) and include: · Catherine Street Railways Bridge (listed under SREP 26) · Street trees – Brush Box plantation at Leys Avenue, Leichhardt (local significance) · Former factory, including interiors at 111 Moore Street, Leichhardt (local significance) · Street trees – row of Port Jackson Figs at Catherine Street (south of Moore Street), Leichhardt (local significance) · Child care centre 'Rose Cottage' including interiors at 1 Coleridge Street, Leichhardt (local significance) · Former State Rail Authority (SRA) Tram shed, including interiors at 25 Derbyshire Road, Leichhardt (local significance) · Former SRA cable store and traffic office, including interiors 29 Derbyshire Road, Leichhardt (local significance) · Department of Education (Sydney Secondary College) at 210 Balmain Road, Leichhardt (local significance). The investigation also includes the following heritage conservation areas under the Leichhardt LEP: · Wetherill Estate Heritage Conservation Area located between North Street and Derbyshire Road south of Allen Street.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, sensitive receivers in the investigation area include: · Annandale Veterinary Hospital at 62 Moore Street, Annandale · My Stepping Stones (Child Care Centre), at 75 Moore Street, Leichhardt.
Waterways and biodiversity	There are no waterways within the investigation area. Vegetation within the investigation area is primarily limited to mature street trees of various sizes located between local roads and property boundaries. There are a number of mature trees, including significant trees and landscaped vegetation on the boundary of War Memorial Park, 36th Battalion Park and Sydney Secondary College Leichhardt. There are heritage listed street trees on Leys Avenue (Brush Box plantation) and Catherine Street south of Moore Street (row of Port Jackson Figs) which are identified under the Leichhardt LEP as having local significance. There is a significant area of vegetation located between the light rail corridor and Lilyfield Road east of Balmain Road in the north western extent of the investigation area.

Environmental aspect	Existing conditions
Geology, soils and contamination	The investigation area includes land classified as Class 3 acid sulfate soils in the north of the investigation area extending from the Rozelle Rail Yards to Balmain Road to the north west of Brenan Street. The remaining land is classified as Class 5 acid sulfate soils and there are no adjacent Class 1, 2, 3 or 4 lands other than the Class 3 land identified in the north. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area south of Brenan Street. Soils landscapes within the investigation area include: · Disturbed terrain soil landscape generally within the Rozelle Rail Yards · Gymea – erosional soil landscape generally east of Catherine Street · Blacktown – residual soil landscape generally west of Catherine Street. The investigation area consists of the Ashfield Shale (black to dark grey shale and laminate) geological formation for the area generally west of Catherine Street and the geological formation consisting of a lithology of medium to coarse grained quartz sandstone generally east of Catherine Street. The area around the Rozelle Rail Yards is defined as man-made fill overlying silty to peaty quartz sand. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register. The State Transit – Leichhardt Depot is located immediately to the east of the investigation area at the corner of Balmain Road and City West Link and is currently listed as 'under assessment' on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	Background noise in the north of the investigation area is dominated by traffic on City West Link. Background noise would also be influenced by bus movements to and from the State Transit – Leichhardt Depot. There is also occasional noise associated with the operation of flight paths from Sydney Airport. The investigation area falls primarily within NCAs 15, 16 and 17 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

Figure 7-7 Construction power - Rozelle environmental constraints 1 of 2

Figure 7-8 Construction power - Rozelle environmental constraints 2 of 2

7.6 Operational power – Rozelle interchange

As detailed in **section 4.2.4** there are two options for provision of a permanent operational power to the Rozelle interchange – Options A and B.

7.6.1 Option A – Iron Cove

One of the options for the permanent power connection (Option A) will run from the Ausgrid substation on Manning Street, Rozelle in an easterly direction to the Iron Cove substation near Victoria Road following existing road reserves. It is also possible that this area could be used for utility works as outlined in **section 3.5**.

The existing environmental conditions in this area of interest are shown on **Figure 7-9** and **Figure 7-10** and are described in **Table 7-5.**

Table 7-5 Operational power – Iron Cove (Option A)

Environmental aspect	Existing conditions
Land use	The investigation area includes primarily an established residential area of Rozelle with some limited commercial development including a car dealership and liquor store fronting Victoria Road and an area of open space (King George Park) adjacent to Iron Cove Bridge. The topography of this area falls toward Iron Cove to the north-west and toward Manning Street and King George Park in the south-west. The residential area includes a number of local streets that run between Victoria Road and Manning Street, a number of which are relatively narrow and quite steep. King George Park forms part of a network of open space along this eastern shoreline of Iron Cove. The Bay Run is a regional pedestrian and cycling link which runs around Iron Cove and joins Iron Cove Bridge near Byrnes Street. A car parking area is available along Manning Street to serve King George Park. There is also an existing substation located in Manning Street adjacent to King George Park.
Traffic and transport	Victoria Road is a major road on the eastern extent of the investigation area with three to four lanes of traffic in each direction. It has limited on-street parking and clearways and bus lanes operating during peak hours. Bus services operate along both sides of Victoria Road. Local streets within the investigation area include Byrnes Street, Clubb Street, Toelle Street, Callan Street, Springside Street, Moodie Street, Manning Street and McCleer Street. For the most part, these are residential streets with on-street parking and footpaths on either side of the road. A number of these streets are narrow, with only one effective trafficable lane due to on-street parking.
Non-Aboriginal Heritage	There are no listed non-Aboriginal sites within the investigation area. The closest site is Iron Cove Bridge which is identified as being of local significance under the SREP 26. There are no Heritage Conservation Areas within the investigation area. The closest is the Iron Cove Heritage Conservation Area on the north east side of Victoria Road.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area. The King George Park Draft Plan of Management referred to "incomplete" land claims lodged by Metropolitan Local Aboriginal Land Council.
Sensitive receivers	Other than the residential land uses described above, there is a children's playground located within King George Park to the north of Byrnes Street. There are no other sensitive receivers within the investigation area.
Waterways and	Iron Cove is located immediately to the north of the investigation area.

Environmental aspect	Existing conditions
biodiversity	A number of mature trees are located within King George Park and along the foreshore area of Iron Cove. Small to medium size street trees are located within a number of the local streets and within the boundary of some residential properties.
Geology, soils and contamination	The investigation area primarily includes land classified as Class 5 acid sulfate soils. There is a discrete area of Class 2 acid sulfate soils extending east from Iron Cove adjacent to Manning Street towards the existing substation. There is the possibility of encountering acid sulfate soils for activities which are likely to lower the water table below one metre within 500 metres of the Class 2 acid sulfate soils land. Soils landscapes within the investigation area consist of the Gymea – erosional soil landscape east of Manning Street and the Hawkesbury – colluvial soil landscape west of Manning Street. The investigation area consists of a lithology of medium to coarse grained quartz sandstone east of Manning Street and man-made fill overlying silty to peaty quartz sand west of Manning Street. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register. The service station located to the south east at 178–180 Victoria Road is currently identified on the List of NSW contaminated sites notified to NSW EPA, however, it is identified as 'Regulation under the *Contaminated Land Management Act 1997* not required'.
Noise environment	Background noise in the investigation area is dominated by traffic on Victoria Road and also occasional noise associated with the operation of flight paths from Sydney Airport. The investigation area falls primarily within NCAs 33 and 36 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

Figure 7-9 Operational power - Iron Cove environmental constraints 1 of 2

Figure 7-10 Operational power - Iron Cove environmental constraints 2 of 2

7.6.2 Option B - Rozelle

As detailed in **section 4.2.4**, one of the options for permanent power connection (Option B) will run from the Ausgrid substation on Manning Street, Rozelle in a southerly direction through to a substation in the Rozelle Rail Yards following existing road reserves.

The existing environmental conditions in this area of interest are shown on **Figure 7-11** and **Figure 7-12** and are described in **Table 7-6**.

Table 7-6 Operational power – Rozelle (Option B)

Environmental aspect	Existing conditions
Land use	Land uses within the investigation area are primarily residential although there is some commercial land use along sections of Darling Street/Balmain Road and Lilyfield Road. There are a number of open space areas within and adjacent to the investigation area such as Easton Park, Rozelle Commons and King George Park.
Traffic and transport	Roads within the investigation area primarily consist of local residential streets with one lane of traffic in each direction, footpaths and on street parking and laneways. Many of the local streets are quite narrow. Major roads in the vicinity of the investigation area include Victoria Road and Darling Street/Balmain Road. Bus services run along both of these roads.
Non-Aboriginal Heritage	Non-Aboriginal heritage items listed under the State Heritage Register and the Leichhardt LEP include: · Callan Park Conservation Area & Buildings at Balmain Road and Manning Street (state significance) · Maxwell House, including interiors at 757 Darling Street (local significance) · Former Fire Brigade/Ambulance Training Centre, including interiors at 747 Darling Street (local significance) · Single storey shops, including interiors at 735 Darling Street (local significance) · Former Police Station, including interiors at 707 Darling Street (local significance) · Single storey commercial building, including interiors at 736 Darling Street (local significance) · A number of listed terrace housing items between Red Lion Street and Belmore Street near Darling Street (local significance) · House, 'Hornsey' including interiors at 42 Hornsey Street (local significance) · House, including interiors at 206 Evans Street · Easton Park (local significance) · Sydney Water sewage pumping station No.6 listed on the section170 NSW State agency heritage register · Semi-detached house, including interiors at 15 and 17 Burt Street (local significance) · Former shop and residence, including interiors at 60 and 62 Ryan Street (local significance) · Cottage and former broom factory, including interiors at 84 Foucart Street (local significance)

Environmental aspect	Existing conditions
	· Semi-detached house, including interiors at 120A and 122 Foucart Street (local significance) · Smith's Hall, including interiors at 56 Burt Street (local significance) · Corner shop and residence, including interiors at 67 Denison Street (local significance) · Shop and residence, including interiors at 69 Denison Street (local significance) · House, 'Rotherhithe Cottage' including interiors at 73 Denison Street (local significance). The investigation also includes the following heritage conservation areas listed under the Leichhardt LEP: · Brennan's Estate Heritage Conservation Area · Easton Park Heritage Conservation Area · Hornsey Street Heritage Conservation Area · The Valley Heritage Conservation Area.
Aboriginal Heritage	Lilyfield Cave (site card 45-6-2278), located at Lamb Street near Lilyfield Road is a closed site listed on the Aboriginal Heritage Information Management System (AHIMS).
Sensitive receivers	Other than the residential land uses described above, sensitive receivers within the investigation area include: · Rosebud Cottage Child Care, located at 5 Quirk Street, Rozelle · Lilyfield Community Centre located at 19 Cecily Street, Lilyfield.
Waterways and biodiversity	There are no waterways within the investigation area. Mature trees are concentrated around areas of open space including Easton Park and Rozelle Commons Park at Cook Street. There are a number of significant trees located on or near the residential streets south of Balmain Road, including but not limited to Cook Street, Denison Street and the streets running parallel between Justin Street and Cecily Street.
Geology, soils and contamination	The investigation area includes land primarily classified as Class 5 acid sulfate soils. There is an area of land classified as Class 2 acid sulfate soils near King George Park and an area of land classified as Class 1 acid sulfate soils at Easton Park. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area, other than in proximity to King George Park and Easton Park. The investigation area consists primarily of the Gymea – erosional soil landscape. There is an area of disturbed terrain at the southern extent of the investigation area south of Lilyfield Road. The investigation area consists primarily of a lithology of medium to coarse grained sandstone. There is an area of man-made fill at the southern extent of the investigation area south of Lilyfield Road. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register or on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	The background noise environment would be primarily influenced by traffic on major roads such as Victoria Road, Darling Street/Balmain Road, Lilyfield Road and City West Link and also occasional noise associated with the operation of flight paths from Sydney Airport. The investigation area falls primarily within NCAs 19, 24, 25, 32 and 33 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

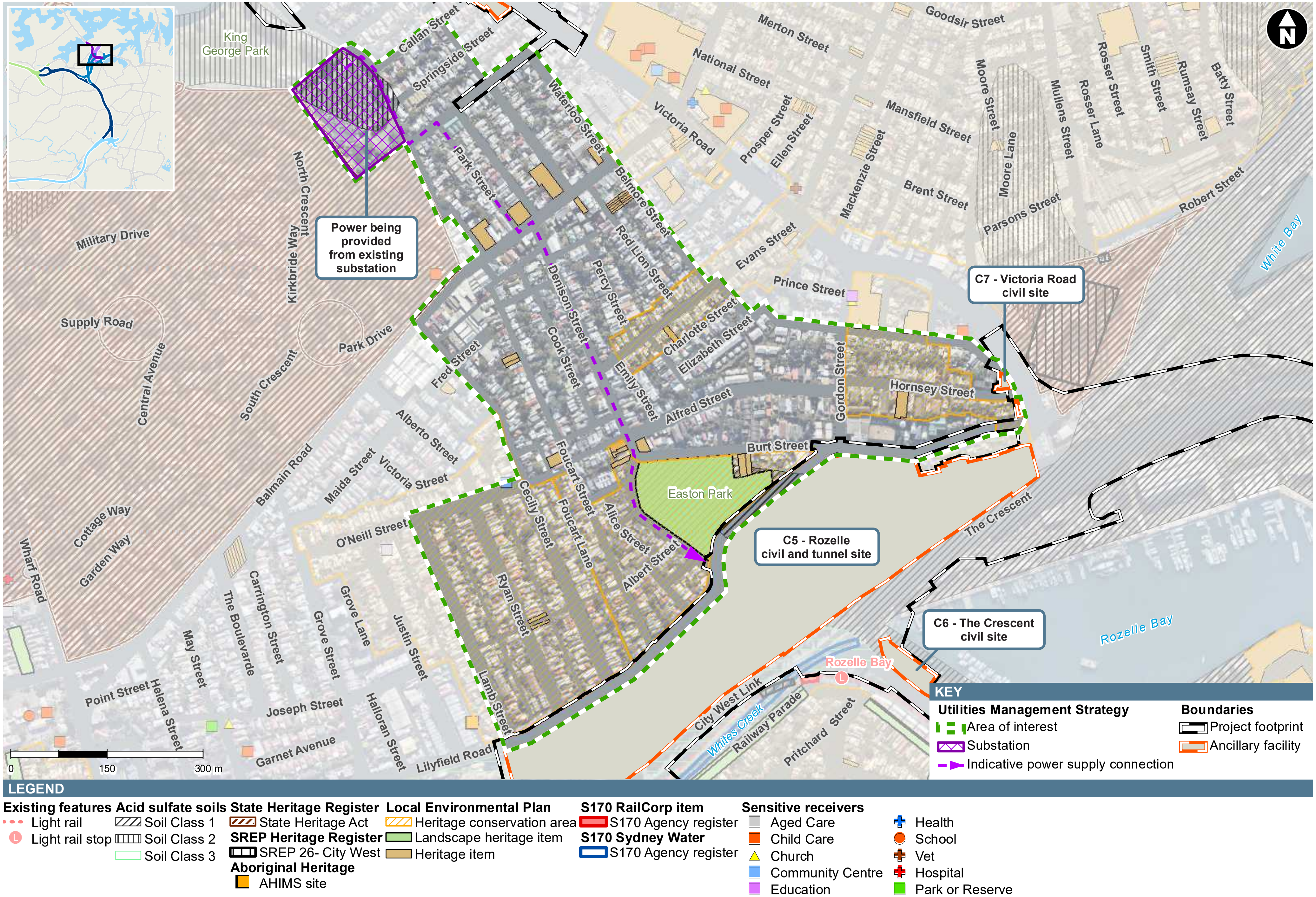


Figure 7-11 Permanent power - Rozelle (Option B) environmental constraints 1 of 2

Figure 7-12 Permanent power - Rozelle (Option B) environmental constraints 2 of 2

7.7 Sydney Trains infrastructure

As detailed in **section 3.4** there are two options for removal and replacement of the Sydney Trains infrastructure from the Rozelle Rail Yards – Options 1 and 2.

7.7.1 Option 1 – Surry Hills

One of the options for relocation of the Sydney Trains switching station in the Rozelle Rail Yards (Option 1) involves reconfiguring the Sydney Trains electricity network to remove the switching station and construct additional feeders outside of the M4-M5 Link project footprint in the Surry Hills area.

This will involve a new electrical feeder connecting between the existing Ausgrid transmission substation at Surry Hills and a Sydney Trains substation in Chalmers Street in the vicinity of Central Station. The existing environmental conditions in this area of interest are shown on **Figure 7-13** and **Figure 7-14** and are described in **Table 7-7**.

Table 7-7 Sydney Trains infrastructure – Surry Hills (Option 1)

Environmental aspect	Existing conditions
Land use	Land use within the investigation area consists primarily of multi-storey mixed use development with ground floor commercial premises below residential apartments. There are pockets of residential land use (terrace housing) on Riley Street, Albion Way and Devonshire Street. There are small pockets of open space located at the western extent of Cooper Street. There are also areas of open space on the north side of Albion Street (Frog Hollow Reserve) and west of Chalmers Street (Prince Alfred Park) within and adjacent to the investigation area respectively. Central Station and the associated rail corridor is located within the western extent of the investigation area.
Traffic and transport	Roads within the investigation area east of Central Station primarily include streets with one lane of traffic in each direction, on street parking and footpaths as well as narrow laneways. Elizabeth Street and Chalmers Street are main roads with multiple traffic lanes in each direction. Riley Street in the eastern extent of the investigation area includes one lane of traffic in each direction and on street parking and cycle lanes on both sides of the road. Foveaux Street includes up to two lanes of traffic in each direction and on street parking.
Non-Aboriginal Heritage	A large number of listed non-Aboriginal heritage items are located within the investigation area. The items are listed under the Sydney LEP, State Heritage Register or the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW). The listed items include (but are not limited to): · Sydney Terminal and Central Railway Stations Group (State significance) · Railway Institute Building at Chalmers Street, Surry Hills (State significance) · Crown Street reservoir, Crown Street, Surry Hills (Sydney Water's section 170 Heritage and Conservation Register) · Crown Street pumping station, Riley Street, Surry Hills (Sydney Water's section 170 heritage register) · Electricity substation No. 63, 112–114 Cooper Street, Surry Hills (section 170 NSW State agency heritage register) · Numerous listed terrace houses primarily concentrated on Riley Street, Surry Hills (local significance) · Royal Exhibition Hotel including interior, 86–92 Chalmers Street, Surry Hills (local significance)

Environmental aspect	Existing conditions
	· Forrester's Hotel including interiors, 332–338 Riley Street, Surry Hills · Former Ford Sherington Trunk Factory including interior, 119–127 Kippax Street, Surry Hills (local significance) · Former 'News Limited' including interior, 61–81 Kippax Street, Surry Hills (local significance) · 1487 Former Prince of Wales Hotel including interior, 33–35 Cooper Street, Surry Hills (local significance) · Evening Star Hotel façade, 8 Cooper Street and 360–370 Elizabeth Street, Surry Hills (local significance) · Former RC Henderson Ltd factory including interiors, 11–13 Randle Street, Surry Hills (local significance) · "Hibernian House" including interior, 328–344 Elizabeth Street, Surry Hills (local significance) · Former 'Metro Goldwyn Mayer' including interior, 20–28 Chalmers Street, Surry Hills (local significance) · Dental Hospital including interior, 2–18 Chalmers Street, Surry Hills (local significance) · Former Farleigh Nettheim & Co Ltd warehouse including interiors, 1–15 Foveaux Street, Surry Hills (local significance) · Former 'Schweppes Building' including interior, 63, 65–67 Foveaux Street, Surry Hills (local significance). The investigation also includes the following heritage conservation areas under the Sydney LEP: · Bourke Street North · Bourke Street South · Reservoir Street and Fosterville · Little Riley Street Conservation Area · Albion Estate Conservation Area · Brumby Street Conservation Area · Cleveland Gardens Conservation Area.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, sensitive receivers within the investigation area include: · SDN Surry Hills Children's Education and Care Centre at 443 Riley Street, Surry Hills · Surry Hills Children's Program Childcare Centre at 402 Riley Street, Surry Hills · SHNC Long Day Care at 405 Crown Street, Surry Hills · Twinkle Twinkle Child Care at 132 Devonshire Street, Surry Hills · Presbyterian Aged Care at 168 Chalmers Street, Surry Hills.

Environmental aspect	Existing conditions
Waterways and biodiversity	There are no waterways within the investigation area. Vegetation within the study area primarily consists of street trees and other landscaped vegetation lining most residential streets. There are also significant mature trees located at the open space areas within or immediately adjacent to the investigation area.
Geology, soils and contamination	The investigation area includes land classified as Class 5 acid sulphate soils and there are no adjacent Class 1, 2, 3 or 4 lands. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area. Soils landscapes within the investigation area consist primarily of the Deep Creek – alluvial and Lucas Heights – residual soil landscape. The investigation area consists of the Ashfield Shale (black to dark grey shale and laminate) geological formation in the western and eastern extent of the investigation area. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register. Legion Cabs (Trading) Cooperative at 69–81 Foveaux Street is listed as 'under assessment' on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	The background noise environment would be primary influenced by the operation of the rail line in proximity to Central Station and by traffic travelling on the road network through the area. The investigation area is in Surry Hills and does not fall within any of NCAs described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

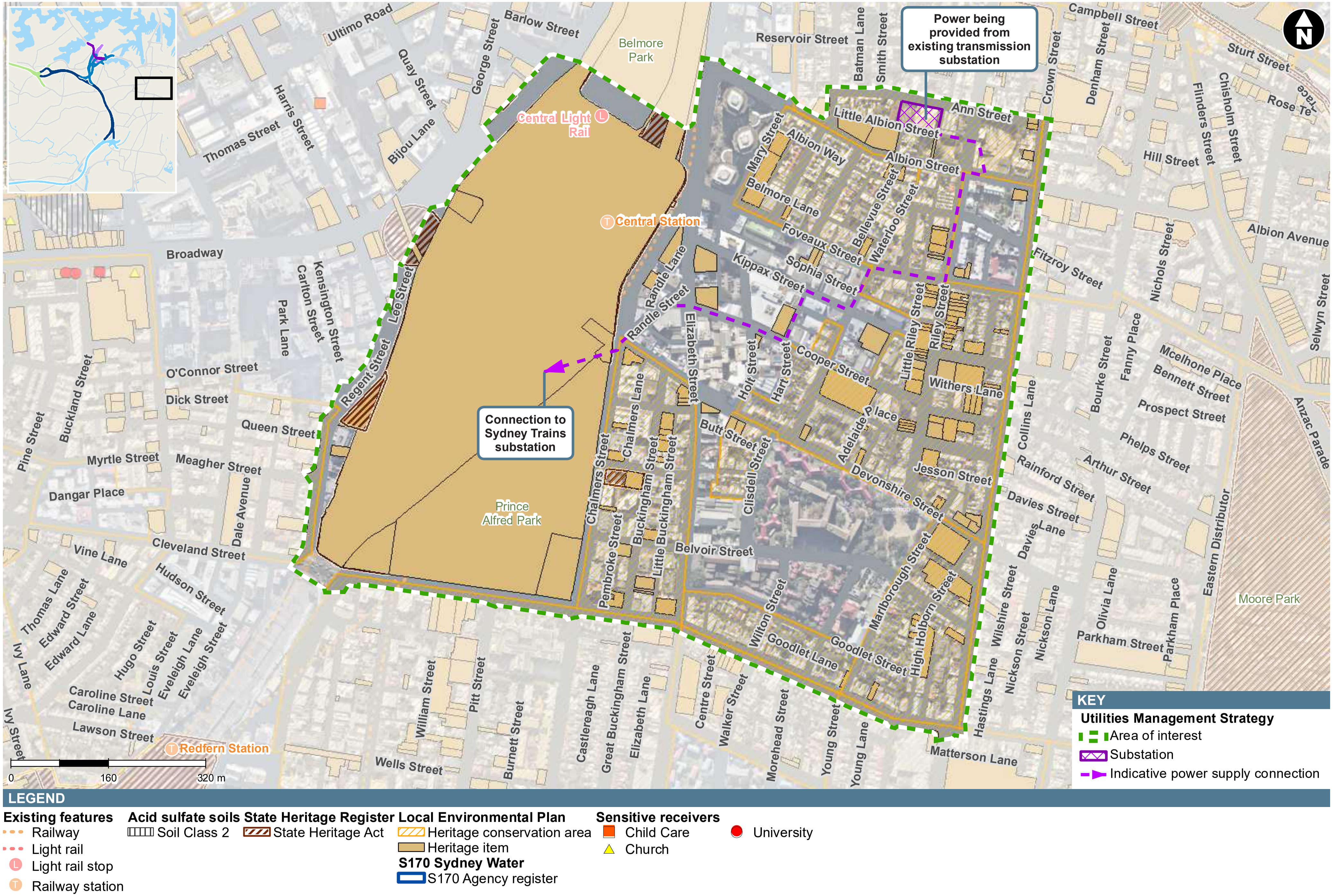


Figure 7-13 Sydney Trains - Surry Hills (Option 1) environmental constraints assessment 1 of 2

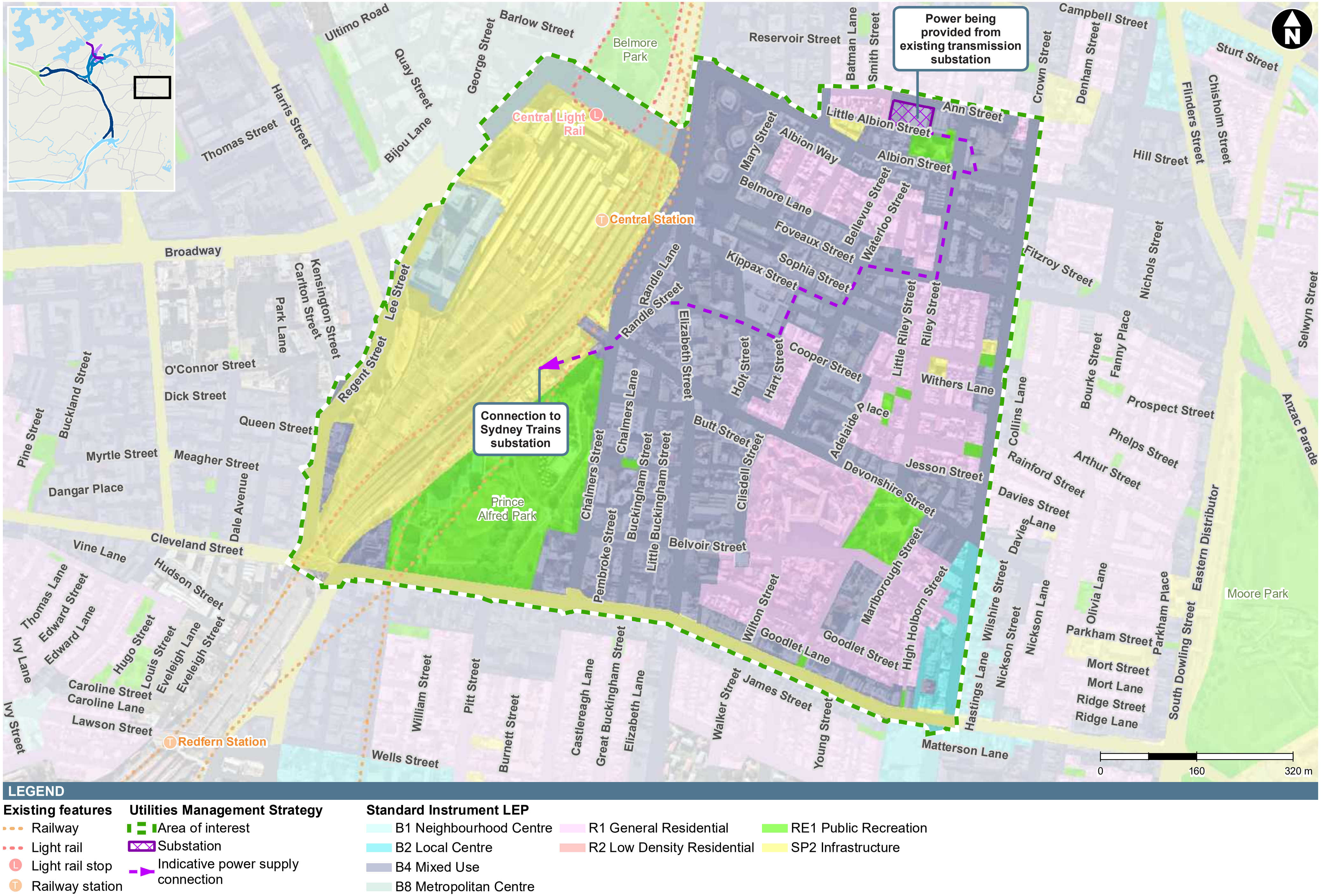


Figure 7-14 Sydney Trains - Surry Hills (Option 1) environmental constraints assessment 2 of 2

7.7.2 Option 2 – Railway Parade, Annandale

As detailed in **section 3.4**, one of the options for relocation of the Sydney Trains switching station in the Rozelle Rail Yards (Option 2) involves either:

- A new site in Railway Parade near the corner of Brenan Street in Annandale which is outside the project footprint; or
- A new site near the corner of James Craig Road and City West Link which is within the project footprint.

A new feeder would also be required to connect with the switching station using existing infrastructure corridors or road reserves. The existing environmental conditions in the Railway Parade, Annandale area of interest which is outside the project footprint are shown on **Figure 7-15** and **Figure 7-16** and are described in **Table 7-8**.

Table 7-8 Sydney Trains infrastructure – Railway Parade, Annandale (Option 2)

Environmental aspect	Existing conditions
Land use	Land use within the investigation area consists primarily of residential properties. There is open space located along the Whites Creek corridor. Major infrastructure within or close to the investigation area includes the Inner West Light Rail corridor and City West Link further to the north.
Traffic and transport	Roads within the investigation area include Brenan Street, Railway Parade, Pritchard Street, Bayview Crescent, Buruwan Lane, Bayview Lane, Kentville Avenue, Kentville Lane, Weynton Street, Johnston Street and The Crescent. Roads within the investigation primarily consist of residential streets with one lane of traffic in each direction, footpaths and on street parking. Johnston Street and parts of The Crescent have two lanes of traffic in each direction and footpaths, while Johnston Street also has areas of on street parking. The Rozelle Bay Light Rail stop is located near the corner of Railway Parade and Bayview Crescent.
Non-Aboriginal Heritage	A number of listed non-Aboriginal heritage items are located within the investigation area. The items are listed under the Leichhardt LEP, SREP 26 or the State Agency section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW) and include: · Sydney Water Whites Creek stormwater channel No.95 listed on Sydney Water's section 170 Heritage and Conservation Register · Arched Bridge, Whites Creek (listed under SREP 26) · Railway Bridge, Railway Parade (listed under SREP 26) · Avenue of Phoenix Canariensis at Railway Parade (local significance) · Street trees, row of palms at Railway Parade (local significance) · Street trees, row of brush box at Bayview Crescent and Johnston Street (local significance) · Iron/sandstone palisade fence at Bayview Crescent (local significance) · Shop and residence, including interiors at 349 Annandale Street. The investigation also includes the Annandale Heritage Conservation Area listed under the Leichhardt LEP.
Aboriginal Heritage	An area of land within the riparian zone of Whites Creek south of Brenan Street has been accepted for registration on the Native Title Register.

Environmental aspect	Existing conditions
Sensitive receivers	Other than the residential land uses described above, there are no sensitive receivers within the investigation area.
Waterways and biodiversity	Whites Creek flows north and east under Brenan Street towards Rozelle Bay. The creek is a concrete lined channel. Vegetation within the investigation area primarily consist of matures street trees within and adjacent to the road corridor. This includes significant mature trees and heritage listed street trees on Railway Parade, Bayview Crescent and Johnston Street. The investigation area also includes the riparian zone along the Whites Creek corridor which consists primarily of mature trees and open space areas.
Geology, soils and contamination	The investigation area includes land classified as Class 1 acid sulfate soils around Brenan Street, Railway Parade and Whites Creek. acid sulfate soils would be encountered for any works one metre below ground surface in this area. The investigation area consists of disturbed terrain soil landscapes generally around Whites Creek and towards the Rozelle Rail Yards and the Gymea – erosion soil landscape in the south western and south eastern extent of the investigation area. The investigation area consists of man-made fill lithology generally around Whites Creek and towards the Rozelle Rail Yards and a lithology of medium to coarse grained quartz sandstone in the south western and south eastern extent of the investigation area. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register or on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	The background noise environment would be primary influenced by traffic on City West Link, The Crescent and Johnston Street and also occasional noise associated with the operation of flight paths from Sydney Airport. The investigation area falls primarily within NCAs 20 and 21 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

Figure 7-15 Sydney Trains - Railway Parade, Annandale (Option 2) environmental constraints 1 of 2

Figure 7-16 Sydney Trains - Railway Parade, Annandale (Option 2) environmental constraints 2 of 2

7.8 Construction power – Pyrmont Bridge Road, Annandale

As detailed in **section 4.1.6**, the construction power connection will run from the Ausgrid substation on Layton Street, Annandale in a westerly direction to the Pyrmont Bridge Road tunnel site (C9) following existing road reserves. The existing environmental conditions in this area of interest are shown on **Figure 7-17** and **Figure 7-18** and are described in **Table 7-9**.

Table 7-9 Construction power – Pyrmont Bridge Road, Annandale

Environmental aspect	Existing conditions
Land use	The area is relatively flat and occupied by various commercial properties fronting Parramatta Road, industrial/warehouse buildings fronting Pyrmont Bridge Road and isolated residential, commercial and mixed-use developments along Mallett and Layton Streets. There is a substation located on the east side of Layton Street. To the south, across Parramatta Road, are a number of commercial properties, residential apartment developments and the Bridge Road School. There are no areas of open space within the investigation area although Camperdown Park is located nearby to the south of Parramatta Road. The *Parramatta Road Corridor Urban Transformation Strategy*, developed by Urban Growth NSW and released in November 2016, identified a number of precincts along the Parramatta Road corridor for future urban renewal including the Camperdown precinct. The Strategy proposes to leverage the precinct's proximity to Sydney University and Royal Prince Alfred Hospital to generate jobs in specialised education and medical industries and to provide student housing and affordable housing. The Strategy has the target to create new homes for 1,400 people and 2,300 new jobs in the precinct by 2050.
Traffic and transport	Major roads within the investigation area include: · Parramatta Road, which is an arterial road with three lanes of traffic in each direction, operational clearways and is generally congested during peak hours · Pyrmont Bridge Road, which is an arterial road with two lanes of traffic in each direction and operational clearways. Other roads within the area include Mallet Street, Layton Street, Mason Street, Isabella Street and Bignell Lane. Mallet Street and Layton Street have one to two lanes of traffic in each direction with on-street parking and footpaths on either side of the road. Isabella Street and Bignell Lane are both one-way streets with no on-street parking, while Mason Street is a narrow two-way street with on-street parking. Bus services operate along Parramatta Road, Pyrmont Bridge Road and Booth Street.
Non-Aboriginal Heritage	Non-Aboriginal heritage items listed under the Sydney LEP include: · Warehouse including interior at 9–11 Layton Street, Camperdown (local significance) · Flats ‘Alexandra Dwellings’ at 27–45 Pyrmont Bridge Road, Camperdown (local significance) · Warehouse on the north west corner of Pyrmont Bridge Road and Booth Street (local significance) · Bridge Road School and Camperdown Park on south side of Parramatta Road (both of local significance) · Kerb and gutter in Chester and Guihen Streets (both of local significance)

Environmental aspect	Existing conditions
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, there are no sensitive receivers within the investigation area. The Bridge Road School is located nearby on the south side of Parramatta Road.
Waterways and biodiversity	There are no waterways within the investigation area. The closest watercourse is Johnstons Creek located some 200 metres to the northwest. There are significant mature trees located on the eastern side of Mallet Street and on both sides of Layton Street. There are also mature trees located along the Johnstons Creek corridor the north west and in the Bridge Road School and Camperdown Park to the south.
Geology, soils and contamination	The investigation area includes land classified as Class 5 acid sulfate soils and there are no adjacent Class 1, 2, 3 or 4 lands. It is therefore unlikely that acid sulfate soils would be encountered within the investigation area. Soils landscapes within the investigation area consist of the Blacktown – residual soil landscape. The investigation area consists of the Ashfield Shale (black to dark grey shale and laminate) geological formation. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register. The 7-Eleven service station at 198 Parramatta Road, Annandale is listed as 'under assessment' on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	Background noise in investigation area is dominated by traffic on Parramatta Road and Pyrmont Bridge Road. The investigation area falls primarily within NCAs 41 and 44 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

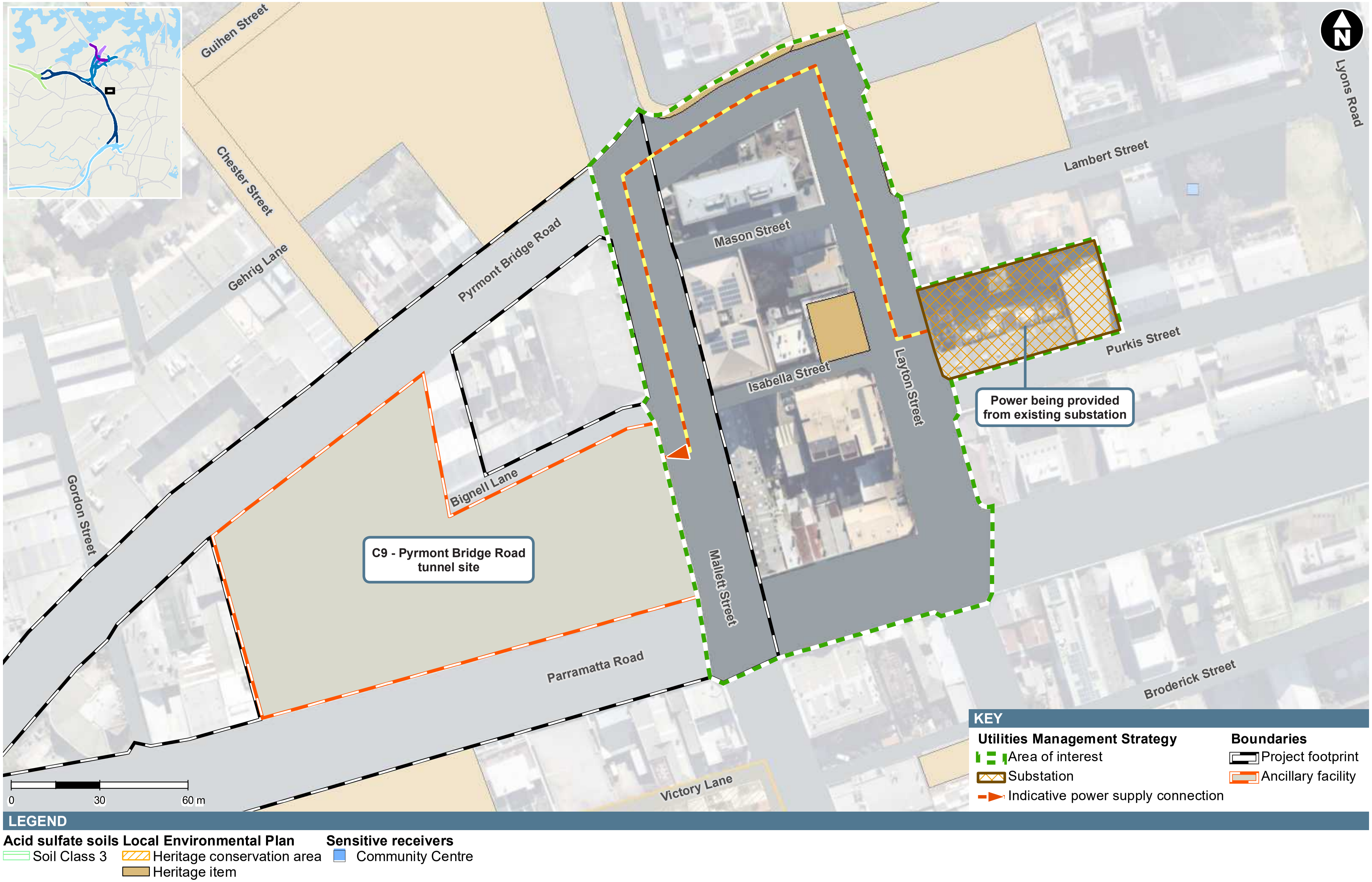


Figure 7-17 Construction power - Pyrmont Bridge Road environmental constraints 1 of 2

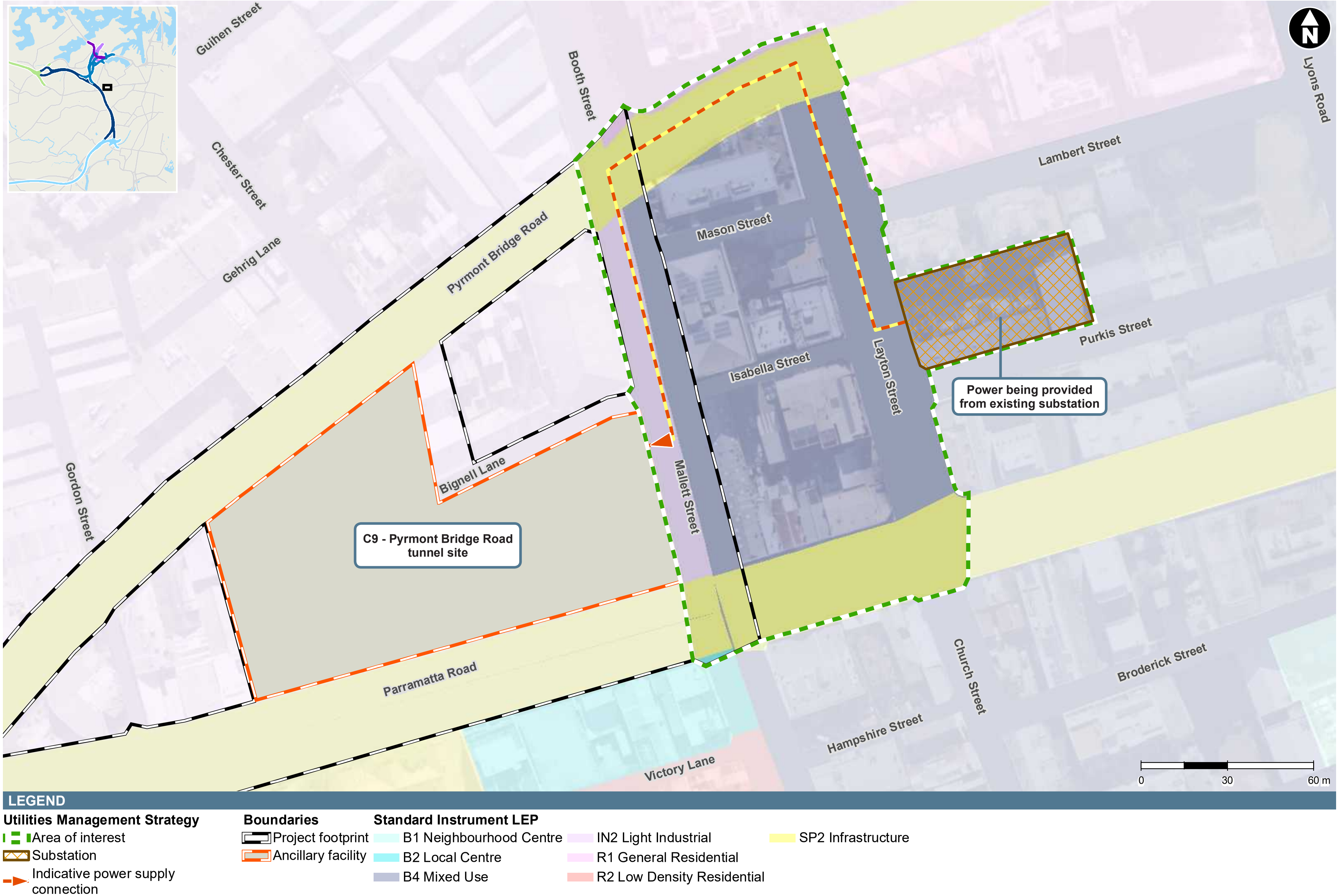


Figure 7-18 Construction power - Pyrmont Bridge Road environmental constraints 2 of 2

7.9 Operational power – St Peters interchange

As detailed in **section 4.2.4**, the permanent power supply connection will run from the Ausgrid substation on Bourke Road which is currently under construction in a south-westerly direction to the Campbell Road substation and ventilation facility following existing road reserves. The existing environmental conditions in this area of interest are shown on **Figure 7-19** and **Figure 7-20** and are described in **Table 7-10**.

Table 7-10 Operational power – St Peters

Environmental aspect	Existing conditions
Land use	Land use in the investigation area is a mix of industrial development along Burrows Road and Alexandra Canal, commercial and industrial development along Princes Highway and some established and infill residential development. Sydney Park is a major area of open space. The area to the south of Campbell Road is being used as a major construction site for the New M5 project and works are continuing in this area until 2020. This includes the site of the former Alexandria Landfill. A substation is currently being constructed by Ausgrid along the west side of Bourke Road and is scheduled for completion in late 2017.
Traffic and transport	Roads within the investigation area include Campbell Road, Burrows Road and Bourke Road. The roads generally have one lane of traffic in each direction and footpaths on either side of the roads. Campbell Road and Burrows Road have on-street parking on both sides of the road. Bourke Road has on-street parking on the eastern side of the road and a cycle lane on its western side. Some of the road network is being upgraded as part of the New M5 project. Bus services in this area operate along Princes Highway, Canal Road and Bourke Road.
Non-Aboriginal Heritage	Non-Aboriginal heritage items within the investigation area include Alexandra Canal, which is listed under Sydney Water's section 170 Heritage and Conservation Register of the *Heritage Act 1977* (NSW) and is of state heritage significance. There are no other listed heritage items in this area.
Aboriginal Heritage	There are no registered Aboriginal sites or sensitive areas in the investigation area.
Sensitive receivers	Other than the residential land uses described above, sensitive receivers within the investigation area include: · Sydney Park at Sydney Park Road, St Peters · Building Blocks Early Childhood Learning Centre at 140 Bourke Road, Alexandria.
Waterways and biodiversity	The Alexandra Canal flows through the investigation area towards Botany Bay. The canal is concrete lined and about 70 metres wide. Vegetation within the investigation area includes mature trees within Sydney Park and along the banks of Alexandra Canal and along road corridors such as Campbell Road, Burrows Road and Bourke Road. A number of trees are being removed along sections of Sydney Park, Campbell Road and Euston Road as part of the New M5 project.

Environmental aspect	Existing conditions
Geology, soils and contamination	The investigation area primarily includes land classified as Class 3 acid sulfate soils. The Alexandra Canal is classified as Class 1 acid sulfate soils. Works would not be undertaken within the Canal. Any works beyond one metre below ground surface in Class 3 acid sulfate soils would be likely to encounter acid sulfate soils. Soils landscapes within the investigation area consist of disturbed terrain soil landscape. The investigation area consists of a lithology quaternary peat, sandy peat and mud to the north of Alexandra Canal and quaternary medium to fine-grained marine sand with podsols to the south of Alexandra Canal. The investigation area does not include any sites identified on the NSW EPA Contaminated Lands Register or on the List of NSW contaminated sites notified to NSW EPA. The former Alexandria Landfill site is listed as 'under assessment' on the List of NSW contaminated sites notified to NSW EPA.
Noise environment	The background noise environment would be primary influenced by traffic movements along Campbell Road and Bourke Road as well as by noise from industrial activity given the nature of the land use within the investigation area. There is also occasional noise associated with the operation of flight paths from Sydney Airport and noise from on-going construction activity associated with the New M5 project. The investigation area falls primarily within NCAs 47, 48, 49, 50 and 55 as described in **Appendix J** (Technical working paper: Noise and vibration) of the EIS.

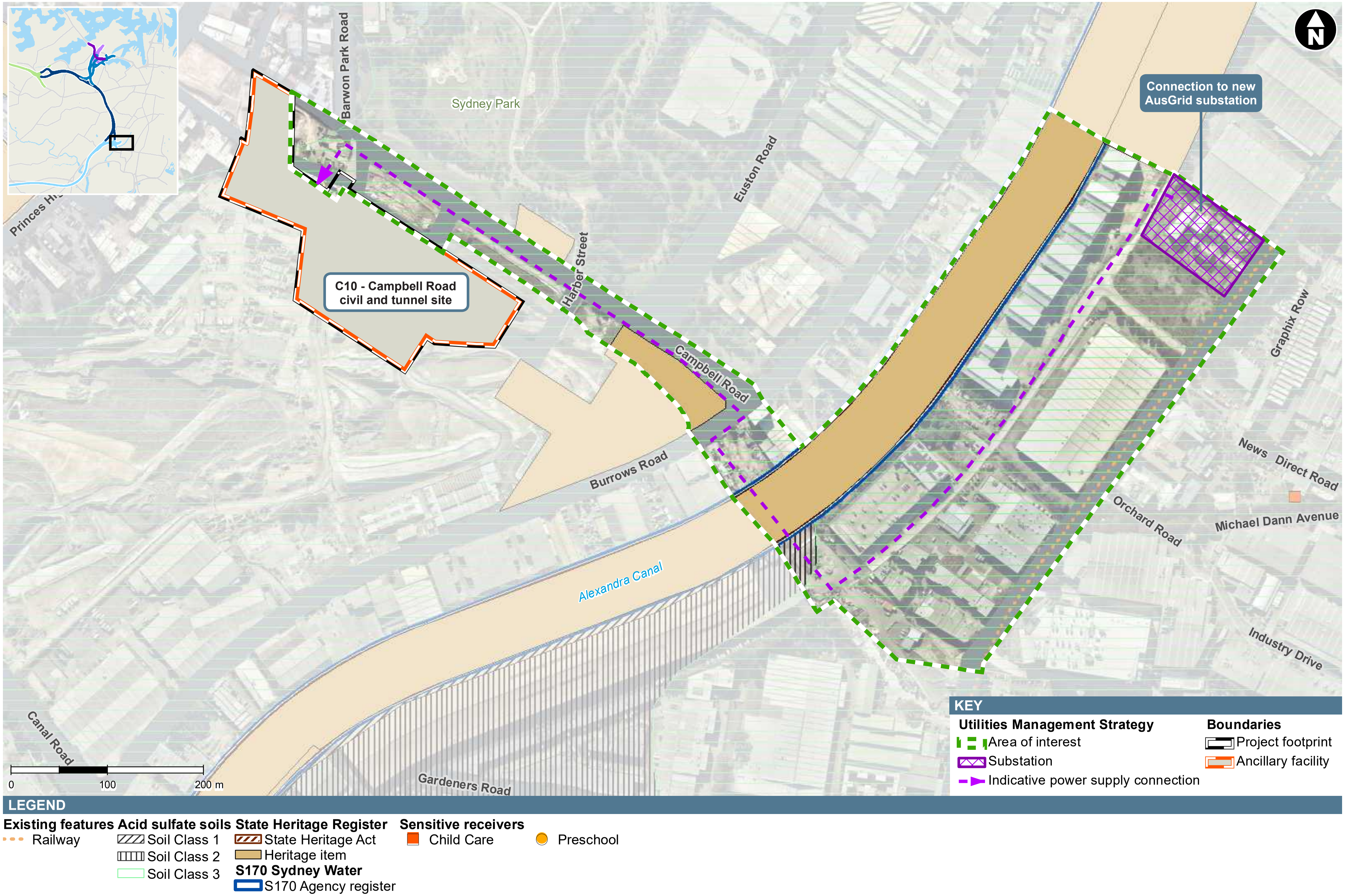


Figure 7-19 Permanent power - Campbell Road, St Peters environmental constraints 1 of 2

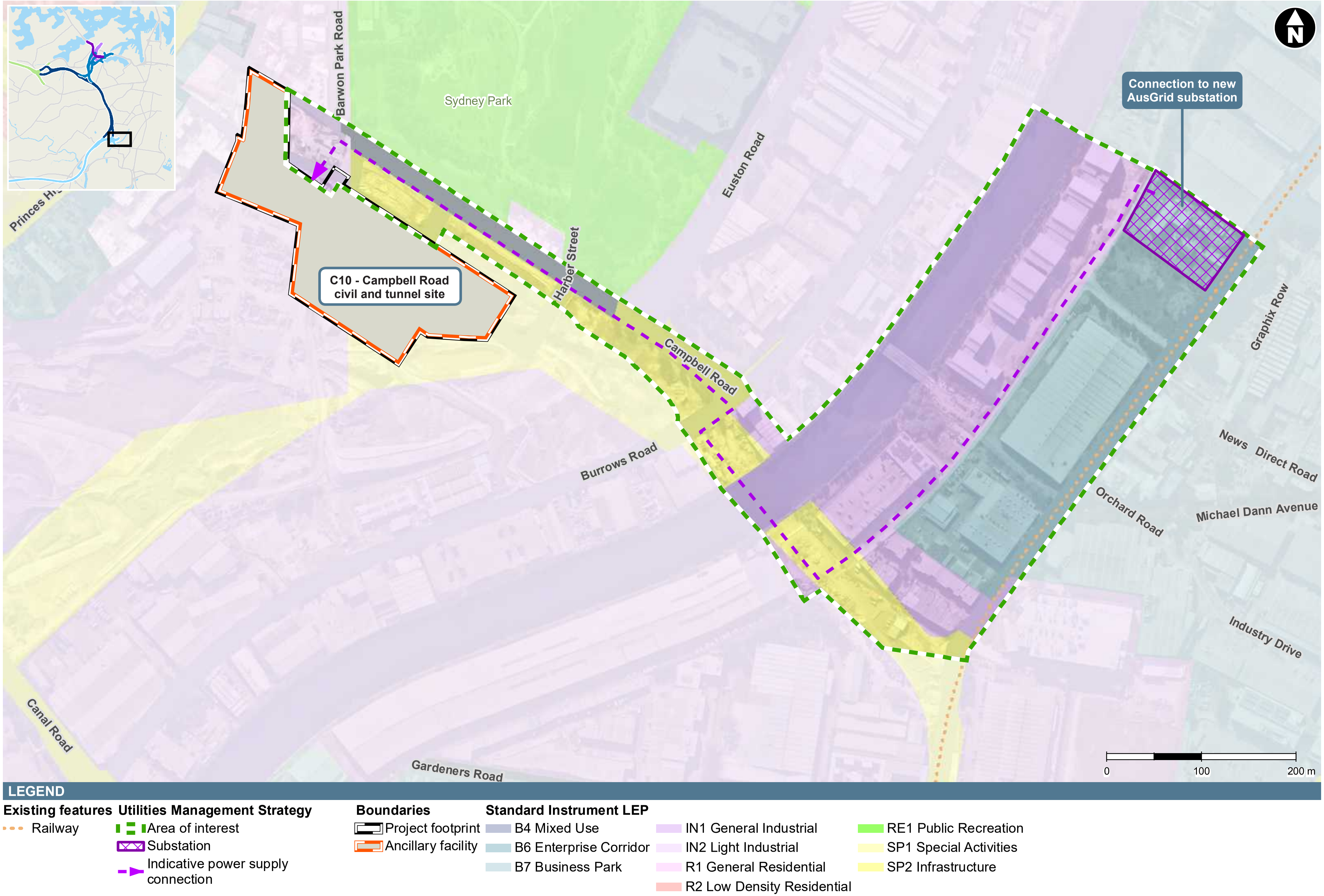


Figure 7-20 Permanent power - Campbell Road, St Peters environmental constraints 2 of 2

8 Potential environmental impacts

8.1 Overview

This section provides an overview of the typical environmental impacts associated with the utility works, power supply connections, Sydney Trains electrical infrastructure and drainage infrastructure proposed for the M4-M5 Link project.

It is proposed that more detailed investigations would be carried out once further consultation with relevant utility service providers has occurred and once a detailed design for the proposed works is confirmed by the contractor. Utility investigations will also be undertaken at the Rozelle Rail Yards in association with the approved site management works. The process for confirming the detail of the utility works and the measures and plans for managing the environmental impacts of the utility works are outlined in **Chapter 10**.

Potential impacts during construction are likely to be short-term and localised in the immediate vicinity of the work area. Potential impacts of utilities during operation are even more limited than potential impacts during construction. Standard and proven management measures such as those contained in the environmental management measures for the EIS and as outlined in **Chapter 10** would be implemented (as appropriate) to avoid and minimise these impacts.

Potential environmental impacts are discussed by key issue in **sections 8.2** to **8.14**.

8.2 Traffic

Potential traffic related impacts during construction works may include:

- Traffic generated by construction vehicles and personnel impacting on the local road network
- Car parking required by construction staff
- Closure of roads or traffic lanes and associated diversions of traffic and traffic delays
- Temporary restricted access to some areas of on-street car parking
- Temporary closure of sections of footpaths or cycle paths and associated diversions
- Temporary relocation of public transport stops.

Potential impacts on property access (eg driveways) is discussed in **section 8.9**.

These traffic and car parking impacts would be temporary and can be managed by adopting the proposed management measures as detailed in **Chapter 10** including workers using designated off-street car parking areas where available, undertaking works outside of peak traffic periods where possible and consulting with the local council prior to commencing construction.

8.3 Air quality

Potential air quality impacts during construction works may include:

- Generation of dust from excavation areas and/or stockpiles
- Tracking of soil from plant and equipment onto the local road network
- Odour in the event that construction works encounter acid sulfate soils or contaminated soil and groundwater
- Emissions from plant and equipment including heavy vehicles.

These impacts would be temporary and can be managed by the proposed management measures as detailed in **Chapter 10** including use of water sprays to minimise dust from exposed areas, covering of truck loads to minimise tracking of dust and regular maintenance of plant and equipment to minimise exhaust emissions.

8.4 Noise and vibration

Potential noise and vibration related impacts during construction works may include:

- High noise generating activities such as concrete cutting and breaking, trenching, joint pit construction and road paving
- Noise from construction works that in some circumstances may be required out of standard construction hours and that may impact on sensitive receivers, including possible sleep disturbance
- Vibration intensive works that may occur in the vicinity of sensitive receivers and sensitive building structures such as heritage listed items or works which may impact sensitive equipment.

The majority of noise and vibration impacts would be temporary during construction and would transition progressively along the utility service corridor thereby impacting particular receivers for only a limited period of time. These impacts can be managed by adopting the proposed management measures as detailed in **Chapter 10** including scheduling of noise intensive works, use of temporary noise barriers or mobile acoustic enclosures, establishing an OOHW procedure, maintaining minimum separation distances between vibration intensive works and sensitive building structures or sensitive equipment, carrying out vibration monitoring and building condition surveys (where necessary).

8.5 Biodiversity

Potential biodiversity related impacts during construction works may include:

- Impacts on native flora, threatened flora species and/or ecological communities (if present) as a result of removal of trees and vegetation such as from within road reserves or public open space areas
- Impacts on native or threatened fauna species (if present) as a result of removal of potential foraging habitat or shelter
- Impacts on native or threatened fauna species (if present) as a result of construction noise and lighting
- Spread of noxious weeds during construction works.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including undertaking pre-clearing surveys, establishing tree protection zones, unexpected threatened species finds procedure, using sensitive construction techniques to avoid impacts on trees, planting suitable replacement trees for any trees to be removed and managing works to avoid the spread of noxious weeds.

8.6 Non-Aboriginal heritage

Potential non-Aboriginal heritage related impacts during construction works may include:

- Direct impacts on listed heritage items such as buildings, structures, trees or kerbs/gutters and including structural vibration impacts
- Indirect visual and amenity impacts on listed heritage items and streetscapes in Heritage Conservation Areas
- Direct impacts on unexpected archaeological finds in the unlikely event that this would occur.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including archival recording of any listed heritage items to be disturbed, adoption of an unexpected heritage finds protocol, maintaining minimum separation distances between vibration intensive works and sensitive building structures, carrying out vibration monitoring and building condition surveys (where necessary).

8.7 Aboriginal heritage

Potential Aboriginal heritage related impacts during construction works may include:

- Direct impacts on AHIMS registered archaeological sites (if present)
- Direct impacts on areas identified as containing potential archaeological deposits, such as along intact watercourses
- Direct impacts on unexpected archaeological finds in the unlikely event that this would occur.

No potential archaeological deposits have been identified in any of the areas of interest investigated. Given the significant disturbance that has occurred in these urban areas, it is considered unlikely that the utility works would impact on any item of Aboriginal heritage.

Any impacts that may occur can be managed by the proposed management measures as detailed in **Chapter 10** including adoption of an unexpected heritage finds protocol.

8.8 Visual

Potential visual impacts during construction works may include:

- Views from sensitive receivers of trench excavation, stockpiles, laydown areas and plant equipment
- Removal of trees or vegetation from within road reserves or open space areas
- Light spill and glare impacting on residential properties during work at night.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including erection of screen barriers around work areas, careful orientation and shielding of lighting to minimise light spill and glare, avoiding tree removal where possible and planting suitable replacement trees for any trees to be removed.

8.9 Land use and socio-economic

Potential land use and socio-economic impacts during construction works include:

- Impact on property access (eg driveways) noting that existing property access would be maintained other than for short periods during the works as agreed in consultation with the property owner
- Impact on visibility of existing commercial businesses
- Impact on access to areas of public open space
- Impact on sensitive land uses such as schools, child care centres and medical facilities
- Amenity impacts on residential land uses adjacent to the work areas
- Temporary disruption to services such as power and water supply during the works
- Generating employment opportunities for workers during the construction phase
- Providing indirect economic benefits for some business during the construction phase.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including providing prior notification to residential, business and other property owners that may be affected.

8.10 Soil and water

Potential impacts on soil and water during construction works include:

- Earthworks during construction create potential for erosion and sedimentation of waterways in the vicinity of the works
- Dewatering of excavated trenches may be required during and after rainfall
- In some locations groundwater may be intercepted and dewatering may be required during excavation of trenches
- Disturbance of acid sulfate soils and exposure to air
- Spills of hydraulic oils and fuels from vehicles and plant equipment may impact on soil and water quality
- Disturbance of contaminated soils (as referred to in **section 8.11**).

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including implementation of erosion and sediment control measures in accordance with the Blue Book Volume 1 (Landcom, 2004), progressive stabilisation of exposed soil surfaces, and implementing procedures for the storage and handling of oils and fuels.

8.11 Contamination

Potential impacts on soil and groundwater from contamination during construction works include:

- Disturbance of asbestos and other potential contaminants in old cabling, conduits, pipes etc
- Mobilisation of contamination in soils by earthworks and movement of plant and equipment
- Mobilisation of contaminants in exposed soils by rainfall or surface water run-off
- Encountering contaminated groundwater during excavation of trenches
- Spills of hydraulic oils and fuels from vehicles and plant equipment may impact on soil and water quality.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including adopting standard health and safety management practices, spoil management, measures for dewatering of groundwater, progressive stabilisation of exposed soil surfaces and adoption of an unexpected contamination finds protocol.

8.12 Waste

Potential waste impacts during construction works may include:

- Excess spoil generated during trench excavation
- Classification and disposal of waste.

These impacts would be temporary and can be managed by the proposed management measures as detailed in **Chapter 10** including procedures for the classification and management of waste in accordance with the NSW EPA Waste Classification Guidelines.

8.13 Electric and magnetic fields

Equipment which forms part of an electricity network, including overhead or underground powerlines, has current flowing through it and produces electric and magnetic fields (EMF). Electricity produces an electric field and a magnetic field and the strengths of these fields decrease rapidly with distance from their source. The level of magnetic fields from the electricity network depends on the amount of current/electrical load, the way the network is configured and the distance from the equipment. The level is not directly related to the voltage. Everyone who regularly uses electricity or electrical appliances is exposed to EMF on an ongoing basis. The balance of current scientific evidence does not indicate that EMF causes adverse health effects.

Proposed utility works that involve power supply connections or which require existing Ausgrid or Sydney Trains electrical infrastructure to be relayed have the potential to produce EMF. It is likely that these utility works would be located within existing road and transport corridors and/or in designated utility service corridors within the project footprint either below ground or above ground. In these locations there is likely to be reasonable separation distance provided to the closest receivers

Potential EMF impacts can be managed by optimising feeder and feeder/joint bay configurations (if required) and where possible locating feeders to increase separation distances to sensitive receivers.

8.14 Cumulative impacts

There is the potential for cumulative impacts associated with the proposed utility works where these works are concurrent or overlap with other works that may be related to either the M4-M5 Link project or other projects such as:

- Other utility works or maintenance works that may be undertaken by utility service providers independent of the M4-M5 Link project
- Construction of other elements of the M4-M5 Link project
- Construction of other stages of WestConnex in particular the M4 East project in the Haberfield/Ashfield area (due for completion in 2019) and the New M5 project in the St Peters area (due for completion in 2020)
- Construction of other projects that may occur in the immediate vicinity of the project footprint particularly in the Rozelle and St Peters areas such as:
- CBD and South East Light Rail (CSELR) maintenance depot at Lilyfield (due for completion in 2019), and in association with CSELR works at Chalmers Street
- Site management works at the Rozelle Rail Yards (due for completion in 2018)
- Proposed future Western Harbour Tunnel and Beaches Link project in the Rozelle area
- Sydney Metro City and Southwest project in the area near Sydenham Station (due for completion in 2024)
- Proposed future Sydney Gateway project in the St Peters and Mascot areas.

Potential cumulative impacts are likely to relate to a range of issues but most particularly issues such as traffic, car parking, noise and vibration, land use, air quality and visual.

These impacts can be managed by the proposed management measures as detailed in **Chapter 10** including regular communication with proponents of other projects, scheduling of works to minimise potential impacts of overlapping projects and progressively staging work to minimise potential impacts. In addition, as part of this Strategy it is proposed that a Utility Co-ordination Committee would be established to ensure better planning for, and co-ordination of, individual utility works. This is discussed in **section 9.5**. A utilities coordinator would manage the process of coordination with the committee.

9 Process for managing proposed utility works

9.1 Overview

The Utilities Management Strategy details the major (trunk) utility works proposed as part of the project based on the concept design which is being considered by the EIS. Other minor utility works which do not meet the definition of construction are not considered as part of this Strategy.

This Utilities Management Strategy provides information in relation to:

- Utility works which are proposed within the project footprint. These utility works have been assessed as part of the EIS and would be subject to the recommended environmental management measures contained in the EIS. They would also be subject to either:
  - The Utilities Relocation Management Plan (URMP) if the works are to be carried out prior to approval of a CEMP or
  - The CEMP if the works are to be carried out after approval of the CEMP
- Utility works which are proposed outside of the project footprint. This Utilities Management Strategy provides the framework for how these utility works would be managed including requirements for environmental constraints analysis and environmental risk assessment to confirm the potential impacts associated with the works and review of the recommended environmental management measures. These utility works proposed outside of the project footprint would also be subject to the URMP of the CEMP.

The Utilities Management Strategy also provides information in relation to requirements for:

- Options assessment
- Stakeholder and community consultation
- Co-ordination of works.

The information contained in this Strategy is likely to change over time as further investigations are carried out, as discussions with utility service providers progress and as the design of the project is refined during detailed design once a contractor has been appointed. This Utilities Management Strategy establishes a process for managing utility works associated with the project.

9.2 Environmental constraints analysis and environmental risk assessment for areas outside of the project footprint

The assessment undertaken in this Strategy has been carried out based on the concept design for the M4-M5 Link project which is assessed in the EIS. It is also based on the investigations carried out to date and consultation undertaken with relevant utility service providers.

More detailed investigations would be carried out and further consultation would be undertaken during the detailed design phase of the project once a design for the proposed works is confirmed by the contractor. This may result in some changes to the proposed utility works.

In these circumstances an updated environmental constraints analysis and risk assessment would be undertaken for utility works in areas outside of the project footprint to confirm that the environmental management measures that would be applied, either through the URMP or the CEMP and sub-plans, are appropriate. If additional environmental impacts are identified as part of this process then the proposed management measures would be reviewed and, if necessary, modified to minimise these impacts.

9.3 Options assessment

For some of the proposed utility works there may be a number of potential route options which are available. In determining a preferred route option, the following criteria would be considered as relevant:

- The requirements of the relevant utility service provider
- Minimising commercial and schedule risk
- The location of existing utility services in relation to the project infrastructure and surrounding exiting utilities
- Allowing ease of access for both construction and maintenance
- Locating infrastructure in areas of previous disturbance such as road reserves or infrastructure corridors
- Adopting the shortest feasible route (all other considerations allowing)
- Where possible, avoiding or minimising impacts on:
  - Sensitive environmental areas (eg watercourse crossings)
  - Known areas of contamination or acid sulfate soils
  - Heritage Conservation Areas and listed heritage items
  - Areas of public open space
  - Visibility of, and access to, commercial businesses
  - Residential and other sensitive receivers
  - Major roads which are heavily trafficked
- Cumulative impacts with other concurrent or overlapping projects
- Where multiple feasible options exist, the views of stakeholders and the local community.

9.4 Stakeholder and community consultation

9.4.1 Consultation

Where reasonable and feasible route options exist for the utility works and time permits, the local community (residential, business and other property owners) would be consulted about the route options. The views arising from this consultation process would be considered among other issues in determining a preferred route option. Consultation would occur in accordance with the Community Communication Strategy for the project.

9.4.2 Notification

Where no feasible route options exist for the utility service adjustment, then the local community who may be affected would be given prior notification of the works, at least five days prior to the works commencing.

9.5 Co-ordination of utility works

To ensure that the potential cumulative environmental impacts associated with proposed utility works are effectively managed it is essential that various individual utility works are co-ordinated.

It is proposed that a Utility Co-ordination Committee would be established to ensure better planning for, and co-ordination of, individual utility works and also to ensure that these works are co-ordinated with other works being undertaken either as part of the M4-M5 Link project and associated with other projects.

The Utility Co-ordination Committee would be established by the contractor for the M4-M5 Link project and would include representatives from the following organisations:

- Roads and Maritime
- Sydney Motorway Corporation
- Ausgrid
- Sydney Trains
- Jemena
- Sydney Water
- Telstra and other telecommunications providers
- Inner West Council
- City of Sydney
- The contractors for other interfacing projects such as M4 East, New M5, CSELR Rozelle maintenance depot at Lilyfield, site management works at Rozelle Rail Yards, Sydney Metro City and Southwest, proposed future Western Harbour Tunnel and Beaches Link project and proposed future Sydney Gateway project as appropriate
- Other key government agency stakeholders such as Urban Growth NSW and the Port Authority of NSW.

The Utility Co-ordination Committee would meet a minimum of four times per year starting prior to commencement of construction of the project (nominally early 2018) until the completion of the construction period (nominally late 2023). The actions agreed at the meetings would be minuted.

The objectives of the Utility Co-ordination Committee would be developed but may include:

- Coordinating timing of project and non-project utility works to avoid working in established respite periods where possible
- Delivering the works efficiently, safely and cost effectively
- Minimising impacts on the environment
- Minimising amenity impacts on the local community, including residents and businesses
- Minimising local traffic and car parking impacts
- Minimising impacts on the road network and public transport services
- Minimising cumulative environmental impacts associated with multiple overlapping projects and individual utility works including limiting the overall extent and duration of disturbance where possible
- Ensuring regular communication of the works program to key stakeholders and the local community.

10 Management measures

10.1 Environmental management measures

The environmental management measures from **Chapter 29** (Summary of environmental management measures) of the EIS would be included in the CEMP and associated sub-plans. These relevant environmental management measures would also form the basis of the URMP for the project.

Typical management measures that would be implemented during utility works are outlined in **Table 10-1**. As outlined in **section 9.2**, the environmental management measures would be reviewed as part of the environmental constraints analysis and risk assessment and would be amended and added to as required having regard to the detailed design of the proposed utility works, the construction methodology to be employed, and the location of the works.

Table 10-1 Utility works – typical management measures

Environmental issue	Typical management measures
Traffic and access	· Construction workers utilise designated off-street car parking areas where available · Minimise periods of time during which roads and footpaths would be closed · Install signage to advise road users of any closures and alternative arrangements · Where possible undertake works outside peak traffic periods · Notify affected communities about temporary traffic and access disruptions · Consultation with the local Council prior to commencement of proposed works · Where utility works are required within main arterial roads · For any utility works on main arterial roads, a Road Occupancy Licence (ROL) and coordination with the Traffic Management Centre (TMC) would be required
Noise and vibration	· Carry out works during standard construction hours except in specific circumstances where out–of-hours work may be required, such as to avoid traffic impacts on arterial roads during peak periods · Scheduling noise intensive works outside of sensitive periods where possible · Establish an Out-of-Hours Work Protocol to guide how out-of-hours work would be conducted, including community notification procedures for affected neighbours, provisions for respite periods and a complaints handling process · Use of temporary noise barriers or mobile acoustic enclosures where practicable · Maintain minimum separation distances between vibration intensive works and sensitive building structures · Carry out vibration monitoring and complete pre and post-construction condition assessments for sensitive building structures or sensitive equipment likely to be impacted by vibration intensive works
Air quality	· Use of water sprays to minimise dust from exposed areas such as trenches and stockpiles · Avoid and remove deposits of loose materials (eg soils) on impervious surfaces to reduce potential for dust generation · Covering truck loads, use of wheel washes and street sweepers to minimise

Environmental issue	Typical management measures
	tracking of dust · Regular maintenance of plant and equipment to minimise exhaust emissions · Turn off vehicles and equipment when not in use
Biodiversity	· Carry out pre-clearing surveys of any potential habitat trees and vegetation to be removed · Establish tree protection zones around trees to be retained · Where appropriate, utilise sensitive construction techniques such as under boring to minimise impacts on the roots of high retention values trees · Minimise removal of vegetation and where appropriate plant replacement trees and vegetation with suitable local native species at completion of construction works · Manage works to avoid the spread of noxious weeds in accordance with the *Noxious Weeds Act 1993* (NSW)
Non-Aboriginal heritage	· Avoid route options that would involve disturbance of listed heritage items · Undertake archival recording of any listed heritage items disturbed by the works · Minimise the use of vibration-intensive equipment and manage associated activities in the vicinity of listed heritage items to avoid potential cosmetic damage · Establish an unexpected heritage finds protocol
Aboriginal heritage	· Establish an unexpected heritage finds protocol · Check registers to confirm no registered sites · Modify route if necessary · Check for Aboriginal Land claims
Visual	· Sensitive siting and design of above ground utility services to minimise visual impacts · Careful orientation and shielding of lighting to minimise light spill and glare
Land use	· Undertake prior notification of works to residential, business and other property owners who may be affected
Soil and water	· Manage surface water and soils to minimise potential erosion and sedimentation of drains and watercourses in accordance with the requirements of the Blue Book · Minimise areas of exposed soil surfaces to reduce erosion · Install sediment control measures · Stabilisation of exposed soil surfaces progressively during construction · Nominating exclusion zones during construction works to protect environmentally sensitive areas such as watercourses · Storing oils and fuels in a suitably bunded, covered and secure area · Adoption of appropriate storage and refuelling controls including a nominated refuelling area
Contamination	· Adopting standard health and safety management practices

Environmental issue	Typical management measures
	· Stabilisation of exposed soil surfaces progressively during construction · Requirements for dewatering of groundwater · Adopting an unexpected contaminated land finds protocol
Waste	· Characterise and manage waste in accordance with the NSW EPA's Waste Classification Guidelines
Electric magnetic fields	· Optimise feeder and feeder/joint bay configurations (if required) · Where possible locating feeders to increase separation distances to sensitive receivers
Cumulative impacts	· Regular communication with other utility service providers, contractors and proponents of other projects · Scheduling of work with other overlapping projects to minimise potential cumulative impacts · Progressively stage construction works to minimise impacts such as traffic, noise and visual impacts

10.2 Environmental management plans

Utility works associated with the project would be subject to the following management framework:

- The relevant environmental management measures outlined in **Chapter 29** (Summary of environmental management measures) of the EIS
- The URMP for utility works undertaken prior to approval of the CEMP. This may be a staged URMP where required
- The CEMP which would outline the environmental management measures and procedures that would be followed during construction
- The measures outlined in **Chapter 9** and **Chapter 10** of this Strategy.

10.3 Other management measures

As part of the Utilities Management Strategy other management measures are also proposed including:

- Where utility works are proposed that are located outside of the project footprint, then an updated environmental constraints analysis and risk assessment would be undertaken. The purpose of this assessment is to confirm that the environmental management measures that would be applied, either through the Utilities Relocation Management Plan or the CEMP and sub-plans, are appropriate. If additional environmental impacts are identified as part of this process then the proposed management measures would be reviewed and, if necessary, modified to minimise these impacts (see **section 9.2**)
- Where multiple feasible route options for utility works exist, a range of criteria to guide the selection of preferred route option would be considered (see **section 4.2.5**)
- Where reasonable and feasible route options for utility works exist and time permits, the local community likely to be affected by the options would be consulted about the route options and their views considered in deciding on a preferred option (see **section 9.4**)
- Where no feasible route options for utility works exist, appropriate notification will be provided to the local community likely to be affected by the proposed works in advance of the works commencing (see **section 9.4**)

- A Utility Co-ordination Committee would be established to ensure better planning for, and co-ordination of, individual utility works and also to ensure that these works are co-ordinated with other works being undertaken as part of the M4-M5 Link project and other projects (see **section 9.5**).

Annexures

Annexure A Existing and proposed utility services

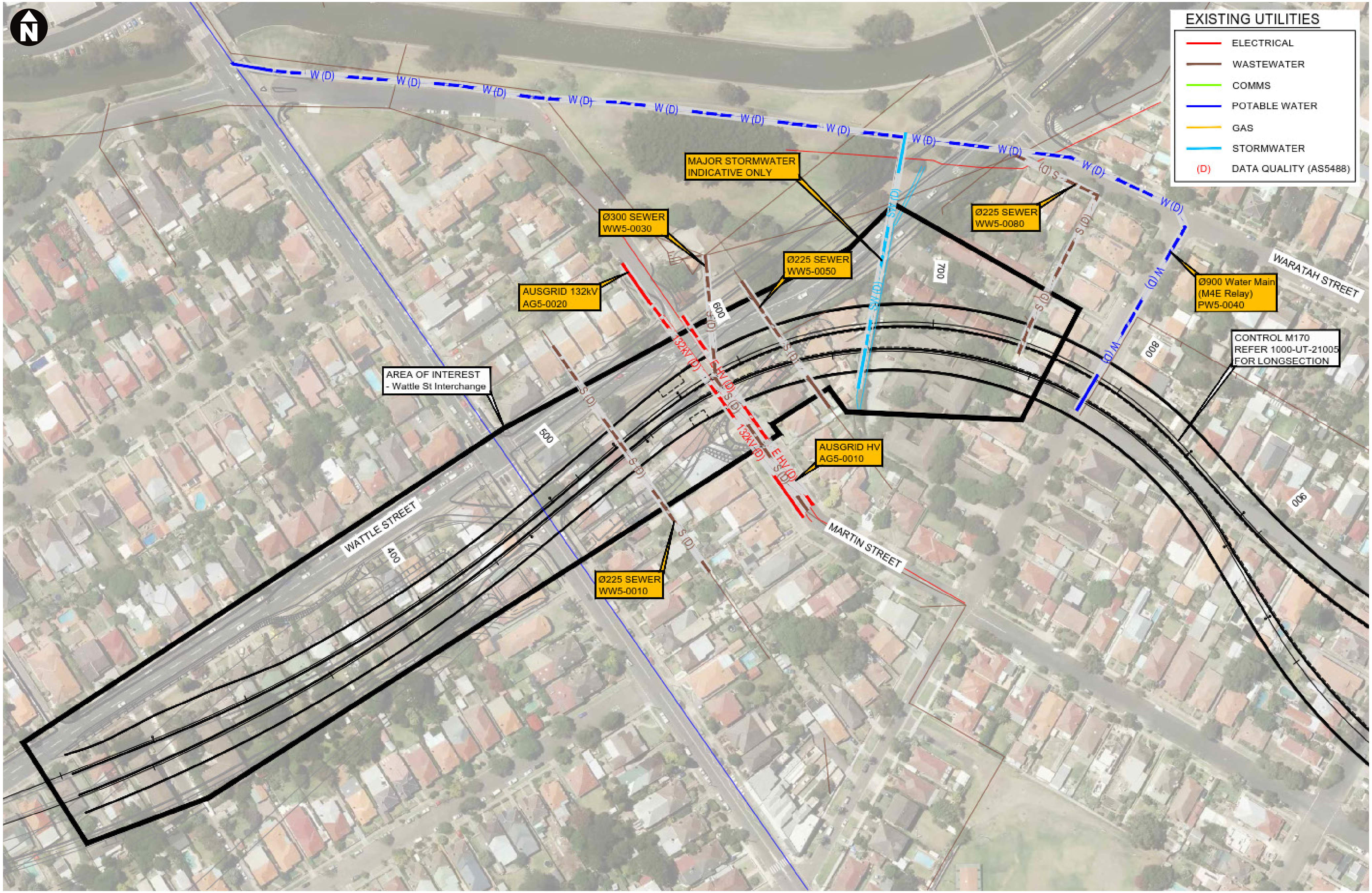


Figure A-1 Exisiting and proposed utility services - Haberfield (Option A)

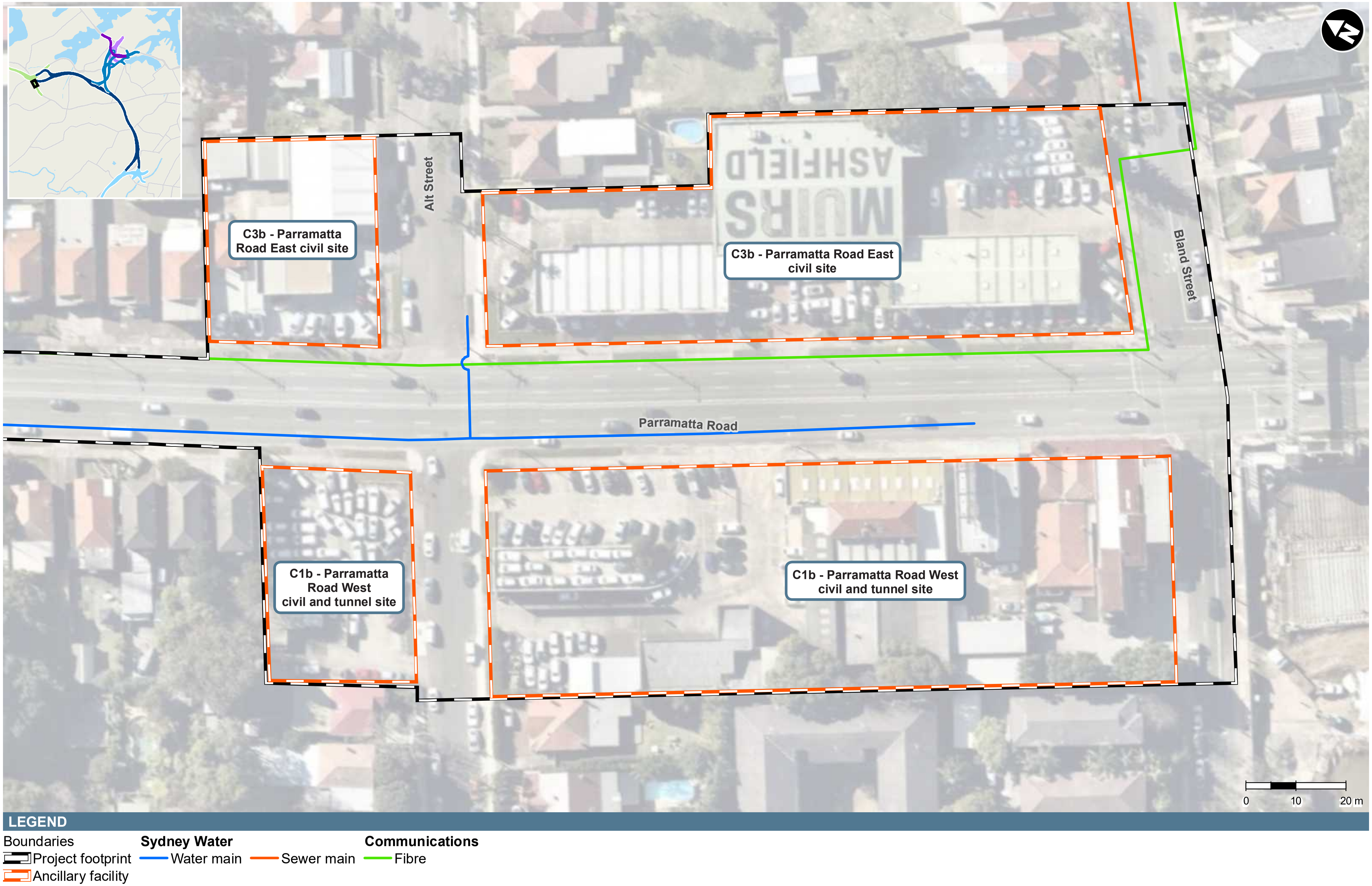


Figure A-2 Exisiting utilities - Haberfield/Ashfield (Option B)

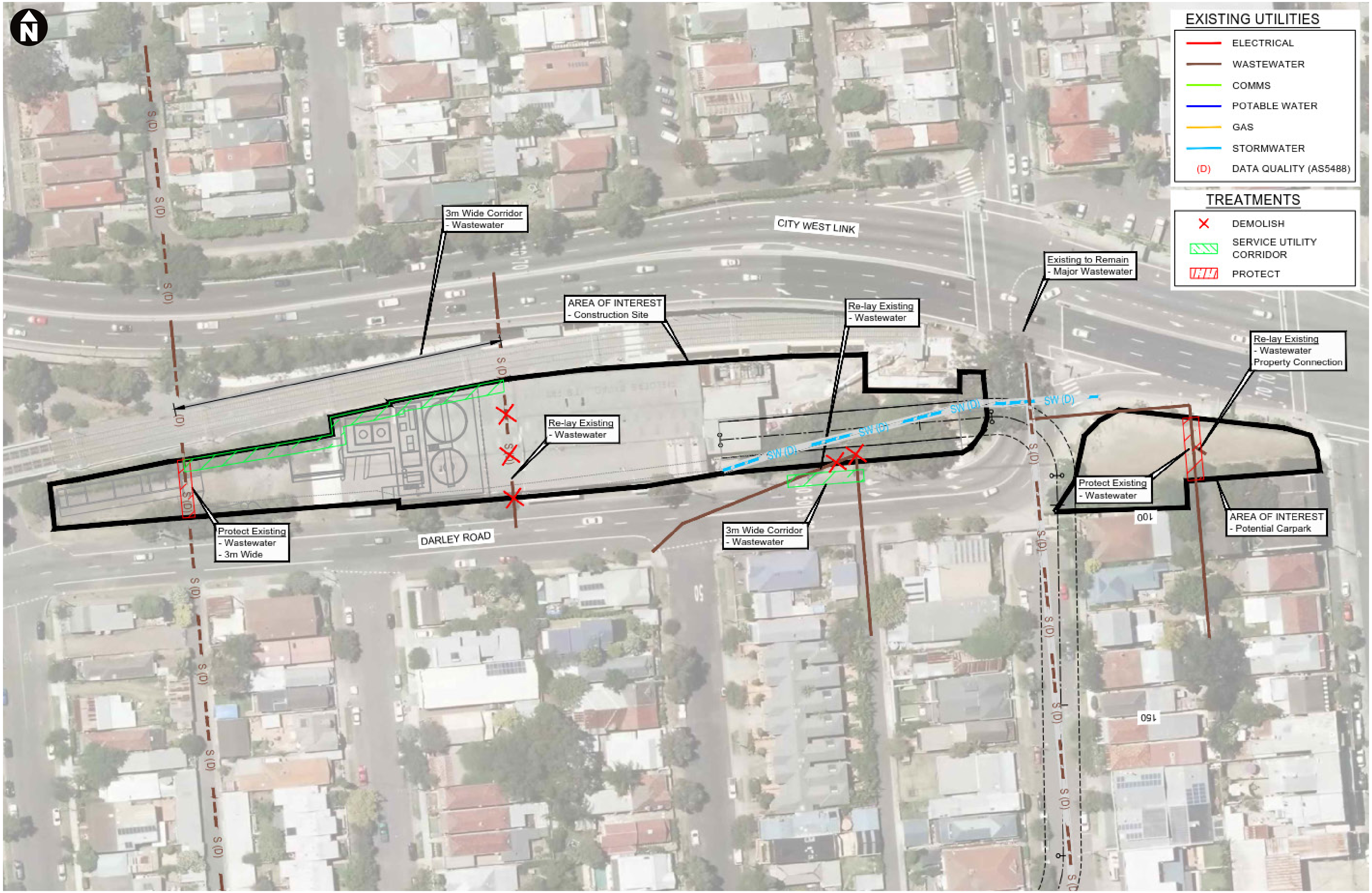


Figure A-3 Existing and proposed utility services - Leichhardt

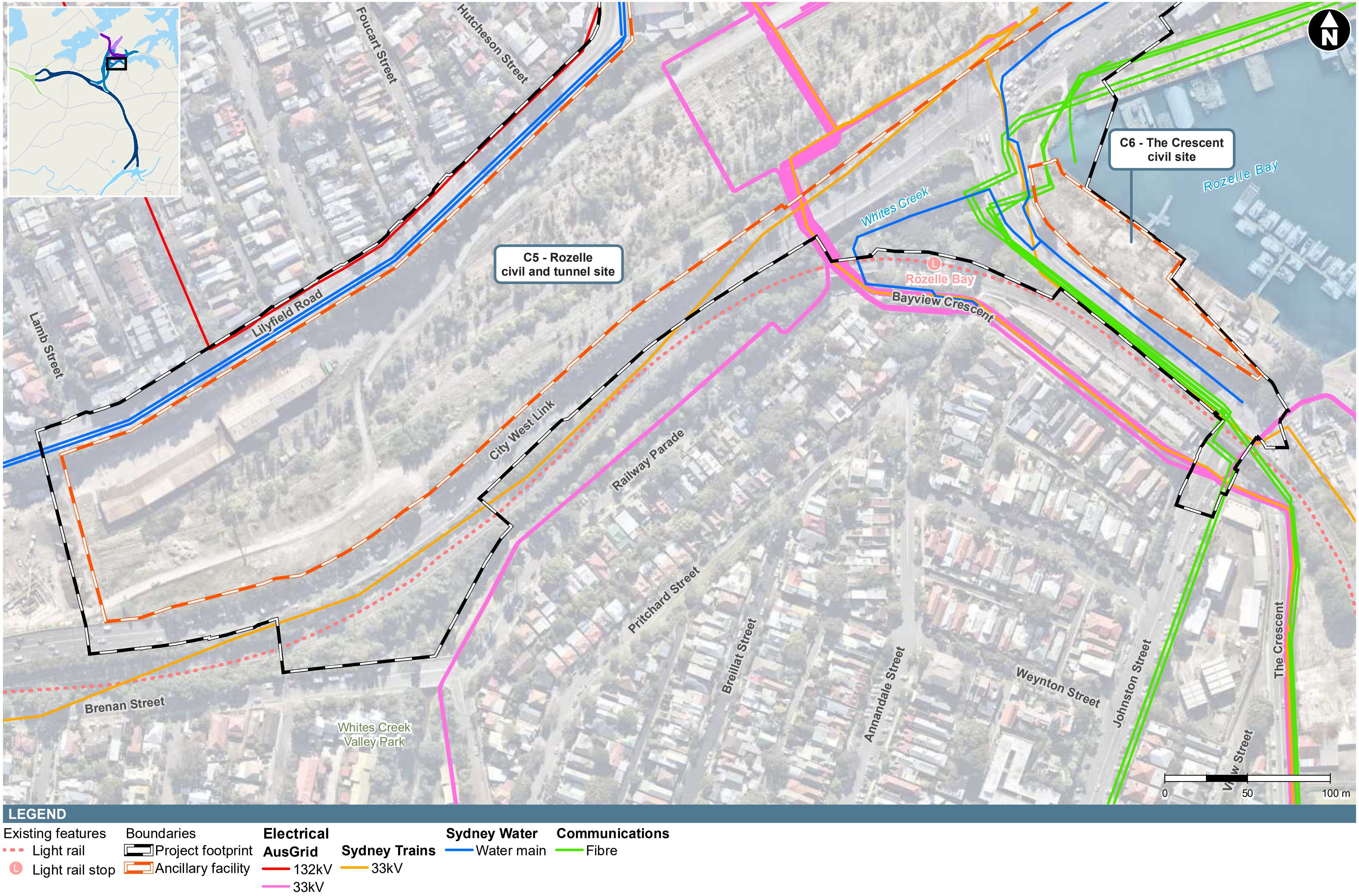


Figure A-4 Existing utility services - Rozelle west

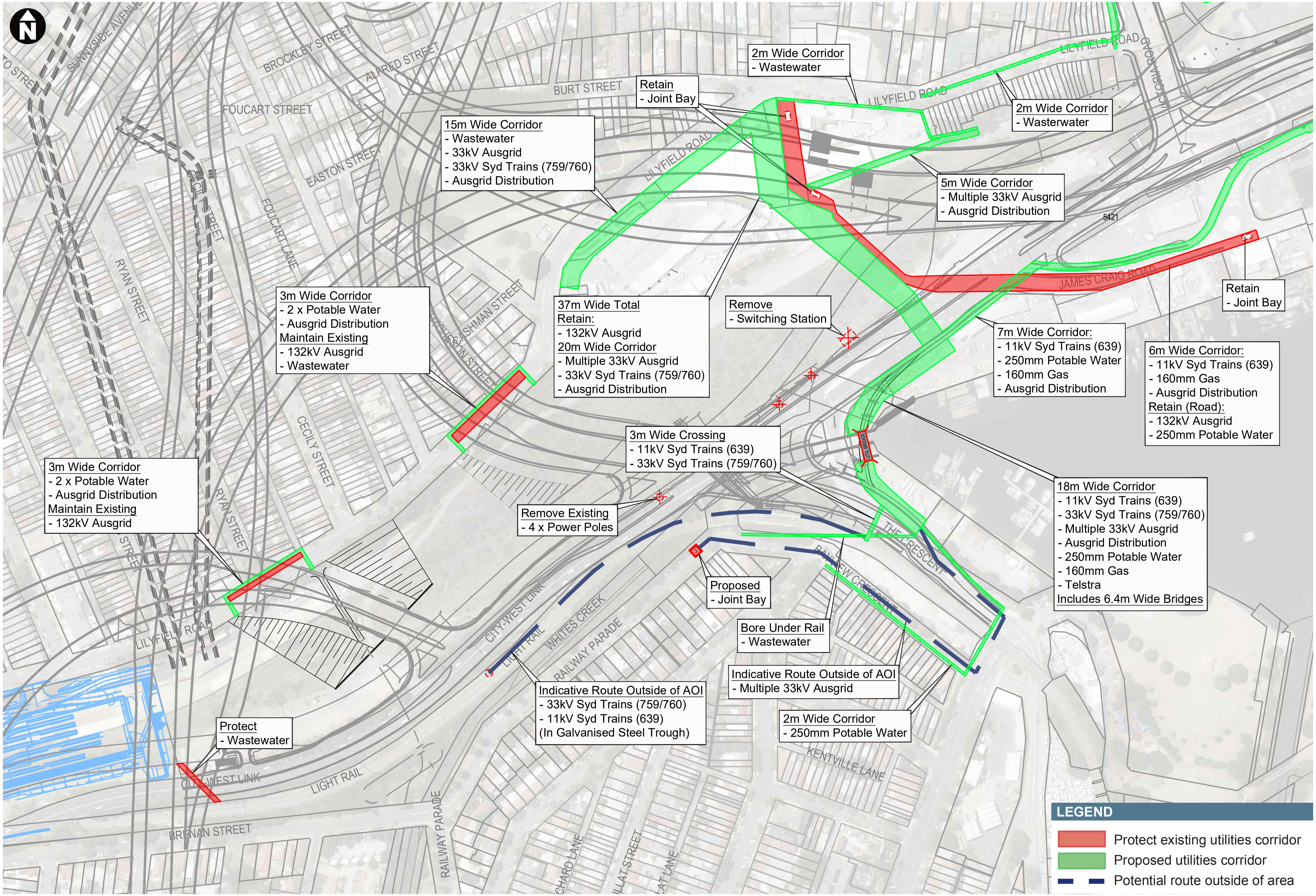


Figure A-5 Proposed utility services - Rozelle west

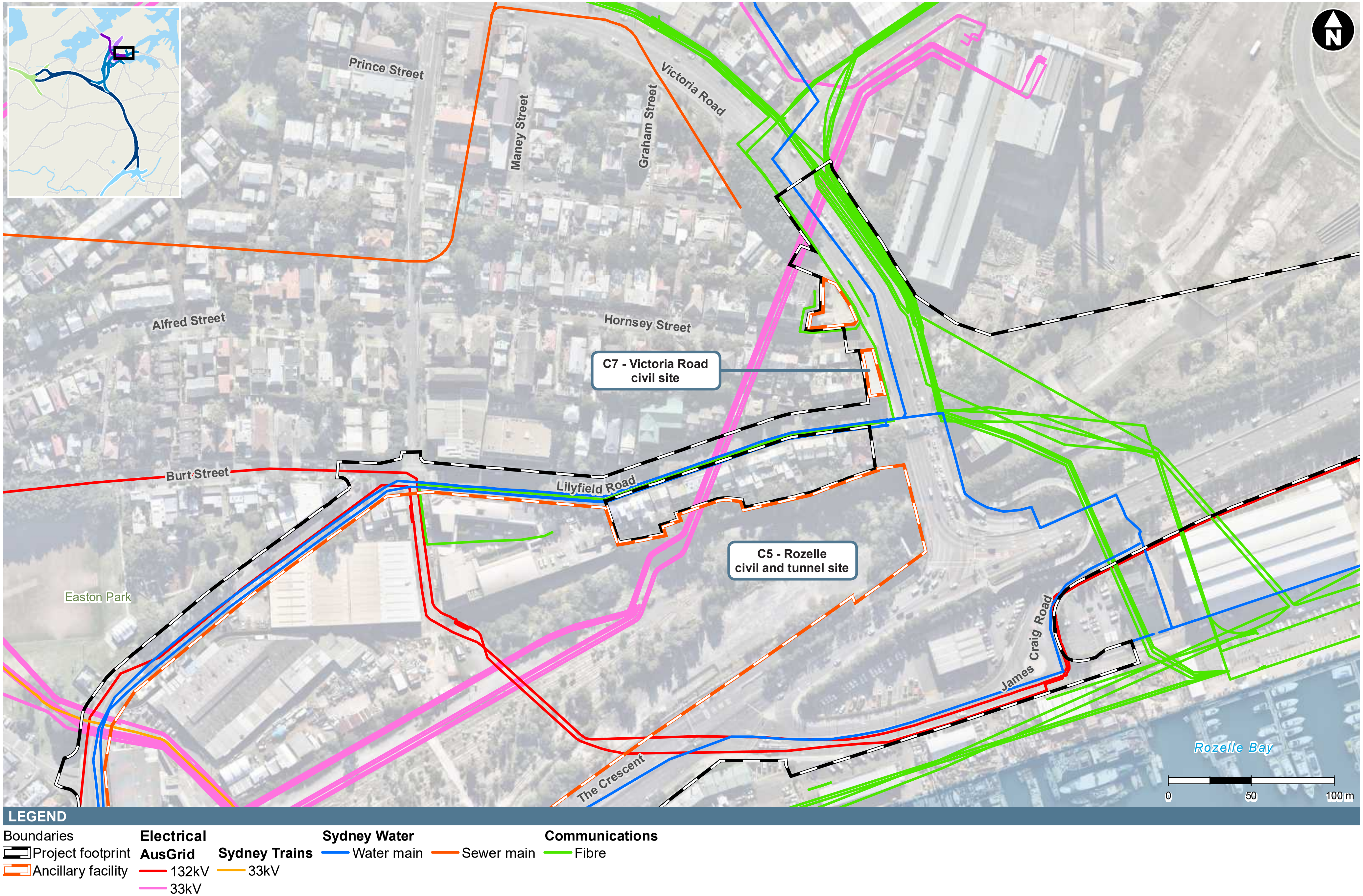


Figure A-6 Existing utility services - Rozelle east

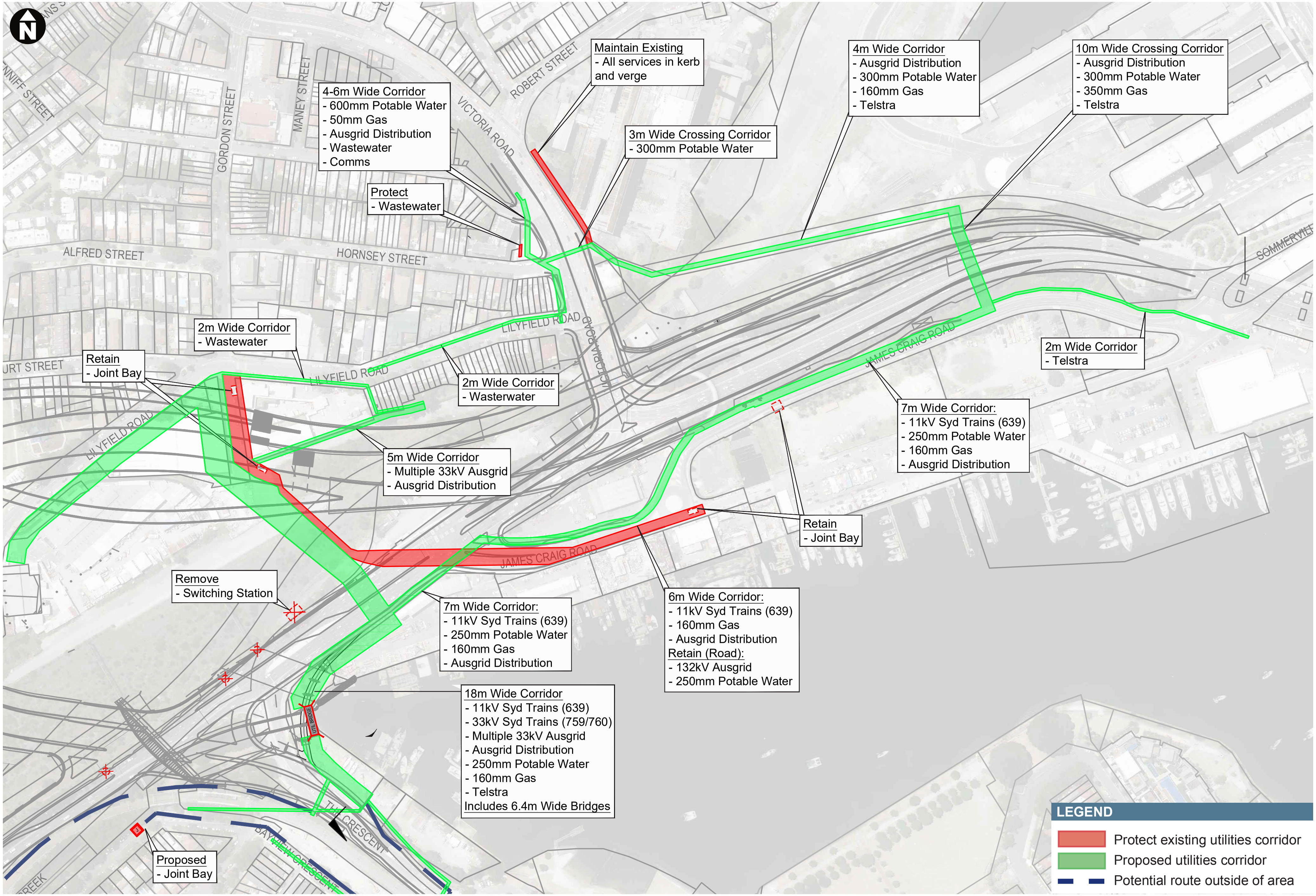


Figure A-7 Proposed utility services - Rozelle east

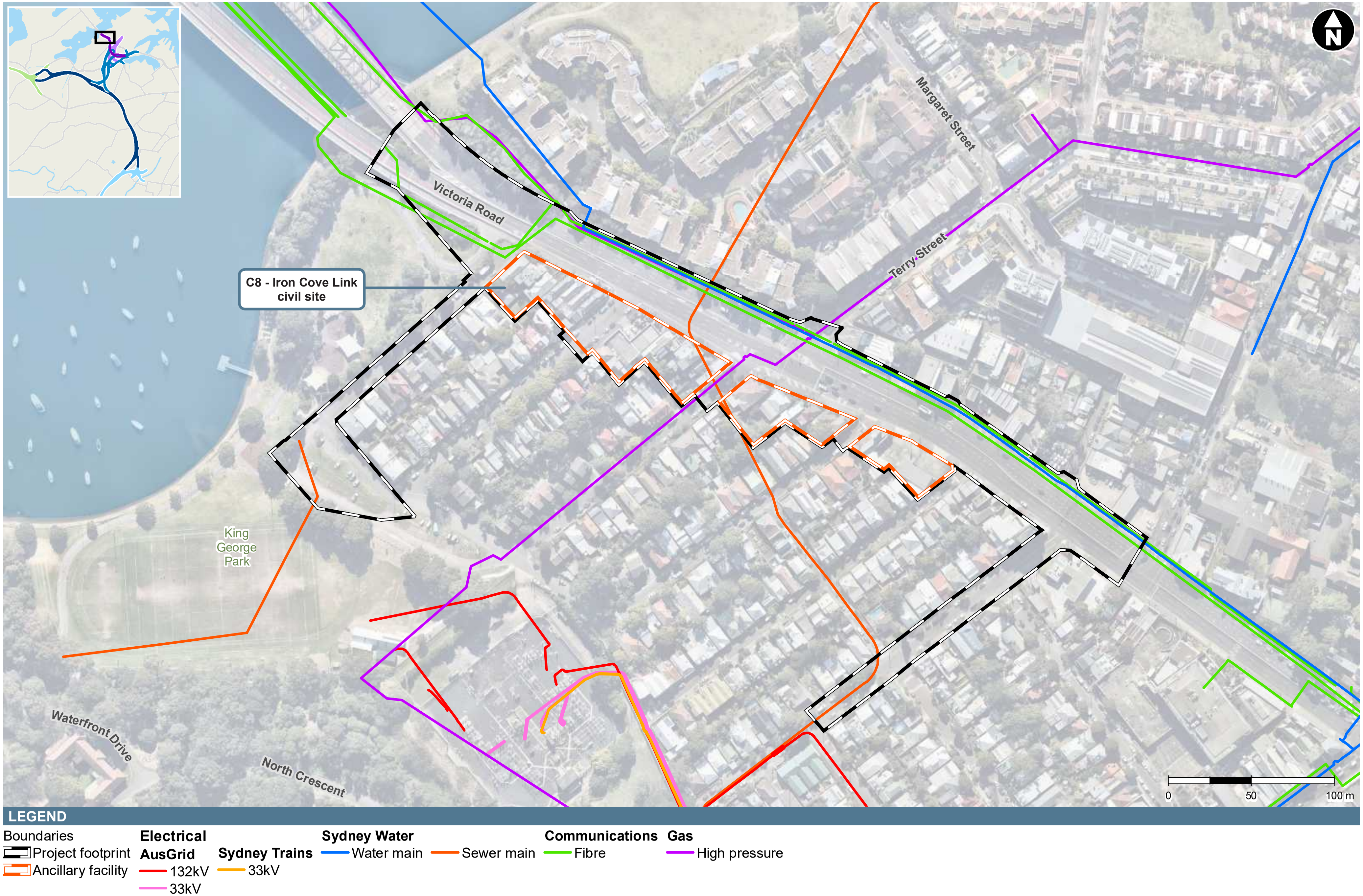


Figure A-8 Existing utility services - Iron Cove

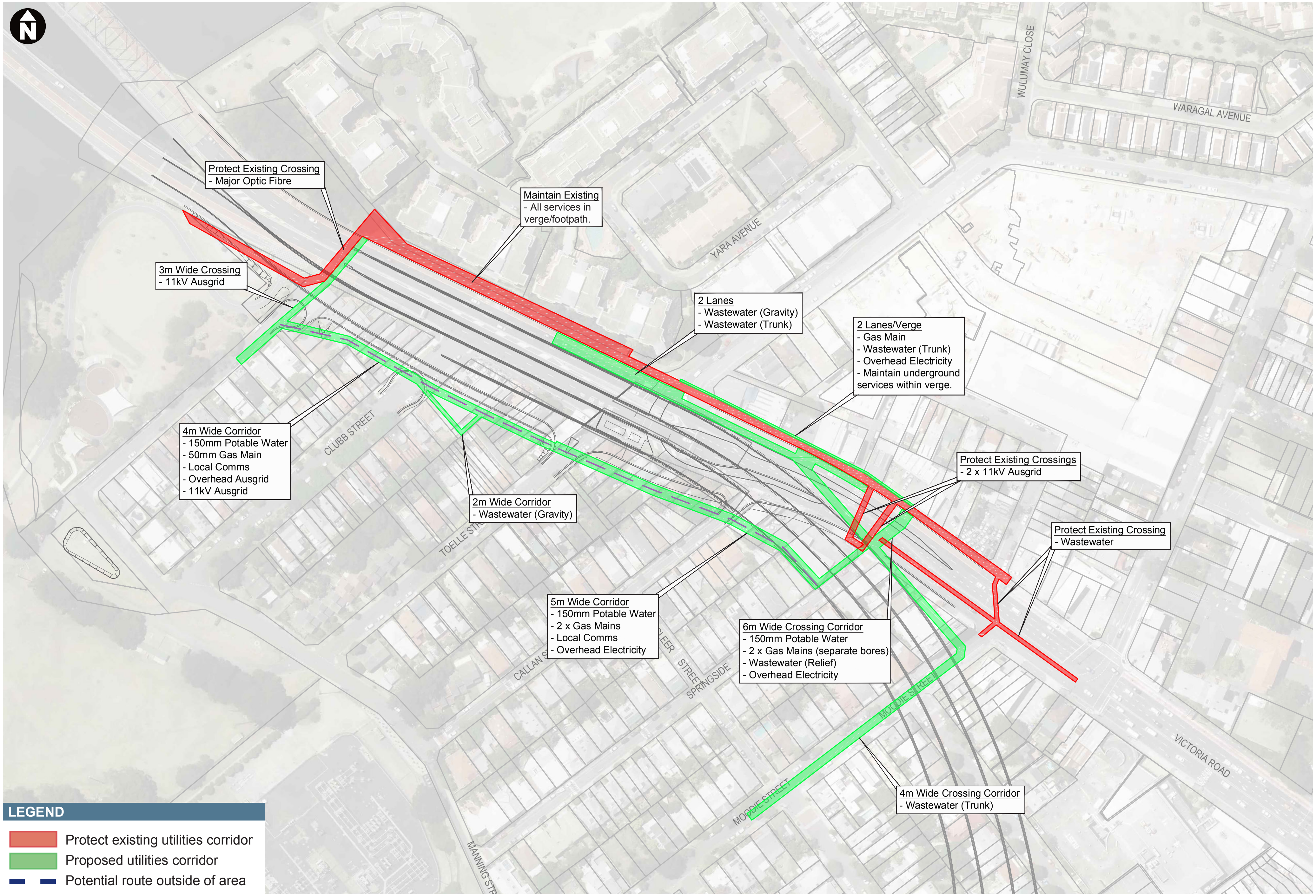


Figure A-9 Proposed utility services - Iron Cove

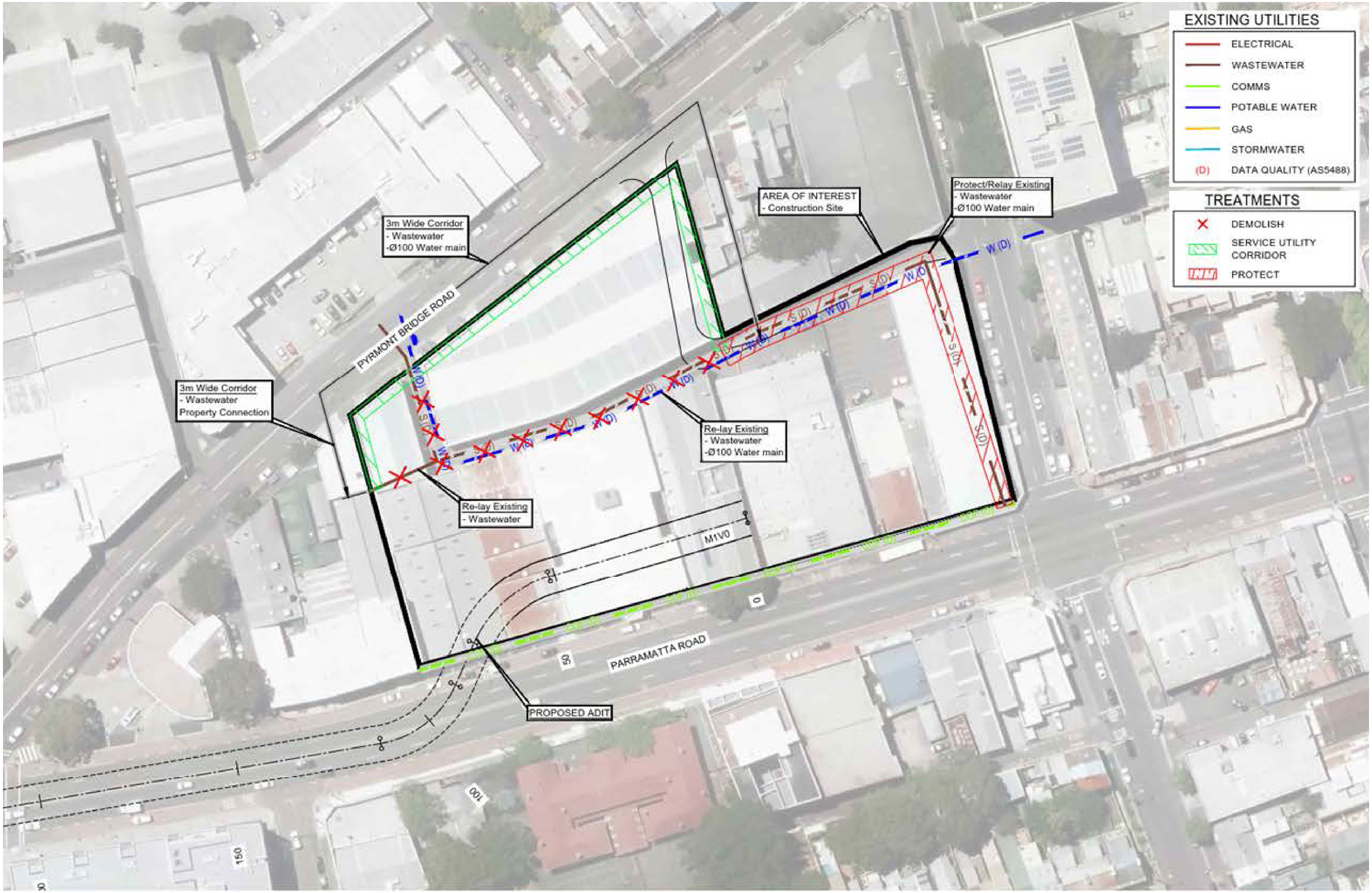


Figure A-10 Existing and proposed utility services - Annandale

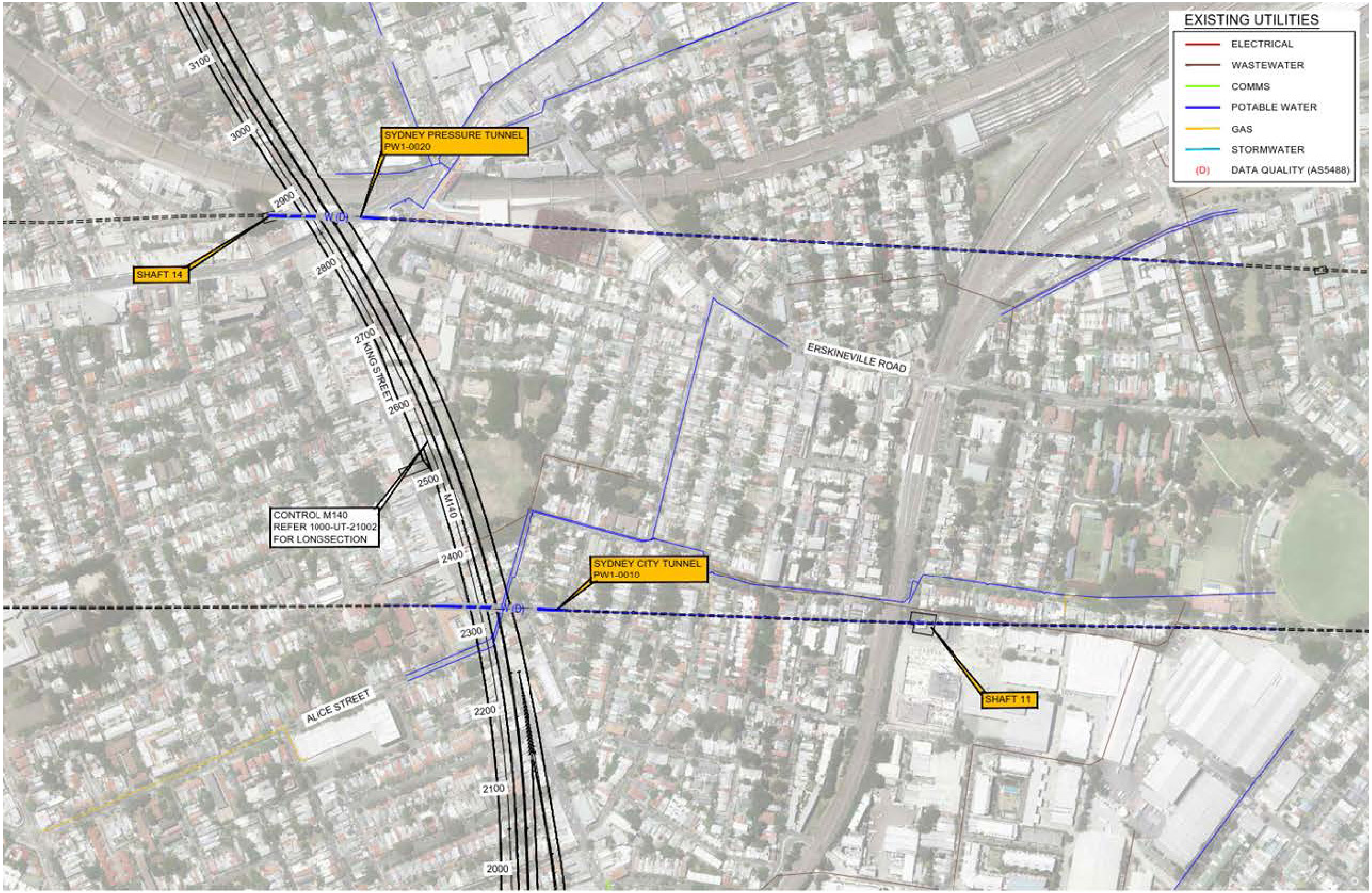
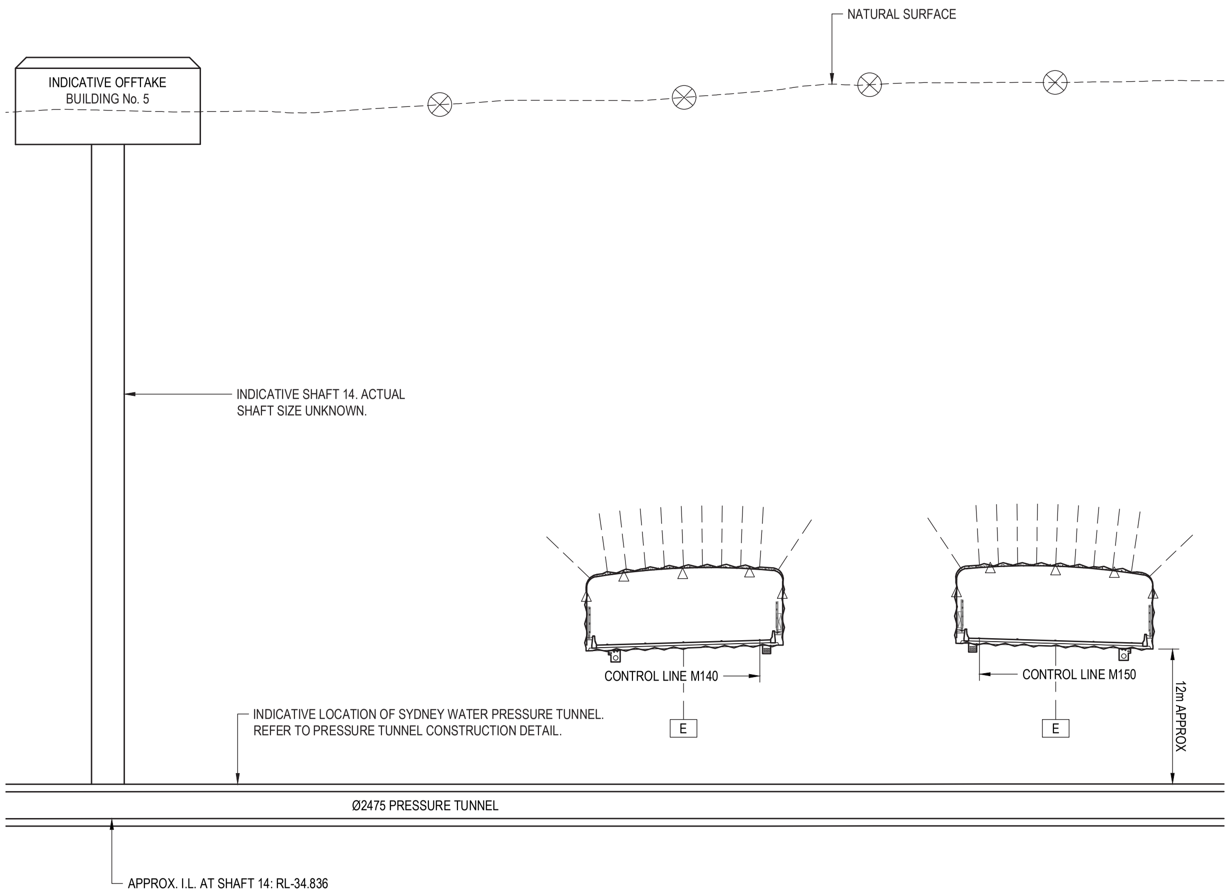


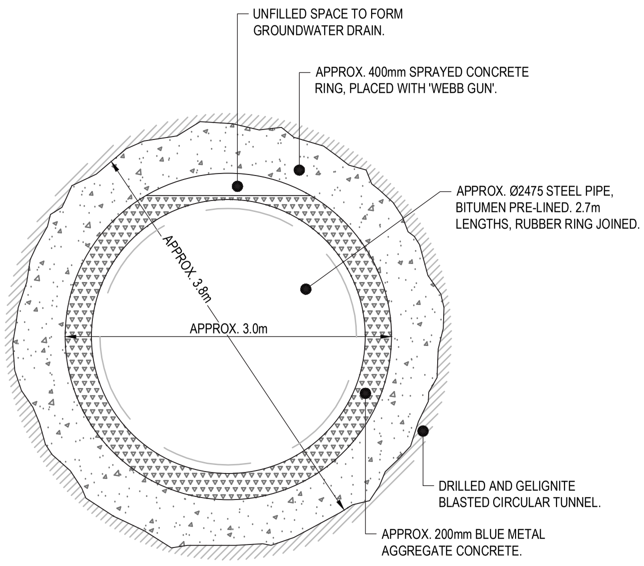
Figure A-11 Sydney Water Tunnels



PRESSURE TUNNEL DETAILED SECTION
SCALE 1:500

NOTES

1. TYPICAL CROSS SECTION PROVIDED FOR ILLUSTRATIVE PURPOSES. TUNNEL STRUCTURE WILL VARY WITH DEPTH & GEOTECHNICAL CONDITIONS.
2. THE LOCATION OF EXISTING UNDERGROUND AND OVERHEAD SERVICES HAS BEEN IDENTIFIED THROUGH THE USE OF DBYD DATA, WORK AS EXECUTED PLANS AND ELECTRONIC DRAWING FILES SOURCED FROM THE INDIVIDUAL UTILITY SERVICE PROVIDER. SERVICE LOCATIONS AND LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE ONLY AND ARE SUBJECT TO FURTHER INVESTIGATION.
3. WORK AS EXECUTED PLANS FOR THE SYDNEY PRESSURE TUNNEL WERE PROVIDED BY SYDNEY WATER ON 05/10/16. DRAWING NO: INDEX22-5-419.
4. REFER DRG. 32012 FOR MAXIMUM EXPECTED SETTLEMENT AND ANGULAR DISTORTION VALUES.
5. MOVEMENT PREDICTION BASED ON THREE HEADINGS AND BOTTOM BENCH EXCAVATION.
6. MONITORING POINTS ARE INDICATIVE ONLY. THE MONITORING REQUIREMENTS AND FREQUENCY WILL BE SUBJECT TO THE AGREEMENT OF SYDNEY WATER.

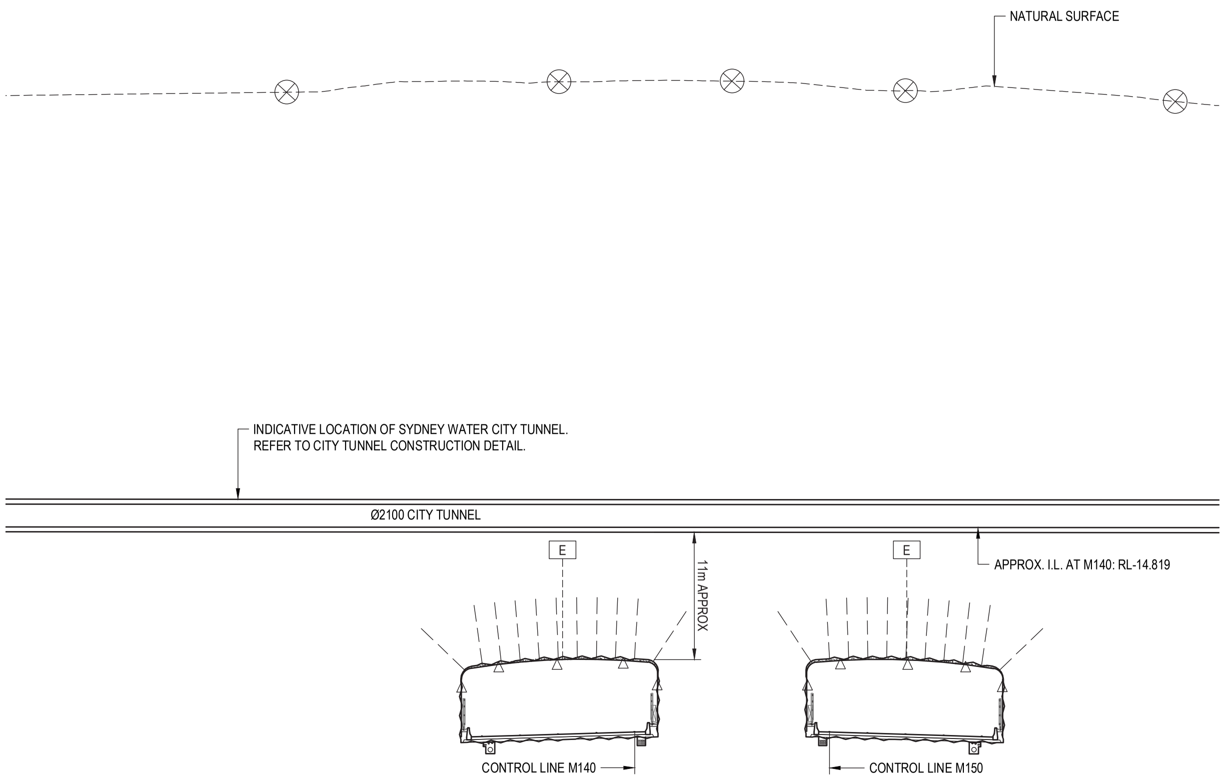


PRESSURE TUNNEL CONSTRUCTION DETAIL
SCALE 1:50

LEGEND:

- OPTICAL SURVEY TARGETS
- GROUND SETTLEMENT MONITORING POINT
- E EXTENSOMETER

Figure A-12 Sydney Water Pressure Tunnel



CITY TUNNEL DETAILED SECTION

SCALE 1:500

NOTES

1. TYPICAL CROSS SECTION PROVIDED FOR ILLUSTRATIVE PURPOSES. TUNNEL STRUCTURE WILL VARY WITH DEPTH & GEOTECHNICAL CONDITIONS.

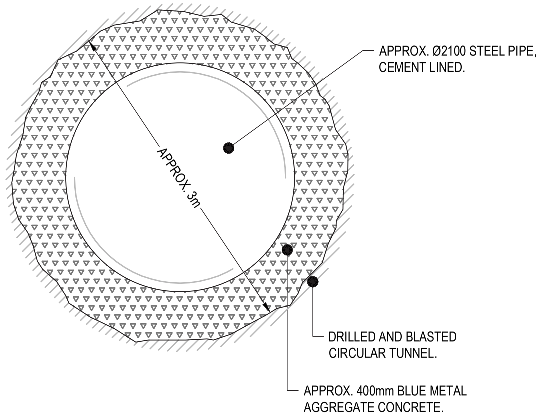
2. THE LOCATION OF EXISTING UNDERGROUND AND OVERHEAD SERVICES HAS BEEN IDENTIFIED THROUGH THE USE OF DBYD DATA, WORK AS EXECUTED PLANS AND ELECTRONIC DRAWING FILES SOURCED FROM THE INDIVIDUAL UTILITY SERVICE PROVIDER. SERVICE LOCATIONS AND LEVELS SHOWN ON THIS DRAWING ARE INDICATIVE ONLY AND ARE SUBJECT TO FURTHER INVESTIGATION.

3. WORK AS EXECUTED PLANS FOR THE SYDNEY CITY TUNNEL WERE PROVIDED BY SYDNEY WATER ON 05/10/16. DRAWING NO: INDEX22-7-43.

4. REFER DRG. 32012 FOR MAXIMUM EXPECTED SETTLEMENT AND ANGULAR DISTORTION VALUES.

5. SETTLEMENT PREDICTION BASED ON THREE HEADINGS AND BOTTOM BENCH EXCAVATION.

6. MONITORING POINTS ARE INDICATIVE ONLY. THE MONITORING REQUIREMENTS AND FREQUENCY WILL BE SUBJECT TO THE AGREEMENT OF SYDNEY WATER.



CITY TUNNEL CONSTRUCTION DETAIL

SCALE 1:50

LEGEND:

- △ OPTICAL SURVEY TARGETS
- ⊗ GROUND SETTLEMENT MONITORING POINT
- E EXTENSOMETER

Figure A-13 Sydney Water City Tunnel

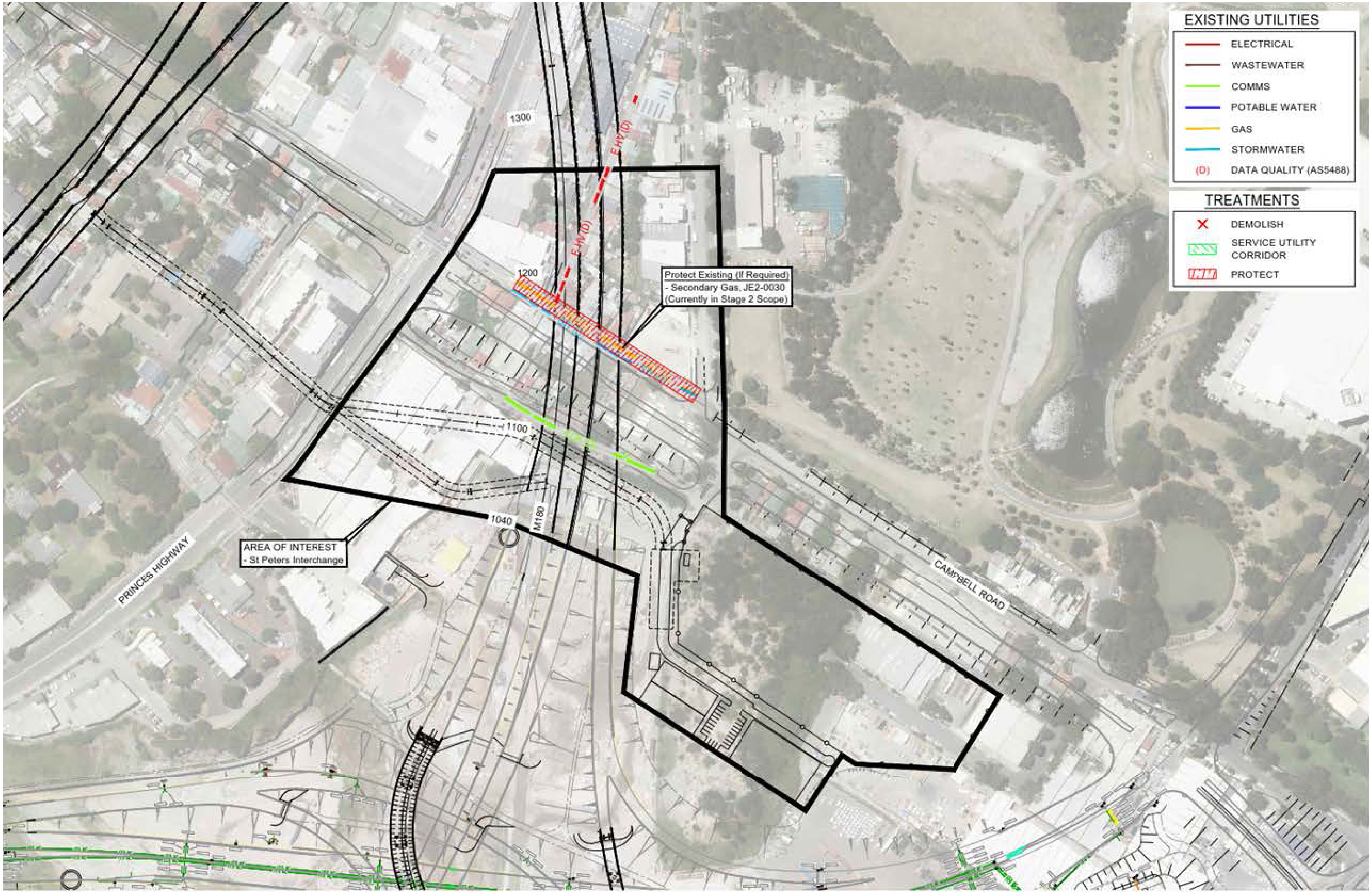


Figure A-14 Existing and proposed utility services - St Peters

Appendix G

Draft community consultation framework

WestConnex

Roads and Maritime Services

WestConnex M4-M5 Link

Draft Community Consultation Framework

August 2017

Client: Roads and Maritime Services

ABN: 76 236 371 088

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AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 AS/NZS4801 and OHSAS18001.

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Glossary of terms and abbreviations

Term	Definition
C	
CBD	Central Business District
CCS	Community Communication Strategy The CCS describes the detail of the community liaison and engagement process and activities, including mitigation measures, that would be the responsibility of the contractor or contractors engaged to carry out design, construction and operation of the project. The CCS would be consistent with principles and practices outlined in this Draft Community Consultation Framework (CCF). The CCS would be submitted to the Secretary of the DP&E for approval no later than one month prior to commencement of any work
CEMP	Construction Environmental Management Plan A plan developed for the construction phase of the project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that the environmental risks are properly managed
Construction	Construction refers to construction and commissioning of the project
CNVMP	Construction Noise and Vibration Management Plan
D	
DP&E	NSW Department of Planning and Environment
DPI-Water	NSW Department of Primary Industries – Water
Draft CCF	Draft Community Consultation Framework Provides an overview of the community consultation and engagement principles and practices that would apply during the construction and operation phase of the project
E	
EIS	Environmental impact statement
Environment	As defined within the *Environmental Planning and Assessment Act 1979* (NSW), all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
I	
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
N	
NRMA	National Roads and Motorists' Association
NSW EPA	NSW Environment Protection Authority
O	
OEH	NSW Office of Environment and Heritage (Formerly DECCW)
Operation	Operation refers to operation and maintenance of the project
P	
Project	A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange
R	
Roads and Maritime	NSW Roads and Maritime Services
S	
SEARs	Secretary's Environmental Assessment Requirements
SMC	Sydney Motorway Corporation

1 Introduction

1.1 Overview

This Draft Community Consultation Framework (Draft CCF) has been prepared to address the NSW Department of Planning and Environment (DP&E) Secretary's Environmental Assessment Requirements (SEARs) that relate to the key issue of socio-economic, land use and property for the WestConnex M4-M5 Link project (the project), as outlined in **Table 1**.

Table 1 SEARs – socio-economic, land use and property

Desired performance outcome	SEARs	Where addressed in the EIS
4. Consultation The project is developed with meaningful and effective engagement during project design and delivery.	1. The project must be informed by consultation, including with relevant local, State and Commonwealth government agencies, infrastructure and service providers, special interest groups (including Local Aboriginal Land Councils, Aboriginal stakeholders, and pedestrian and bicycle user groups), affected landowners, businesses and the community.	Details of consultation activities carried out and information provided to stakeholders during preparation of the EIS are provided in **Chapter 7** (Consultation). **Table 2** in this document provides an initial list of stakeholders based on analysis to date and identifies the anticipated tools that would be used to engage and consult with these stakeholders during construction.
	2. The Proponent must document the consultation process, and demonstrate how the project has responded to the inputs received.	Details of the consultation process and how feedback has informed the development of the EIS are provided in **Chapter 7** (Consultation). This document describes how feedback from stakeholders would be gathered and how this would inform the project during its construction and operation phases (subject to project approval).
	3. The Proponent must describe the timing and type of community consultation proposed during the design and delivery of the project, the mechanisms for community feedback, the mechanisms for keeping the community informed, and procedures for complaints handling and resolution.	Details of the consultation activities and mechanisms for gathering feedback during the EIS phase of the project are outlined in **Chapter 7** (Consultation). This document relates the proposed community consultation approach during the construction and operation phases of the project, should it be approved. **Section 4** of this document describes the communication tools that would be used to inform and seek feedback from project stakeholders and the community. **Section 5** of this document outlines the proposed enquiries

Desired performance outcome	SEARs	Where addressed in the EIS
		and complaints handling procedure. Additionally, **section 6** of this document details the monitoring, reporting and evaluation of community and stakeholder consultation procedures. **Section 7** outlines consultation on specific issues and how these would be addressed, including, for example, consultation on utilities works.
9. Socio-economic, Land Use and Property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	8. A draft Community Consultation Framework must be prepared identifying relevant stakeholders, procedures for distributing information and receiving/responding to feedback and procedures for resolving stakeholder and community complaints during construction and operation. Key issues that must be addressed in the draft Framework include, but are not limited to: (a) traffic management (including property access, pedestrian access); (b) landscaping/urban design matters; (c) construction activities including out of hours work; and (d) noise and vibration mitigation and management.	This draft Community Consultation Framework, which is included in the EIS as **Appendix G**. Key issues are addressed in **Chapter 7** (Consultation) of the EIS.
14. Heritage The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places. The design, construction and operation of the project	4. Where impacts to Aboriginal objects and/or places are proposed, consultation must be undertaken with Aboriginal people in accordance with the current guidelines.	Consultation undertaken for the EIS is outlined in **Chapter 21** (Aboriginal heritage). For the construction and operational phases of the project, should it be approved, a Construction Heritage Management Plan would detail how construction impacts on historic and Aboriginal heritage would be minimised and managed, including training and induction processes for construction personnel.

Desired performance outcome	SEARs	Where addressed in the EIS
avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage and Aboriginal objects and places.		

This Draft CCF provides an overview of the community consultation principles and practices that would apply during the construction and operation phases of the project. This Draft CCF includes a list of project stakeholders in **Table 2** based on the SEARs and research and consultation to date and identifies, at a strategic or high level:

- Procedures for engaging/consulting with these stakeholders
- Procedures for gathering, managing and using feedback and information from these stakeholders.

Should the project be approved, a Community Communication Strategy (CCS) would be prepared to support the design and construction of the project and for 12 months following the completion of construction of the project (see **Figure 1**). The CCS would describe in detail the NSW Roads and Maritime Services (Roads and Maritime) community liaison and engagement process and activities, including mitigation measures and conditions of project approval for the project development, delivery and operation. The CCS would be consistent with principles and practices outlined in this Draft CCF.

Consultation and engagement would take place during each phase of project development as identified in **Figure 1** below.

Each stage of the CCS would focus on key issues of interest to the community and impacts likely to be experienced by the community as identified in the EIS. This may include but would not be limited to:

- Traffic management (including property access, pedestrian and cycle access)
- Landscaping/urban design matters
- Construction activities including out-of-hours work
- Noise and vibration mitigation and management.

Figure 1 shows stages of engagement that would be carried out during the subsequent phases of the project, if approved. The key phases include detailed design, pre-construction, construction and operation. Each of these key phases includes specific project milestones for gathering and responding to community and stakeholder feedback.

Detailed design

- **Post approvals**
  - Ad-hoc consultation on any material changes to the design (from that presented in the EIS).
  - Would include information sessions, distribution of information materials and a call for feedback to be considered in the design refinement.
- **Preferred design**
  - It may be necessary to release the preferred design for consultation. This would largely depend on how materially different it is from the design presented in the EIS.
  - Would include information sessions, distribution of information materials and a call for feedback to be considered in the design refinement.

Pre-construction

- **Pre-construction**
  - Engage key stakeholders and communities in the development of the Construction Environmental Management Plan for the project
  - Would include face-to-face meetings and briefings, gathering feedback for consideration and inclusion in the plans as needed.

Construction

- **Start of construction**
  - Inform local community about upcoming work in advance of works commencing.
  - Would include notifications, website updates, community updates and electronic newsletters as a minimum.
  - 24-7 community enquiries and complaints line would be operational during this period.
- **During construction**
  - Inform local community and stakeholders about upcoming work and project milestones.
  - Engage community and local stakeholders on key plans including Urban Design and Landscape Plan, seeking feedback for inclusion in the plans.
  - Would involve information sessions, community updates, notifications, website updates, social media updates, advertisements as needed, electronic newsetters, face-to-face meetings, media activities, on-site signage.
  - 24-7 community enquiries and complaints line would be operational during this period.

Operation

- **Opening to traffic**
  - Inform local community and stakeholders about site demobilisation, completion of work and landscaping activities to be carried out.
  - Educate motorists about new motorway opening and how to use the new motorway.
  - Would include information sessions, community updates, notifications, website updates, social media updates, advertisements as needed, electronic newsetters, face-to-face meetings, media activities, on-site signage.
  - 24-7 community enquiries and complaints line would be operational during this period.
- **Operation (for 12 months after project completion)**
  - Inform local community and stakeholders about maintenance activities that may result in impacts.
  - Inform motorists of closures and detours during maintenance work.
  - Would include notifications, website updates, social media updates, advertisements as needed and on-site signage.
  - 24-7 operations line would be operational during this period.

Figure 1 Consultation process following project approval

Noting the SEARs for the project, this Draft CCF is structured as follows:

- Consultation purpose and objectives
- Enquiries and complaints handling
- Monitoring and evaluation
- Communication tools
- Stakeholder analysis providing details on:
  - All stakeholders
  - Indicative tools for consulting/engaging with these stakeholders
  - Specific issues, communications and management strategies appropriate for traffic management, landscaping/urban design, construction activities and noise and vibration mitigation
  - Communication during operation.

2 Consultation purpose and objectives

This Draft CCF describes the proposed approach to managing community and stakeholder engagement during the construction and operation of the project. Should the project be approved, the principles and guidelines of this Draft CCF would be applied in developing the project's community consultation strategies, specific to design and construction and operations and maintenance.

Throughout project development, delivery and operation, a series of engagement principles would apply. Teams working on the project would always endeavour to:

- Make the most of opportunities to involve stakeholders and the community in the project
- Arrange engagement activities at times and places that are convenient for our stakeholders and provide online options where possible
- Respond to reasonable requests from the community and stakeholders for additional engagement activities and information
- Acknowledge and understand diverse views on the project
- Use feedback to positively influence the project design and delivery.

By applying these principles, the community and stakeholder consultation process would aim to:

- Promote a high level of community and stakeholder awareness of construction activities and related work
- Provide accurate and timely information to communities and stakeholders
- Provide a timely response to issues and concerns raised by stakeholders and the community
- Identify issues for consideration in construction management and the operation of the project
- Address issues to improve outcomes for community and stakeholders, where possible and, in doing so, reduce the impact of the project.

3 Stakeholder identification

3.1 Pre-construction and construction

Prior to the start of construction, the project team would:

- Review the consultation requirements in the conditions of approval and include this in the CCS
- Review and confirm stakeholders relevant to the project
- Assess feedback and information gathered during consultation to date, to understand further informational needs
- Identify appropriate tools for informing and consulting these stakeholders during, before and after construction
- Use this information and analysis to prepare the CCS.

Table 2 below provides a high-level, draft list of stakeholders based on analysis to date and identifies the anticipated tools that would be used to engage and consult with these stakeholders during construction. This list would be reviewed and additional stakeholders would be added as they become known to the project.

Communication tools and activities for informing and consulting with stakeholders would be employed flexibly, to suit the nature and scale of stakeholders' interests or issues. Timing would be determined and included in the CCS.

Table 2 Project stakeholders

Stakeholder group	Stakeholders	Indicative communication tools
Local elected representatives at a Federal, State and local government level	· Minister for WestConnex · Minister for Roads, Maritime and Freight · Federal Member for Sydney · Federal Member for Grayndler · Member for Heffron · Member for Newtown · Member for Balmain · Member for Summer Hill · Councillors at Inner West Council (following September 2017 elections) · Councillors at City of Sydney Council	· Meetings and briefings · Phone, emails and letters · Community updates distributed via email, post and made available online

Stakeholder group	Stakeholders	Indicative communication tools
Government agencies, local councils	· NSW Department of Planning and Environment · NSW Environment Protection Authority (NSW EPA) · Heritage Council of NSW · NSW Department of Primary Industries - Lands · NSW Department of Primary Industries – Water (DPI-Water) · NSW Department of Primary Industries - Fisheries · NSW Office of Environment and Heritage (including the Heritage Division) (OEH) · Metropolitan Local Aboriginal Land Council · NSW Health (including Sydney Local Health District) · Transport for NSW (including Transport Management Centre and Sydney Coordination Office) · UrbanGrowth NSW · Port Authority of NSW · Fire & Rescue NSW · City of Sydney Council · Inner West Council · NSW State Emergency Services	· Meetings and briefings · Phone, emails and letters · Community updates
Council Reference Groups and other established project stakeholder groups	· Inner West Council, Community Liaison Group · WestConnex Community Reference Group · WestConnex Urban Design Review Panel · Air Quality Community Consultative Committee	· Ongoing meetings and briefings as required and agreed to by the groups' members · As required by the groups' Terms of Reference
Local community	· Residents near construction sites including construction ancillary facilities · Residents in surrounding suburbs to the project · Motorists · Bus passengers, pedestrians and cyclists	· Work notification letters, phone calls and face-to-face meetings including door-knocking · Community information sessions/public displays · Community update newsletters (including electronic newsletters) · Social media posts · Press releases and local media stories · Project information line · Project website updates · Livetraffic.com updates · Variable message signs and other roadside signage (for

Stakeholder group	Stakeholders	Indicative communication tools
		motorists) · Radio advertising (traffic alerts) · Newspaper advertising
Businesses	· Business owners and tenants adjacent to construction sites and ancillary facilities	· Work notification letters, phone calls and face-to-face meetings including door-knocking · Community information sessions/public displays · Community update newsletters (including electronic newsletters) · Social media posts · Press releases and local media stories · Project information line · Project website updates · Livetraffic.com updates · Radio advertising (traffic alerts) · Newspaper advertising · Working with council business coordinators
Community service providers	· Local schools · Childcare centres · Hospitals · Local religious organisations · Nursing homes and aged care facilities	· Briefings and/or meetings · Community information sessions/public displays · Community update newsletters · Newspaper advertising · Press releases and local media stories · Project information line · Posters · Project website
Peak industry groups	· Infrastructure Partnerships Australia · Road Freight Industry Council · Australian Logistics Council · Bicycle NSW (and local cycling clubs) · Pedestrian Council of Australia · NSW Taxi Council · Uber · NatRoads Ltd · National Roads and Motorists' Association (NRMA) · Planning Institute of Australia · Urban Taskforce · National Trust · Warren Centre	· Meetings and/or briefings · Letters, phone calls, emails · Community updates

Stakeholder group	Stakeholders	Indicative communication tools
Utility services	· Sydney Water · Sydney Trains · AusGrid · Jemena · Telstra · Optus · TPG (AAPT)	· Meetings · Letters, phone calls, emails
Media	· Local media (media circulated in the immediate project area) · Linguistically Diverse Media (media circulated in the immediate project area) · Metropolitan media · National media	· Media releases · Media conferences/briefings · Telephone and email contact

3.2 Operation

During operation of the project, stakeholders, including the community, authorities, agencies and motorists, would be kept informed about activities related to the operation, maintenance and management of the motorway.

Most of this communication would relate to providing traffic and transport information, but may also include communication of operational monitoring data, where required. The methods of communication utilised to inform stakeholders during the operation of the project are outlined in **section 5.3** of this document.

Key stakeholders during operation would include (but would not be limited to):

- Road users
- Communities near the tunnel portals (Haberfield, Rozelle near Iron Cove Bridge, St Peters)
- Communities around the Rozelle interchange.

4 Communication tools

4.1 Construction

A range of communication tools would be used to inform and consult with communities and stakeholders. These would include:

- Postal notifications of proposed work
- Web-based information including information provided through social media accounts
- Videos and animations to assist in community understanding of key project features or activities
- Meetings with key stakeholders
- Staffed information sessions and outreach activities
- Drop-in centre
- Updates to Livetraffic.com
- A 24-hour toll-free enquiries and complaints line
- An email contact address
- Translation and interpreting service
- Project updates distributed via email and/or post and published on the project website
- Advertisements and media announcements
- Variable message signs and roadside/motorway signage
- Emails to registered stakeholders
- Door-knocking at properties adjacent to project sites.

These communication tools would be provided in accessible formats to support people with disabilities.

4.2 Operation

During operations and when completing maintenance activities, the community and stakeholders would be kept informed about activities that may impact local communities or road users. Tools may include:

- Web-based information including information provided through social media accounts
- Temporary notices on shared paths or other public facilities impacted by work
- Radio advertising
- Email, phone, fax and postal contact details
- Variable message signs
- Updates to LiveTraffic.com
- Notifications to local properties on expected impacts of scheduled or emergency maintenance work.

5 Enquiries and complaints handling procedure

A complaints management system consistent with ISO 10002:2014 *(Guidelines for complaint management in organisations)* would be developed and implemented prior to the commencement of construction. The system would be maintained during construction and operation by the relevant contractors and would be made available to the Secretary of DP&E. This section of the Draft CCF outlines the activities to be undertaken during each phase of the project to establish and maintain the complaints management system.

5.1 Pre-construction

A number of dedicated project services have been established (refer to **Chapter 7** (Consultation) of the EIS) for project communication and consultation. These would be maintained throughout construction and for a period of 12 months after completion of project construction. These services include:

- Points of contact: a toll-free telephone number, postal address and email address. During and immediately following construction, the toll-free telephone number would operate 24 hours a day, seven days a week (24/7)
- Translating and interpreting service
- Project website
- A dedicated acquisition line providing an ongoing dispute resolution, counselling program and contact information to relevant services for all relocated persons.

These contact details have already been provided to community members and stakeholders via the project website, community updates and notifications and would be prominently positioned on all communications materials before, during and after construction.

5.2 Construction

Details of how to make a complaint or enquiry would be included in all communication material such as community updates, work notifications, advertisements and the project website. The WestConnex toll-free telephone service would operate 24/7 prior to construction and continue for 12 months after the project opens.

A complaints and enquiry database would be maintained to record the details, response and outcome of the complaint/enquiry. All complaints would be investigated as outlined in **Figure 2** and an appropriate response would be provided to the complainant. The flow chart below demonstrates a typical enquiries and complaints handling process. A similar process would be adopted for the project. Response times would be specified for each step of the process.

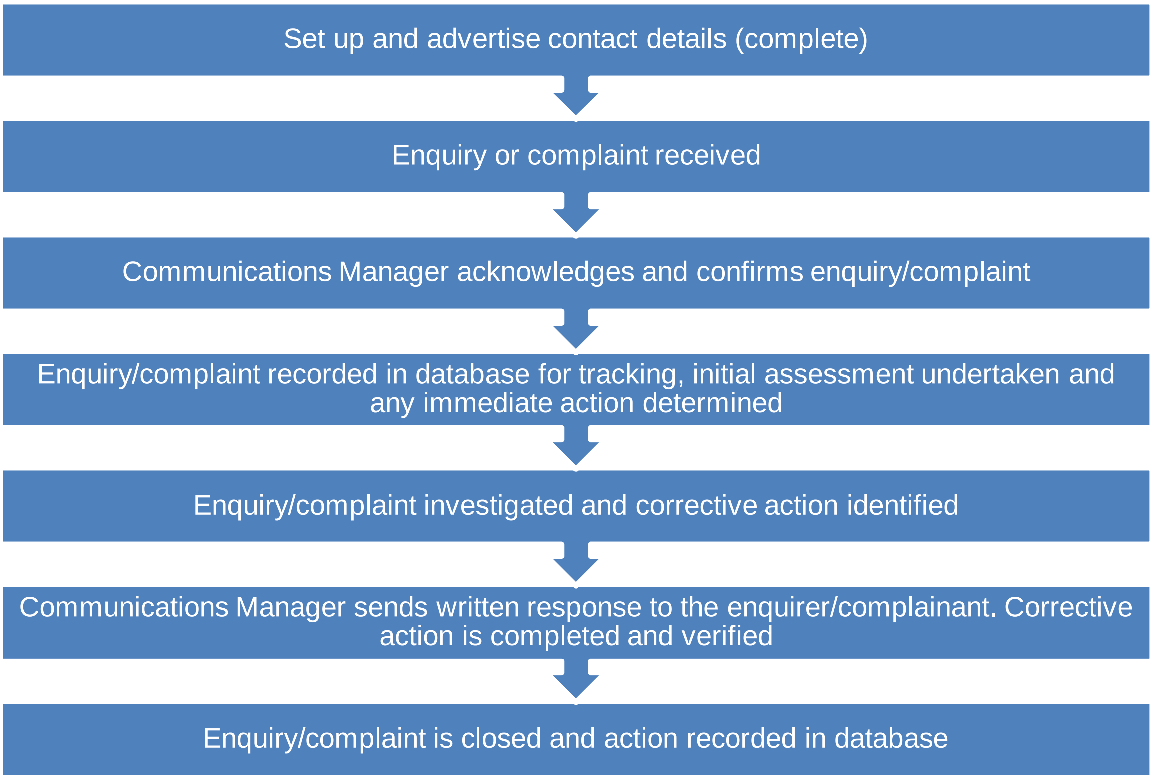

Figure 2 Typical enquiries and complaints handling process

5.3 Operation

During operation of the project, the operation and maintenance provider would field calls related to the operation and maintenance of the motorway. Enquiries or complaints relating to the condition of the infrastructure or road surface, or traffic incidents, would be managed and responded to immediately to ensure the smooth operation of the motorway.

Other enquiries and community representations would be responded to within five working days. Representations classified as complaints would be acknowledged within two working days. All enquiries, complaints and representations would be recorded in a database. Roads and Maritime would provide tolling services and would field enquiries, representations and complaints related to tolling.

6 Monitoring, reporting and evaluation

6.1 Construction

The performance and effectiveness of the community consultation and engagement activities undertaken during construction of the project would be regularly monitored for effectiveness. Processes and communication channels would be modified based on feedback or issues identified during the monitoring process.

Data would be collected during community consultation and engagement activities for monitoring, reporting and evaluation purposes such as:

- Examining the adequacy of the CCS and its implementation in achieving strong community and consultation outcomes
- Measuring the performance, timeliness and effectiveness of communication activities and tools
- Providing evidence of proactive communication
- Identifying trends and hot-spots for complaints or issues, including repeated complaints about preventable issues and working with construction teams to implement further mitigation measures as needed to further reduce impacts.

6.2 Operation

During operation of the project, the operations room would be required to ensure the project company is informed of all community issues and decisions affecting the community.

7 Specific issue communication and management

7.1 Construction

It is anticipated that some aspects of the project's construction would require specific communications and/or management strategies due to the nature of the potential impact and/or stakeholder group. Any such strategies would be guided by this framework and included in the CCS.

Teams working on the project would communicate early and provide information that is easy to understand where construction impacts are likely to cause an inconvenience to local residents and commuters particularly if those impacts relate to traffic, noise, dust and health.

Indicative communication and management strategies are identified below for the following specific construction issues:

- Air quality management
- Traffic management, including property and pedestrian access during construction
- Construction activities and 'out-of-hours' work that may lead to noise and vibration impacts
- Heritage matters
- Social and economic issues
- Water quality, hydrology, groundwater and flooding matters
- Tunnelling and vibration management
- Visual amenity
- Noise mitigation and acoustic treatments
- Cumulative impacts.

These communications and management strategies would be further developed prior to construction as part of the CCS.

7.1.1 Air quality management

Following project approval, an Air Quality Community Consultative Committee would be established to focus on the results of local air quality monitoring during and after construction.

Engagement with the NSW EPA, Office of the NSW Chief Scientist and Engineer and NSW Health on the design of the tunnel and air quality systems would continue. Information would be provided on the website on how the tunnel ventilation system would operate.

7.1.2 Traffic management (including property and pedestrian access)

A Construction Traffic and Access Management Plan would be developed prior to construction to outline measures for traffic control, safety and management, traffic staging and access, a workforce car parking strategy and monitoring of truck marshalling areas. Changes to roads or paths would be communicated to emergency services, public transport operators, other road user groups and any other affected stakeholders.

Regular consultation would continue with organisations across the Transport for NSW cluster (Sydney Trains, Roads and Maritime, Sydney Buses, Sydney Metro) to minimise impacts associated with light rail and rail track works and other major road work activities. Consultation to date has led to the development of an Active Transport Strategy (refer to **Appendix N** (Technical working paper: Active transport strategy) of the EIS) to guide the development of active transport network links by the project.

Specific road-user stakeholders and their issues would be identified prior to construction during the detailed planning phase (including motorists, pedestrians, cyclists, emergency services, peak freight organisations, NSW Taxi Council, transport and freight unions, local schools, major event organisers).

Potentially impacted property owners would be consulted about changes to property access during all stages of project development, delivery and operations. Communication tools and/or activities would be selected to suit the broad geographic spread of motorists using the M4-M5 Link, M4 and M5 motorway corridors, Parramatta Road, the Princes Highway and surrounding network (for example through traffic alerts released to media outlets, variable message signs, traffic alerts and Livetraffic.com web updates).

The WestConnex website, Facebook page, Twitter account, toll-free community enquiry line and email address would continue to be available for the community to find out about and/or report traffic issues.

7.1.3 Construction activities including out-of-hours work

A Construction Environmental Management Plan would be developed to address impacts related to construction activities identified in the EIS. This would include management measures to reduce to avoid impacts from noise and vibration, dust, traffic impacts as well as respite and out-of-hours work.

The Utilities Management Strategy (**Appendix F**) details the management options for the relocation or adjustment of utilities, including consultation with service providers and communities. This strategy would be updated and consultation would continue to inform the detailed utility relocation should the project be approved.

Meetings would be held with stakeholders near construction ancillary facilities and work sites, especially residents and businesses, to understand their needs and manage these in a reasonable manner.

- Regular consultation would occur with organisations across the Transport for NSW cluster (Sydney Trains, Roads and Maritime Services, Sydney Buses, Sydney Metro) to minimise impacts associated with light rail/rail track works and other road work activities
- Prior notice would be provided for all construction activities and any planned out-of-hours work.

7.1.4 Heritage matters

A Construction Heritage Management Plan would detail how construction impacts on historic and Aboriginal heritage would be minimised and managed including training and induction processes for construction personnel.

Regular consultation would continue with the NSW Heritage Council, OEH Heritage Division and other stakeholders.

7.1.5 Social and economic issues

A Social Infrastructure Plan would be developed in consultation with the community and relevant councils. This Plan would outline measures for maintaining community connectivity and provision of community and social facilities. The WestConnex Community Connections Program, described in **Chapter 7** (Consultation), would continue throughout construction of the project.

7.1.6 Water quality, hydrology, groundwater and flooding matters

A Flood Mitigation Strategy would be prepared by a suitably qualified and experienced person in consultation with directly affected landowners, DPI-Water, OEH and the relevant local councils. The strategy is relevant to both construction and operational phases of the project.

7.1.7 Noise and vibration mitigation and management

A Construction Noise and Vibration Management Plan (CNVMP) would be prepared for the project. The CNVMP would assist in ensuring that construction noise complies with the construction noise management levels set for the project and by prescribing noise and vibration monitoring, reporting and response procedures.

In addition to managing noise and vibration impacts, the CVNMP would also outline communications and management strategies for construction noise and vibration such as:

- Construction scheduling to minimise noise impacts including time and duration restrictions, respite periods and frequency of noise generating activities
- Procedures for notifying residents of construction activities likely to affect their amenity through noise and vibration
- An out-of-hours work protocol
- Contingency plans would be implemented in the event of non-compliances and/or noise and vibration complaints.

Regular consultation would continue with NSW EPA and sensitive receivers.

7.1.8 Tunnelling and vibration management

To assist in managing the impacts of tunnelling and vibration:

- Information would be provided, including to the media, on the tunnelling works including construction staff numbers, equipment, expertise, experience, and safety precautions
- Pre-condition building surveys would be done at properties within 50 metres from the edges of the tunnels and ramps to document existing conditions – with the agreement of affected landowners and prior notification to occupants
- Property owners, businesses and residents along the tunnel alignment would be contacted to ensure they have the relevant project team contact information to seek further information where needed
- Information specifically on tunnelling is available on the WestConnex website
- An online map would be made available via the project website to assist people to quickly and clearly see the tunnel alignment
- The project website would be updated regularly to show the progress of tunnel construction
- A toll-free 24-hour telephone service would be available in case of any queries or complaints
- If required, an Independent Property Impact Assessment Panel would be called up on to resolve issues and disputes including but not limited to disputes regarding rectification or compensation for impacts to third party property and infrastructure.

7.1.9 Visual amenity

To ensure the best possible outcomes in terms of landscaping and visual amenity:

- Early engagement would take place with councils and key stakeholder groups regarding street plantings and landscaping, noise mitigation structures, complementary urban design elements, open space and impacts on visual amenity (including any potential overshadowing impacts)
- Consultation would occur with affected residents regarding design and implementation of noise walls/hoardings, location of construction ancillary facilities and screening, vegetation removal and landscaping.

7.1.10 Cumulative impacts of concurrent project activities

Community respite periods would be coordinated with other neighbouring projects and utility service providers, as far as is practical.

7.2 Operation

During operation of the project, consultation would support works affecting the community, with issues escalated for management as required to ensure the smooth operation of the motorway. Consultation procedures would be outlined within an Operational Environmental Management Plan for the project or in the context of the Operators Environmental Management System. The operational requirements outlined below also include elements of stakeholder and community consultation.

7.2.1 Landscaping and urban design

Opportunities would be identified to seek and incorporate community and stakeholder feedback into the Urban Design and Landscape Plan for the project.

There would be ongoing consultation with UrbanGrowth NSW to ensure that the area where the project interfaces with the White Bay Power Station Destination achieves appropriate integration from a landscaping/visual, heritage and active transport connectivity perspective.

7.2.2 Residual land management

A Residual Land Management Plan would be prepared in consultation with relevant local councils and communities prior to the project opening to motorists. The Plan would identify the feasible uses of remaining project land and the timing for the implementation of actions for this land.

7.2.3 Emergency Response Plan

The operator would develop an Emergency Response Plan for the operation of the project. This Plan would include protocols and procedures to account for the need of peoples with disabilities who may encounter access problems in emergency situations.

8 Conclusion

This Draft CCF acts as a reference for the development of the CCS that would to be used during the construction and operational phases of project works. The CCS would guide the project team's interactions with the community and stakeholders and set standards for proactive engagement.

Appendix H

Technical working paper: Traffic and transport

WestConnex

Roads and Maritime Services

WestConnex – M4-M5 Link

Technical working paper: Traffic and transport

August 2017

Client: Roads and Maritime Services

ABN: 76 236 371 088

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Glossary of terms and abbreviations

Term	Definition
A	
AADT	Annual Average Daily Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a period of a year; divided by the number of days per year. It is calculated from mechanically obtained axle counts
ADT	Average Daily Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a seven-day period during a set number of weeks; divided by the total number of days. It is calculated from mechanically obtained axle counts
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average peak one hour in the AM peak period between 7.00 am–9.00 am on a normal working weekday
At-grade	A road at ground level, not on an embankment or in a cutting
ATC	Automatic Traffic Count
AWT	Average Weekday Traffic. The total volume of traffic (24 hours) passing a roadside observation point over a five-day weekday period during a set number of weeks (outside of school/public holidays); divided by the total number of days. It is generally calculated from axle counts of passing vehicles
B	
Bus lane	A traffic lane dedicated to buses, but which can also be used by taxis, bicycles and motorcycles
C	
Campbell Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at St Peters
Campbell Road motorway operations complex	An area where operational ancillary facilities are established. Located within the St Peters interchange, south of Campbell Road at St Peters, on land occupied during construction by the Campbell Road civil and tunnel site
Campbell Road ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at St Peters, within the St Peters interchange site
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes
CBD	Central Business District
CCTV	Closed-Circuit Television
CEMP	Construction Environmental Management Plan. A site specific plan developed for the construction phase of a project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that environmental risks are properly managed
City Centre Access Strategy	Sydney Centre Access Strategy (Transport for NSW 2013)
CNVG	*Construction Noise and Vibration Guideline* (Roads and Maritime, 2016)
CNVIS	Construction Noise and Vibration Impact Statements

Term	Definition
CNVMP	Construction Noise and Vibration Management Plan
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design
Construction	Includes all physical work required to construct the project
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, workforce parking, maintenance workshops and offices
Construction fatigue	Impact on receivers in the vicinity of concurrent and/or consecutive construction activities
Corridor	A substantial segment of the transport network, in which parallel, possibly competing, transport routes (and modes, where appropriate) operate between two locations
CSSI	Critical State significant infrastructure
CTAMP	Construction Traffic and Access Management Plan
Cul-de-sac	A street or road that is open for vehicular traffic at one end only
Culvert	A structure that allows water to flow under a road
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own
Cut-and-cover	A method of tunnel construction whereby the structure is built in an open excavation and subsequently covered
D	
Darley Road civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Leichhardt
Darley Road motorway operations complex	An area where operational ancillary facilities are established. Located at Leichhardt, south of City West Link and the Inner West Light Rail line on land occupied during construction by the Darley Road civil and tunnel site
Design speed	A nominal speed which determines the geometric design features of a road
Detailed design	The phase of the project following concept design where the design is refined, and plans, specifications and estimates are produced, suitable for construction
Detour	An alternative route, using existing roads, made available to traffic
Design speed	A nominal speed which determines the geometric design features of a road
Divided road	A road with a separate carriageway for each direction of travel created by placing a physical separation (eg median) between the opposing traffic directions
Do minimum	A model scenario that does not incorporate the proposed project infrastructure
Do something	A model scenario that incorporates the proposed project infrastructure
Do something cumulative	A model scenario that incorporates the proposed project infrastructure and other relevant project infrastructure
DP&E	NSW Department of Planning and Environment
E	
EB	Eastbound

Term	Definition
EIS	Environmental Impact Statement
Enabling works	Works which are required to enable the commencement of the main construction works
Entry ramp	A ramp by which one enters a limited-access highway/tunnel
Environment	Includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings (from EP&A Act)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
Exit blocking	Queuing traffic from a downstream link or intersection that blocks traffic from being able to travel through and exit an intersection
Exit ramp	A ramp by which one exits a limited-access highway/tunnel
F	
F6 Extension (previously referred to as SouthLink)	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor. The project is being delivered by NSW Roads and Maritime Services and would be subject to separate assessment and planning approval
Footpath	The paved area in a footway
Footprint	The extent of the impact that a development (in plan-view) makes on the land
Footway	An area open to the public designated for the movement of pedestrians or has one of its main uses for pedestrians
Freeways	Fast, high volume, access controlled roads that primarily link regional hubs and cities usually with grade separated intersections and without traffic lights
Freight Strategy	NSW Freight and Ports Strategy (Transport for NSW 2013b)
G	
Gateway to the South	An accelerated pinch points program, the Gateway to the South Pinch Points Program aims to ease congestion and improve journey reliability on Sydney's key southern corridors. The NSW Government has committed $300 million to address critical pinch points along the A1, A3 and A6 routes south of the M5 Motorway
Grade separation	The separation of road, rail or other transport modes, so that crossing movements at intersections are at different levels
GMA	Greater Metropolitan Area. This area includes the Sydney Greater Capital City Statistical Area and the Illawarra and Lower Hunter regions.
GVM	Gross Vehicle Mass
H	
h	Hour
ha	Hectare/s
Haberfield civil and tunnel site/Haberfield civil site	Construction ancillary facilities for the M4-M5 Link project located at Haberfield
HCV	Heavy Commercial Vehicle. Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Austroads Vehicle Classification System

Term	Definition
I	
IDM	Intersection Diagnostic Monitor
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
Inner West Council	The amalgamation of the former local government areas of Ashfield, Leichhardt and Marrickville, proclaimed on 12 May 2016
Inner West subsurface interchange	A subsurface interchange at Leichhardt and Annandale that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link
Inside shoulder	The area of pavement outside the traffic lanes that is closest to the ‘fast’ lane
Interchange	An intersection of two or more roads that typically uses grade separation, and one or more ramps, to permit traffic on at least one carriageway to pass through the junction without directly crossing any other traffic stream
Iron Cove Link	Around one kilometre of twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge
Iron Cove Link civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
Iron Cove Link motorway operations complex	An area where operational ancillary facilities are established. Located south of the realigned Victoria Road carriageway between Callan Street and Springside Street at Rozelle, on land occupied during construction by the Iron Cove Link civil site
Iron Cove Link ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at Rozelle
J	
Junction	A place where two or more roads meet
K	
KGRIU	King Georges Road Interchange Upgrade A component of the WestConnex program of works. Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project
km/h	Kilometres per hour
L	
Local road	A road or street used primarily for access to abutting properties
LCV	Light Commercial Vehicle. Vehicles up to 4.5 tonnes Gross Vehicle Mass (GVM), including cars which have been registered for business use
LGA	Local Government Area
Local road	A road or street used primarily for access to abutting properties
LoS	Level of service. A qualitative measure describing operational conditions within a traffic stream or intersection and the perception by motorists and/or passengers
M	
M4 East mainline stub tunnels	Eastbound and westbound extensions of the M4 East mainline tunnel being built as part of the M4 East project (to connect with the M4-M5 Link)

Term	Definition
M4 East mainline connection	The underground connection between the M4-M5 Link mainline tunnels and the M4 East mainline stub tunnels
M4 East Motorway/project	A component of the WestConnex program of works. Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange
M4 Motorway	The M4 Motorway is a 40 kilometre motorway that extends from Concord in Sydney's inner west to Lapstone at the foothills of the Blue Mountains
M4 Widening	A component of the WestConnex program of works. Widening of the existing M4 Motorway from Parramatta to Homebush
M4-M5 Link	The project which is the subject of this EIS. A component of the WestConnex program of works
M5 East Motorway	Part of the M5 Motorway corridor. Located between Beverly Hills and Sydney Airport (General Holmes Drive)
M5 motorway corridor	The M5 East Motorway and the M5 South West Motorway
M5 South West Motorway	Part of the M5 Motorway corridor. Located between Prestons and Beverly Hills
Mainline tunnels	The M4-M5 Link mainline tunnels connecting with the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters
Managed motorway	A managed motorway uses active traffic management to reduce congestion, improve reliability of travel times and inform travellers of real-time incidents and expected travel times to set destination along the motorway
Median	The central reservation which divides a carriageway for traffic travelling in opposite directions
Midblock	A general location on a road between two intersections
Mode	A type or method of transport movement – including for the road corridor: cars, buses, bikes and pedestrians
Motorway	Fast, high volume controlled access roads. May be tolled or untolled
N	
National Road Network	AusLink National Land Transport Network
NB	Northbound
Network productivity	Indication of efficiency of a road network, which can be expressed in terms of vehicle kilometres travelled and vehicle hours travelled per day
New M5 Motorway/project	A component of the WestConnex program of works. Located from Kingsgrove to St Peters (under construction)
New M5 mainline stub tunnels	Northbound and southbound extensions of the New M5 mainline tunnel being built as part of the New M5 project (to connect with the M4-M5 Link)
New M5 mainline connection	The underground connection between the M4-M5 Link mainline tunnels and the New M5 mainline stub tunnels

Term	Definition
Northcote Street civil site	A construction ancillary facility for the M4-M5 Link project located at Haberfield
NSW	New South Wales
O	
OOHW	Out-of-hours work
Outside shoulder	The area of pavement outside the traffic lanes that is closest to the 'slow' lane
Overbridge	Bridge that conveys another road, rail or pedestrians over the described road
P	
Parramatta Road corridor	The Parramatta Road corridor is the area from Parramatta CBD to Sydney CBD, generally between the Main Western Rail line in the south and the Parramatta River to the north
Parramatta Road East civil site	A construction ancillary facility for the M4-M5 Link project at Haberfield
Parramatta Road Transformation Strategy	The Parramatta Road Corridor Urban Transformation Strategy (UrbanGrowth NSW 2016)
Parramatta Road ventilation facility	A ventilation facility located on the south-eastern corner of the Parramatta Road / Wattle Street intersection (referred to as the Eastern ventilation facility in the M4 East project EIS). The facility is being built as part of the M4 East project. As part of the M4-M5 Link project, fitout works would be carried out on a section of this facility
Parramatta Road West civil and tunnel site	A construction ancillary facility for the M4-M5 Link project at Ashfield
Peak spreading	Increases in traffic demand in time periods immediately before or after the critical AM peak and PM peak periods, with commensurate decreases in the forecast peak period traffic demand
PCU	Passenger Car Unit
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average peak one hour in the PM peak period between 3.00 pm–6.00 pm on a weekday hour
Portal	The entry and/or exit to a tunnel
Pre-construction	All work prior to, and in respect of the State significant infrastructure, that is excluded from the definition of construction
Private vehicle	Includes all motorised vehicles such as cars, 4WDs, vans, motorbikes, motor scooters, utes and trucks, not registered for business use
Project	A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is NSW Roads and Maritime Services
Public transport	Includes train, bus (government and private), ferry (government and private) and light rail (government and private) services

Term	Definition
PV	Passenger vehicle
Pyrmont Bridge Road tunnel site	A construction ancillary facility for the M4-M5 Link project at Annandale
R	
REF	Review of Environmental Factors
RNP	Road Noise Policy
Roads and Maritime	NSW Roads and Maritime Services (formerly NSW Roads and Traffic Authority (RTA))
Roadside furniture	A general term covering all signs, street lights, protective devices for the control, guidance and safety of traffic and convenience of road users
Road reserve	An area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel
Roadside	The area from the edge of the carriageway to the boundary of the road reserve
Roundabout	An intersection where all traffic travels in one direction clockwise around a central island
Rozelle civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Lilyfield and Rozelle
Rozelle East motorway operations complex	An area where operational ancillary facilities are established. Located at the western end of the Rozelle Rail Yards on land occupied during construction by the Rozelle civil and tunnel site
Rozelle interchange	A new interchange at Lilyfield and Rozelle that would connect the M4-M5 Link mainline tunnels with City West Link, Anzac Bridge, the Iron Cove Link and the proposed future Western Harbour Tunnel and Beaches Link
Rozelle Rail Yards	The Rozelle Rail Yards is bound by City West Link to the south, Lilyfield Road to the north, Balmain Road to the west, and White Bay to the east. Note that the project only occupies part of the Rozelle Rail Yards site
Rozelle ventilation facility	Ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels. Located at the Rozelle Rail Yards, the ventilation supply facility is located at the Rozelle West motorway operations complex and a ventilation exhaust facility at the Rozelle East motorway operations complex
Rozelle West motorway operations complex	An area where operational ancillary facilities are established. Located at the central/eastern end of the Rozelle Rail Yards, on land occupied during construction by the Rozelle civil and tunnel site
RTA	NSW Roads and Traffic Authority (now NSW Roads and Maritime Services)
S	
s	Seconds
SACL	Sydney Airport Corporation Limited
Saturation flow	The number of vehicles per hour that could pass through a signalised intersection on a specific approach lane if the signal remained green for the entire 60 minutes
SB	Southbound
SCATS	Sydney coordinated adaptive traffic system

Term	Definition
Screenline	Theoretical boundaries specifically designed to collectively analyse directional and two-way traffic volumes
SEARs	Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Secretary of the NSW Department of the Planning and Environment under section 115Y of the *Environmental Planning and Assessment Act 1979* (NSW)
Sensitive receiver/receptor	Includes residences, educational institutions (including preschools, schools, universities, TAFE colleges), health care facilities (including nursing homes, hospitals), religious facilities (including churches), child care centres, passive recreation areas (including outdoor grounds used for teaching), active recreation areas (including parks and sports grounds), commercial premises (including film and television studios, research facilities, entertainment spaces, temporary accommodation such as caravan parks and camping grounds, restaurants, office premises, retail spaces and industrial premises)
Shoulder	The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement
Smart Motorway Operations	A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and on-ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway
SMC	Sydney Motorway Corporation
SMPO	Sydney Motorways Project Office
STM	Strategic Travel Model, operated by Transport for NSW Transport Performance and Analytics
St Peters interchange	A component of the New M5 project, located at the former Alexandria Landfill site at St Peters. Approved and under construction as part of the New M5 project. Additional construction works proposed as part of the M4-M5 Link project.
Staging	Refers to the division of the project into multiple contract packages for construction purposes, and/or the construction or operation of the overall project in discrete phases
Stub tunnel	Driven tunnels constructed to connect to potential future motorway links
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct
T	
The Bays Precinct Transformation Plan	Transformation Plan: The Bays Precinct, Sydney (UrbanGrowth NSW 2015)
The Crescent civil site	A construction ancillary facility for the M4-M5 Link project located at Annandale
Traffic efficiency	Measured by savings (and delays) in travel time
Transport infrastructure	Permanent installations including roads, rail, buildings and storage associated with transport
TCS	Traffic Control Signal
TfNSW	Transport for New South Wales
TMC	Transport Management Centre

Term	Definition
TPA	Transport Performance and Analytics business unit within Transport for NSW (formerly Transport for NSW's Bureau of Transport Statistics and Bureau of Freight Statistics)
Transport for NSW	NSW Government Department Transport for NSW
Truck and dog construction vehicle	A vehicle with 20 cubic metre capacity and maximum length of 19 metres
U	
Unreleased demand	In a microsimulation traffic model, this is the number of vehicles unable to enter the model due to congestion extending back into model entry points. The number of unreleased vehicles is an indication of the effectiveness of the modelled network in meeting the forecast traffic demand. The lower the number of unreleased vehicles, the better the modelled network is able to accommodate the forecast demand flows
V	
Veh	Vehicle
Veh/h	Vehicle per hour
Ventilation facility	Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels. May comprise one or more ventilation outlets
VHT	Vehicle Hours Travelled
Victoria Road civil site	A construction ancillary facility for the M4-M5 Link project located at Rozelle
VKT	Vehicle Kilometres Travelled
V/C	Volume to Capacity ratio
VTTS	Value of Travel Time Savings
W	
Wattle Street civil and tunnel site	A construction ancillary facility for the M4-M5 Link project located at Haberfield
Wattle Street interchange	An interchange to connect Wattle Street (City West Link) with the M4 East and the M4-M5 Link tunnels. Approved and under construction as part of the M4 East project. Additional construction works proposed as part of the M4-M5 Link project
WB	Westbound
WDA	WestConnex Delivery Authority
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest
WestConnex program of works	A program of works that includes the M4 Widening, King Georges Road Interchange Upgrade, M4 East, New M5 and M4-M5 Link projects
WRTM	WestConnex Road Traffic Model

Executive summary

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the WestConnex M4-M5 Link (the project), which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities.

The other component projects of WestConnex include the M4 East and New M5 (both with planning approval granted and under construction), M4 Widening and King Georges Road Interchange Upgrade (both with planning approval granted, construction completed and open to traffic). Related projects include the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and the F6 Extension (undergoing concept development and subject to separate planning approval processes).

The key strategic traffic objectives of the project are to:

- Provide an efficient motorway link between the M4 and M5 motorways and improve traffic flow on the motorway network
- Enable long term development of the motorway network, including facilitating new cross-harbour capacity and connections to Sydney's south
- Improve accessibility and reliability of commercial vehicle movement in the M4 and M5 corridors to economic centres, including to Sydney Airport and Port Botany economic zone
- Improve traffic conditions and ease future congestion on the inner western and south-western road network, including Parramatta Road, supporting urban regeneration and growth
- Improve overall network productivity.

The project objectives support the overarching objectives of the WestConnex program of works, which are described in **Chapter 3** (Strategic context and project need) of the environmental impact statement (EIS).

Existing traffic and transport environment

The project is located within an east–west corridor, between Haberfield and Rozelle, and within a north–south corridor, between Rozelle and St Peters. The western end of the project would tie into the M4 East tunnels and the Wattle Street interchange, while the southern end would tie into the New M5 tunnels and the St Peters interchange. The project would include an interchange at Rozelle, north of City West Link, a tunnel connection between the Rozelle interchange and Victoria Road near the eastern abutment of Iron Cove Bridge (the Iron Cove Link), and connections to the existing road network including City West Link and Victoria Road/Anzac Bridge.

The study area for this assessment was informed by the forecast traffic and transport changes from the WestConnex Road Traffic Model version 2.3 (WRTM v2.3), a strategic traffic model that covers the Sydney metropolitan area. The study area broadly encompasses an area extending from the Parramatta River in the north to Sydney Airport in the south and from the Eastern Distributor in the east to Haberfield and Marrickville in the west. It contains major road transport corridors including parts of four of the main travel demand corridors in Sydney, being:

- Parramatta to the Sydney central business district (CBD) via Strathfield (which includes the M4 East, Parramatta Road and City West Link)

- Parramatta to the Sydney CBD via Ryde (which includes Victoria Road)
- Sydney Airport to the Sydney CBD (which includes Princes Highway and Southern Cross Drive)
- Liverpool to Sydney Airport (which includes the M5 East Motorway).

The study area also contains major public transport corridors and infrastructure including parts of the Sydney Trains suburban railway network, light rail and bus networks. Public transport corridors that extend into the study area include the Parramatta to the Sydney CBD via Strathfield corridor, serviced by train and bus, the Parramatta to the Sydney CBD via Ryde corridor, serviced by bus, the Bankstown to the Sydney CBD corridor, serviced by rail, and the Sydney Airport to the Sydney CBD corridor, serviced by train.

There are key freight routes that extend within the study area on the road network, including:

- M4 Motorway to Sydney Airport and Port Botany via Parramatta Road, Sydenham Road and Canal Road
- Southwest Sydney to Sydney Airport and Port Botany via the existing M5 East Motorway
- Southwest Sydney to the Sydney CBD via the M5 and M1 motorways.

Freight train movements through the study area use parts of both the Sydney Trains suburban network and the Metropolitan Freight network. The Metropolitan Freight network connects Port Botany to intermodal terminals including those at Cooks River and Enfield, and also to the NSW TrainLink network.

The existing active transport (pedestrian and cycle) network within the study area comprises regional and local routes. The majority of regional routes are segregated pedestrian and cycle paths, with the local routes primarily being either shared paths or pedestrian paths supported by on-road cycle paths. While there are significant local active transport routes throughout the M4-M5 Link corridor, there are gaps in regional routes. Existing and proposed active transport networks within the study area are detailed in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

Existing road network performance

The road network in the study area currently functions under high levels of traffic demand, which often exceeds the operational capacity, especially citybound during the AM peak period.

The four main travel demand corridors mentioned above include some of the most highly congested road corridors in Sydney, with demand already exceeding capacity during peak periods. Major routes in the study area, such as Parramatta Road, City West Link, Victoria Road, Anzac Bridge/Western Distributor, Southern Cross Drive, Princes Highway and King Street, all experience significant congestion with resultant increase in travel time and variability, which can cause typical morning and evening peak hours to spread over longer periods, and extend the peak period.

Over the past five years, the majority of crashes on the major roads in the study area were rear-end crashes, which is consistent with roadways operating at or beyond capacity and on which significant queuing occurs.

In the AM peak period, eastbound traffic operations in the vicinity of the proposed Rozelle interchange are limited by various existing road network configurations, capacities and operational behaviours on and around Anzac Bridge/Western Distributor. These include the merge between The Crescent underpass and Victoria Road left turn, and general weaving on Anzac Bridge and the Western Distributor, which can affect traffic flows to entry and exit ramps.

Tidal operations (changes to the configuration of lanes) occur in the AM peak period on the Sydney Harbour Bridge with the northbound lanes reduced from four lanes to three lanes. This reduction, combined with weaving and merging on the Sydney Harbour Bridge deck and approach, causes queuing on the Western Distributor. Downstream capacity constraints at the Bathurst Street exit ramp also cause queues back onto the Western Distributor. All of these factors limit the eastbound throughput of Anzac Bridge/Western Distributor.

In the Haberfield, Rozelle and St Peters road networks, current average speeds of less than 30 kilometres per hour in the AM and PM peak periods are reported on several key roads. Intersection analyses demonstrate that several locations experience significant congestion and operate at a poor level of service during the AM and PM peak hour periods. These congested conditions may cause traffic to seek alternate routes.

Strategic context

The transport network in Sydney is expected to be put under increasing pressure over the next 20 years. *A Plan for Growing Sydney* (NSW Government 2014) indicates that from 2011 to 2031, Sydney's population is forecast to increase from 4.3 to 5.9 million, which equates to an average of 80,000 additional residents per year. Moreover, by 2036, the number of trips made around Sydney each day is forecast to increase by 31 per cent from 16 to 21 million vehicle movements. This growth will place increasing pressure on the NSW transport network and the key travel demand corridors connecting regional cities and major centres across the greater Sydney metropolitan area.

Key corridors currently accommodate high levels of daily traffic including freight, commuter and leisure travel. Users of these corridors frequently experience congestion and delay, particularly during weekday and weekend peak periods. Both the *NSW Long Term Transport Master Plan* (Transport for NSW 2012) and the *State Infrastructure Strategy Update 2014* (*State Infrastructure Strategy*) (Infrastructure NSW 2014) identified the need to plan and invest in the future of Sydney's motorway network, which provides vital infrastructure connections within and between travel demand corridors. Any investment in motorway infrastructure has to be aligned with supporting public and active transport initiatives to achieve an increase in capacity, while aiming to reduce the reliance on and demand for private vehicles on the future road network.

The WestConnex project is one part of a broader solution to these emerging pressures. While public transport is also part of this mix, it is recognised that not all trips in Sydney can be served by public transport, especially trips to dispersed destinations or commercial trips requiring the movement of large or heavy goods/materials. A congested road network also affects road-based public transport, increasing bus travel times and journey time variability.

For these reasons, the NSW Government is also investigating and investing in light rail, metro, bus rapid transit and motorways to provide a multi-modal response to the future challenges. In this context, WestConnex is an enabler of integrated transport and land use planning, supporting the development of initiatives including The Bays Precinct and the *Parramatta Road Corridor Urban Transformation: Infrastructure Schedule* (UrbanGrowth NSW 2016).

Methodology

The preliminary environmental investigations conducted prior to carrying out this EIS and the Secretary's Environmental Assessment Requirements (SEARs) indicated that traffic and transport was one of the key environmental considerations for the project. This report details the subsequent traffic and transport assessment undertaken as part of the EIS for the project.

The traffic forecasting and modelling undertaken for this assessment consisted of both strategic and operational modelling. Strategic modelling using the WRTM was carried out to derive future traffic demands, based on planned and forecast changes in population and employment, and to understand the metropolitan-wide impacts of the project, while operational modelling (using microsimulation models) was carried out to understand the more detailed impacts such as the performance of interchanges and the level of service performances of tunnels and at merges and weaves.

The assessment has covered the following scenarios:

- Base case (2015): the road network prior to the commencement of the M4 East and New M5 or other new projects or upgrades. For operational traffic modelling, 2015 was adopted as the base case to match the year of traffic survey data
- Construction (2021): future road network assessed with NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade (KGRIU) and New M5 complete and operational. Nominal construction year adopted as representative of the peak construction traffic generation of the project
- At opening (2023): it is proposed that the project would be constructed and fully operational by 2023. The following scenarios have been assessed in the project year of opening:

– Operation ‘do minimum’ or ‘without project’ (2023): with M4 Widening and KGRIU operational and assumes that NorthConnex, M4 East, and New M5, which are approved, fully funded and under construction, are complete, but that the M4-M5 Link has not been built. It is called ‘do minimum’ rather than ‘do nothing’ as it assumes ongoing improvements would be made to the broader road and public transport network over time including some new infrastructure and intersection enhancements to improve capacity and cater for traffic growth

– Operation ‘with project’ (2023): with the 2023 ‘do minimum’ projects completed and the M4-M5 Link complete and open to traffic

– Operation ‘cumulative’ (2023): with 2023 ‘do minimum’ projects and M4-M5 Link completed, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel projects operational. The proposed future Western Harbour Tunnel has been tested without an operational surface connection at Rozelle

- Future 10 years after opening (2033): assessment of the future operation of the project and transport network elements 10 years after opening. The following scenarios have been assessed:

– Operation ‘do minimum’ or ‘without project’ (2033): with the same 2023 ‘do minimum‘ projects complete and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth but does not include the M4-M5 Link

– Operation ‘with project’ (2033): with the 2033 ‘do minimum’ projects completed and the M4-M5 Link complete and open to traffic

– Operation ‘cumulative’ (2033): with the 2033 ‘do minimum’ projects and M4-M5 Link completed, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel, Beaches Link and the F6 Extension projects complete and operational. The proposed future Western Harbour Tunnel and Beaches Link has been tested without an operational surface connection at Rozelle.

These scenarios are summarised in **Table ES-1**.

Table ES-1 Traffic assessment scenarios

Scenario	Year	Existing road network	WestConnex					NorthConnex	Sydney Gateway	Western Harbour Tunnel (to North Sydney)	Beaches Link (to Seaforth)	F6 Extension
			M4 Widening	M4 East	KGRIU	New M5	M4-M5 Link					
Base year	2015	✓										
Construction	2021	✓	✓	✓	✓	✓		✓				
Do minimum (without project)	2023	✓	✓	✓	✓	✓		✓				
With project	2023	✓	✓	✓	✓	✓	✓	✓				
Cumulative	2023	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Do minimum (without project)	2033	✓	✓	✓	✓	✓		✓				
With project	2033	✓	✓	✓	✓	✓	✓	✓				
Cumulative	2033	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Future conditions without the project (including M4 East and New M5)

In the future, there is a forecast growth in travel demand for both traffic and public transport, due to a forecast increase in population and employment. This causes increased congestion levels on the road network. The section below provides an overview of conditions on the future road network without the M4-M5 Link project.

Sydney metropolitan road network

The overall forecast growth in traffic demand is consistent with the forecast increase in population in the Sydney Metropolitan Area. Importantly, this growth in traffic is not confined to major routes – increased traffic on many roads in Sydney is forecast without the project in the 2023 and 2033 peak periods, as vehicles seek to avoid the congested arterial road network by travelling along lower order roads.

A reduction in daily traffic is forecast along Parramatta Road (west of the M4 East Parramatta Road ramps) in 2023 and 2033 as a result of the M4 East, and on the M5 East as a result of the New M5. However, increased daily traffic is forecast along Parramatta Road (east of the M4 East Parramatta Road ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge, Western Distributor and Anzac Bridge, as well as other urban arterial roads, such as Victoria Road, City West Link, Hume Highway, Canterbury Road, Stoney Creek Road, Olympic Drive, Centenary Drive and Anzac Parade approaching the Sydney CBD in both 2023 and 2033.

Wattle Street interchange and surrounds

With forecast traffic growth, the network performance in Haberfield around the Wattle Street interchange without the project is forecast to deteriorate over time. This part of the road network is forecast to be unable to accommodate the future traffic demands, with slow average speeds (less than 15 kilometres per hour) and queuing forecast during peak periods by 2033.

The forecast traffic demand results in increased congestion along Dobroyd Parade, Parramatta Road and Frederick Street in the future. Intersection performance is expected to be an issue in the vicinity of the Wattle Street interchange, such as at the Parramatta Road/Wattle Street and Parramatta Road/Liverpool Road intersections.

Rozelle and surrounds

With forecast traffic growth, the network performance in the vicinity of Rozelle without the project is forecast to deteriorate over time, with longer queues forecast on the Western Distributor and flow breakdown on Anzac Bridge, Victoria Road and City West Link in the AM peak period. In the PM peak period, the network performance is also forecast to deteriorate over time, with the network unable to accommodate the future traffic demands.

Intersection performance analysis demonstrates that by 2033, without the project, more intersections along Victoria Road are forecast to experience significant congestion during the peak hours than currently do.

St Peters interchange and surrounds

As with the other interchanges, forecast traffic growth without the project is expected to negatively impact the network performance around the St Peters interchange and surrounds. The introduction of the St Peters interchange with the opening of the New M5 project – but without the M4-M5 Link project – along with increased demand to and from Sydney Airport, is forecast to increase traffic demand in an already congested area, and cause a drop in average speeds in the network during peak hours.

The main areas of congestion are forecast to be in Mascot, in particular Gardeners Road, O'Riordan Street, Botany Road and the Princes Highway corridors. Intersections along these corridors are forecast to be unable to cope with increased demand and many are forecast to experience significant congestion during the peak hours. Poor overall intersection performance is likely to contribute not only to local congestion, but, in extreme cases, may cause queuing on the St Peters interchange exit ramps back to the mainline of the New M5 Motorway.

Future conditions with the project (operational traffic assessment)

A number of key benefits and improvements are forecast as a result of the project:

- Non-motorway roads in the Inner West local government area (LGA) are forecast to experience faster trips with the daily average speed increasing by about 10 per cent. Similarly, the vehicle distance travelled on non-motorway roads is forecast to reduce by about 12 per cent. This indicates that on average, these trips are fewer in number and faster
- Improved network productivity on the metropolitan network, with more trips forecast to be made or longer distances travelled on the network in a shorter time. The forecast increase in vehicle kilometres travelled (VKT) and reduction in vehicle hours travelled (VHT) is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT also forecast on non-motorway roads
- The project, along with investment in other road, public transport and active transport projects, would help to accommodate the forecast growth in population and travel demand in the Sydney metropolitan area
- Reduced travel times are forecast on key corridors, such as between the M4 Motorway corridor and the Sydney Airport/Port Botany precinct
- Reduced traffic is forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, King Georges Road and Sydenham Road
- Around 2,000 heavy vehicles are forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday.

Where the project would connect to the existing road network, increased congestion is forecast in parts of Mascot, along Frederick Street at Haberfield, Victoria Road north of Iron Cove Bridge, Johnston Street at Annandale and on the Western Distributor. A number of these areas are forecast to improve when the proposed future Sydney Gateway and the proposed future Western Harbour Tunnel and Beaches Link are completed.

Forecast traffic in the mainline tunnels

Table ES-1 presents the two-way daily average weekday traffic (AWT) volumes that are forecast on the mainline tunnel sections of the project. Analysis indicates that operational performance levels of the mainline tunnels are forecast to be satisfactory in the 2023 scenarios and in the 2033 'with project' scenario. The 2033 'cumulative' scenario analysis indicates traffic flows on the motorway are forecast to be denser compared to the 2033 'with project' scenario, with a corresponding reduction in level of service in the peak hours. This is due to the additional motorway links in the 'cumulative' scenario (proposed future Western Harbour Tunnel and Beaches Link, Sydney Gateway, and F6 Extension projects), resulting in more traffic in the M4-M5 Link. Even with this increased density, average motorway speeds are still forecast to be 60 kilometres per hour or above in the peak hours.

Table ES-1 Two-way daily average weekday traffic (AWT) forecast in the M4-M5 Link mainline tunnels

Scenario	Year	Location	
		Between Wattle Street interchange and Rozelle interchange	Between Rozelle interchange and St Peters interchange
With project	2023	89,000	61,500
Cumulative		107,000	96,000
With project	2033	99,500	70,000
Cumulative		126,000	119,500

Source: WRTM v2.3, 2017

Network productivity

The addition of the M4-M5 Link provides a significant overall improvement to network productivity. As shown in **Table ES-2**, an overall increase in daily VKT and a reduction in daily VHT on the road network are forecast. This means that more trips could be made or longer distances travelled on the network in a shorter time. The forecast increase in VKT and reduction in VHT is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT forecast on the non-motorway roads. This indicates the additional network capacity provided by the project would assist in accommodating the forecast growth in population and travel demand that would otherwise contribute to worsening road network and traffic conditions without the project. This trend continues in the 'cumulative' scenario, with reduced daily VKT and VHT forecast for the non-motorway roads.

Table ES-2 Comparison of daily VKT and VHT for metropolitan Sydney under future scenarios

Scenario	Year	Daily VKT ('000 km)			Daily VHT ('000 hours)		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2015	23,940	74,810	98,750	400	2,520	2,920
Do minimum (without project)	2023	26,880	86,520	113,400	470	3,160	3,630
With project		27,730	86,050	113,780	480	3,120	3,600
Cumulative		27,980	85,970	113,950	470	3,110	3,570
Do minimum (without project)	2033	31,030	101,900	132,930	590	4,670	5,560
With project		32,010	101,410	133,430	600	4,610	5,220
Cumulative		33,780	100,650	134,420	600	4,500	5,100

Source: WRTM v2.3, 2017

Parallel routes analysis

As a result of the additional road network capacity provided by the project, the two-way future year AWT traffic demand compared to a 'without project' scenario is predicted to significantly decrease on:

- City West Link and Parramatta Road, east of the M4 East Wattle Street and Parramatta Road ramps respectively, by about 25 per cent in the 2023 and 2033 'with project' and 'cumulative' scenarios
- King Street in St Peters by about 20 per cent in the 2023 and 2033 'with project' scenarios
- Stanmore Road in Stanmore by about 15 per cent in the 2023 and 2033 'with project' and 'cumulative' scenarios
- Lyons Road in Russell Lea by about 15 per cent in the 2023 and 2033 'with project' scenarios, and about 20 per cent in the 2023 and 2033 'cumulative' scenarios
- Southern Cross Drive and the Sydney Harbour Tunnel by about 20 per cent and 25 per cent respectively in the 2023 and 2033 'cumulative' scenarios.

The M4-M5 Link would provide alternative parallel options to the roads listed above in the 'with project' scenario and with the proposed future Western Harbour Tunnel and Sydney Gateway (and Beaches Link and F6 Extension in 2033) in the 'cumulative' scenarios. The screenline analysis, presented in **Chapter 9**, found no major shifts in daily traffic onto parallel routes as a result of the project.

The reduction in traffic demand on these major traffic routes is likely to improve speed, journey reliability and safety on these corridors compared to a 'without project' scenario. The M4-M5 Link, combined with proposed future Sydney Gateway would improve connectivity between Sydney's international gateways (Sydney Airport and Port Botany), western Sydney and places of business across the Sydney region. The project would also provide additional route options along the corridor and therefore increase network resilience in the event of accidents or network disturbances.

There are significant reductions in forecast daily traffic volumes along Victoria Road (south of the proposed Iron Cove Link), King Georges Road, Stanmore Road, Addison Road and Sydenham Road compared to the 'without project' scenario. A decrease in the daily volume of heavy vehicles on surface roads is also forecast, as heavy vehicles shift onto the M4-M5 Link. Daily heavy vehicle volumes on Parramatta Road and City West Link are forecast to drop by 40 to 50 per cent, and roads in the Inner West, such as Stanmore Road, Sydenham Road, Marrickville Road and King Street, are forecast to drop by 20 to 50 per cent.

With the project, 2023 and 2033 peak period travel times are forecast to reduce between the M4 corridor and the Sydney Airport/Port Botany precinct, with traffic shifting from the A3 (King Georges Road) corridor to the M4-M5 Link. Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by about 10 minutes, which is part of a 25 to 30 minute saving comparing the 'project' scenario to a scenario without WestConnex.

Further reductions on this route would occur in the 2023 and 2033 'cumulative' scenarios. Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by a further 10 minutes in the 2023 'cumulative' scenario. This saving is part of a 35 minute saving comparing the 2023 'cumulative' scenario to a scenario without WestConnex. Average peak period travel times are forecast to reduce by a further five minutes in the 2033 'cumulative' scenario. This saving is part of a 40 minute saving comparing the 2033 'cumulative' scenario to a scenario without WestConnex.

In the 2033 'cumulative' scenario, increases are forecast in daily two-way volumes on Johnston Street, north of Parramatta Road in Annandale (about five to 15 per cent in the 'with project' scenario and about 10 to 20 per cent in the 'cumulative' scenario) and on Gladesville Bridge (about five per cent in the 'with project' scenario and 10 to 20 per cent in the 'cumulative' scenario). These increases reflect the forecast demand to and from the Rozelle area due to the new connectivity being provided by the Rozelle interchange.

Wattle Street interchange and surrounds

'With project' operational performance summary

In 2023, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- The impacts in the AM peak period are positive with travel times improving compared to 'without project' conditions. The number of vehicles on the surface road network is reduced as a result of traffic shifting to the M4-M5 Link, with subsequent benefits to the surface traffic network
- The network is also expected to undergo general improvement in performance in the PM peak when compared to 'without project' conditions, with vehicles travelling eastbound on Parramatta Road and citybound on City West Link experiencing the greatest benefits. As in the 'without project' scenario, demand for Frederick Street southbound remains high and so travel times along this section of the network remain long with queuing back along Wattle Street.

In 2033, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- In both AM and PM peak hours, the 'with project' scenario is forecast to better accommodate anticipated increases in demand than the 'without project' scenario, with intersection and network performance improvements across this part of the road network, although parts of the network are forecast to still experience congestion.

'Cumulative' operational performance summary

In both 2023 and 2033, comparing the 'cumulative' scenario to the 'with project' scenario, there are relatively minor changes in network performance, with the exception of a reduction in queuing and delays from Frederick Street to City West Link, as a result of a reduction in forecast demand to City West Link.

Rozelle interchange and surrounds

'With project' operational performance summary

By 2023, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- There is a substantial increase in overall forecast traffic demand in this area during the AM peak hour due to the new connectivity being provided by the Rozelle interchange, with eastbound congestion issues on the Western Distributor, mainly due to downstream exit blocking from Sydney Harbour Bridge. Congestion on the Western Distributor and across Anzac Bridge in the eastbound direction is forecast to cause queuing and delays on City West Link and Victoria Road and, for brief periods, the M4 eastbound exit ramp and the Iron Cove Link ramp to Anzac Bridge. Approaches to address this are discussed in the mitigation section
- In the PM peak hour, there are travel time improvements in the peak westbound direction towards City West Link and Victoria Road due to the Iron Cove Link and M4 connectivity. There are also forecast eastbound delays on the same roads caused by forecast traffic demand increases to Sydney Harbour Bridge.

By 2033, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- In the AM peak period, Anzac Bridge/Western Distributor is more congested citybound because of a forecast increase in demand due to the new connectivity being provided by the Rozelle interchange. As in 2023, citybound movements are mainly affected by the downstream exit blocking from Sydney Harbour Bridge. Congestion on the Western Distributor and across Anzac Bridge is forecast to cause delays and queues on City West Link and Victoria Road, as well as the M4 East exit ramp and the Iron Cove Link ramp to Anzac Bridge. Approaches to address this are discussed in the mitigation section
- In the PM peak period, the modelled road network with the project performs better than the 'without project' scenario, especially westbound from the Sydney CBD, due to the introduction of free flow connections from Anzac Bridge to the M4 East and Iron Cove. There is large unreleased demand on Western Distributor (as in the base case), The Crescent and Johnston Street by the end of the peak hour, indicating vehicles are likely to struggle to enter the modelled network in the peak hour.

'Cumulative' operational performance summary

In both 2023 and 2033, comparing the 'cumulative' scenario to the 'with project' scenario:

- Anzac Bridge/Western Distributor is forecast to be less congested eastbound in the AM peak period due to traffic reassigning to the proposed future Western Harbour Tunnel (and Beaches Link in the 2033 'cumulative' scenario)
- In the PM peak period, the network functions similar to the project case, with fewer unreleased vehicles on Western Distributor due to traffic reassigning to Western Harbour Tunnel (and Beaches Link in the 2033 'cumulative' scenario).

Primarily due to capacity constraints on Anzac Bridge and the Western Distributor, forecast demands cannot access the road network during the peak periods due to congestion extending back into model entry points. This occurs at the model boundaries on Victoria Road, City West Link and The Crescent/Johnston Street. Potential mitigation measures are discussed in **section 11.2**.

St Peters interchange and surrounds

The surface road network in the model is unable to accommodate the forecast peak hour demands without the additional road capacity provided by the proposed future Sydney Gateway. The proposed future Sydney Gateway introduces a bypass to Mascot town centre and, in its absence, it would be necessary to introduce upgrades at a number of intersections.

'With project' operational performance summary

In 2023, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- With the intersection upgrades, the 'with project' scenario performance is forecast to be similar to the 'without project' scenario. While average AM peak hour network traffic speeds and travel times are comparable, average network speeds in the PM peak hour are 28 per cent slower.

In 2033, comparing the 'with project' scenario to the 'do minimum' or 'without project' scenario:

- In the AM peak hour, with the intersection upgrades, the 'with project' scenario is forecast to provide improved network operation when compared with the 'without project' case. In the PM peak hour, the 'with project' scenario performs worse, with lower average network speed and longer travel times. Intersections are forecast to operate at similar or worse level of service.

Consistent with what was reported in the New M5 EIS, these results indicate that the complete WestConnex program of works, as well as the Sydney Gateway, is required to ensure the St Peters interchange area operates satisfactorily.

'Cumulative' operational performance summary

In 2023, comparing the 'cumulative' scenario to the 'with project' scenario:

- The 'cumulative' scenario has higher forecast traffic demands than the 'with project' scenario. Sydney Gateway provides a bypass to Mascot town centre, which contributes to improved network performance. Even with the forecast increased traffic demands, higher average network speed are forecast in both peaks
- Average network speed improves as a result of Sydney Gateway. However, buses only use the surface road network, which is still congested in both scenarios. As a result, despite higher average speed in the overall network, buses spend a similar amount of time travelling in the network.

In 2033, comparing the 'cumulative' scenario to the 'with project' scenario:

- Similar to the 2023 network performance results, the 'cumulative' scenario has a higher forecast demand than the 'with project' scenario, but both peaks are forecast to perform better than the 'with project' scenario. In both peaks, higher average network speeds are predicted in the 'cumulative' scenario network in spite of higher demands in the network. Similar to the 2023 scenarios, buses spend a comparable amount of time travelling in the network in the 2033 'cumulative' scenario.

Operations under staged opening

The mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters are planned for completion in 2022, while the Rozelle interchange is planned for completion in 2023. Therefore, there would be a period of around 12 months during which the mainline tunnels would be operational without the Rozelle interchange and the Iron Cove Link, although at a reduced lane capacity of only two lanes in each direction. Constructing the project in two stages would allow the mainline tunnels to operate independently before the completion of the Rozelle interchange and the Iron Cove Link and allow the benefits to the Sydney metropolitan road network of linking the M4 East and the New M5 component projects to be realised as soon as possible.

Under the staged opening, a two-way AWT of about 49,500 vehicles per day is forecast to use the mainline tunnels. Operational modelling indicates that the forecast peak hour volumes would be within the capacity of the two lanes and a level of service D or better is forecast.

In a 'mainline only' scenario, the Wattle Street and St Peters interchanges are the only entry and exit points for M4-M5 Link traffic. A comparison was made of the forecast traffic volumes at the Wattle Street interchange area and the St Peters interchange area in this 'mainline only' scenario with the other scenarios tested in this EIS. This comparison found that the forecast two-way traffic in a 'mainline only' scenario for the AM peak, PM peak and daily time periods was less than forecast traffic in some of the other scenarios tested in the EIS. Therefore, the temporary 'mainline only' scenario was not modelled as a separate scenario as the impact of higher forecast traffic volumes was tested in other scenarios in this assessment.

Management of impacts – operational

The management of operational traffic and transport impacts would be focused around the three interchanges at Wattle Street, Rozelle and St Peters. As with the M4 East and New M5 projects, Roads and Maritime would undertake a Road Network Performance Review, in consultation with Transport for NSW and relevant councils. This would confirm the operational traffic impacts of the M4-M5 Link on surrounding arterial roads and major intersections at both 12 months and five years after the commencement of operation of the M4-M5 Link. The assessment would be based on future updated traffic surveys taken during operation and the methodology used would be comparable with that used in this assessment.

Wattle Street interchange and surrounds

The analysis has identified key constraints impacting the performance of the network on Frederick Street (southbound), Parramatta Road (eastbound) and City West Link (citybound) in the ‘without project’ scenario. The forecast congestion on Parramatta Road and City West Link are generally reduced by the M4-M5 Link project, particularly in 2023. It is expected that the M4 East Road Network Performance Review would examine potential management measures following the collection of updated (post-opening) data that would facilitate an understanding of actual project outcomes and update management measures, if necessary.

Notwithstanding the above, Roads and Maritime proposes to investigate the identified exit blocking from Frederick Street through the Parramatta Road/Wattle Street intersection in the ‘with project’ scenario. The exit blocking arises from forecast increase in southbound traffic demand, combined with capacity restrictions at downstream intersections and limited storage space on Frederick Street. Management measures to be investigated, in consultation with relevant local councils, could include:

- Queuing and capacity monitoring and management on the Frederick Street/Milton Street corridor
- Managing lane use and utilisation to improve the operation of the corridor.

Rozelle interchange and surrounds

The analysis has shown that Anzac Bridge/Western Distributor is currently at or close to capacity in the 2015 base case, particularly in the AM peak where existing operational and geometric features of the road network limit the capacity. As a result, the predicted increase in traffic demands in all future scenarios cannot be accommodated without some form of traffic or network management.

With the M4-M5 Link operational, there is an increase in the forecast eastbound AM peak hour demand, because the M4 East exit ramp and the Iron Cove Link to Anzac Bridge/Western Distributor provide bypasses of City West Link and Victoria Road respectively. Once the proposed future Western Harbour Tunnel and Beaches Link is operational, this forecast growth in demand reduces, but is still forecast to exceed the capacity of Anzac Bridge/Western Distributor.

Roads and Maritime is developing a strategy to ensure appropriate network integration in the areas surrounding the Rozelle interchange, including:

- Capacity improvement measures – a number of areas have been identified for investigation to improve capacity including the intersection of the Western Distributor and Pyrmont Bridge Road at Pyrmont, the merge and weave arrangements on the Western Distributor close to Darling Harbour, modifications through the use of moveable medians on the approaches to the Harbour Bridge and a review of kerbside use of the road network at the interfaces with the Western Distributor to remove key bottlenecks and allow additional capacity where appropriate
- Project staging options – effective staging of the opening of major projects would also keep forecast demands closer to capacity and adjustments to current staging and program timelines for major projects with the surrounding network may be required. Investigations are underway by Roads and Maritime to determine the effect and viability of altering key project timelines to achieve the best road network performance. This may include timing projects to reduce ‘spikes’ in the forecast demand that would exceed capacity operation and ensure effective control of traffic. As many of these projects are still in development, the requirements for staging are yet to be determined
- Demand management measures – demand management measures are being considered to effectively manage peak demand on critical links. These include the use of Smart Motorways (including ramp metering, variable speed limits and lane use management) and arterial

management through the re-optimisation of the Sydney coordinated adaptive traffic system (SCATS)[1] to manage the altered traffic patterns that will occur with the introduction of the project.

Specific measures will be identified as investigations progress and their implementation will depend on their complexity and appropriate timing to minimise impact on the community. Roads and Maritime will carry out these investigations in consultation with councils and the NSW Department of Planning and Environment to develop a program of works.

The Crescent, Johnston Street and Ross Street are forecast to experience increased levels of demand with the introduction of the project, with people travelling to and from the southern fringe of the Sydney CBD through the Annandale area. A strategy is being developed by Roads and Maritime to ensure the impacts of the project and other proposed transport projects are minimised. The strategy will involve investigating and identifying capacity improvement and mitigation measures along The Crescent, Ross Street and Johnston Street. These measures will be implemented in a staged approach to accommodate forecast demand, firstly for the M4-M5 Link and thereafter for the proposed future Western Harbour Tunnel and Beaches Link.

St Peters interchange and surrounds

The analysis has indicated a deteriorated network performance in the St Peters and Mascot area with the project. However, once Sydney Gateway is in place, a considerable amount of traffic would be removed from the St Peters and Mascot area and the network performance improved to a level generally better than in the ‘without project’ scenarios. Sydney Gateway is expected to be open at a similar time to the M4-M5 Link and separate planning, environmental assessment and approvals processes are underway. Specific interim mitigation measures for the ‘with project’ scenario are therefore not proposed.

Should the Sydney Gateway project be delayed for a significant length of time, it is expected that both the New M5 Road Network Performance Review Plan (conditioned as part of the New M5 approval) and the proposed M4-M5 Link Road Network Performance Review would confirm the operational traffic impacts of the projects on surrounding arterial roads and major intersections. These reviews are scheduled at 12 months and five years after the commencement of operation of the New M5 and the M4-M5 Link respectively. Key intersections in the St Peters and Mascot areas are already identified for review in the New M5 Road Network Performance Review Plan as part of the New M5 conditions of approval and the following additional intersections should be included in the M4-M5 Link Road Network Performance Review Plan:

- Gardeners Road/Kent Road
- Gardeners Road/O’Riordan Street
- Kent Road/Coward Street
- Bourke Road/Coward Street
- Kent Road/Ricketty Street.

These reviews would examine potential management measures at these locations, and other locations as identified in the Road Network Performance Review, to improve performance following the collection of data that would facilitate a clearer understanding of actual project impacts.

Construction traffic assessment

The majority of the project footprint is located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities, construction of the tunnel portals, the Rozelle interchange, interfaces with the Wattle Street interchange and the St Peters interchange, other surface roadworks, ventilation facilities, tunnel support facilities and other ancillary operations buildings and facilities.

[1] The Sydney coordinated adaptive traffic system (SCATS) is a traffic management system used to synchronise traffic signals to optimise traffic flow.

Construction of the project is expected to occur over a period of around five years (2018 to 2023). Based on the indicative construction program, 2021 was used as the assessment year for construction impacts, as this is when peak construction traffic volumes are expected. Heavy vehicles would be required to deliver and remove construction plant, equipment and materials as well as remove spoil and waste from the construction sites. Wherever possible, access to construction ancillary facilities is proposed to be gained directly from major arterial roads. Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable. Additionally, construction would result in increased use of light vehicles on the surrounding road network associated with the construction workforce, including shift workers for tunnelling activities.

While construction traffic would impact on the operation of the road network surrounding the construction facilities, the analysis indicates that the intersection levels of service are forecast to generally not be significantly impacted, with the exception of the Wattle Street/Ramsay Street, Dobroyd Parade/Timbrell Drive, City West Link/James Street and City West Link/The Crescent intersections. This is due to City West Link and Wattle Street being one of the key routes for construction traffic. Impacts due to temporary lane closures and speed reductions, particularly during traffic staging, would also occur. A Construction Traffic and Access Management Plan (CTAMP) will be prepared and implemented to minimise disruption to road users.

As the volume of traffic generated by construction is expected to be relatively low compared to existing traffic, the effects of this short term increase on the existing road network is not expected to significantly impact road safety in the study area, though there is still a risk with construction traffic interacting with general traffic.

Management of impacts – construction

Prior to the commencement of construction of the project, a CTAMP would be prepared as part of the Construction Environmental Management Plan. The CTAMP would include the guidelines, general requirements and principles of traffic management to be implemented during construction. It would be prepared in accordance with Austroads *Guide to Road Design* (with appropriate Roads and Maritime supplements), the RTA *Traffic Control at Work Sites* manual and AS1742.3: *Manual of uniform traffic control devices – Part 3:Traffic control for works on roads*, and any other relevant standard, guide or manual. It would seek to minimise delays and disruptions, and identify and respond to any changes in road safety as a result of construction works.

Specifically, the CTAMP would include a detailed travel management strategy for construction staff at the various worksites, in consultation with local councils and stakeholders associated with any facilities adjacent to the project site. This strategy would include the promotion of public transport and carpooling to reduce worksite-related vehicle movements, and also investigate feasible options for the provision of vehicle parking strategies to reduce parking on local roads. In addition to development of CTAMP, mitigation strategies would be implemented to manage and control construction traffic, where reasonably practical.

1 Introduction

NSW Roads and Maritime Services (Roads and Maritime) is seeking approval to construct and operate the WestConnex M4-M5 Link (the project), which would comprise a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project would also include an interchange at Lilyfield and Rozelle (the Rozelle interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project would be carried out at the Rozelle interchange.

Together with the other components of the WestConnex program of works and the proposed future Sydney Gateway, the project would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities.

Approval is being sought under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) for the project. A request has been made for the NSW Minister for Planning to specifically declare the project to be State significant infrastructure and also critical State significant infrastructure. An environmental impact statement (EIS) is therefore required.

1.1 Overview of WestConnex and related projects

The M4-M5 Link is part of the WestConnex program of works. Separate planning applications and assessments have been completed for each of the approved WestConnex projects. Roads and Maritime has commissioned Sydney Motorway Corporation (SMC) to deliver WestConnex, on behalf of the NSW Government. However, Roads and Maritime is the proponent for the project.

In addition to linking to other WestConnex projects, the M4-M5 Link would provide connections to the proposed future Western Harbour Tunnel and Beaches Link, the Sydney Gateway (via the St Peters interchange) and the F6 Extension (via the New M5).

The WestConnex program of works, as well as related projects, are shown in **Figure 1-1** and described in **Table 1-1**.

Table 1-1 WestConnex and related projects

Project	Description	Status
WestConnex program of works		
M4 Widening	Widening of the existing M4 Motorway from Parramatta to Homebush.	Planning approval under the EP&A Act granted on 21 December 2014. Open to traffic.
M4 East	Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street interchange.	Planning approval under the EP&A Act granted on 11 February 2016. Under construction.
King Georges Road Interchange Upgrade	Upgrade of the King Georges Road interchange between the M5 West and the M5 East at Beverly Hills, in preparation for the New M5 project.	Planning approval under the EP&A Act granted on 3 March 2015. Open to traffic.

Project	Description	Status
New M5	Duplication of the M5 East from King Georges Road in Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters. The St Peters interchange allows for connections to the proposed future Sydney Gateway project and an underground connection to the M4-M5 Link. The New M5 tunnels also include provision for a future connection to the proposed future F6 Extension.	Planning approval under the EP&A Act granted on 20 April 2016. Commonwealth approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) granted on 11 July 2016. Under construction.
M4-M5 Link (the project)	Tunnels connecting to the M4 East at Haberfield (via the Wattle Street interchange) and the New M5 at St Peters (via the St Peters interchange), a new interchange at Rozelle and a link to Victoria Road (the Iron Cove Link). The Rozelle interchange also includes ramps and tunnels for connections to the proposed future Western Harbour Tunnel and Beaches Link project.	The subject of this EIS.
Related projects		
Sydney Gateway	A high-capacity connection between the St Peters interchange (under construction as part of the New M5 project) and the Sydney Airport and Port Botany precinct.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.
Western Harbour Tunnel and Beaches Link	The Western Harbour Tunnel component would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component would comprise a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah and Wakehurst Parkway at Seaforth. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.
F6 Extension	A proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor.	Planning underway by Roads and Maritime and subject to separate environmental assessment and approval.

1.2 Study area

The study area for this assessment was informed by the forecast traffic and transport changes from the WestConnex Road Traffic Model version 2.3 (WRTM v2.3), a strategic traffic model that covers the Sydney metropolitan area. The extent of the study area and the areas requiring operational modelling assessment were determined through analysis of forecast WRTM v2.3 traffic flow differences as a result of the project.

The study area broadly encompasses an area extending from the Parramatta River in the north to Sydney Airport in the south and from the Eastern Distributor in the east to Haberfield and Marrickville in the west. It is predominantly focused on the corridor between Haberfield and Rozelle, the corridor between Rozelle and St Peters, the corridor between Haberfield and St Peters, as well as the surface road networks around the Wattle Street, Rozelle and St Peters interchanges, as shown in **Figure 1-2**. Changes on strategic roads outside of this study area are assessed in the Sydney metropolitan road network sections and those outside the operational model areas are assessed through a screenline analysis, presented in **Chapter 9**. Further justification of the operational modelling areas is contained in **Annexure B**.

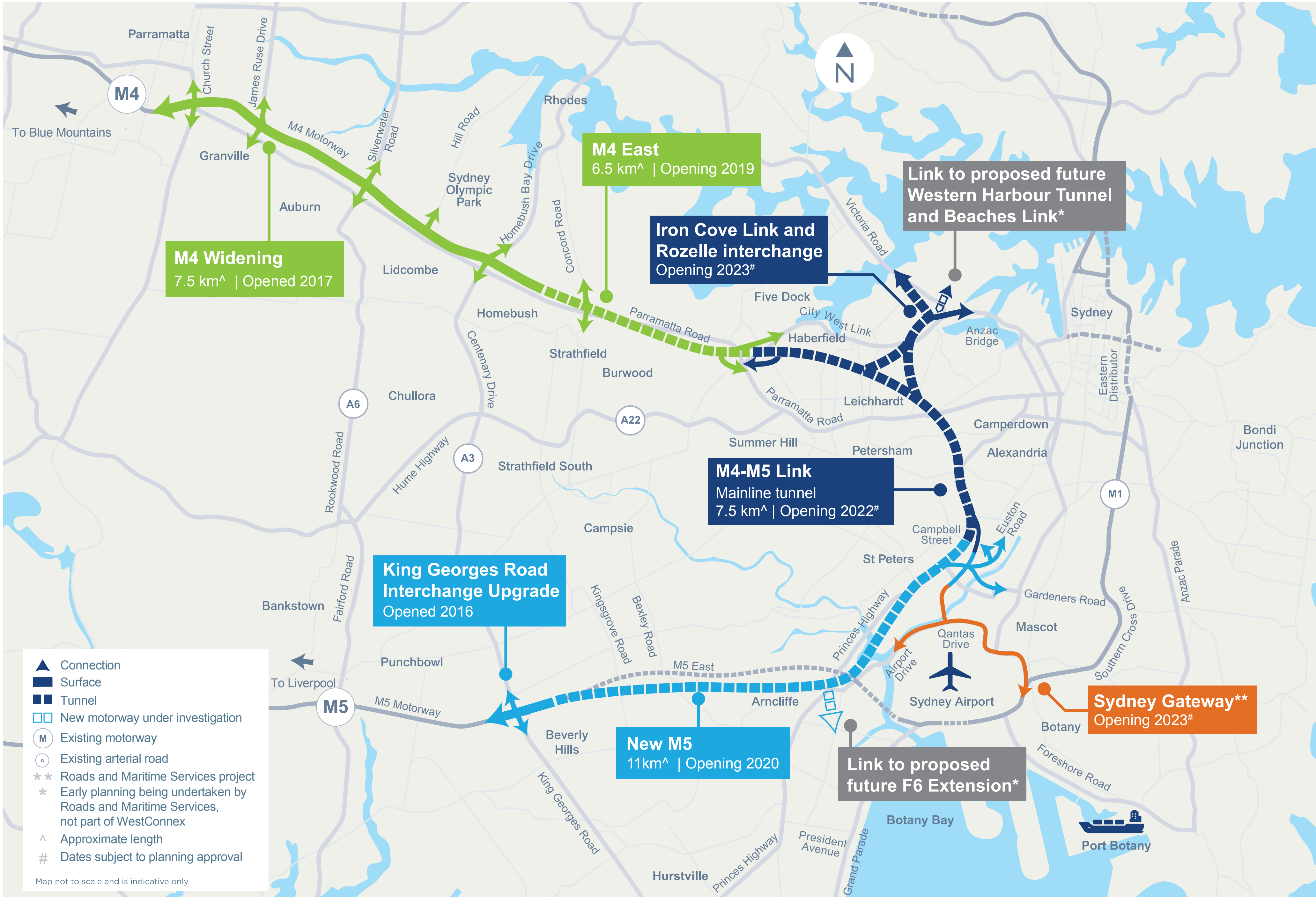

Figure 1-1 Overview of WestConnex and related projects

LEGEND

Existing features

- Waterway
- Railway
- Light rail
- Suburb boundary
- Arterial road
- Subarterial road
- Local road

Traffic study area

- Boundary

Figure 1-2 Study area

1.3 Purpose of this report

The purpose of this traffic and transport assessment is to support the EIS for the project by assessing and reporting existing and future traffic conditions. Specifically, the assessment includes the following:

- A review of existing traffic conditions, including a description of transport infrastructure in the study area, daily and peak hour traffic patterns, details of public transport frequency and mode share, and a review of active transport (pedestrian and cycle) networks, including pedestrian and cyclist networks
- Existing and future year intersection and roadway traffic volumes utilising outputs from the WRTM v2.3, with a particular focus on the project area between Haberfield, Rozelle and St Peters; including the predicted transfer of fixed and induced travel demand to the project from alternative transport corridors
- Construction traffic impacts, including an assessment of construction-related vehicles travelling on strategic and local roads that would provide access to the construction ancillary facilities
- Report on the operational performance of the existing and future road network around the Wattle Street, Rozelle and St Peters interchanges, as well as the M4-M5 Link in-tunnel traffic performance, during the AM peak and PM peak hours
- A holistic traffic and transport assessment that also includes crash analysis, travel speeds and travel time analysis and opportunities to enhance public transport networks within the project area. Opportunities to enhance active transport networks are discussed and presented in a separate active transport report (refer to **Appendix N** (Technical working paper: Active transport strategy) of the EIS)
- A suite of measures proposed to mitigate and manage traffic and transport impacts of the project during construction and operation.

1.4 SEARs and agency comments

In preparing this Technical working paper: Traffic and transport, the Secretary's Environmental Assessment Requirements (SEARs), issued for the M4-M5 Link project (SSI 7485) on 3 March 2016 and revised on 9 November 2016 and 3 May 2017, have been addressed. The key matters raised by the SEARs for consideration in the Technical working paper: Traffic and transport and where this technical working paper addresses these matters are outlined in **Table 1-2**.

In addition, agency letters, which accompany the SEARs and are applicable to traffic and transport, were issued by Inner West Council, City of Sydney Council, NSW Health and Port Authority of NSW. Details of how these matters were addressed in this assessment are included as **Annexure A**.

Table 1-2 How SEARs have been addressed in this report

SEARs	
Traffic and Transport	
Requirement	**Section where addressed in report**
1. The Proponent must assess **construction** transport and traffic (vehicle, pedestrian and cyclists) impacts, including, but not necessarily limited to:	– **Chapter 7**
(a) a considered approach to route identification and scheduling of transport movements, particularly outside standard construction hours;	– **Section 7.3**
(b) the number, frequency and size of construction related vehicles (passenger, commercial and heavy vehicles, including spoil management movements);	– **Section 7.3**
(c) construction worker parking;	– **Section 7.3**
(d) the nature of existing traffic (types and number of movements) on construction access routes (including consideration of peak traffic times and sensitive road users and parking arrangements);	– **Section 7.4** and **7.5**

SEARs	
Traffic and Transport	
Requirement	**Section where addressed in report**
(e) access constraints and impacts on public transport, pedestrians and cyclists;	– **Section 7.4** and **7.5**
(f) the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network associated with construction of the project. Where the closure, diversion or reconfiguration are temporary, provide an estimate of the duration of the altered access arrangements; and	– **Section 7.4** and **7.5**
(g) the cumulative traffic impacts of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex.	– **Section 7.6**
2. The Proponent must model and/or assess the **operational** transport impacts of the project including, but not necessarily limited to:	– **Chapters 9, 10 and 12**
(a) forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the project and the surrounding road, cycle and public transport network, including potential shifts of traffic movements on alternate routes outside the proposal area (such as toll avoidance) and impact of permanent street closures directly attributable to the SSI;	– **Chapters 9, 10** and **Annexure D**
(b) travel time analysis;	– **Sections 10.1**, **10.3**, **10.4**, **10.5**, **12.2**, **12.4**, **12.5** and **12.6**
(c) performance of key interchanges and intersections by undertaking a level of service analysis at key locations, for peak periods;	– **Sections 10.1**, **10.3**, **10.4**, **10.5**, **12.2**, **12.4**, **12.5** and **12.6**
(d) wider transport interactions (local and regional roads, cycling, public and freight transport), taking into account the Sydney City Centre Access Strategy, planned future urban release areas such as The Bays Precinct and planned future port activities and uses;	– **Section 3.4**, **10.1**, **10.4**, **12.2** and **12.5**
(e) the redistribution of traffic and impacts on traffic volumes and levels of service on the road network resulting from changes to the design of the M4-M5 Link as modelled in the traffic assessments for the M4 East and New M5 projects;	– **Annexure C**, **Sections 9**, **10.1**, **10.3**, **10.4**, **10.5**, **12.2**, **12.4**, **12.5** and **12.6**
(f) induced traffic and operational implications for existing and proposed public transport (particularly with respect to strategic bus corridors and bus routes and permanent closure/relocation of bus stops) and consideration of opportunities to improve public transport;	– **Sections 10.1**, **10.3**, **10.4**, **10.5**, **12.2**, **12.4**, **12.5** and **12.6**
(g) impacts on cyclists and pedestrian access and safety, including on known routes and future proposals, such as along Lilyfield Road;	– **Appendix N** (Technical working paper: Active transport strategy) of the EIS
(h) opportunities to integrate cycling and pedestrian elements with surrounding networks and within the project; and	– **Appendix N** (Technical working paper: Active transport strategy) of the EIS

SEARs	
Traffic and Transport	
Requirement	**Section where addressed in report**
(i) property and business access and on street parking. The assessment must provide an explanation for the scope of the modelled area, including justification of the nominated boundaries.	– **Sections 10.3**, **10.4**, **10.5**, **12.4**, **12.5** and **12.6** – **Section 1.4** and **Annexure B**

1.5 Structure of this report

This report has been structured as follows:

- **Chapter 2** presents an overview of the project
- **Chapter 3** provides an appreciation of the strategic transport context of the project
- **Chapter 4** documents the traffic modelling approach adopted to predict future travel demand and traffic volumes for the project and surrounding road network and to assess construction and operational impacts
- **Chapter 5** provides an overview of the existing traffic and transport conditions, including details of public transport frequency and patronage and a summary of daily and peak hour traffic patterns
- **Chapter 6** outlines the operational performance of the existing road network in terms of network performance and intersection levels of service, travel times and crashes
- **Chapter 7** documents the impact assessment undertaken for the construction scenarios
- **Chapter 8** provides details of future traffic and transport operational conditions without the project
- **Chapter 9** presents a strategic assessment of future daily and peak hour traffic volumes and patterns with the project
- **Chapter 10** documents the impact assessment undertaken for peak hour operational scenarios with the project
- **Chapter 11** documents management measures that are proposed to mitigate the traffic and transport impacts of the project
- **Chapter 12** documents the impact assessment undertaken for the cumulative peak hour operational scenarios
- **Chapter 13** provides a conclusion to the traffic and transport assessment.

A separate active transport report (refer to **Appendix N** (Technical working paper: Active transport strategy) of the EIS) addresses pedestrian and cycling impacts of the project, as well as planned active transport infrastructure as part of the project.

2 The project

2.1 Project location

The project would be generally located within the City of Sydney and Inner West local government areas (LGAs). The project is located about two to seven kilometres south, southwest and west of the Sydney central business district (CBD) and would cross the suburbs of Ashfield, Haberfield, Leichhardt, Lilyfield, Rozelle, Annandale, Stanmore, Camperdown, Newtown and St Peters. The local context of the project is shown in **Figure 2-1**.

2.2 Overview of the project

Key components of the project are shown in **Figure 2-1** and would include:

- Twin mainline motorway tunnels between the M4 East at Haberfield and the New M5 at St Peters. Each tunnel would be around 7.5 kilometres long and would generally accommodate up to four lanes of traffic in each direction
- Connections of the mainline tunnels to the M4 East project, comprising:
  - A tunnel-to-tunnel connection to the M4 East mainline stub tunnels east of Parramatta Road near Alt Street at Haberfield
  - Entry and exit ramp connections between the mainline tunnels and the Wattle Street interchange at Haberfield (which is currently being constructed as part of the M4 East project)
  - Minor physical integration works with the surface road network at the Wattle Street interchange including road pavement and line marking
- Connections of the mainline tunnels to the New M5 project, comprising:
  - A tunnel-to-tunnel connection to the New M5 mainline stub tunnels north of the Princes Highway near the intersection of Mary Street and Bakers Lane at St Peters
  - Entry and exit ramp connections between the mainline tunnels and the St Peters interchange at St Peters (which is currently being constructed as part of the New M5 project)
  - Minor physical integration works with the surface road network at the St Peters interchange including road pavement and line marking
- An underground interchange at Leichhardt and Annandale (the Inner West subsurface interchange) that would link the mainline tunnels with the Rozelle interchange and the Iron Cove Link (see below)
- A new interchange at Lilyfield and Rozelle (the Rozelle interchange) that would connect the M4-M5 Link mainline tunnels with:
  - City West Link
  - Anzac Bridge
  - The Iron Cove Link (see below)
  - The proposed future Western Harbour Tunnel and Beaches Link
- Construction of connections to the proposed future Western Harbour Tunnel and Beaches Link project as part of the Rozelle interchange, including:
  - Tunnels that would allow for underground mainline connections between the M4 East and New M5 motorways and the proposed future Western Harbour Tunnel and Beaches Link (via the M4-M5 Link mainline tunnels)
  - A dive structure and tunnel portals within the Rozelle Rail Yards, north of the City West Link / The Crescent intersection
  - Entry and exit ramps that would extend north underground from the tunnel portals in the

Rozelle Rail Yards to join the mainline connections to the proposed future Western Harbour Tunnel and Beaches Link

- A ventilation outlet and ancillary facilities as part of the Rozelle ventilation facility (see below)

- Twin tunnels that would connect Victoria Road near the eastern abutment of Iron Cove Bridge and Anzac Bridge (the Iron Cove Link). Underground entry and exit ramps would also provide a tunnel connection between the Iron Cove Link and the New M5 / St Peters interchange (via the M4-M5 Link mainline tunnels)
- The Rozelle surface works, including:
  - Realigning The Crescent at Annandale, including a new bridge over Whites Creek and modifications to the intersection with City West Link
  - A new intersection on City West Link around 300 metres west of the realigned position of The Crescent, which would provide a connection to and from the New M5/St Peters interchange (via the M4-M5 Link mainline tunnels)
  - Widening and improvement works to the channel and bank of Whites Creek between the light rail bridge and Rozelle Bay at Annandale, to manage flooding and drainage for the surface road network
  - Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road
  - New and upgraded pedestrian and cyclist infrastructure
  - Landscaping, including the provision of new open space within the Rozelle Rail Yards
- The Iron Cove Link surface works, including:
  - Dive structures and tunnel portals between the westbound and eastbound Victoria Road carriageways, to connect Victoria Road east of Iron Cove Bridge with the Iron Cove Link
  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Modifications to the existing intersections between Victoria Road and Terry, Clubb, Toelle and Callan streets
  - Landscaping and the establishment of pedestrian and cycle infrastructure
- Five motorway operations complexes; one at Leichhardt (MOC1), three at Rozelle (Rozelle West (MOC2), Rozelle East (MOC3) and Iron Cove Link (MOC4)), and one at St Peters (MOC5). The types of facilities that would be contained within the motorway operations complexes would include substations, water treatment plants, ventilation facilities and outlets, offices, on-site storage and parking for employees
- Tunnel ventilation systems, including ventilation supply and exhaust facilities, axial fans, ventilation outlets and ventilation tunnels
- Three new ventilation facilities, including:
  - The Rozelle ventilation facility at Rozelle
  - The Iron Cove Link ventilation facility at Rozelle
  - The Campbell Road ventilation facility at St Peters
- Fitout (mechanical and electrical) of part of the Parramatta Road ventilation facility at Haberfield (which is currently being constructed as part of M4 East project) for use by the M4-M5 Link project
- Drainage infrastructure to collect surface and groundwater for treatment at dedicated facilities. Water treatment would occur at
  - Two operational water treatment facilities (at Leichhardt and Rozelle)
  - The constructed wetland within the Rozelle Rail Yards
  - A bioretention facility for stormwater runoff within the informal car park at King George Park at

Rozelle (adjacent to Manning Street). A section of the existing informal car park would also be upgraded, including sealing the car park surface and landscaping

- Treated water would flow back to existing watercourses via new, upgraded and existing infrastructure
- Ancillary infrastructure and operational facilities for electronic tolling and traffic control and signage (including electronic signage)
- Emergency access and evacuation facilities, including pedestrian and vehicular cross and long passages and fire and life safety systems
- Utility works, including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities. A Utilities Management Strategy has been prepared for the project that identifies management options for utilities, including relocation or adjustment. Refer to **Appendix F** (Utilities Management Strategy) of the EIS.

The project does not include:

- Site management works at the Rozelle Rail Yards. These works were separately assessed and determined by Roads and Maritime through a Review of Environmental Factors under Part 5 of the EP&A Act (refer to **Chapter 2** (Assessment process) of the EIS)
- Ongoing motorway maintenance activities during operation
- Operation of the components of the Rozelle interchange which are the tunnels, ramps and associated infrastructure being constructed to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project.

Temporary construction ancillary facilities and temporary works to facilitate the construction of the project would also be required.

2.2.1 Staged construction and opening of the project

It is anticipated the project would be constructed and opened to traffic in two stages (as shown in **Figure 2-1**).

Stage 1 would include:

- Construction of the mainline tunnels between the M4 East at Haberfield and the New M5 at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1) and Campbell Road motorway operations complex (MOC5)
- These works are anticipated to commence in 2018 with the mainline tunnels open to traffic in 2022. At the completion of Stage 1, the mainline tunnels would operate with two traffic lanes in each direction. This would increase to generally four lanes at the completion of Stage 2, when the full project is operational.

Stage 2 would include:

- Construction of the Rozelle interchange and Iron Cove Link including:
  - Connections to the stub tunnels at the Inner West subsurface interchange (built during Stage 1)
  - Ancillary infrastructure at the Rozelle West motorway operations complex (MOC2), Rozelle East motorway operations complex (MOC3) and Iron Cove Link motorway operations complex (MOC4)
  - Connections to the surface road network at Lilyfield and Rozelle
  - Construction of tunnels, ramps and associated infrastructure as part of the Rozelle interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project
- Stage 2 works are expected to commence in 2019 with these components of the project open to traffic in 2023.

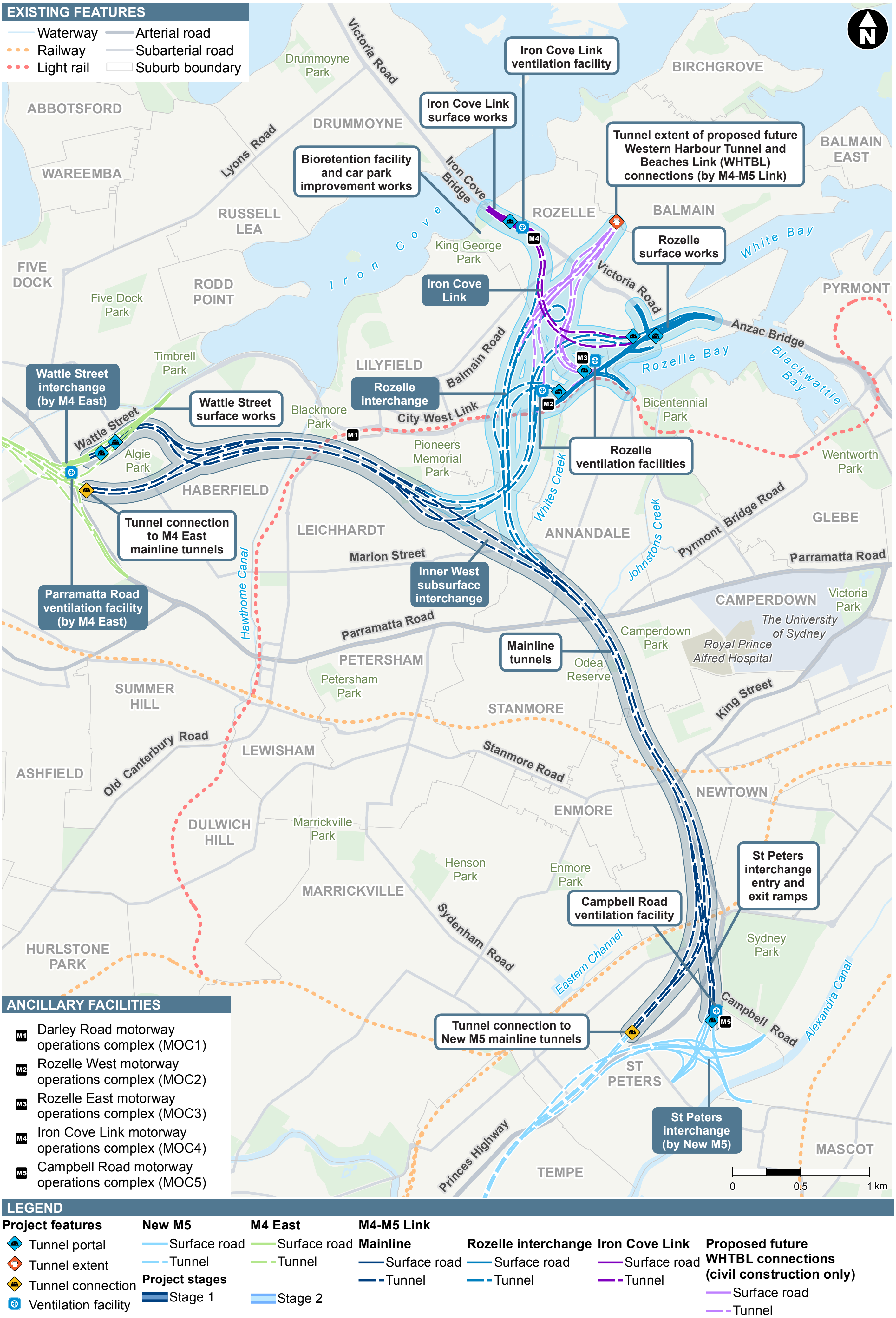

Figure 2-1 Overview of the project

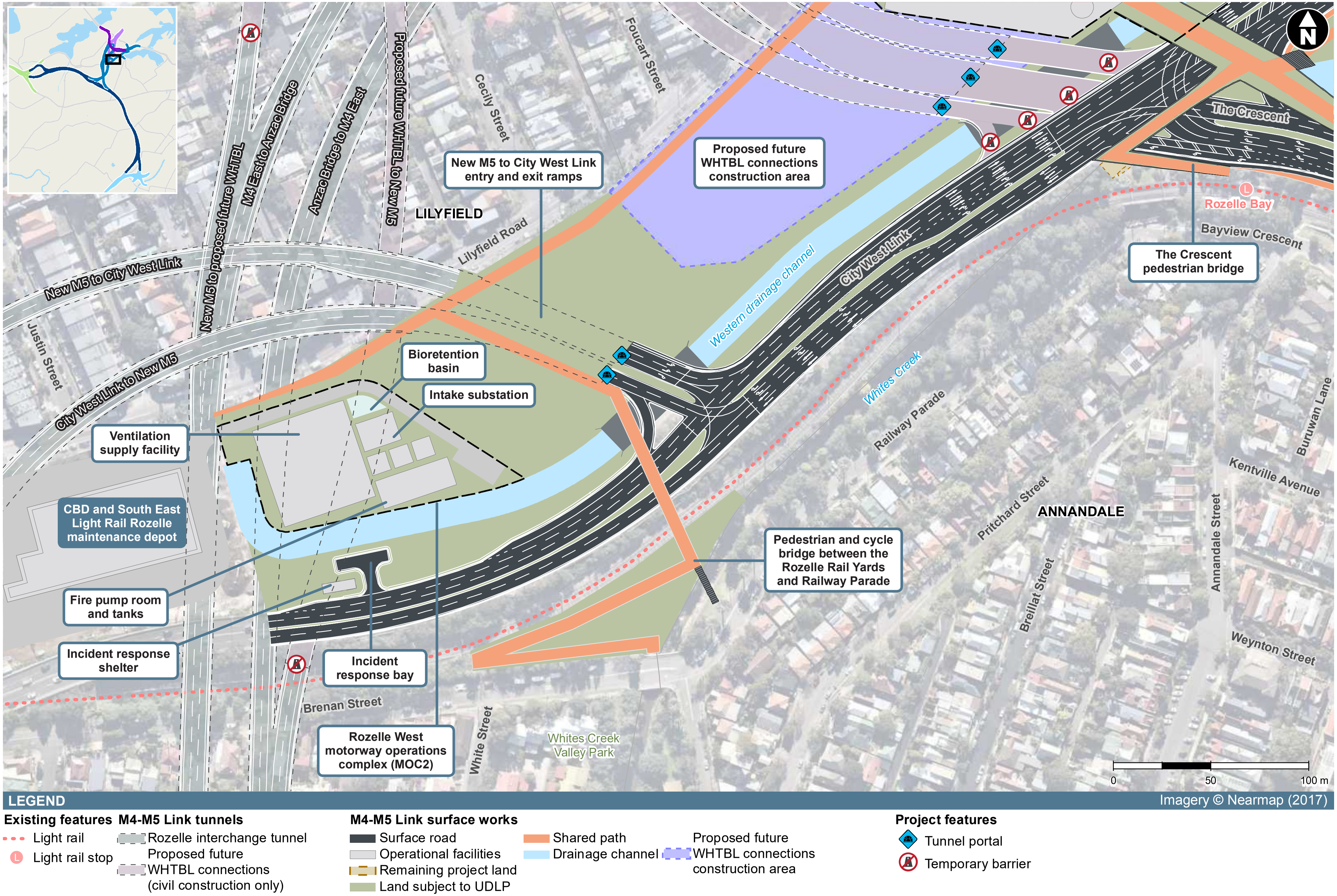

Figure 2-2 Rozelle interchange surface works overview - Map 1

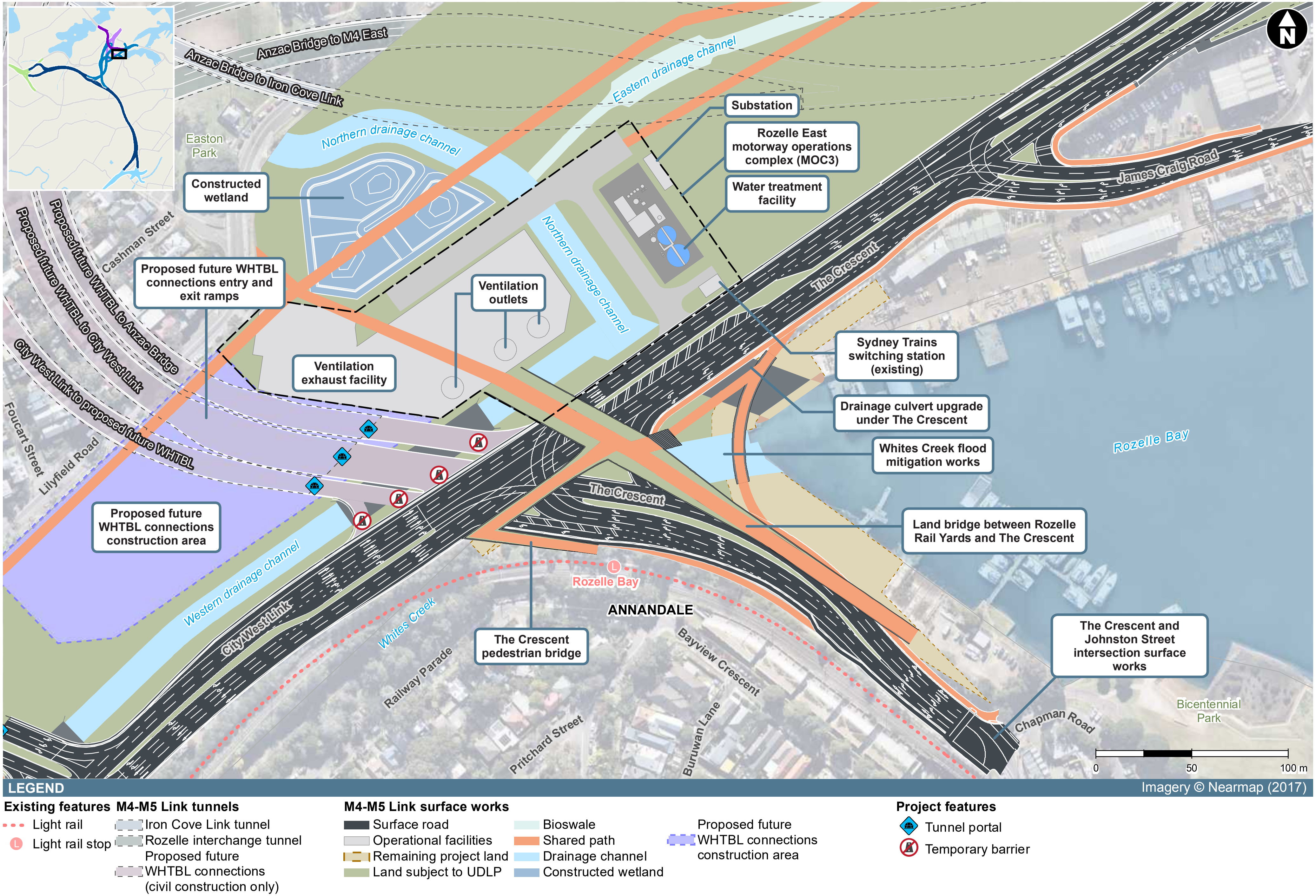

Figure 2-3 Rozelle interchange surface works overview - Map 2

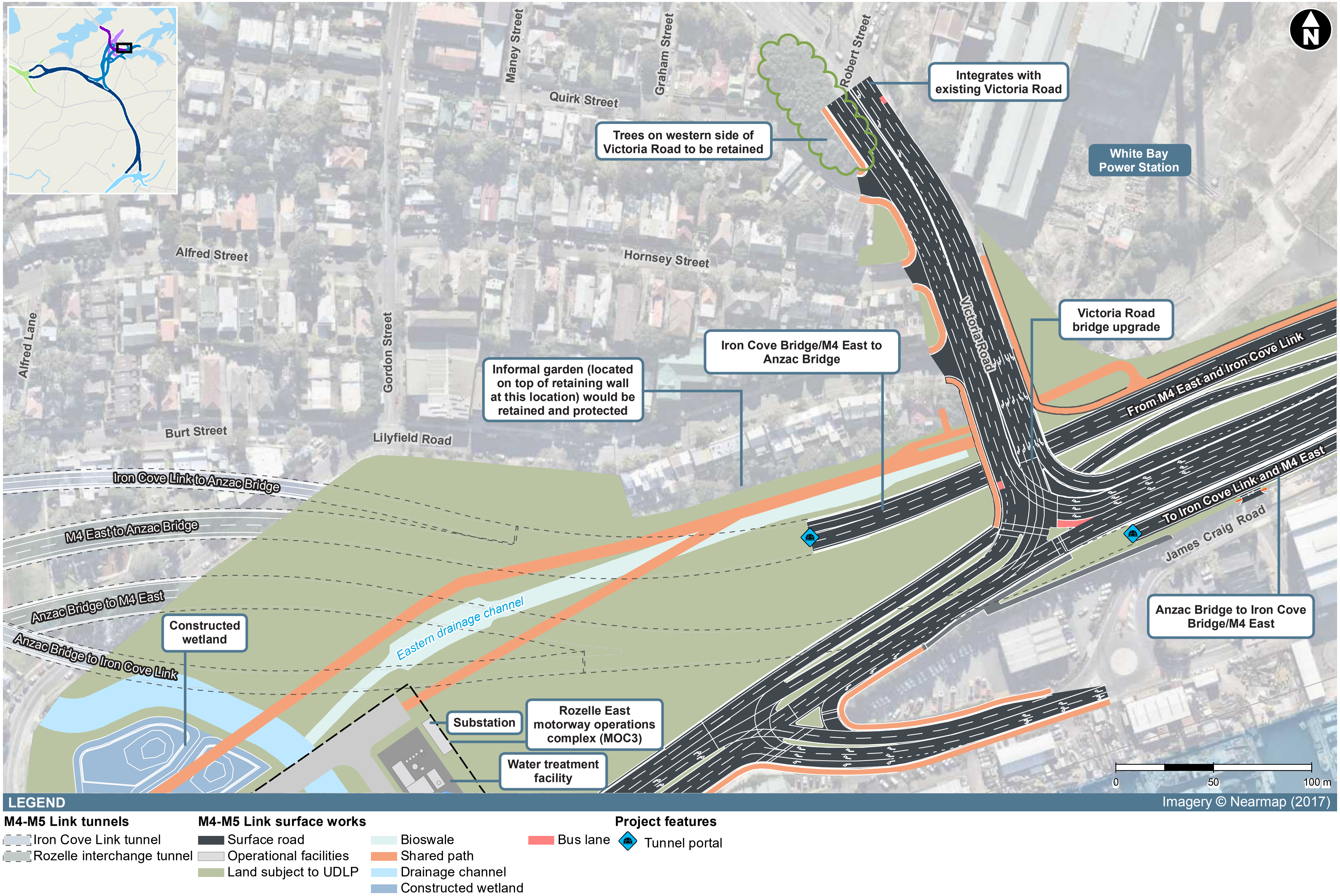

Figure 2-4 Rozelle interchange surface works overview - Map 3

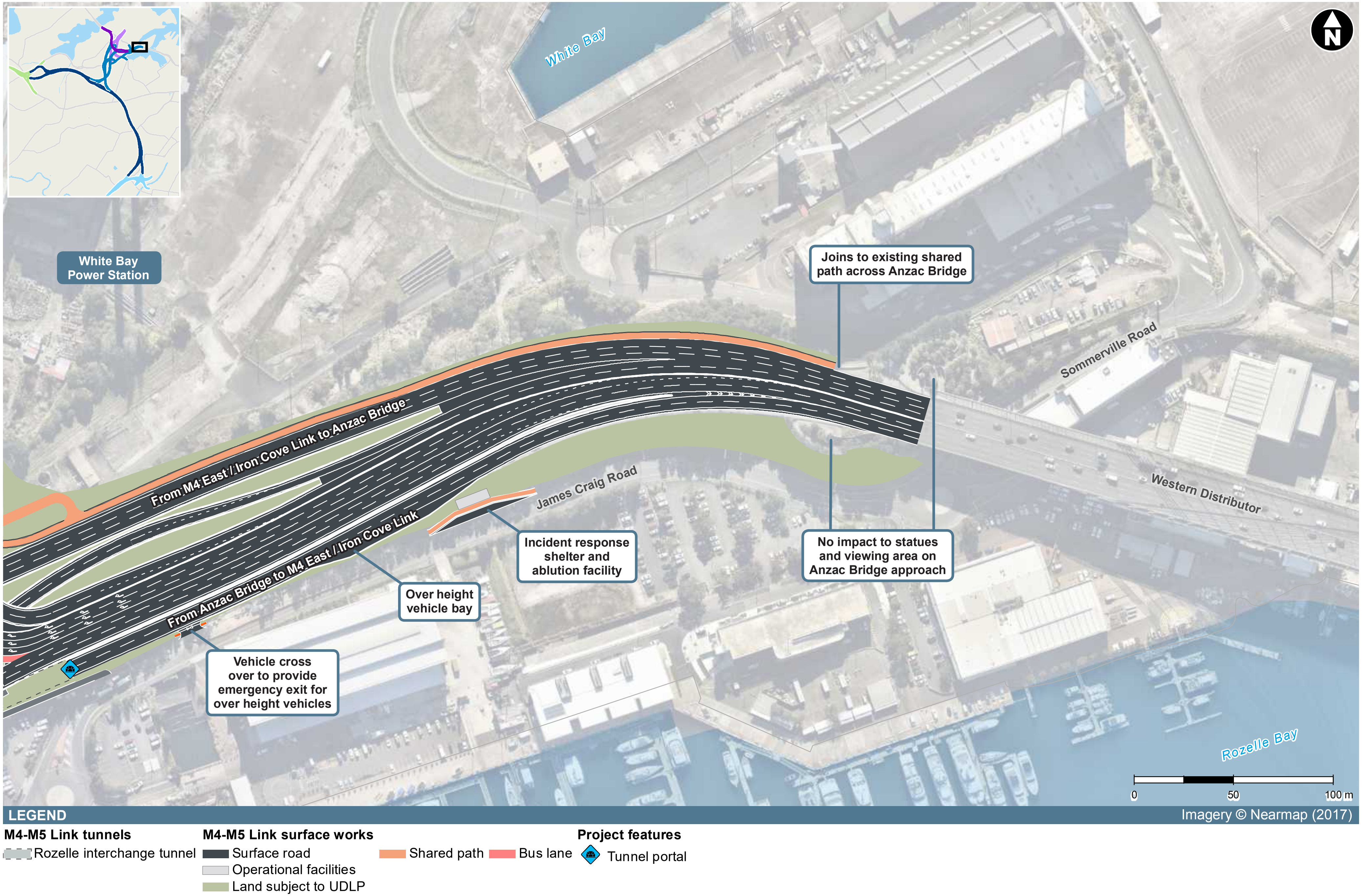

Figure 2-5 Rozelle interchange surface works overview - Map 4

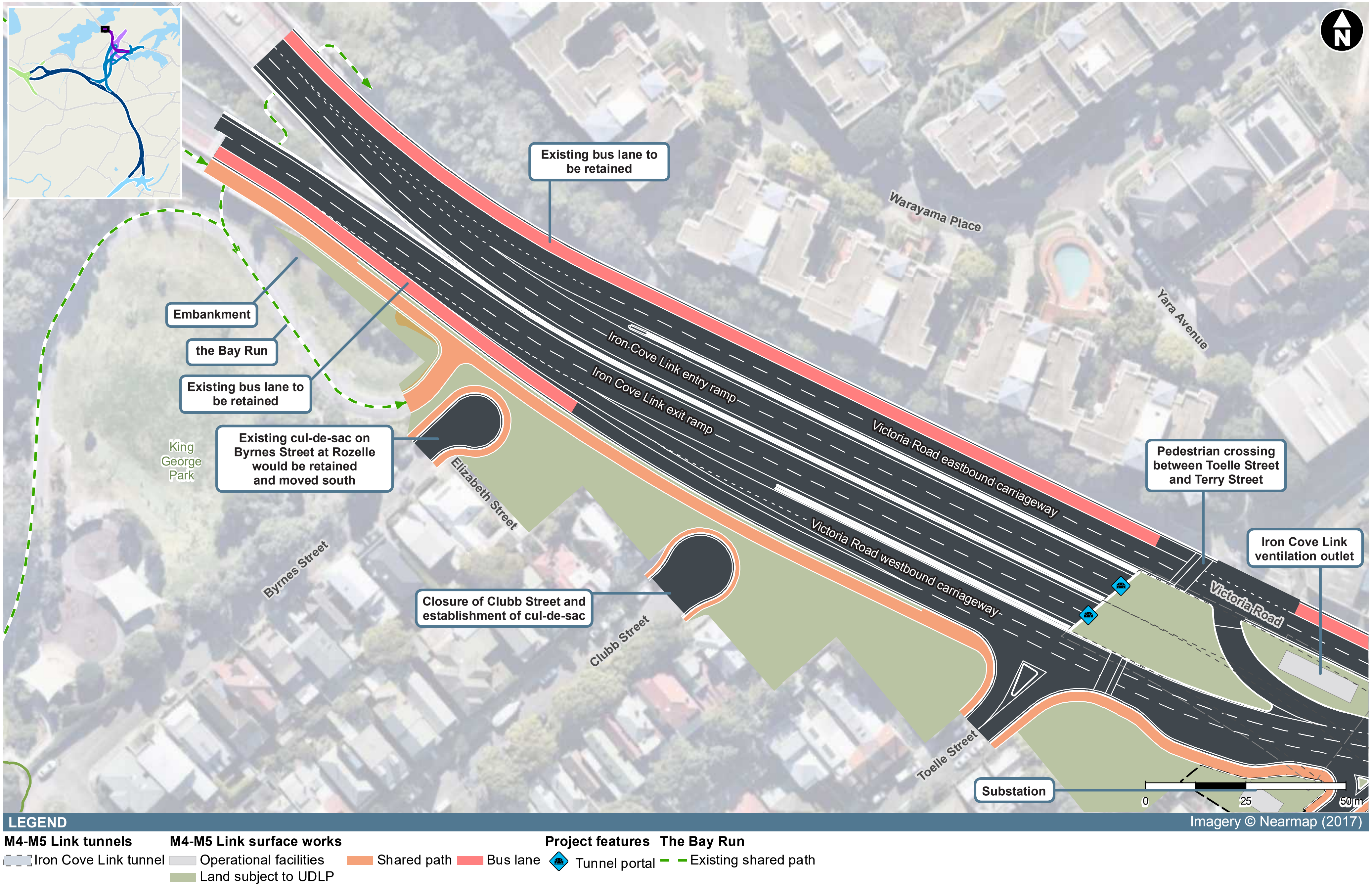

Figure 2-6 Iron Cove Link surface works - Map 1

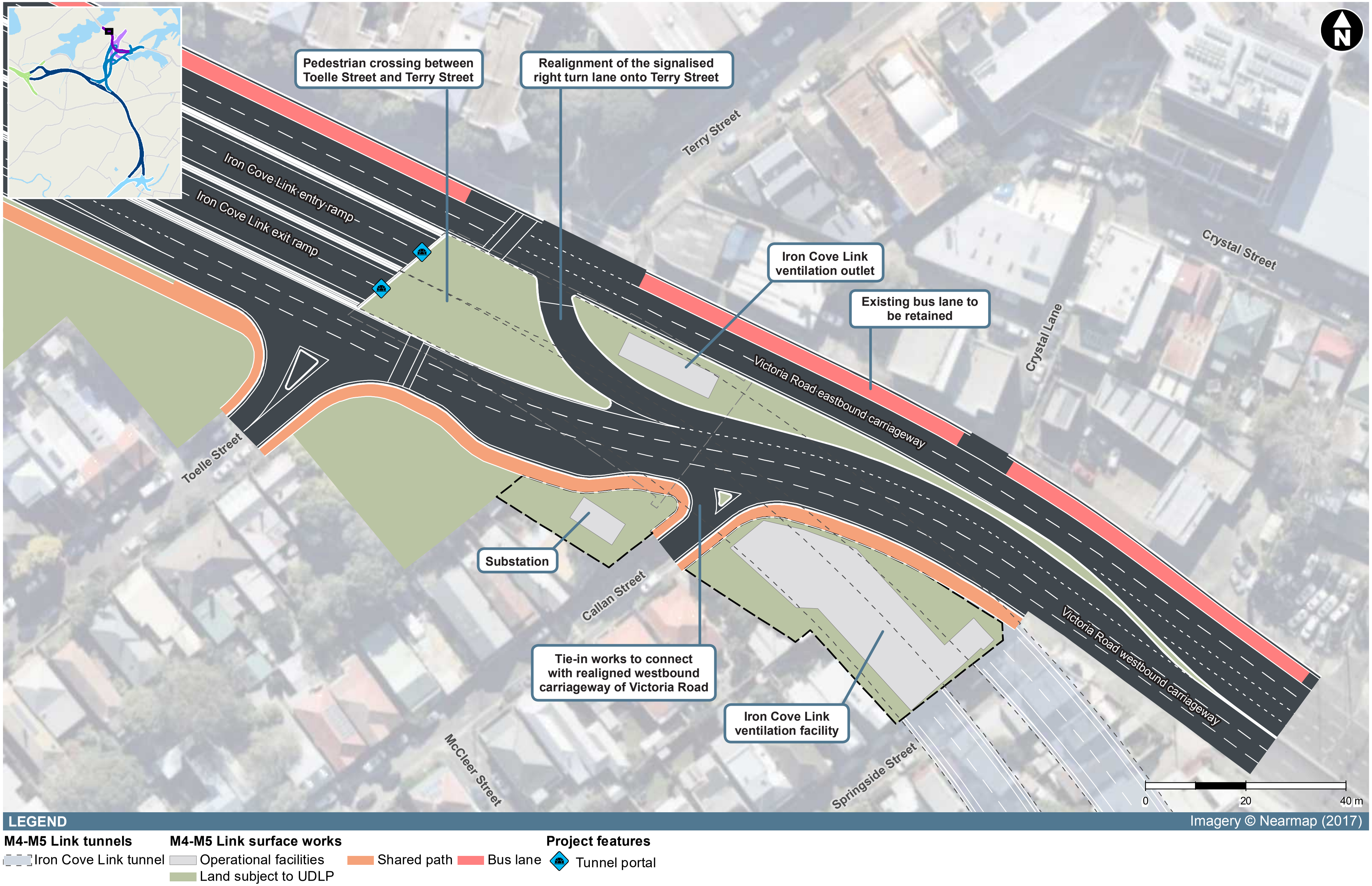

Figure 2-7 Iron Cove Link surface works - Map 2

2.3 Construction activities

2.3.1 Overview

An overview of the key construction features of the project is shown on **Figure 2-8** and would generally include:

- Enabling and temporary works, including provision of construction power and water supply, ancillary site establishment including establishment of acoustic sheds and construction hoarding, demolition works, property adjustments and public and active transport modifications (if required)
- Construction of the road tunnels, interchanges, intersections and roadside infrastructure
- Haulage of spoil generated during tunnelling and excavation activities
- Fitout of the road tunnels and support infrastructure, including ventilation and emergency response systems
- Construction and fitout of the motorway operations complexes and other ancillary operations buildings
- Realignment, modification or replacement of surface roads, bridges and underpasses
- Implementation of environmental management and pollution control facilities for the project.

A more detailed overview of construction activities is provided in **Table 2-1**.

Table 2-1 Overview of construction activities

Component	Typical activities
Site establishment and enabling works	• Vegetation clearing and removal • Utility works • Traffic management measures • Install safety and environmental controls • Install site fencing and hoarding • Establish temporary noise attenuation measures • Demolish buildings and structures • Carry out site clearing • Heritage salvage or conservation works (if required) • Establish construction ancillary facilities and access • Establish acoustic sheds • Supply utilities (including construction power) to construction facilities • Establish temporary pedestrian and cyclist diversions
Tunnelling	• Construct temporary access tunnels • Excavation of mainline tunnels, entry and exit ramps and associated tunnelled infrastructure and install ground support • Spoil management and haulage • Finishing works in tunnel and provision of permanent tunnel services • Test plant and equipment
Surface earthworks and structures	• Vegetation clearing and removal • Topsoil stripping • Excavate new cut and fill areas • Construct dive and cut-and-cover tunnel structures • Install stabilisation and excavation support (retention systems) such as sheet pile walls, diaphragm walls and secant pile walls (where required) • Construct required retaining structures • Excavate new road levels
Bridge works	• Construct piers and abutments • Construct headstock • Construct bridge deck, slabs and girders • Demolish and remove redundant bridges

Component	Typical activities
Drainage	• Construct new pits and pipes • Construct new groundwater drainage system • Connect drainage to existing network • Construct sumps in tunnels as required • Construct water quality basins, constructed wetland and bioretention facility and basin • Construct drainage channels • Construct spill containment basin • Construct onsite detention tanks • Adjustments to existing drainage infrastructure where impacted • Carry out widening and naturalisation of a section of Whites Creek • Demolish and remove redundant drainage
Pavement	• Lay select layers and base • Lay road pavement surfacing • Construct pavement drainage
Operational ancillary facilities	• Install ventilation systems and facilities • Construct water treatment facilities • Construct fire pump rooms and install water tanks • Test and commission plant and equipment • Construct electrical substations to supply permanent power to the project
Finishing works	• Line mark to new road surfaces • Erect directional and other signage and other roadside furniture such as street lighting • Erect toll gantries and other control systems • Construct pedestrian and cycle paths • Carry out earthworks at disturbed areas to establish the finished landform • Carry out landscaping • Closure and backfill of temporary access tunnels (except where these are to be used for inspection and/or maintenance purposes) • Site demobilisation and preparation of the site for a future use

Twelve construction ancillary facilities are described in this EIS (as listed below).To assist in informing the development of a construction methodology that would manage constructability constraints and the need for construction to occur in a safe and efficient manner, while minimising impacts on local communities, the environment, and users of the surrounding road and other transport networks, two possible combinations of construction ancillary facilities at Haberfield and Ashfield have been assessed in this EIS. The construction ancillary facilities that comprise these options have been grouped together in this EIS and are denoted by the suffix a (for Option A) or b (for Option B).

The construction ancillary facilities required to support construction of the project include:

- Construction ancillary facilities at Haberfield (Option A), comprising:
  - Wattle Street civil and tunnel site (C1a)
  - Haberfield civil and tunnel site (C2a)
  - Northcote Street civil site (C3a)
- Construction ancillary facilities at Ashfield and Haberfield (Option B), comprising:
  - Parramatta Road West civil and tunnel site (C1b)
  - Haberfield civil site (C2b)
  - Parramatta Road East civil site (C3b)
- Darley Road civil and tunnel site (C4)
- Rozelle civil and tunnel site (C5)

- The Crescent civil site (C6)
- Victoria Road civil site (C7)
- Iron Cove Link civil site (C8)
- Pyrmont Bridge Road tunnel site (C9)
- Campbell Road civil and tunnel site (C10).

The number, location and layout of construction ancillary facilities would be finalised as part of detailed construction planning during detailed design and would meet the environmental performance outcomes stated in the EIS and the Submissions and Preferred Infrastructure Report and satisfy criteria identified in any relevant conditions of approval.

The construction ancillary facilities would be used for a mix of civil surface works, tunnelling support, construction workforce parking and administrative purposes. Wherever possible, construction sites would be co-located with the operational footprint to minimise property acquisition and temporary disruption. The layout and access arrangements for the construction ancillary facilities are based on the concept design only and would be confirmed and refined in response to submissions received during the exhibition of this EIS and during detailed design.

2.3.2 Construction program

The total period of construction works for the project is expected to be around five years, with commissioning occurring concurrently with the final stages of construction. An indicative construction program is shown in **Table 2-2**.

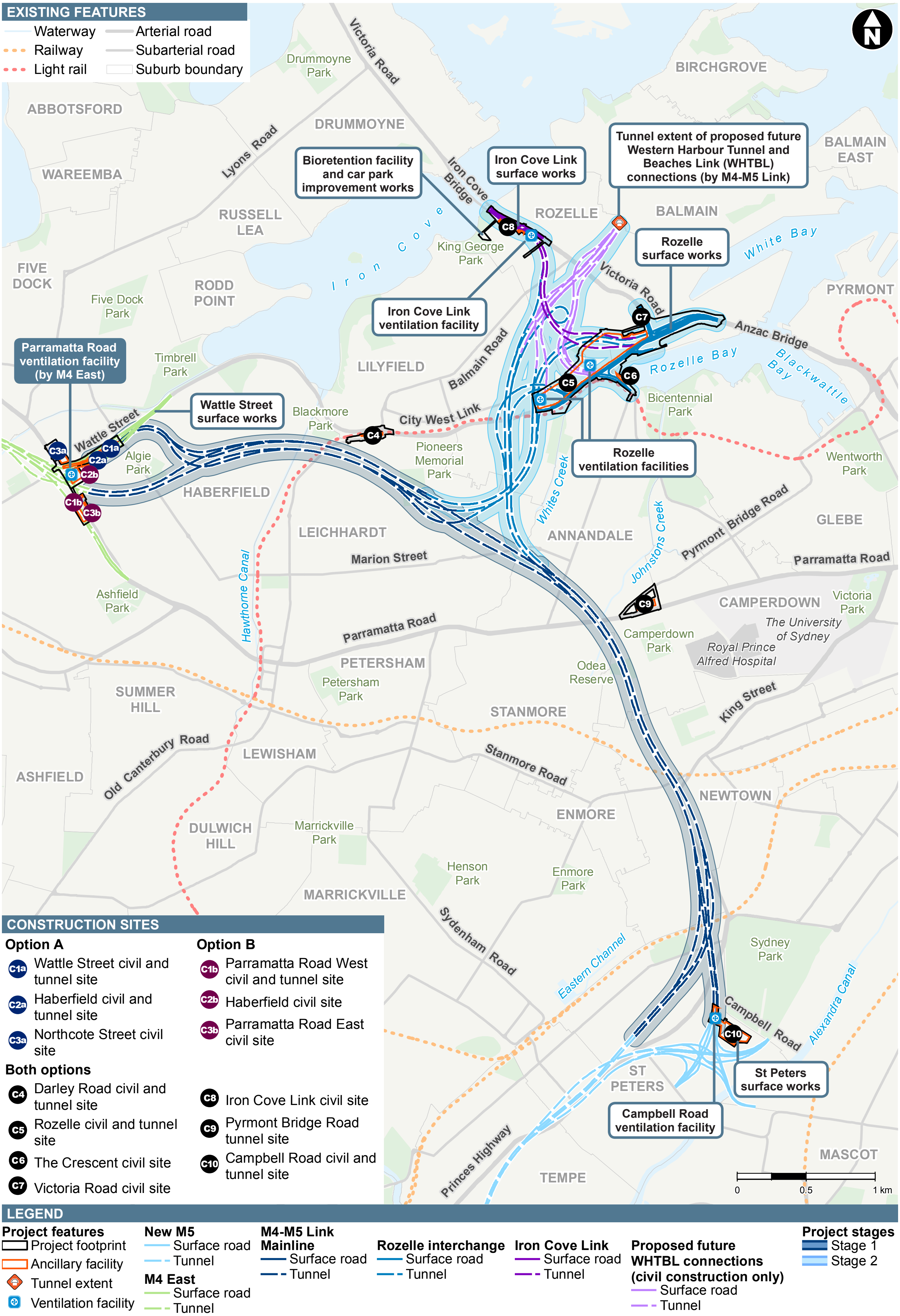

Figure 2-8 Overview of project footprint and ancillary facilities

Table 2-2 Indicative construction program

Construction activity	Indicative construction timeframe 2018				2019				2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Mainline tunnels																								
Site establishment and establishment of construction ancillary facilities			■	■	■	■	■	■	■	■														
Utility works and connections			■	■	■	■	■	■																
Tunnel construction				■	■	■	■	■	■	■	■	■	■											
Portal construction				■	■	■	■	■																
Construction of permanent operational facilities												■	■	■	■	■								
Mechanical and electrical fitout works														■	■	■								
Establishment of tolling facilities															■	■								
Site rehabilitation and landscaping																■	■	■	■					
Surface road works																	■	■	■					
Demobilisation and rehabilitation																			■	■				
Testing and commissioning																■	■	■	■	■				
Rozelle interchange and Iron Cove Link																								
Site establishment and establishment of construction ancillary facilities				■	■	■	■	■	■															
Utility works and connections and site remediation				■	■	■	■	■																
Tunnel construction									■	■	■	■	■	■	■	■	■							
Portal construction						■	■	■	■															
Construction of surface road works						■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■			
Construction of permanent operational facilities						■	■	■	■	■	■	■	■	■	■	■								
Mechanical and electrical fitout works													■	■	■	■	■	■	■	■				
Establishment of tolling facilities																		■	■					
Site rehabilitation and landscaping																			■	■	■			
Demobilisation and rehabilitation																						■	■	
Testing and commissioning																			■	■	■	■	■	

3 Strategic transport context

3.1 Appreciation of the strategic context

The traffic and transport assessment methodology was developed with consideration of relevant strategic planning and transport policies to provide a firm understanding of the traffic and transport effects of the project and how they respond to the WestConnex objectives.

Investment in customer focused transport infrastructure is a NSW Government priority and essential to sustainable economic growth and prosperity, in Sydney and the wider region. *A Plan for Growing Sydney* (NSW Government 2014) indicates that over the 20 years from 2011 to 2031, Sydney's population is forecast to increase from 4.3 to 5.9 million, which equates to an average of 80,000 additional residents per year. Moreover, by 2036, the number of trips made around the city each day is forecast to increase by 31 per cent from 16 to 21 million vehicle movements[2].

This growth, particularly with population and employment located in different parts of the city, would put increasing pressure on the NSW transport network and the 46 travel demand corridors connecting the regional cities and major centres across the greater Sydney metropolitan area, as shown in **Figure 3-1**. It is recognised that not all trips can be served by public transport, especially leisure trips or commercial trips that require the movement of large or heavy goods/materials. Each corridor currently accommodates high levels of daily traffic including freight, commuter and leisure travel and the trips using the corridors experience congestion and delay, particularly during the weekday and weekend peak periods.

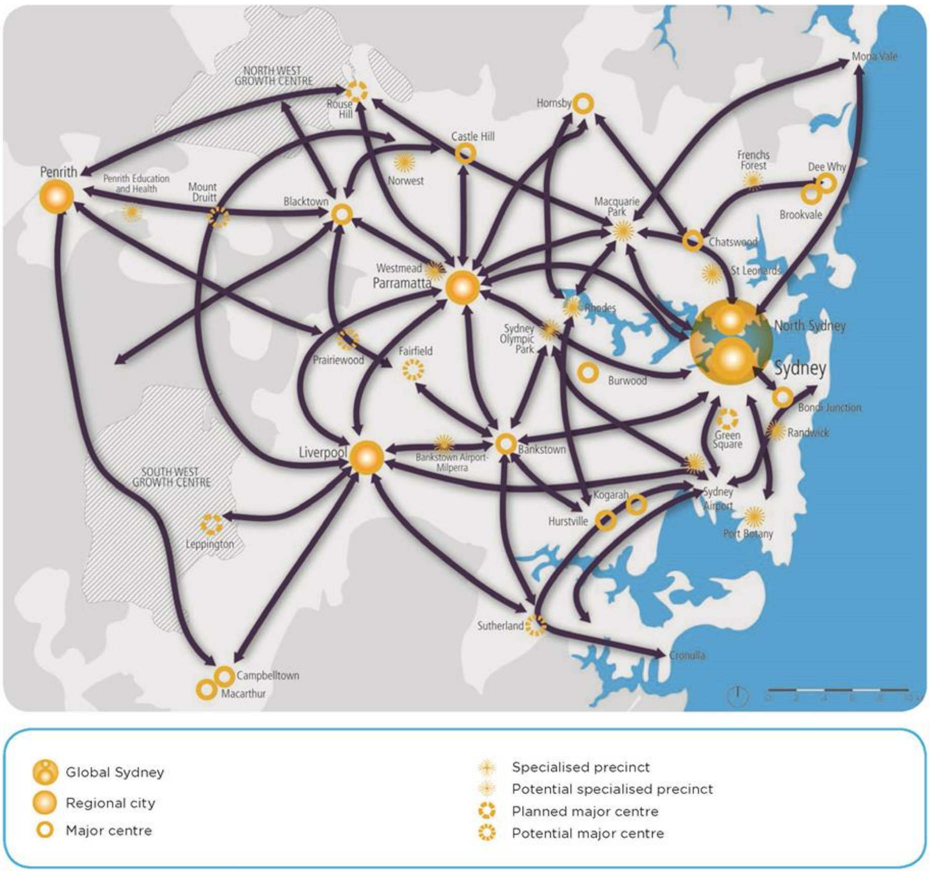

Figure 3-1 Sydney travel demand corridors

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

[2] NSW Government, *A Plan for Growing Sydney,* 2014.

Changes in transport technology and trip patterns, due to developments like autonomous vehicles, and increased use of web-based transport on demand services, may affect future travel demand, but there is a lack of conclusive quantitative evidence on what these effects might be. Therefore, this has been excluded from the analysis. For the purposes of this study and the traffic forecasts used, assumptions around technology and the economics of energy and economic performance are assumed to be constant for all future scenarios, ie with and without the project.

The study area for the traffic and transport assessment includes parts of the Sydney Trains suburban railway network, light rail and bus networks, freight rail and road access to the Sydney CBD, Port Botany, and Sydney Airport. The study area also covers parts of four of the main travel demand corridors:

- Parramatta to the Sydney CBD via Strathfield
- Parramatta to the Sydney CBD via Ryde
- Sydney Airport to the Sydney CBD
- Liverpool to Sydney Airport.

3.1.1 Parramatta to the Sydney CBD via Strathfield

This is the main corridor connecting western Sydney to the Global Economic Corridor (a corridor that extends from the CBD north to Macquarie Park and south to Sydney Airport and Port Botany) and carries the highest number of transit passengers of any corridor in Sydney (with over 40,000 in the peak hour period towards the Sydney CBD).

Key transport routes within this corridor include the Western Rail Line, M4 Motorway and Parramatta Road, City West Link and the Inner West Light Rail. Continued investment is proposed to ease congestion and provide capacity for future growth, including the M4 East (which is under construction), the M4-M5 Link, and the proposed Parramatta Light Rail and Sydney Metro West.

The corridor is one of the most constrained strategic transport corridors in Sydney, as illustrated by the following operational performance statistics in the *NSW Long Term Transport Master Plan* (Transport for NSW 2012) (*Transport Master Plan*):

- The majority of rail services along the Western Rail Line have load factors greater than 100 per cent of seated capacity from Strathfield onwards in the AM peak period
- For drivers travelling between Parramatta and the Sydney CBD, both the M4 Motorway and Parramatta Road are congested and at capacity during peak periods
- Most bus services on Parramatta Road are full during peak periods and experience variable travel times, with an average variance of up to eight minutes in the morning (AM) and evening (PM) peak periods due to congestion at the CBD end of the journey
- Growth in demand on this corridor is forecast to result in car travel times increasing by 16 minutes between the Sydney CBD and Parramatta during peak travel times by 2031 compared to 2011, assuming no increase in road capacity, ie a ‘do nothing’ scenario
- Rail passenger demand is forecast to exceed existing capacity by 2031.

Recent Transport for NSW data measured at Redfern Station in March 2016 confirm congested rail conditions:

- T1 Western Line trains have an average load factor of 148 per cent of seated capacity in the AM peak period
- T1 Northern Line via Strathfield trains have an average load factor of 148 per cent of seated capacity in the AM peak period
- T2 Inner West Line trains have an average load factor of 126 per cent of seated capacity in the AM peak period
- T2 South Line trains have an average load factor of 109 per cent of seated capacity in the AM peak period.

Figure 3-2 illustrates the impacts a 'do nothing' scenario would have on the performance of public and private transport along the Parramatta to the Sydney CBD via Strathfield transport corridor. The figure shows that AM peak volume/capacity (V/C) ratios are consistently increasing (particularly for Dobroyd Parade/City West Link and Anzac Bridge) over the 20 year period. This suggests that an increase in capacity across the network is required to maintain the level of service currently provided.

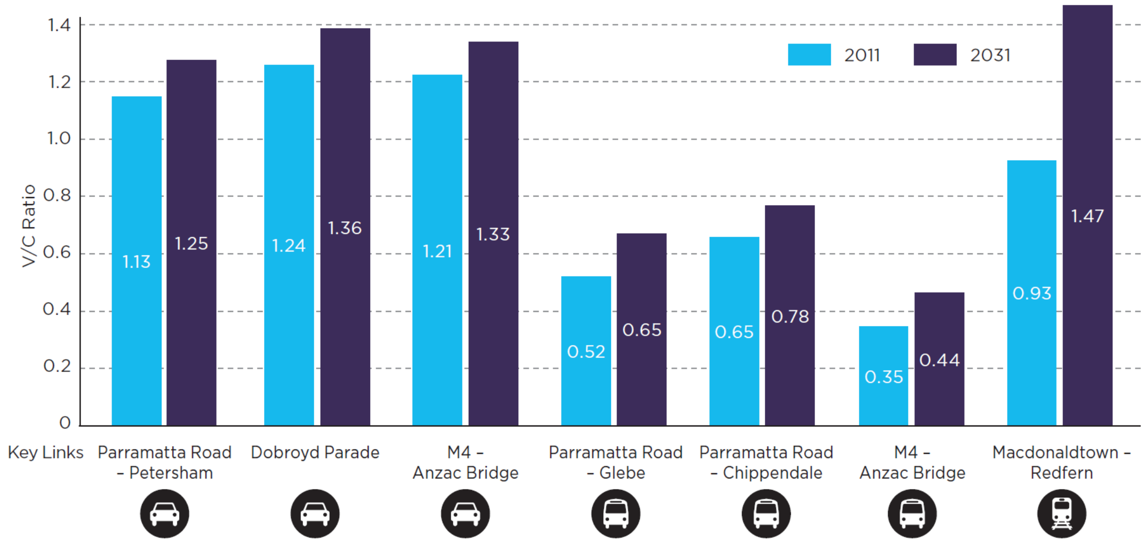

Figure 3-2 Parramatta to the Sydney CBD via Strathfield corridor: AM peak V/C – 2011 | 2031 'do nothing' scenario

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

3.1.2 Parramatta to the Sydney CBD via Ryde

This corridor is centred on Victoria Road, which connects Parramatta with the Sydney CBD and services a range of travel demands. The section of Victoria Road between Drummoyne and Anzac Bridge carries an average of around 75,000 vehicles each weekday across Iron Cove Bridge. It is one of the most congested road corridors in Sydney, as illustrated by the following operational performance statistics in the *Transport Master Plan*:

- Average peak period speeds below 20 kilometres per hour between Hunters Hill and Rozelle
- Between Drummoyne and Anzac Bridge, 19 bus routes carry an average 40,000 passengers across Anzac Bridge each weekday, one of the busiest bus corridors in Sydney
- Transit lanes on Victoria Road have improved bus flow, providing citybound bus commuters with travel time savings of up to 17 minutes in the AM peak period before the installation of the transit lanes. Even so, there is still variability in bus travel times of between eight and 10 minutes due to the volume of buses.

Figure 3-3 illustrates the impacts a 'do nothing' scenario would have on the performance of public and private transport along Victoria Road at Iron Cove. The figure shows that AM peak V/C ratios are consistently increasing over the 20 year period. Forecast growth in this corridor is also high due to growth at Ryde and Macquarie Park, inner Sydney and Parramatta. This suggests that an increase in capacity across the network is required to maintain the level of service currently provided.

Figure 3-3 Parramatta to the Sydney CBD via Ryde corridor: AM peak V/C – 2011 | 2031 'do nothing' scenario

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

3.1.3 Sydney Airport to the Sydney CBD

The corridor linking Sydney Airport to the Sydney CBD is serviced by a motorway link (Southern Cross Drive/Eastern Distributor); an arterial road network that provides access to Redfern, Central Station and the southern end of the Sydney CBD; and the East Hills Rail Line that connects the Airport to Central Station and the City Circle.

The Sydney Airport to Sydney CBD corridor experiences high levels of congestion, as illustrated by the following operational performance statistics in the 2012 *Transport Master Plan*:

- Southern Cross Drive operates at capacity during the AM peak period, with average speeds of 35 kilometres per hour
- Due to congestion on the Eastern Distributor, traffic diverts onto the adjacent arterial road network including O'Riordan and Bourke Streets, which are also congested
- The Airport Rail Line is approaching seated capacity between Green Square Station and Central Station.

Transport for NSW data measured at Green Square Station in March 2016 confirms increased rail congestion:

- The T2 Airport Rail Line has an average load factor of 130 per cent of seated capacity in the AM peak period. Continued rapid growth in residential development at Mascot, Green Square and surrounds is likely to place greater demand on this line.

Figure 3-4 illustrates the impacts a 'do nothing' scenario would have on the performance of public and private transport along the Sydney Airport to Sydney CBD corridor. The figure shows that AM peak V/C ratios are consistently increasing over the 20 year period.

Increasing activity at Sydney Airport and Port Botany, population and employment growth in the South Sydney and airport areas (including Green Square) would result in higher traffic volumes along strategic connections to the growing southwest region of Sydney, including the M5 Motorway, placing increasing pressure on this corridor. This suggests that an increase in capacity across the network is required to maintain the level of service currently provided.

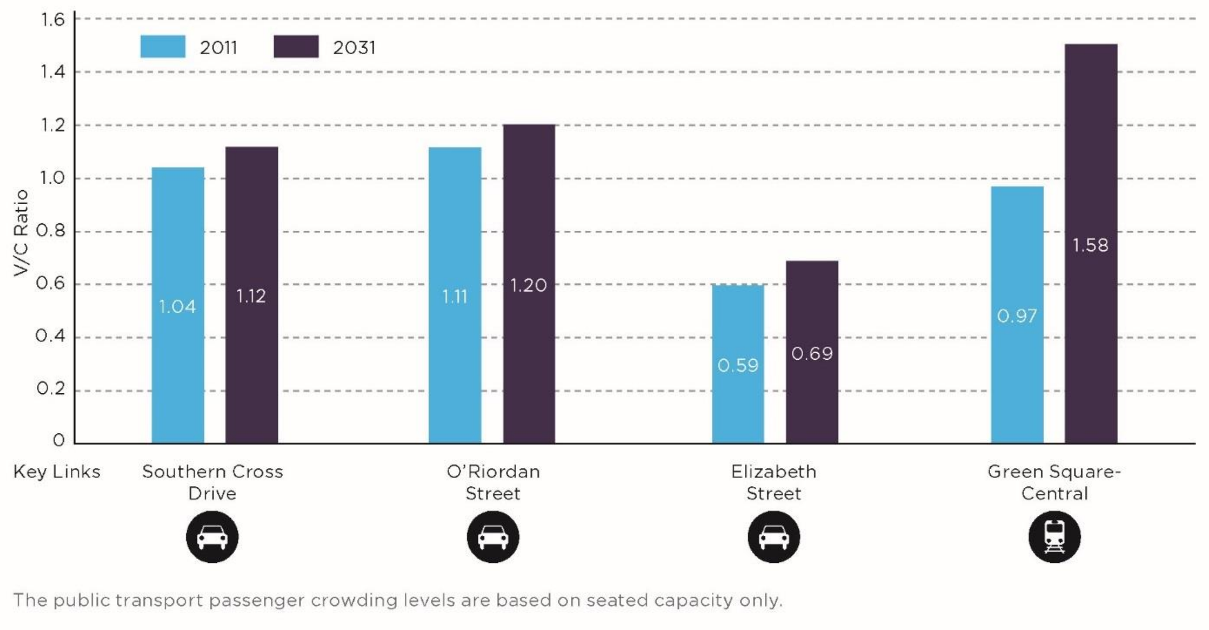

Figure 3-4 Sydney Airport to the Sydney CBD corridor: AM peak V/C – 2011 | 2031 'do nothing' scenario

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

3.1.4 Liverpool to Sydney Airport

This corridor, linking regional NSW and southwest Sydney to Sydney Airport and Port Botany, is serviced by the M5 South West and the M5 East motorways and the East Hills Rail Line that connects stations from the southwest to Central Station via the airport.

The Liverpool to Sydney Airport corridor experiences high levels of congestion, as illustrated by the following operational performance statistics in the 2012 *Transport Master Plan*:

- The M5 Motorway is very congested and operates at capacity during the peak hours, with average speeds below 40 kilometres per hour
- The East Hills Line is approaching capacity at Wolli Creek and further growth has implications for the capacity of the rail system to accommodate demand at Sydney Airport.

Figure 3-5 illustrates the impacts a 'do nothing' scenario would have on the performance of public and private transport along the Liverpool to Sydney Airport corridor. The figure shows that AM peak V/C ratios are consistently increasing over the 20 year period.

The high population growth forecast in southwest Sydney would place increasing pressure on this corridor. This suggests that an increase in capacity across the network is required to maintain the level of service currently provided.

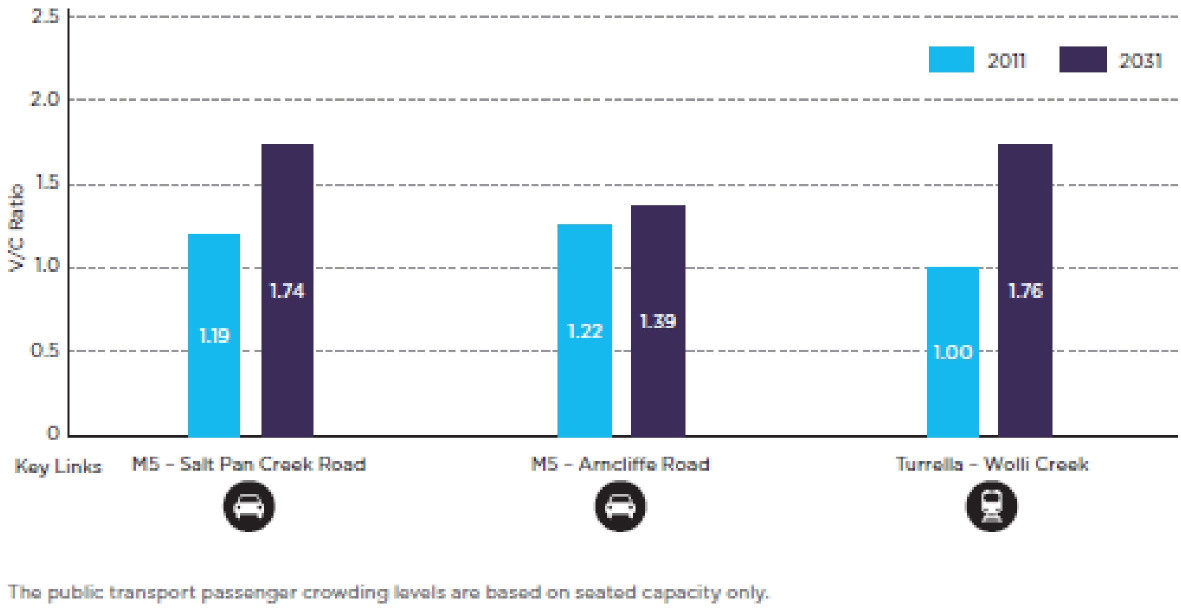

Figure 3-5 Liverpool to Sydney Airport corridor: AM peak V/C – 2011 | 2031 'do nothing' scenario

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

3.2 Sydney metropolitan transport movement – general traffic

The M4-M5 Link would provide a new strategic connection that is currently performed by other motorways (eg Southern Cross Drive), arterial roads (eg Victoria Road, City West Link, Parramatta Road and Botany Road) and lower-order roads, which are nearing capacity as ongoing development and population growth places additional pressure on the road network. The proposed M4-M5 Link would also provide for network redundancy.

Most of the motorways and arterial roads in the Parramatta to Sydney CBD and the Sydney Airport to Sydney CBD corridors experience significant congestion in the peak traffic periods, with high travel time variability for private and public transport vehicles.

Average weekday traffic (AWT) volumes on strategic roads in the vicinity of the project in the base case are shown in **Figure 3-6**. Observations on the traffic movements along these strategic roads are:

- East of the Wattle Street interchange, east–west traffic movement is focused on Dobroyd Parade/City West Link and Parramatta Road. City West Link then merges with Victoria Road and links to Anzac Bridge/Western Distributor to provide the main east–west movement to the east of the Rozelle interchange
- Southeast of the Rozelle interchange, north–south traffic movement is focused on the Eastern Distributor, with Abercrombie Street, Regent Street, Chalmers Street and Elizabeth Street providing secondary north–south routes
- North of the St Peters interchange, north–south traffic is mainly focused on the Princes Highway and King Street, while traffic from the airport and Port Botany area also use O'Riordan Street and Botany Road.

Traffic movements across the Sydney Harbour primarily use either the Sydney Harbour Bridge via the Western Distributor or Sydney Harbour Tunnel via the Eastern Distributor, making these two connections among the most critical in the broader road network. The proposed future Western Harbour Tunnel and Beaches Link, in conjunction with the M4-M5 Link, would create a bypass of the Sydney CBD for traffic movements between the North Shore and western Sydney, reducing the volume of traffic using the existing cross-harbour connections and Anzac Bridge.

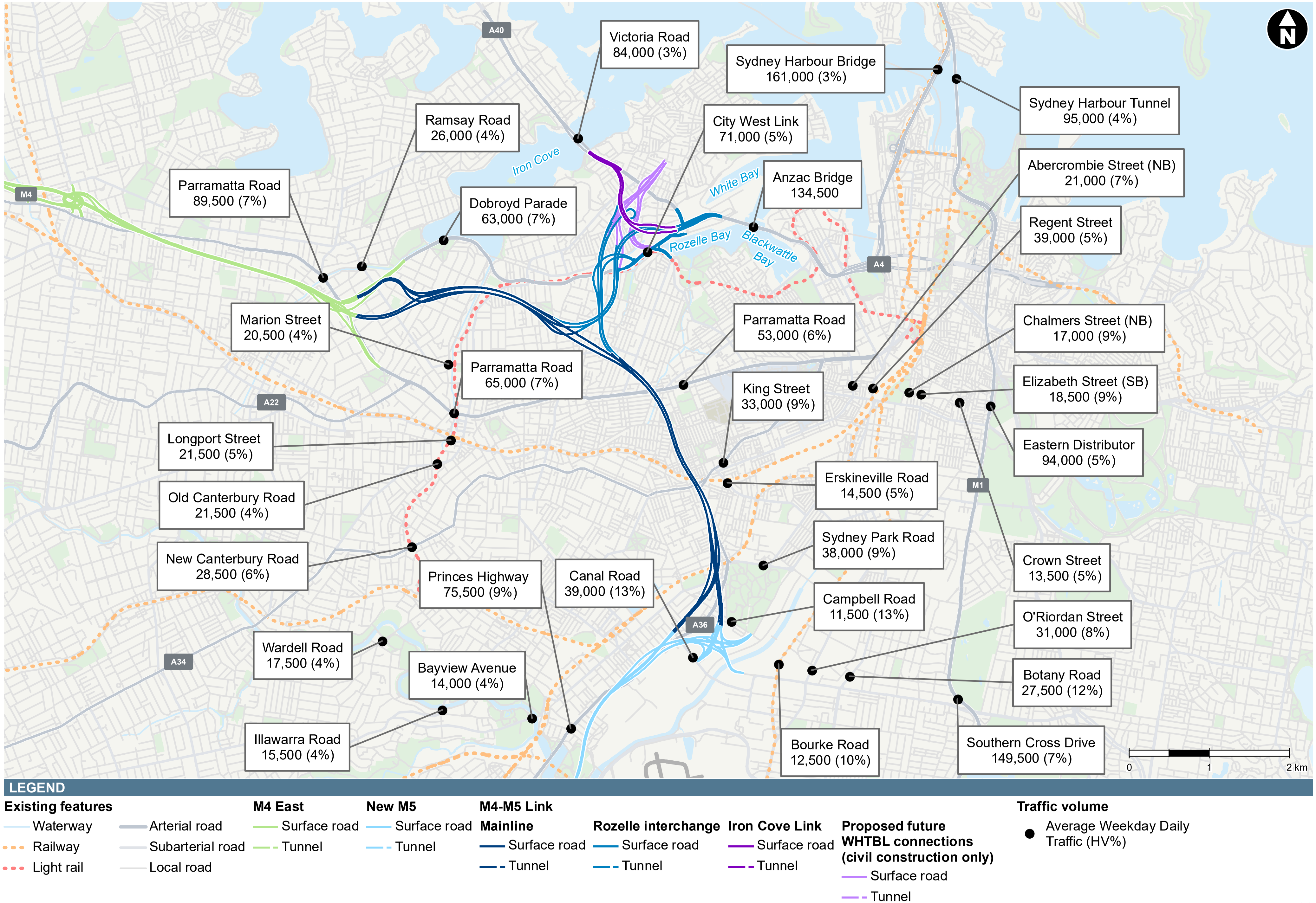

Figure 3-6 Average weekday traffic (AWT) volumes on strategic roads

3.3 Sydney metropolitan transport movement – freight traffic

3.3.1 General

The NSW freight network consists of a system of rail lines, roads, ports, Sydney Airport and regional airports, and intermodal terminals. The *NSW Freight and Ports Strategy* (Transport for NSW 2013) (the *Freight Strategy*) states that the NSW freight task is expected to almost double over the next 20 years. This forecast growth has implications for the capacity of the existing road network, with increased heavy vehicle volumes forecast on King Georges Road, M4, M5 and M7 motorways, and key connections to Port Botany, as shown in **Figure 3-7**.

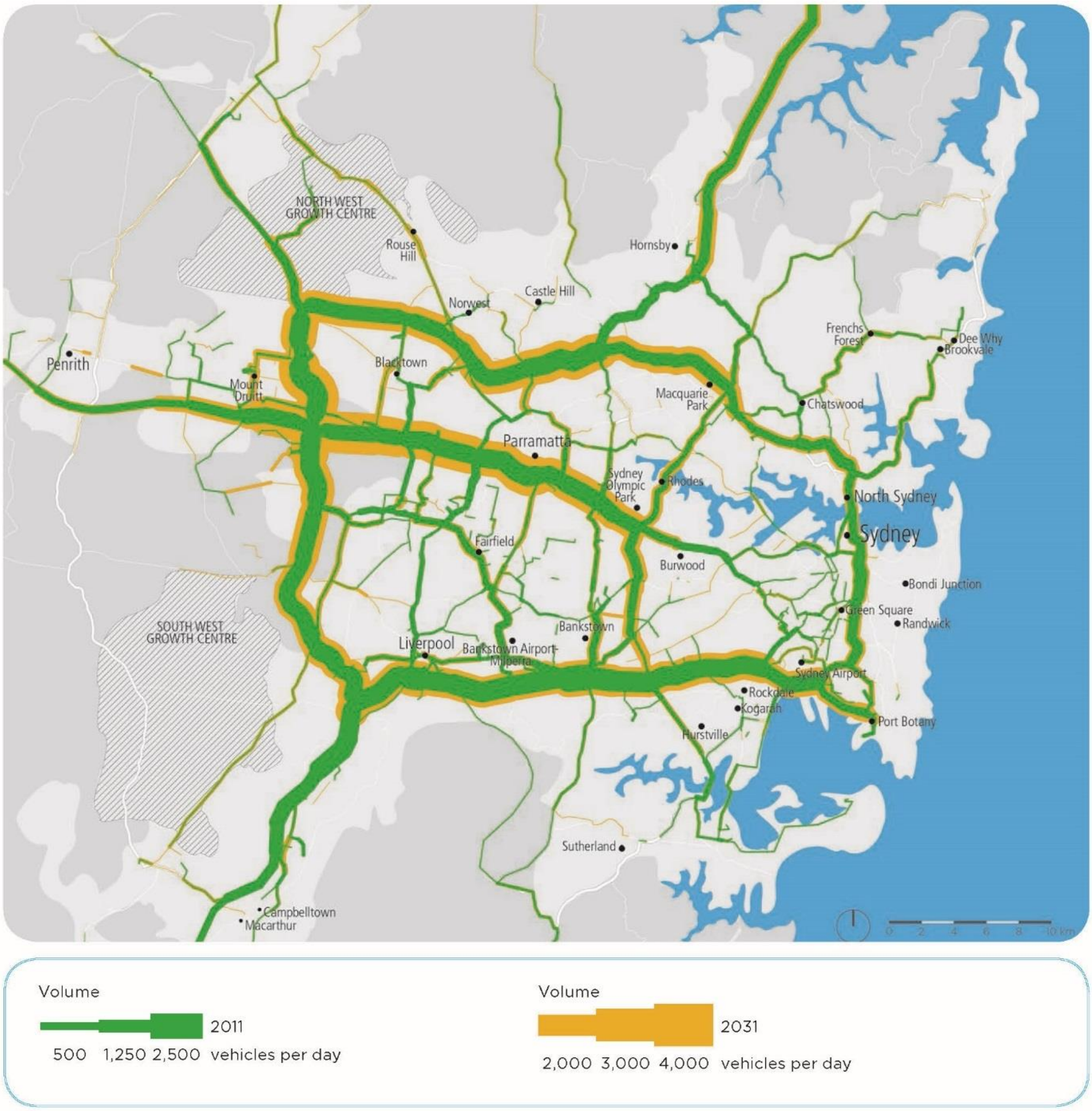

Figure 3-7 Heavy vehicle movements in Sydney, 2011 and 2033

Source: *NSW Long Term Transport Master Plan* (Transport for NSW 2012)

To deliver a freight network that supports the projected growth of the NSW economy, one of the actions in the *Freight Strategy* is '*Action 2B: Develop and maintain capacity for freight on the road network*', with a task to '*connect and complete Sydney's motorway network*'[3]. The WestConnex program of works is included in a list of key motorway connections that would provide operational benefits for freight movement by providing additional capacity on corridors where existing motorways or arterial roads currently provide the transport task, including the M4 Motorway/Parramatta Road corridor and the M5 Motorway corridor.

The M4 Motorway/Parramatta Road corridor is the principal east–west transport corridor connecting the Sydney CBD and Inner West to Parramatta via Sydney Olympic Park. Parramatta Road also provides an important local and regional traffic function, which has often conflicted with its strategic importance to the wider road network.

The M5 Motorway corridor is a key freight, commercial and passenger route between Sydney Airport, Port Botany, the St George area, south-western Sydney and the Southern Highlands. Without additional motorway capacity, it is estimated that the M5 Motorway corridor would not be able to accommodate the additional traffic by 2031[4].

Sydney's heavy vehicle freight task is highly dependent on the motorway network. More than 37 per cent of all heavy vehicle freight kilometres travelled in the Sydney Metropolitan Area is on the motorway and highway network, even though the network represents less than 17 per cent of the arterial road network[5]. Road freight accounted for 63 per cent of total freight tonnes transported around NSW in 2011. If the coal freight task is excluded, which is predominantly rail-borne, the road share of the freight task was 90 per cent in 2011[6].

Average weekday heavy vehicle volumes on strategic roads in the vicinity of the project are shown on **Figure 3-8**. Heavy vehicle movements are focused on the motorway links (Sydney Harbour Bridge, Eastern Distributor, Southern Cross Drive and Anzac Bridge) and the major arterial roads (Parramatta Road, Dobroyd Parade/City West Link, Princes Highway), as well as Botany Road to and from the Port Botany/Sydney Airport precinct.

[3] Transport for NSW, NSW Freight and Ports Strategy, November 2013.
[4] Transport for NSW, December 2012.
[5] Jacobs, WestConnex M5 – King Georges Road interchange upgrade: Traffic and transport assessment, August 2014.
[6] Transport for NSW, November 2013.

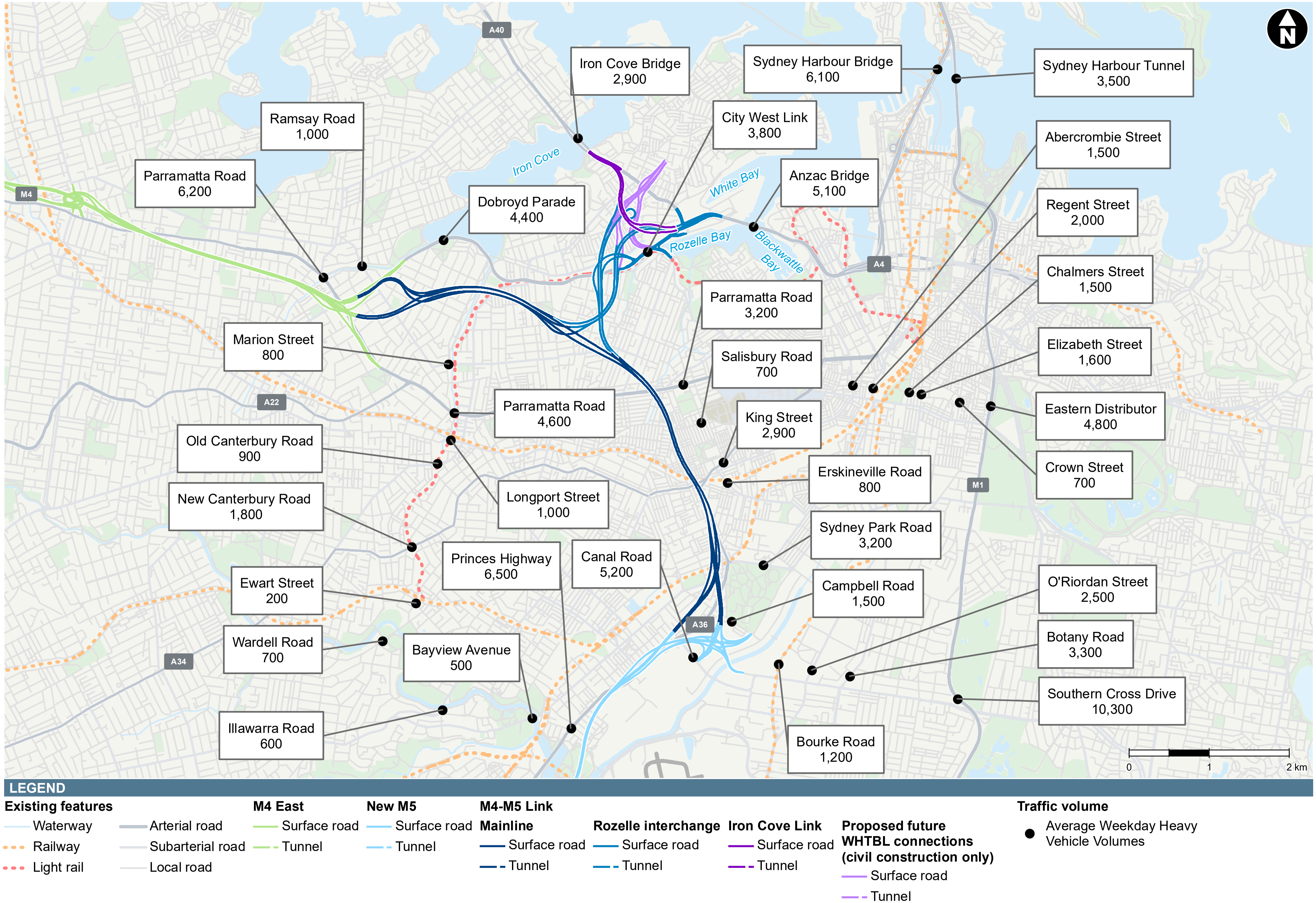

Figure 3-8 Average weekday heavy vehicle volumes on strategic roads

3.3.2 Port Botany and Sydney Airport precinct

Port Botany is Sydney's container terminal, and a major source of freight movements. Freight access into Port Botany is therefore crucial. The *Freight Strategy* identifies a missing motorway link between the M4 Motorway and Port Botany – this is particularly significant when it is considered the majority of Port Botany containers are destined for locations in or along the M4 Motorway corridor[7].

Sydney Airport is also a major source of freight movement. The airport handles about 48 per cent of Australian international air freight and is Australia's largest transport and logistics hub[8]. Sydney Airport provides an interchange between air, sea and land freight and serves as an air freight hub for NSW.

Figure 3-9 indicates the current Sydney Road Freight Hierarchy and highlights the use of other routes, such as King Georges Road to the west, O'Riordan Street, Bourke Road, Coward Street, Kent Road and Canal Road, north of Sydney Airport, and routes further north towards Parramatta Road, such as Railway Road, Sydenham Road, Livingstone Road and Old Canterbury Road, which serve as arterial links to and from Port Botany. These routes perform a mix of functions (mobility and access), which consequently conflict during peak periods resulting in a drop in the operational performance.

The 2011 throughput of containers at Port Botany is projected to more than triple by 2031. The *Freight Strategy* notes that even with a targeted increase in rail mode share, the M5 Motorway would not be able to accommodate additional container traffic when combined with the forecast background growth from employment and population by 2031. By 2033, Sydney Airport is projected to handle about 1.0 million tonnes of freight, an increase of more than 60 per cent from 2012 volumes.

Port deliveries are already moving into the off-peak periods to avoid congestion. Existing congestion and low travel speeds on the M5 Motorway reduces the hourly throughput of vehicles below its capacity for many hours of the day. Accommodating forecast growth in this corridor will require a package of solutions to meet the needs of freight and other road users. Actions in the *Transport Master Plan* focusing on road upgrades and improved rail operations to support a doubling of freight on rail by 2020 are critical to meeting the forecast growth at Port Botany by 2031.[9]

In addition to capacity constraints, other network constraints also limit the operation of higher productivity vehicles. In the study area, these include[10]:

- Higher Mass Limits (HML) semi-trailer and B-double restriction on the Giovanni Brunetti Bridge on Marsh Street over the Cooks River
- 4.3 metre clearance limit in the Airport and Cooks River Tunnel on the M5 East Motorway
- Circuitous 4.6 metre over height vehicle surface route between the M5 East Main Tunnel and Port Botany
- 4.28 metre clearance limit at light rail bridge on Johnston Street.

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[7] NSW Government, *Port Botany and Sydney Airport Transport Improvement Program: Submission to Infrastructure Australia*, November 2011.
[8] Sydney Airport Corporation Limited, *Sydney Airport Master Plan 2033*, December 2013.
[9] Transport for NSW, November 2013.
[10] NSW Government, November 2011.

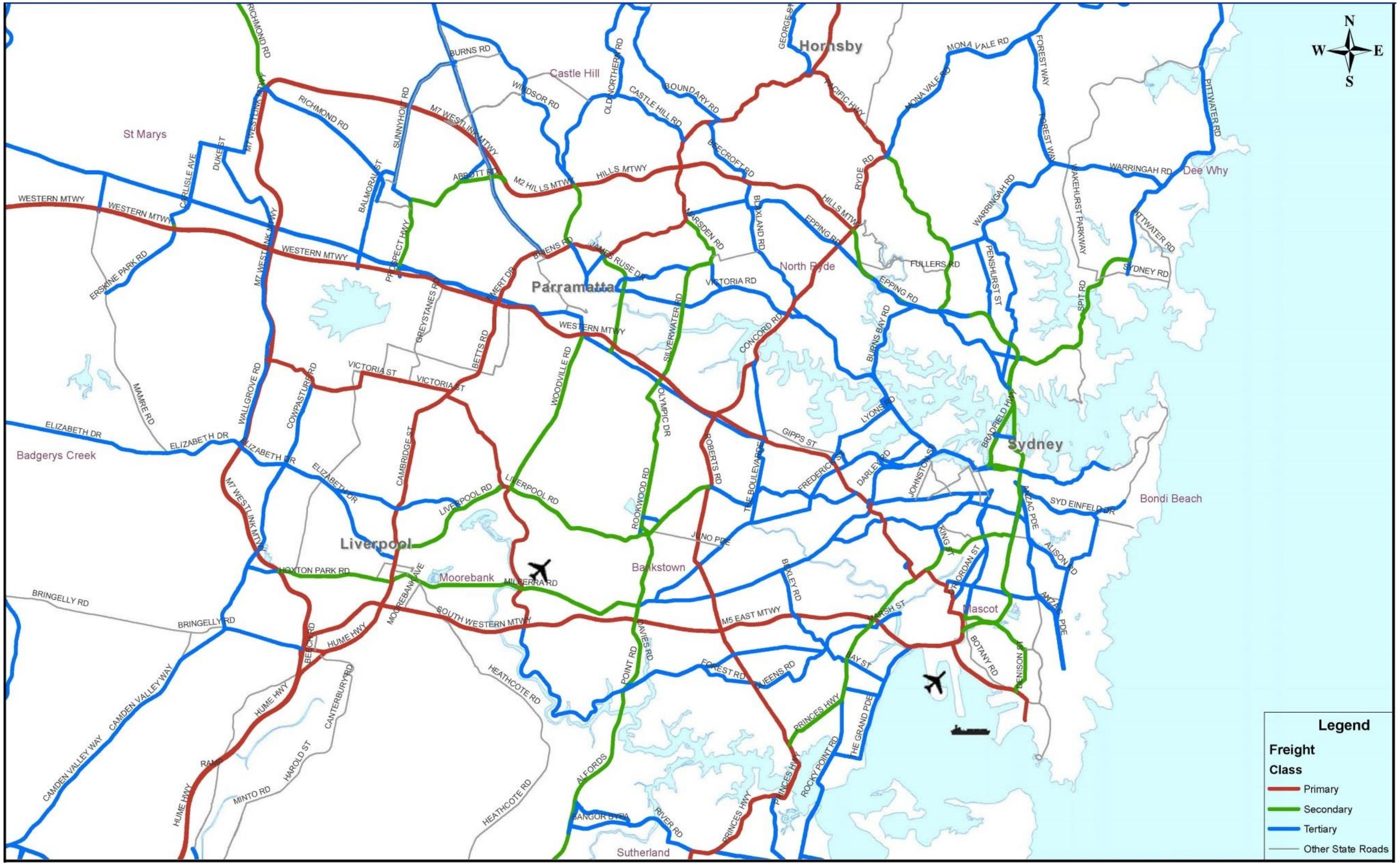

Figure 3-9 Sydney Road Freight Hierarchy

Source: Metropolitan Road Freight Hierarchy on the State Road Network Practice Note, June 2011

3.4 Transport policy and plans

3.4.1 NSW Long Term Transport Master Plan

To improve existing conditions with regard to road safety, traffic efficiency and people movement and to meet the future challenges facing the operation and performance of strategic corridors, the NSW Government and Roads and Maritime identified the need for a clear and integrated long term transport plan. The *Transport Master Plan* sets out a framework to provide clear direction and guidance for transport infrastructure projects in NSW over the next 20 years identifying investment in roads, rail and public and active transport modes. The *Transport Master Plan* identifies challenges in the NSW transport system and provides details of various projects, such as the North West Rail Link (now part of Sydney Metro) and CBD and South East Light Rail, and feasibility investigations of light rail or other high capacity public transport for corridors including Victoria Road and Parramatta Road, to address these challenges and provide an integrated and modern transport system.

One of the key transport areas identified in both the *Transport Master Plan* and the *State Infrastructure Strategy Update 2014* (*State Infrastructure Strategy*) (see **section 3.4.2**) is the need to plan and invest in the future of Sydney's motorway network, which provides vital infrastructure connections within and between the 46 travel demand corridors. Investment in motorway infrastructure has to be aligned with supporting public and active transport initiatives to achieve an increase in capacity, while aiming to reduce the reliance and demand of private vehicles on the future road network. The NSW Government is investigating and investing in Light Rail, Metro, Bus Rapid Transit and motorway projects to provide a multi-modal response to the future challenges.

Figure 3-10 provides details of the proposed motorway improvement measures that have been developed to bridge gaps in the Sydney motorway network by 2031. The *Transport Master Plan* recognises that WestConnex would support Sydney's long term economic growth through improved motorway access and connections linking Sydney's international gateways including the Sydney Airport, Port Botany, western Sydney and employment areas across Sydney. It also states that WestConnex would relieve road congestion and thereby improve the speed, reliability and safety of travel in the M4 and M5 corridors, including parallel arterial roads.

The *Transport Master Plan* identifies the need for progressive delivery of WestConnex. The *Transport Master Plan* commits the NSW Government to develop integrated land use and transport outcomes in conjunction with the delivery of WestConnex. These are recognised in the *Transport Master Plan* and include public transport projects, such as Sydney Metro (North West, City and Southwest) and the CBD and South East Light Rail.

3.4.2 State Infrastructure Strategy 2012–2032

The *State Infrastructure Strategy* is a 20 year strategy that identifies and prioritises the delivery of critical public infrastructure to drive productivity and economic growth. Infrastructure NSW's assessment of the state's existing infrastructure highlighted critical deficiencies in urban road capacity. The *State Infrastructure Strategy* identifies strategic infrastructure options to meet the challenges of population growth and substantial increases in freight volumes.

The *State Infrastructure Strategy* recognises the economic impacts and other constraints created by reduced functionality along the project corridor. This corridor is important for freight and business transport, and provides connections to Global Sydney, its cultural precincts and its 'global economic corridor'. The WestConnex program of works is identified in the *State Infrastructure Strategy* as a critical program of work with a range of benefits including reduced congestion, improved access to the major international gateways of Sydney Airport and Port Botany (facilitated through connections provided by the St Peters interchange), the future Western Sydney Airport, and improved industrial and business efficiency including along the project corridor.

In November 2014, Infrastructure NSW released a revised State Infrastructure Strategy – the *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014; *State Infrastructure Strategy Update*) – to guide the allocation of funds from the NSW Government's asset recycling program, as part of the NSW Government's Rebuilding NSW initiative.

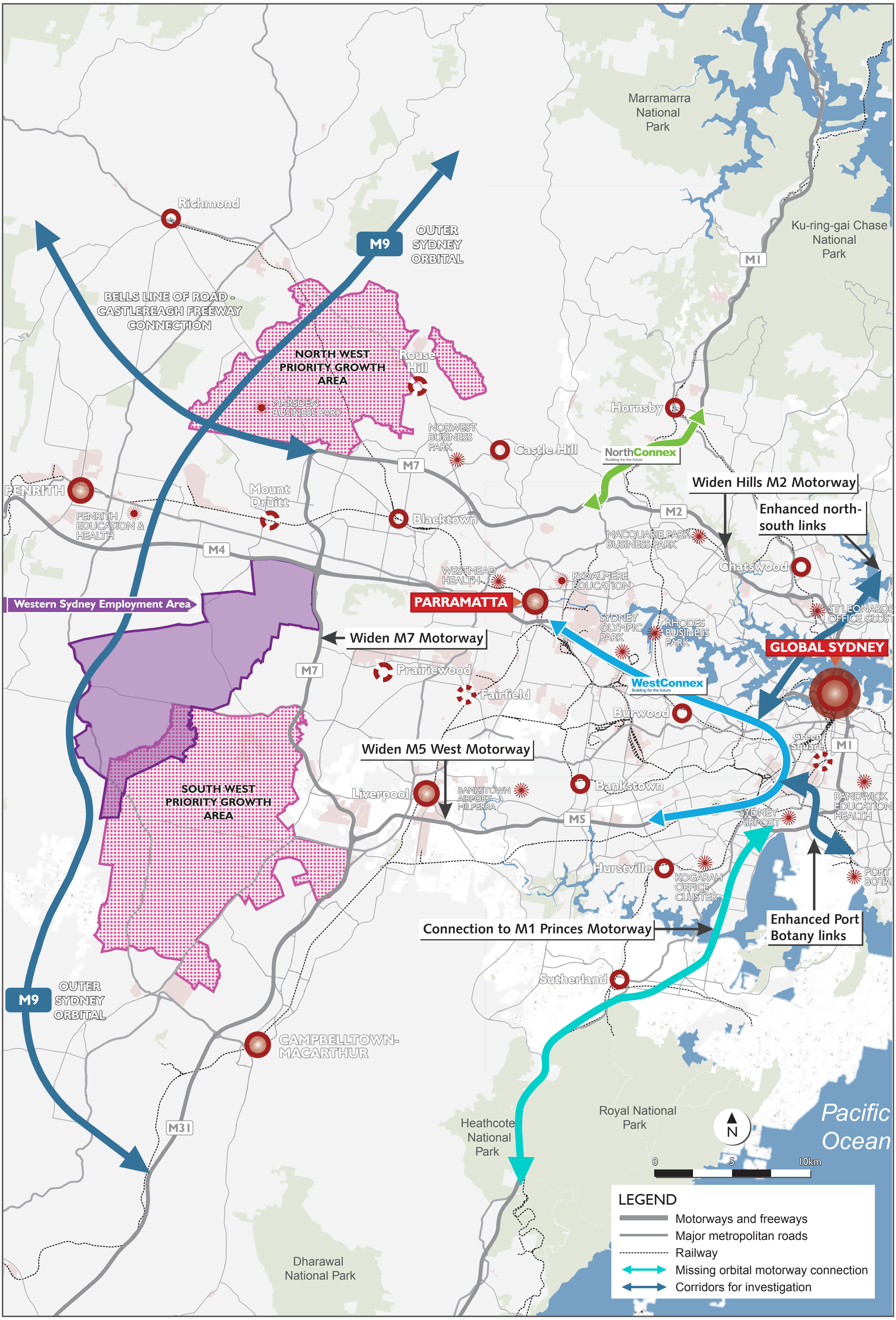

Figure 3-10 Proposed motorway improvement measures

The *State Infrastructure Strategy Update* identified extensions to WestConnex to include connections to Victoria Road and Anzac Bridge to the north and a connection to President Avenue at Rockdale to the south. These extensions (the proposed future Western Harbour Tunnel and Beaches Link, and the F6 Extension), coupled with a completed WestConnex program of works, would provide a western bypass of the CBD, reducing pressure on the Sydney orbital network and reducing journey times to Sydney's southern suburbs. The update identified the Western Sydney Airport Motorway link extending west from the M7, and Outer Sydney Orbital, which would link to Western Sydney Airport.

3.4.3 NSW Freight and Ports Strategy

The aim of the *Freight Strategy* is to provide a transport network in NSW that allows the efficient flow of goods to the market.

The *Freight Strategy* identified that the NSW road network carried 63 per cent of the total freight volume in 2011, with 33 per cent of freight carried by rail in the same year, and that the role of heavy vehicles in moving freight across NSW is substantial and would continue to be for the foreseeable future. The *Freight Strategy* identifies the challenge of increasing the capacity of NSW roads to support the growth in freight task. The traffic analysis in this report has considered the impact that the planned future port activities and uses would have on the road network as part of the forecast traffic volumes assessed in the future year scenarios.

The *Freight Strategy* has two main objectives: to deliver a freight network that efficiently supports the projected growth of the NSW economy and to balance freight needs with those of the broader community and the environment. The project supports the following strategic action programs identified in the *Freight Strategy*:

- Network efficiency – the project would improve network efficiency, delivering travel time savings. This would provide more efficient movement of freight, thereby reducing operational freight costs
- Network capacity – the project would provide increased road capacity along the corridor between the M4 and M5 corridors, a key missing link between these two freight movement corridors which are currently heavily congested
- Network sustainability – the provision of an alternative route and the resultant travel time savings and reduced vehicle hours travelled would also lead to savings in greenhouse gas emissions.

The *Freight Strategy* recognises there are significant economic efficiency implications for NSW if major changes are not made to ports and related road and rail systems in the next 20 years. While dedicated freight rail lines are relatively well served by capacity development plans, there is limited available capacity on the shared rail network in metropolitan areas for freight traffic. One action of the *Transport Master Plan* is to implement rail freight infrastructure enhancements to increase the share of freight carried on the rail network.

There are opportunities to move more freight on the rail network, which is considered a priority for the NSW Government. Notwithstanding this, should the current target of doubling the share of container freight moved via rail by 2020 be met through initiatives such as those outlined above, more than 70 per cent of Port Botany's trade would still be transported using the road network, requiring significant investment to support the port and airport precincts.

Improvements to the freight rail network would contribute to relieving road congestion by shifting freight away from the road network. However, as the freight task and Sydney's population continue to expand, and the road transport demand along the M4 and M5 motorways continues, road congestion would persist. This would impede the economic growth of Sydney and the productivity of freight generating land uses such as Port Botany. Although improvements to freight rail would enhance movements along the rail network, these initiatives would not cater for diverse travel demands that require road as well as rail transport.

The *Freight Strategy* includes an action to connect and complete Sydney's motorway network including priority freight movements. It recognises the infrastructure provided through WestConnex, including the M4-M5 Link, would be a key component in expanding capacity on NSW roads that would provide benefits for freight movement, particularly around major freight activity centres such as Sydney's international gateways, Port Botany and Sydney Airport.

3.4.4 Sydney City Centre Access Strategy

The *Sydney City Centre Access Strategy* (Transport for NSW 2013) (*City Centre Access Strategy*) is the NSW Government's long term strategy to deliver a fully integrated transport network in Sydney's city centre that meets the growing transport needs for all transport modes. The *City Centre Access Strategy* aims to prioritise and allocate street space for public transport, general traffic, pedestrians, cyclists, taxis and service vehicles.

The anticipated impacts of the project, and the objectives and actions contained in the *City Centre Access Strategy*, have been considered together to determine potential transport interactions between the project and the strategy. The planned actions contained in the *City Centre Access Strategy* are reflected in the Strategic Travel Model (STM). STM is operated by Transport for NSW Transport Performance and Analytics and is used to project travel patterns in Sydney, Newcastle and Wollongong under different land use, transport and pricing scenarios. STM provided the trip forecasts used in WRTM, and therefore the planned actions contained in the *City Centre Access Strategy* are accounted for in the project evaluation.

Traffic forecasts show that the project is generally anticipated to have little impact, or to reduce traffic on some roads that are identified in the strategy as city centre bypass routes, such as the Cahill Expressway. However, other roads identified as city centre bypass routes are forecast to have increased traffic as a result of the project, including the Western Distributor, and the Cross City Tunnel. While these forecast increases are not counter to the *City Centre Access Strategy*, changes in traffic volumes on these roads should be considered in the planning and implementation of the traffic and bypass priority routes. There is little impact forecast on the roads within the CBD, while reductions are forecast for access roads to the CBD from the south, such as Broadway and City Road.

3.4.5 The Bays Precinct Transformation Plan

The Bays Precinct, located about two kilometres west of the Sydney CBD, encompasses the areas surrounding Blackwattle Bay, Rozelle Bay and White Bay. The Bays Precinct comprises eight precincts, including the former Rozelle Rail Yards, White Bay Power Station, White Bay and Rozelle Bay and Bays Waterways. The *Bays Precinct Urban Transformation Plan* (UrbanGrowth NSW 2015) (*The Bays Precinct Transformation Plan*) establishes the strategy for how The Bays Precinct would be developed over 20 years for residential, employment, entertainment and open space uses.

The NSW Government’s direction for The Bays Precinct is ‘to drive an internationally competitive economy, through the creation of great destinations on Sydney Harbour that would transform Sydney, NSW and Australia’ (UrbanGrowth NSW 2015). The Bays Precinct delivery is intended to be staged and coordinated with the planning and delivery of WestConnex and the long term considerations of The Bays Precinct’s port uses. *The Bays Precinct Transformation Plan* recognises that an efficient transport system enables urban transformation, and that transport solutions for The Bays Precinct would need to integrate with planning for a growing Sydney, including the consideration of varied transport modes, but with a focus on improving public and active transport options. Planning for the project has considered the planned impact that the transformation of The Bays Precinct would have on the road network. This includes anticipated changes in the volume of vehicle trips to and from The Bays Precinct.

3.4.6 Parramatta Road Corridor Urban Transformation Strategy

The *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016) (*Parramatta Road Transformation Strategy*) identifies areas along the corridor (between Granville in the west to Camperdown in the east) where there would be a focus on encouraging growth and changes in the long term (about 30 years). The aim of the strategy is to create an environment with good design, land use mix, housing choice and infrastructure, as well as improved access to community facilities and services and access to public and active transport.

WestConnex is identified within the *Parramatta Road Transformation Strategy* as a catalyst for the restoration of the Parramatta Road corridor, as it is forecast to reduce through traffic on the surface roads in the corridor. ‘Through traffic’ in this context refers to traffic that travels more than five kilometres along Parramatta Road to destinations away from Parramatta Road. The reduction in traffic, particularly trucks, would provide opportunities to improve public and active transport along Parramatta Road and in its immediate surrounds.

As the project is forecast to significantly reduce traffic volumes on Parramatta Road east of the M4 East Parramatta Road ramps, it would help to support future planned development in three of the urban renewal precincts identified in the *Parramatta Road Transformation Strategy*, namely Taverners Hill, Leichhardt and Camperdown.

A key element of the *Parramatta Road Transformation Strategy* is the delivery of improved public transport services along Parramatta Road, including the potential development of bus rapid transit. This project, together with the M4 East project, is forecast to reduce traffic on Parramatta Road between Burwood and the Sydney CBD, which would in turn allow for potential improvements in public transport priority along Parramatta Road. One of the conditions of approval for the M4 East project includes a requirement for the M4 East project to dedicate at least two lanes of Parramatta Road between Burwood and Haberfield for the sole use of public transport. This space-proofing requirement is incorporated into the design of the M4 East project so that future public transport initiatives on Parramatta Road can be integrated with the WestConnex program of works. The project, together with the M4 East project, therefore complements the plans envisaged in the *Parramatta Road Transformation Strategy*.

The *Parramatta Road Transformation Strategy* also plans for the future construction and delivery of walking and cycling infrastructure at key locations along the Parramatta Road corridor. This new infrastructure is not part of the project and would be subject to separate planning assessment and approval. Improvements to the active transport network that would be delivered by the project are described in **Appendix N** (Technical working paper: Active transport strategy) of the EIS. The forecast reduction in traffic volumes on Parramatta Road would also help to improve the north–south connectivity across Parramatta Road, which is currently a major constraint in the corridor.

4 Assessment methodology

4.1 Relevant guidelines and policies

The following guidelines were followed in carrying out this assessment:

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads 2013)
- *Traffic Modelling Guidelines* (Roads and Maritime 2013)
- *Guide to Traffic Generating Developments Version 2.2* (NSW Roads and Traffic Authority (RTA) 2002).

4.2 Methodology – traffic forecasting and modelling process

This section provides an overview of the three stage traffic forecasting and modelling that was undertaken for this assessment, as outlined in **Figure 4-1**. The objective was to make best use of available traffic count data and modelling software to determine base and future traffic conditions for the project and surrounding road network in terms of estimating travel demand and traffic volumes. These traffic conditions were then used to assess the operational performance of the network, in scenarios with and without the project. Subsequent sections provide further details of the process and assumptions for each stage of the forecasting and modelling.

4.2.1 Stage 1 – Traffic demand forecasting

The WRTM v2.3, which was developed and operated by Roads and Maritime Services, provides a platform to understand changes in future weekday travel patterns under different land use, transport infrastructure and pricing scenarios. Although the WRTM is a network-wide model that encompasses existing and future road networks in the Sydney Metropolitan area, it was principally developed to assess infrastructure improvements associated with the WestConnex component projects individually and in combination. The WRTM v2.3 was used for this EIS, and as traffic models undergo constant development and refinement, it is anticipated that future projects would use further iterations of WRTM as they become available.

Modelling approach

The WRTM was developed in the following stages:

- A review of the available transport planning models and data was undertaken to determine the optimal models and data to provide an appropriate foundation for the WRTM
- Base and future population and employment data for metropolitan Sydney was sourced from Transport for NSW Transport Performance and Analytics (TPA), which are available at five year intervals
- Available toll choice modelling techniques were assessed in the current Sydney context where multiple competing toll roads cover a substantial portion of the developed Greater Sydney metropolitan area
- Project specific Value of Travel Time Savings (VTTS) surveys of drivers' willingness to pay tolls were undertaken to inform the toll choice modelling to enable the model to best reflect current driver behaviour in the specific context of the WestConnex component projects
- Existing road infrastructure was reviewed for the base year. A set of future road infrastructure projects for the modelled Sydney metropolitan area for future years was developed and is consistent with its current funding and planning policies. These projects formed the basis for the future 'do minimum' networks modelled in WRTM.

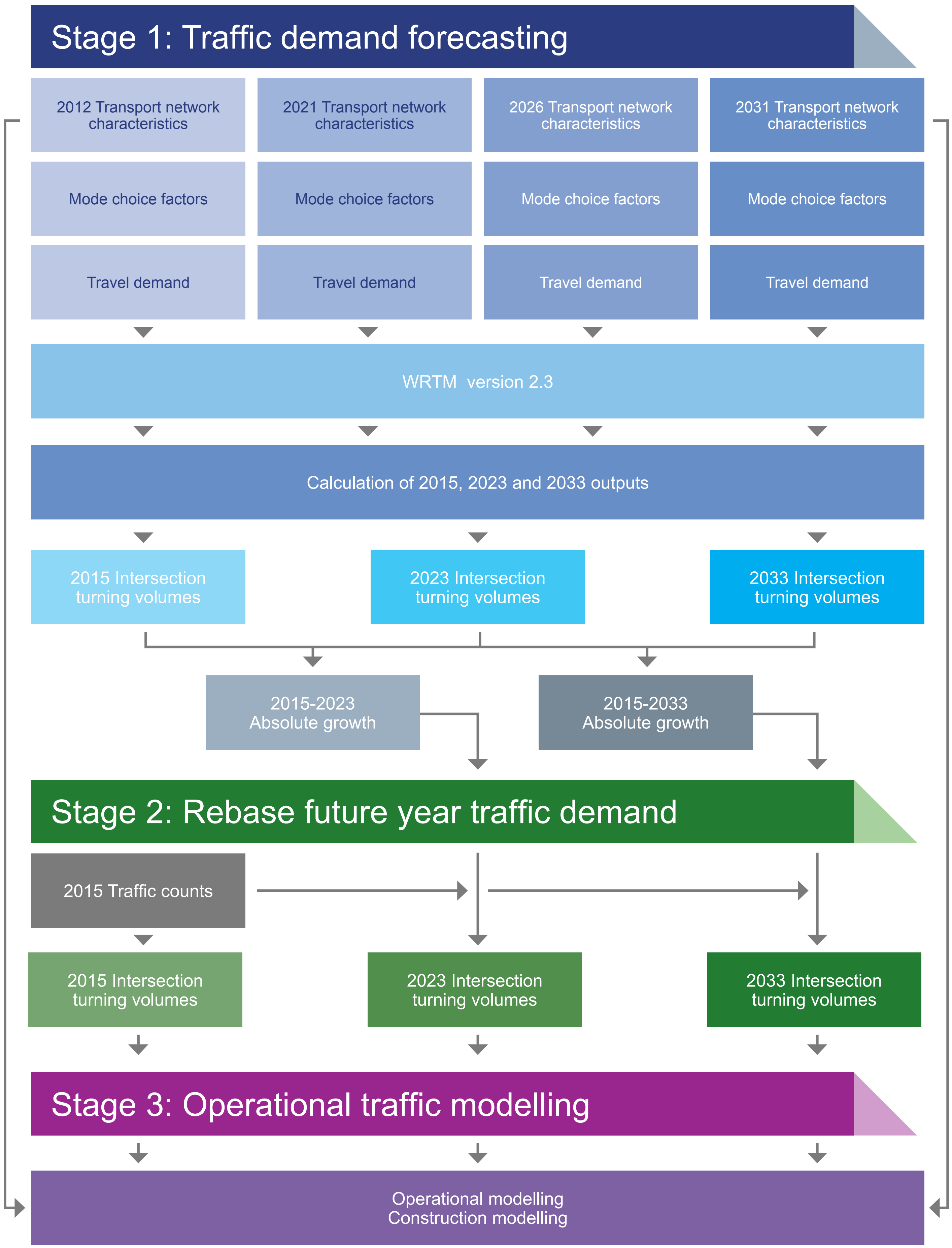

Figure 4-1 Overview of traffic forecasting and modelling approach

- The WRTM project model was developed and calibrated to current observed travel behaviour, then validated against 2012 Sydney-wide travel behaviour from a series of traffic count and travel time surveys. It was then adjusted to reflect driver behaviour on Sydney's toll roads as indicated by the VTTS surveys. The model calibration and validation processes maintained a specific focus and refinement in the area of the WestConnex program of works. The WRTM comprises separate weekday time period sub-models, with average one hour peak multi-class traffic assignments run for[11]:
  - AM period: (7.00 am – 9.00 am)
  - Daytime inter-peak: (9.00 am – 3.00 pm)
  - PM period: (3.00 pm – 6.00 pm)
  - Evening off-peak: (6.00 pm – 7.00 am)
- The WestConnex program of works was coded into the WRTM future year models
- Future demands were estimated by applying future year traffic growth forecast by the STM to the WRTM to produce the most likely or future base case scenario. Traffic estimates were produced by the WRTM for the years 2021, 2026 and 2031. The demands for 2023 (assumed year of opening) were then determined by interpolating between the 2021 and 2026 demands. The demands for 2033 (assumed year of opening plus 10 years) were determined by extrapolating the demands from the 2026 and 2031 demand matrices. This produced vehicle demands by time period for an average weekday at each year and vehicle class for toll assessment.

Traffic demand data contained within this traffic and transport assessment was taken from the WRTM, following assessment of the model calibration and validation by independent peer reviewers and agreement that the model is suitable for this purpose.

Data inputs into the WRTM

Available data was initially used as primary inputs for the development of the WRTM including:

- Traffic volume counts for screenlines and project specific counts
- Road travel time surveys undertaken in December 2012
- Base 2011 and future year vehicle demand matrices by travel purpose from the STM sourced from TPA in June 2016
- Population and employment by small zone area provided by TPA consistent with demographics released by NSW Department of Planning and Environment (DP&E) in September 2014 (version Land Use (LU)14v4)
- Household travel survey data collected by TPA
- Private car driver stated and revealed preference value of travel time survey data collected in early 2013
- Commercial vehicle stated preference value of travel time survey data collected in late 2012
- Aerial photography collected for detailed auditing of road networks
- Recently completed and future infrastructure project lists, including information from Transport for NSW. Transport for NSW is delivering and planning the following Sydney Metro projects:
  - Sydney Metro Northwest (Rouse Hill to Chatswood) – under construction, the first stage of Sydney Metro would deliver eight new railway stations and 4,000 commuter car parking spaces to Sydney's Northwest and has been included in the future strategic modelling

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[11] A comparison of weekday and weekend traffic volumes in the study area was undertaken. This revealed that the peak weekday hourly volumes are similar or higher than the peak weekend hourly volumes. Therefore, the weekday scenario is the worst traffic situation and is appropriate to be tested as such. This is also standard assessment methodology and consistent with all previous WestConnex assessments.

- Sydney Metro City and Southwest (Chatswood to Bankstown) – the second stage of Sydney Metro would extend the metro rail across Sydney Harbour, through Sydney CBD and to Bankstown. It would deliver seven new railway stations and is currently in the planning phase. It has been included in the future strategic modelling
- Sydney Metro West was recently announced by NSW Government and is planned to link Parramatta and Sydney's CBDs and serve Sydney Olympic Park and The Bays Precinct along the route. This project is at the early stage of development and has not been included in the future strategic modelling

- Existing strategic models and data within the Sydney region.

Structure of the WRTM

The regional WRTM traffic forecasting model process comprises two separate elements: Base Demand Model (based on STM with updates to incorporate more recent data) and WRTM toll choice assignment model (an assignment module to incorporate toll choice behaviour). The role of each element of WRTM, and interaction between each element, is outlined in the following subsections:

Base demand model

The base demand model was developed using the STM with updated information used to produce improved travel demand matrices for detailed toll choice route assignment and project appraisal testing. The base demand model provides the forecast capability to address changes in land use, trip distribution and mode choice and produces vehicle traffic demands for peak and off-peak periods for subsequent allocation to routes in the detailed WRTM toll choice assignment model.

Toll choice assignment model

The WRTM toll choice assignment model was developed to test impacts of toll and infrastructure strategies and provide infrastructure project traffic forecasts. The model is designed to forecast the traffic choosing to use tolled and non-tolled routes for the representative peak and inter-peak periods of the day. The development of the Toll choice assignment model included:

- VTTS survey analysis to investigate people's willingness to pay tolls to use toll roads based on project specific market research surveys
- Development of improved road traffic demand matrices for the following vehicle classifications:
  - Private vehicles: cars not registered for business use
  - Light commercial vehicles (LCV): vehicles up to 4.5 tonnes gross vehicle mass (GVM) (or under 2.8 metre height/12.5 metre length), including cars registered for business use
  - Heavy commercial vehicles (HCV): all vehicles with a GVM of more than 4.5 tonnes that have been registered for business use[12].

To support the development of the WRTM, an investigation was undertaken into the various toll choice assignment methods in the Sydney and Australian context. Based on the assessment, it was determined that the WRTM toll choice assignment model should adopt a distributed Value of Time (VOT) multi-class equilibrium assignment methodology.

The key reasons were:

- The methodology was considered a valid approach for the WRTM toll choice assignment model for assessing WestConnex. It would address the functional requirements of the project model with capabilities to consider a range of tolling strategies and scenario tests
- The approach appears to be emerging as an industry standard and has recently been used as the preferred modelling approach for a number of Australian toll roads.

[12] Within the WRTM, trucks are all vehicles of Austroads class 3 and higher. While trucks carrying hazardous materials would not be able use the tunnels, most of these restrictions apply to a subset of articulated vehicles and are not relevant to rigid vehicles, which are the majority of the truck class.

The WRTM toll choice assignment model was constructed to model the range of driver behaviour and was adjusted to match the observed patronage on the existing toll facilities. A series of validation checks was undertaken to verify the performance of the WRTM.

Land use projections

The WRTM is linked to the STM, which includes the trip generation, trip distribution and mode choice modules and incorporates demographic data related to land uses including population, employment and education enrolment projections. For WRTM v2.3, this data has been supplied by TPA as data extracts from the STM and is based on the latest population and employment projections.

These population and employment projections are based on the latest land use data (version LU14v4) provided by TPA. This data has been projected from 2011 Census data and incorporates known major urban renewal projects and developments, including those around Green Square and Mascot town centres. The base vehicle demands from STM are consistent with these demographic assumptions and therefore provide a consistent base for the future demands used in the WRTM. Projects and developments included in the WRTM v2.3 modelling also include the strategic directives contained in *A Plan for Growing Sydney* (NSW Government 2014) in 14 transport and land use corridors:

- Arncliffe to Banksia
- The Bays Precinct
- Broader Western Sydney Employment Area
- Central to Eveleigh
- Glenfield to Macarthur
- Greater Macarthur Investigation Area
- North-western Growth Area
- Parramatta
- Second (Western) Sydney Airport
- South-western Growth Area
- Sydney Metro – Bankstown to Sydenham
- Sydney Metro – City and Inner Southwest
- Sydney Metro – Northwest
- Sydney to Parramatta (including the Parramatta Road Urban Transformation Strategy).

The WRTM has also included planned future port activities and uses, for instance at Port Botany, Sydney Airport Freight terminal and intermodal terminals.

Induced demand

Traffic growth on new or upgraded roads is generally a result of the following influences:

- Regional increase in number of trips due to population growth and increased economic activity
- Trips attracted from competing routes or modes as a result of improved travel times on the new or upgraded road
- Induced demand as a result of improved travel times between homes and destinations, such as workplaces, shopping centres and education facilities, which cause changes to region-wide trip patterns.

Even with no growth in regional population and economic activity, a new or substantially upgraded road can induce changes in trip patterns which then appear as induced traffic demand. The WRTM includes the changes in traffic associated with all three of the above sources of traffic, with induced demand equating to about 0.3 per cent additional daily trips in the Sydney metropolitan area in 2033.

Modelled scenarios

In considering the future, several scenarios need to be considered, reflecting the timeframe under which the project would be delivered and the extent of other infrastructure developments. These scenarios were explored through development of specific modelled scenarios, reflecting various future travel demands.

Examined demand cases were represented by specific forecast years:

- 2015 was adopted as the base case
- 2023 was adopted as the project opening case for the project
- 2033 was adopted as the case for 10 years after opening as required in the Roads and Maritime assessment guidelines.

The scenarios were modelled in the WRTM by combining future year demands with future networks. As WRTM has a base year of 2012 and models future years in five year intervals, the above years were calculated by interpolating and extrapolating between 2012, 2021, 2026 and 2031 outputs. Traffic was assigned using the calibrated road assignment model, taking account of changes in toll choice behaviour over time. The WRTM provided growth in AM peak and PM peak roadway and intersection turning volumes for input to operational traffic modelling stage scenarios:

- **Base case (2015)**: current road network with no new projects or upgrades. For the operational modelling, 2015 was adopted as the base case to match the year of traffic survey data collection, and represents road network conditions prior to the start of construction of the M4 Widening, M4 East, KGRIU and the New M5 projects
- **Operation 'do minimum' or 'without project' (2023)**: The 'do minimum' or 'without project' scenario assumes that NorthConnex, M4 Widening, M4 East, KGRIU and New M5 are complete, but that the third stage of the WestConnex program of works, the M4-M5 Link, has not been built. It is called 'do minimum' rather than 'do nothing' as it assumes that ongoing improvements would be made to the broader road and public transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth
- **Operation 'with project' (2023)**: With the 2023 'do minimum' projects completed and the M4-M5 Link complete and open to traffic
- **Operation 'cumulative' (2023)**: With the 2023 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway and the Western Harbour Tunnel component of the proposed future Western Harbour Tunnel and Beaches Link complete and operational
- **Operation 'do minimum' or 'without project' (2033)**: a future network including NorthConnex, M4 Widening, M4 East, KGRIU and New M5 and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth but does not include the M4-M5 Link
- **Operation 'with project' (2033)**: With the 2033 'do minimum' projects completed and the M4-M5 Link complete and open to traffic
- **Operation 'cumulative' (2033)**: With the 2033 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and F6 Extension complete and operational.

Bandwidth plots used in this assessment are produced directly from WRTM for 2012 and future years in five year intervals. Therefore, the bandwidth plots in this report use 2012 as a proxy for 2015, 2021 as a proxy for 2023, and 2031 as a proxy for 2033.

While the construction impact of the proposed future Western Harbour Tunnel entry and exit ramps at the Rozelle interchange is included in this EIS, a comprehensive operational traffic impact of these ramps is not part of this EIS. Due to the ongoing development of the proposed future Western Harbour Tunnel and Beaches Link project, this would be assessed in the future Western Harbour Tunnel and Beaches Link EIS. While a high level assessment of potential impacts is provided in **Chapter 12,** the above modelled cumulative scenarios assume a sub-surface, motorway-to-motorway connection between the proposed future Western Harbour Tunnel and Beaches Link and the M4-M5

Link, but do not assume a surface connection to and from the proposed future Western Harbour Tunnel and Beaches Link at the Rozelle interchange.

Changes from the M4 East and New M5 EIS assessments

As mentioned above, strategic traffic models typically undergo constant development and refinement. WRTM v2.3 was used for this EIS, while WRTM v2.1 was used for both the M4 East EIS and the New M5 EIS. Since the M4 East and New M5 EIS traffic assessments were undertaken, updates to the WRTM inputs have occurred, as well as enhancements to the WRTM zones and growth processing. These updates and enhancements include:

- NSW DP&E updated land use forecasts, including in particular, revised land use development along Parramatta Road, The Bays Precinct and in Mascot town centre, as well as increased precision in respect of the land use zoning used in the WRTM
- Evolution and refinement of the M4-M5 Link design, with increases in the number of lanes in the mainline tunnels from three lanes to four lanes, revised layout for the refined Rozelle interchange, the addition of the Iron Cove Link and the removal of the previously proposed Camperdown interchange.

The future years assessed in the M4 East and New M5 EIS traffic assessments were 2021 and 2031. Due to the delivery timeframe of the M4-M5 Link project, 2023 and 2033 have been used. Therefore, the travel demand and traffic volumes are also being forecast to different years compared to the EISs for the M4 East and New M5 projects. A direct comparison between the modelled results of the previous EIS and this EIS would therefore not be a like-for-like comparison.

The changes in forecast traffic volumes resulting from the changes in design of the M4-M5 Link compared to that used in the traffic assessments for the M4 East and New M5 projects is presented in **Annexure C**.

4.2.2 Stage 2 – Future year traffic demand for operational assessment

The WRTM was used to generate base and future year traffic demand matrices for the weekday AM peak and PM peak hours. As mentioned above, the key objective of the WRTM demand modelling was to forecast traffic demand and growth in traffic volumes in the M4 and M5 corridors, the M4-M5 Link, and other key roads in the project area, based on expected population and employment changes, and proposed road network improvements for the six future modelling scenarios. From this, the forecast growth in travel demand and traffic volumes on the road network could be derived for each scenario for application in the more detailed operational modelling.

This growth in traffic volumes was then applied to the balanced turning counts, derived from traffic surveys undertaken on the road network, and used to create the traffic flows used in the future year operational modelling, based on practices described in Roads and Maritime modelling guidelines. Where a future reduction in traffic demand is anticipated, the absolute growth is expressed as a negative.

This approach, which is consistent with the modelling adopted for the previous M4 Widening, M4 East and New M5 EISs, makes the best use of observed traffic count data as the basis for future year travel demand and traffic volumes and patterns. More specifically, this approach provides the most accurate representation of how the modelled increase in future traffic would affect existing observed network travel demands and the resultant network operation.

4.2.3 Stage 3 – Operational traffic modelling assessment

M4-M5 Link motorway

The M4-M5 Link mainline tunnels, from the interface with the M4 East mainline in the north at the Wattle Street interchange in Haberfield to the New M5 mainline tunnels in the south at St Peters were modelled using microsimulation modelling software. The ability for this software to model individual vehicle behaviour and interaction with the road network and other road users enabled densities and level of service for the mainline tunnels of the project to be reported. AM and PM peak period models were developed and the mainline tunnels divided into five sections for reporting purposes:

- Section 1: Interface with M4 East, east of Wattle Street interchange ramps

- Section 2: Wattle Street interchange ramps to Rozelle interchange ramps
- Section 3: Rozelle interchange bypass
- Section 4: Rozelle interchange ramps to St Peters interchange ramps
- Section 5: Interface with the New M5, south of St Peters interchange ramps.

Using future year travel demands, densities and levels of service were assessed at 200 metre intervals along the mainline for 2023 and 2033 for the 'with project' and 'cumulative' scenarios.

Interchanges and surrounding road network

While the WRTM provides strategic travel demand forecasts across the Sydney metropolitan area, more detailed models were required to fully evaluate operational impacts on the surrounding road network in the vicinity of each of the Wattle Street, Rozelle and St Peters interchanges.

Traditional analytical intersection assessment tools, eg SIDRA, do not provide a whole of network assessment and tend to work best at evaluating individual, isolated intersections or small networks of intersections. Microsimulation modelling software, which models individual vehicle behaviour, such as weaves and merges and interactions with the network and other road users, are better tools for evaluating network operation particularly in congested networks with motorway entry and exit ramps that would have weaving and merging movements.

The VISSIM microsimulation modelling package was used to model impacts at the Wattle Street and Rozelle interchange locations while the operational traffic modelling for the St Peters interchange was undertaken in the Paramics microsimulation modelling package, using the same model as was used in the New M5 EIS. Traffic demands used in the New M5 EIS were based on WRTM v2.1, while demands used in this EIS were from WRTM v2.3. LinSig, a micro-analytical network modelling software package was also used to provide the initial traffic signal settings for the microsimulation operational models.

Base year model development – operational

It is standard modelling practice to create base year models that replicate existing traffic conditions before developing any future year scenarios. Base models of the road network around each of the Wattle Street and Rozelle interchange locations for the AM and PM peak periods were developed, calibrated and validated to simulate the operation of the existing road network under present day traffic demands. A 2014 calibrated and validated base model at the St Peters interchange had been developed for the New M5 EIS and was used as a proxy for the 2015 base year model for this project.

The boundary for the operational modelling area was informed by the forecast WRTM v2.3 traffic volume differences around the interchanges as a result of the project. These modelling area boundaries at the Wattle Street interchange and St Peters interchange are generally consistent with those for the M4 East and New M5 EISs. Further justification of the operational modelling areas is contained in Annexure B.

The base year model extents at each of the interchange locations are indicated in **Figure 4-2** to **Figure 4-4**. A separate intersection model was developed at the Victoria Road/Lyons Road intersection to assess the forecast impacts on Lyons Road and Victoria Road in this vicinity, as shown in **Figure 4-2**.

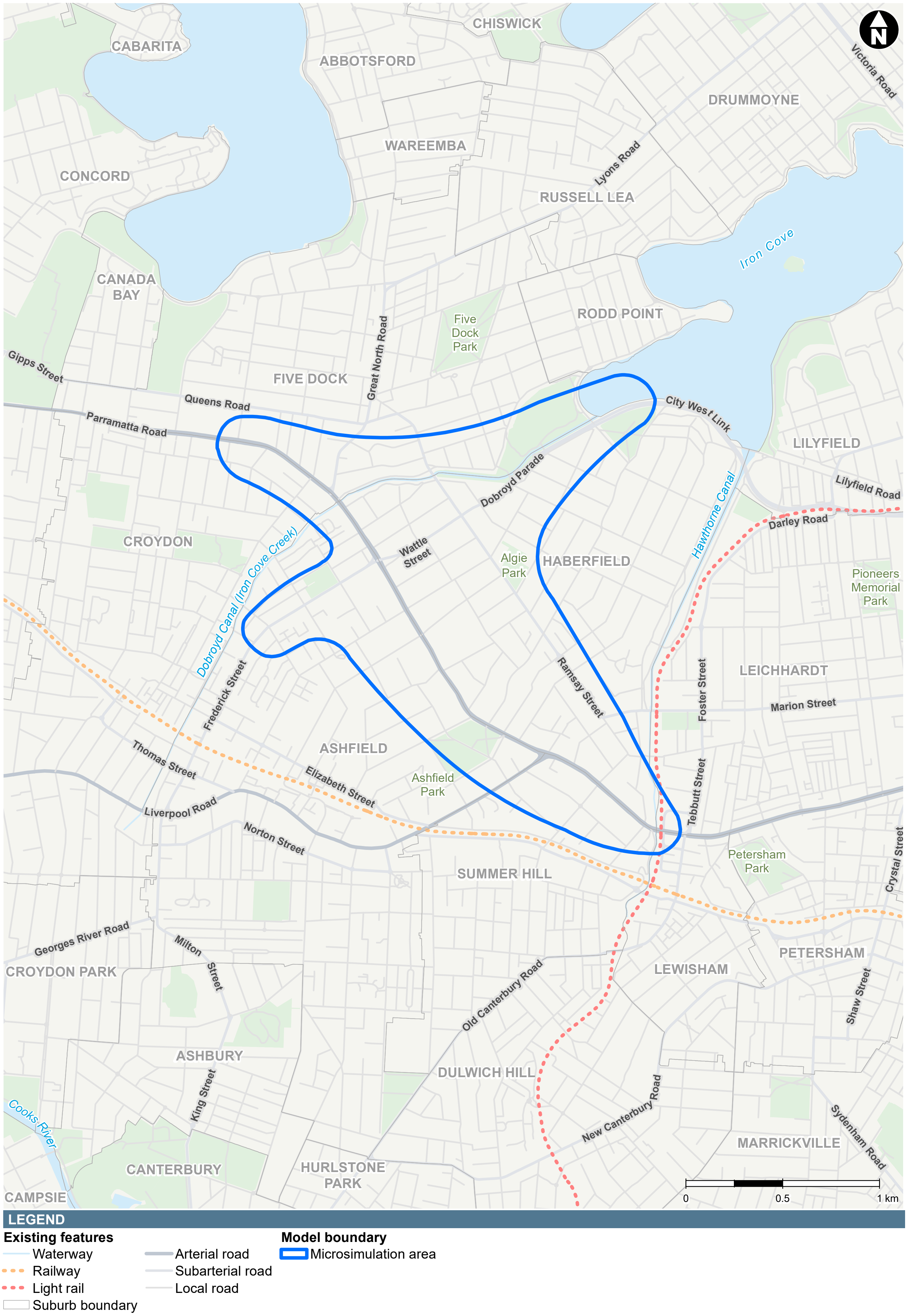


Figure 4-2 Wattle Street interchange operational model boundary

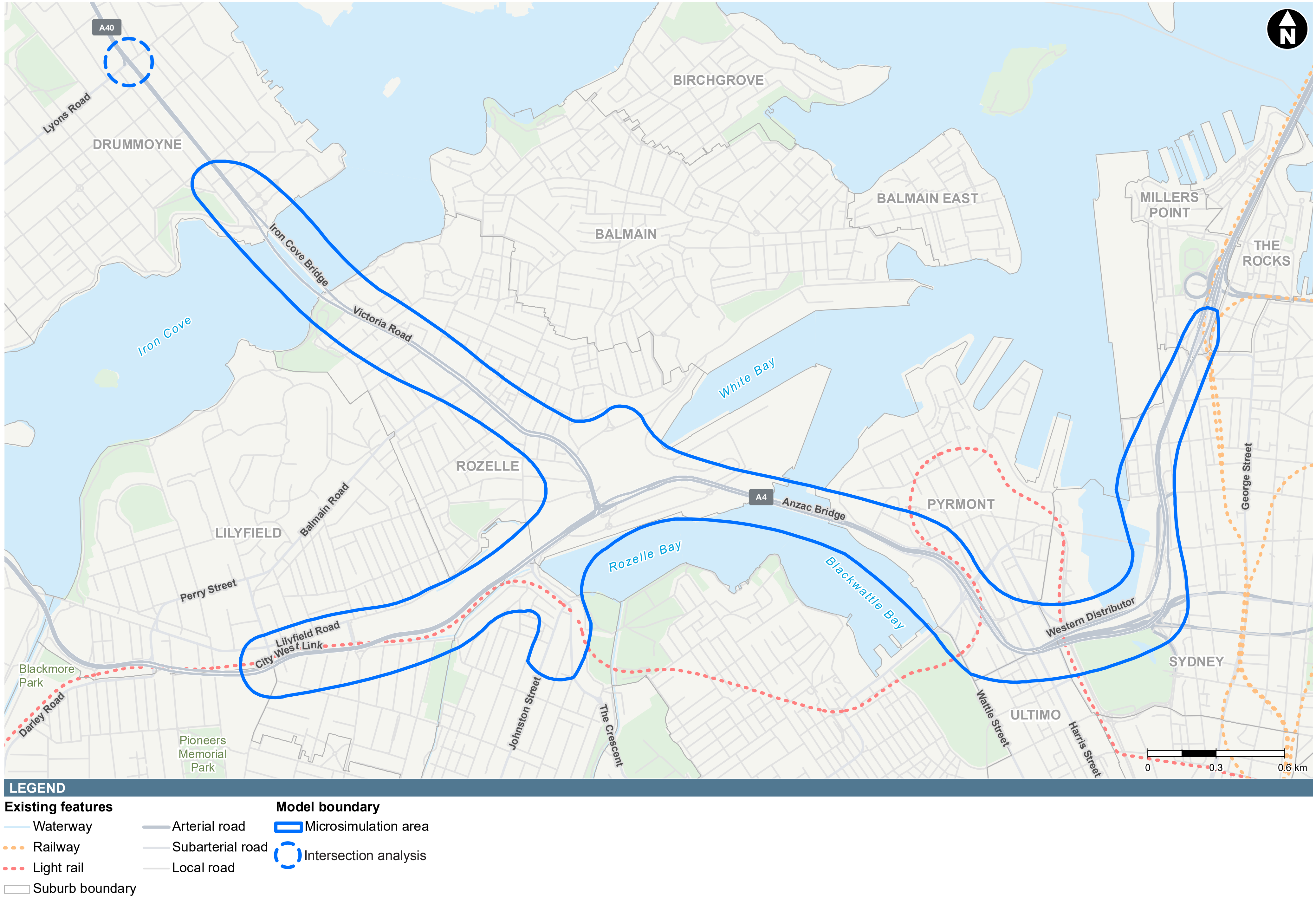
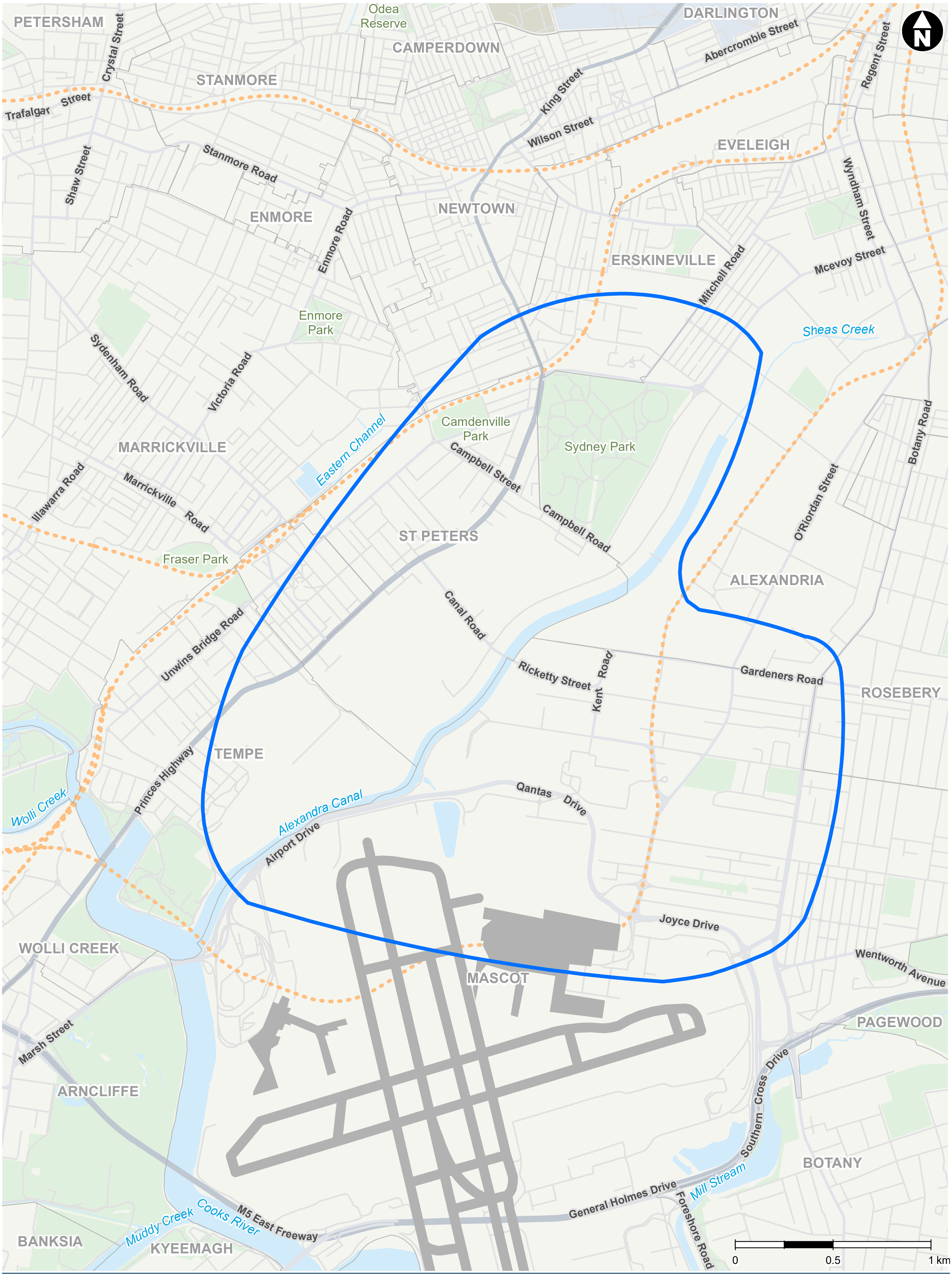


Figure 4-3 Rozelle interchange operational model boundary



LEGEND

Existing features
Waterway
Railway
Suburb boundary
Arterial road
Subarterial road
Local road

Model boundary
Microsimulation area

Figure 4-4 St Peters interchange operational model boundary

To ensure an accurate representation of existing traffic conditions, the base simulation models were calibrated and validated as per Roads and Maritime modelling guidelines to align with existing traffic conditions. The following data sources were used in the calibration and validation process:

- Aerial photography: The modelled network layout was primarily based on aerial photography and Traffic Control Signal (TCS) plans. Additionally, intersection geometry was verified during site inspections
- Intersection turning counts: a series of AM peak and PM peak hour turning count surveys were undertaken in 2015 at the majority of the modelled intersections. In addition, Sydney Coordinated Adaptive Traffic System (SCATS) traffic count data was used to derive turning volumes for intersections where no survey data was available
- Intersection Diagnostic Monitor data (IDM): IDM data provides a comprehensive record of traffic signal operation statistics (cycle and phase timings etc) at signalised intersections
- Saturation flows: SCATS LX data was used to identify the saturation flow characteristics for individual approach lanes
- Site inspections: AM peak and PM peak site visits were completed at all intersection locations by the traffic modellers to observe and document:
  - Intersection geometry
  - Lane usage
  - Sample traffic signal timings
  - 'Dead green' time (green traffic light phase, but vehicles unable to advance due to queuing ahead or downstream blocking effects)
  - Pedestrian delays
  - Posted speed limits
  - Location of parking and bus stop (if applicable)
  - Bottlenecks and pinch points in the study area
- Strategic model cordon matrices ie volume of traffic going in and out of the boundary of the modelled road network from specified origins to specified destinations.

The operational model demand matrices comprised were developed in the following stages:

- Cordon applied to WRTM v2.3 to obtain initial origin/destination matrices for the model areas
- Initial matrices were expanded to match the simulation model zoning system (there are fewer zones in the WRTM cordon area due to the nature of this model and these zones needed to be disaggregated for the simulation models)
- ‘Target’ zone origin and destination totals were determined based on observed count data where available. At locations where count data was not available, the WRTM totals were retained
- Matrices were furnessed to match ‘target’ volumes. Furnessing is a common process used in transport modelling to factor the rows and columns of a demand matrix in an iterative manner to obtain totals that match the ‘target’ volumes.

The resulting matrices were then used as inputs to the simulation models with ensuing refinements carried out as part of the calibration process.

Future year model development – operational

Following the calibration and validation of the AM and PM peak period base year simulation models, future year networks and traffic demands were developed for 2023 and 2033 to assess the future performance of the study area. These 2023 and 2033 models catered for the assessment of the following scenarios:

- ‘Without project’ or ‘do minimum’ scenario

- ‘With project’ scenario
- ‘Cumulative’ scenario.

The growth in WRTM forecasts was used to grow the demands from the base year to the relevant future year models. While the simulation models are over two to four hour peak periods, WRTM forecasts typical one hour peak (AM and PM) volumes. The forecast one hour volumes were extrapolated across the full simulation periods to reflect typical demand profiles on either side of the peak hours. This profile was based on observed count data across the relevant networks, eg the road networks surrounding the M4-M5 Link interchanges.

In some cases, the forecast one hour future demand would exceed the physical road capacity. This calculated future excess demand was then distributed into the hours before and after the peak hour to correspond with anticipated peak spreading, effectively predicting longer peak periods in future.

In the St Peters interchange model area, the demand growth forecast by the WRTM in the ‘with project’ scenarios caused the operational models to become inoperable during the AM and PM peak hours, primarily due to the forecast growth in peak hour trips to and from Sydney Airport. This suggests that not all of the forecast demand to and from the airport could be accommodated in the peak hour without the proposed future Sydney Gateway project.

The airport peak hour demand was therefore reduced in the ‘with project’ scenarios as summarised in **Table 4-1**. For consistency and comparison purposes, this peak hour demand reduction was also applied to the ‘do minimum’ or ‘without project’ scenario. Forecast trips that were removed are reported in the network performance tables. In the ‘cumulative’ scenarios, with Sydney Gateway, no growth reduction was applied, with the full forecast demand to and from the Sydney Airport precinct used in the models.

Table 4-1 Summary of growth reduction factors used in operational modelling in ‘without project’ and ‘with project’ scenarios

Model zone	AM peak		PM peak	
	2023	2033	2023	2033
Sydney Airport (Domestic Airport terminals)	0.75	0.75	0.7	0.7

The modelling reflects the design of proposed local road upgrades and interchanges proposed as part of the project. Projects within other Roads and Maritime programs were included in the operational modelling. Projects and programs include:

- Pinch Point Program through the Easing Sydney’s Congestion office – this include upgrades to the Parramatta Road/Great North Road and the Princes Highway/Railway Road intersections
- Airport North Precinct – upgrades to roads north of Sydney Airport to improve traffic flow and connections to the airport and Port Botany.

The Alexandria to Moore Park Connectivity Upgrade project is outside of the operational modelling boundary at the St Peters interchange. While investigations into the King Street Gateway project are underway, no confirmed road layout changes are available, and so this project has not been included in the operational modelling around the St Peters interchange.

Construction modelling

Base year model development

Similar to the operational assessment, the construction modelling methodology included deriving base year traffic patterns and developing base and future year traffic models. To ensure an accurate representation of existing conditions, further network traffic counts were gathered across the study area in the locations of the proposed construction ancillary facilities.

Base year construction models were developed in LinSig as, unlike the interchanges assessed in the operational case, detailed interactions such as weaving and merging are not prevalent. This is a similar approach to that used in the M4 East and New M5 EIS construction impacts assessments. The construction models were calibrated in a similar manner to that already described for the operational models.

Future year model development

Based on the planned construction activities, a worst case construction traffic scenario was assumed to be the period of spoil removal from tunnel construction during 2021. The current road network with the addition of the M4 East and New M5 projects was assumed for the road network in the construction scenario.

AM and PM peak hour models for 2021 were developed to assess the future performance of the road network during construction. In a similar way to the future operational demand volumes, the growth forecast by the WRTM was used to derive the background traffic demand for 2021.

Construction traffic was then added to the background traffic. This was based on the proposed construction methodology, covering vehicle types, volumes and construction traffic routes to and from the various construction ancillary facilities. The performances of the intersections in the vicinity of the constructions ancillary facilities were then calculated.

4.3 Methodology – assessment criteria

Generally, traffic operational performance can be assessed in several ways, including:

- At a network level, in terms of total distance travelled and total time travelled
- For single-point assessment at a mid-block level, showing changed travel routes and impacts
- At an intersection level, showing changed performance of these typically constraining elements of urban road networks.

Traditionally, shorter distance and less time travelled through a network imply increased network efficiency. However, because demands and networks may be different, higher values may well be indicative of a better performing network because more vehicles are able to travel through the network to reach their destinations, while shorter distance may be caused by congestion and slower vehicle speeds.

Given the existing congested traffic in the study area, single-point assessment criteria do not present a complete picture of road network traffic operations. Traditional mid-block and intersection levels of service do not recognise that traffic is often constrained upstream, meaning that vehicles cannot get to the evaluation point giving an unrealistically low level of demand. Similarly, they do not recognise that traffic is constrained downstream; meaning vehicles are queued through the evaluation point. The measurements therefore reveal only throughput at that point, not realistic performance. The operation of the modelled road network as a whole is regarded as being of prime importance, recognising that there may be single locations where there may be improvement, while at others some deterioration. These should therefore not be considered in isolation. The critical evaluation is that the project does not overburden the network and provides more efficient network operations as a whole.

4.3.1 Interchange network performance

As discussed above, the WRTM was used to assign traffic demand on the strategic road network using the land use and demographic assumptions based on input provided by the STM. The WRTM is intended for use as a Sydney-wide traffic assignment model and is not intended to be used for detailed traffic operational analysis of the road network, which requires more specialised software, such as microsimulation software, which has been used in this assessment.

The project involves interaction of wide, congested multi-lane carriageways and development of interchanges between at-grade and sub-surface road infrastructure. Given the complex nature of these interactions, it is important to recognise and visualise the impact that the project would have on the road network. Of particular importance is merge behaviour at tunnel portals and potential blocking of entry and exit ramps. Such behaviour is best represented by microsimulation modelling.

Microsimulation software was selected for detailed network and intersection analysis due to its ability to model individual vehicle interactions, traffic signal effects, overtaking manoeuvres, and queuing. The visual representation and interaction of individual vehicles is of particular importance where merge and weave behaviour, as well as differential lane utilisation, are expected to have an impact on traffic capacity.

Modelling parameters collected and reported for the AM and PM peak hours in each scenario modelled were:

- Total vehicle demand – number of vehicles wanting to use the modelled network
- Vehicle kilometres travelled – total distance travelled by vehicles travelling through the modelled network
- Vehicle time travelled approaching and in network – the total time taken by vehicles to enter and drive through the modelled network
- Total vehicles arrived – the number of vehicles completing their journey on the network
- Total stops made by vehicles in the network, either due to intersection controls or congestion – the number of stops that vehicles make while travelling through the modelled network. Generally, the fewer stops, the less congested the network is
- Average speed of vehicles – the average speed at which vehicles travel through the network. Calculated by dividing the VKT by the vehicle time travelled. Generally, the higher the speed, the better the network operates
- Travel time for typical cross-network trips – the time taken by vehicles to travel between two points in the network. Used as a comparison of how the network is performing, although with changes in the network, vehicles can take different routes between points
- Unreleased demand at the end of peak hour – the number of vehicles unable to enter the model due to congestion extending back to model entry points. The number of ‘unreleased’ vehicles is an indication of the effectiveness of the network. Generally, the lower the number of unreleased vehicles, the better the network is able to accommodate travel demand.

4.3.2 Level of service

Level of service (LoS) is a measure to describe the operational conditions and efficiency of a roadway or intersection. The definition of LoS generally outlines the operating conditions in terms of speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and road safety. It is a qualitative measure describing operational conditions within a roadway or intersection, as perceived by motorists and/or passengers.

Mid-block levels of service

Table 4-2 shows the six levels of service for mid-block carriageway locations, ranging from LoS A–F, with LoS A representing optimum operating conditions (free flow) and LoS F the poorest (forced or breakdown in flow). When a roadway performance falls below LoS D, investigations are generally initiated to determine if suitable remediation can be provided. In built up areas, limited road capacity and high demand mean that LoS E and LoS F are regularly experienced by motorists at pinch points on the existing strategic road network in Sydney. These conditions are generally experienced during peak periods. Roads and Maritime has an established program office (*Easing Sydney’s Congestion*) aimed at delivering improvements to relieve congestion at pinch points and improving performance on strategic roads.

The level of service for freeways or motorways is calculated from the vehicle density, which is the traffic volume divided by the average passenger car speed. Density is measured in passenger car units (PCU[13]) per kilometre per lane (PCU/km/ln). The assessment of level of service for the M4-M5 Link mainline tunnels has used these density measurements.

As explained above, due to the existing congested traffic conditions experienced on the surface road network in the study area during peak periods, it is not proposed to report mid-block level of service for the surface road network, but rather the network performance and intersection level of service.

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[13] PCU = passenger car unit. This accounts for the amount of road space differing types of vehicles use, with heavy vehicles or buses taking up more space than cars or light commercial vehicles.

Intersection levels of service

Average delay is commonly used to assess the operational performance of intersections, with level of service used as an index. A summary of the intersection level of service criteria is shown in **Table 4-3**.

For the purpose of analysing intersection performance in this assessment, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed. This allows for an assessment of the intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

Similar to the mid-block performance measures, common practice suggests that when intersection performance falls to LoS D, investigations should be initiated to determine if suitable remediation can be provided. However, limited road capacity and high demand mean that LoS E and LoS F are regularly experienced by motorists at pinch points on the existing strategic road network in Sydney, generally during peak periods. It should also be noted that capacity constraint can be used as a demand management technique, which discourages car travel and that conversely, over-provision of capacity can encourage more car use.

Table 4-2 Mid-block level of service definitions and criteria

LoS	Definition	Multi-lane roads[1]	Freeways[2]
		V/C ratio	Density (PCU/km/ln)
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high.	≤ 0.26	≤ 7.0
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort is a little less than with level of service A.	0.27 to 0.41	7.1 to 11.0
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.	0.42 to 0.59	11.1 to 16.0
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow would generally cause operational problems.	0.60 to 0.81	16.1 to 22.0
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream would cause breakdown.	0.82 to 1.00	22.1 to 28.0
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.	> 1.00	> 28.0

Notes: [1] Where free flow speed is taken as 70 kilometres per hour
[2] Where free flow speed is taken as 90 kilometres per hour

Source: A*ustroads, Guide to Traffic Management – Part 3 Traffic Studies and Analysis*, Second Edition 2013

Table 4-3 Level of service criteria for intersections

LoS	Average delay/vehicles (sec/veh)	Traffic signals/roundabouts	Give way and stop signs
A	≤ 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: *Guide to Traffic Generating Developments*, RTA 2002

5 Existing traffic and transport environment

5.1 Introduction

This section outlines the existing traffic and transport environment within the study area, which includes the area around the proposed Wattle Street, Rozelle and St Peters interchanges, and the corridors between proposed Wattle Street and Rozelle interchanges, Rozelle and St Peters interchanges, and Wattle Street and St Peters interchanges. All data presented in this section represents the base case or existing traffic and transport conditions and is founded on the latest publicly available information.

The existing traffic and transport environments of the areas around the Wattle Street and St Peters interchanges are derived from the Traffic and Transport Assessment of the M4 East EIS (AECOM, September 2015) and Traffic and Transport Technical working paper of the New M5 EIS (AECOM, November 2015). Therefore, the existing conditions discussed at the Wattle Street and St Peters interchanges reflect conditions prior to the commencement of construction of the M4 East and the New M5.

5.2 Wattle Street interchange and surrounds

The existing travel behaviours and volumes in the vicinity of the project are heavily influenced by the current function of Parramatta Road. Classified as a state road, it forms a major east–west Sydney metropolitan road corridor. Consequently, the balance between traffic function and access generally favours through traffic movements, with a focus on capacity and congestion management measures that enhance the operational performance for large volumes of trips along Parramatta Road.

Alternative east–west arterial roads within the study area include Frederick Street/Wattle Street/Dobroyd Parade/City West Link, Queens Road/Gipps Street/Patterson Street, Ramsay Street and the Hume Highway. The Frederick Street/Wattle Street/Dobroyd Parade/City West Link corridor is a major connector between Sydney's western and south-western suburbs and the Sydney CBD as well as for local traffic. The corridor is part of a northeast link which extends for about 13 kilometres from the intersection of Punchbowl Road and King Georges Road in Punchbowl, to join the Western Distributor at its intersection with Victoria Road. It provides an alternative route to Parramatta Road into the Sydney CBD from inner-southern and inner-western Sydney.

The Hume Highway, to the south of Parramatta Road, is classified as a state road which provides an important metropolitan connection for local and regional traffic. It extends from Liverpool in south-western Sydney, to join Parramatta Road near Summer Hill.

5.2.1 Modes of travel

The Wattle Street interchange is located within the Inner West LGA. Travel mode share for the Inner West LGA in comparison with the Sydney Greater Metropolitan Area (GMA) is shown in **Table 5-1**. The Inner West LGA has a higher share of public transport due to the area's proximity to the Sydney CBD and frequent bus services. The largest difference to the Sydney GMA data is in 'walk only' trips, which account for 32 per cent of all trips in the Inner West LGA compared to 18 per cent in the Sydney GMA. This could be attributed to factors including the walkability of many neighbourhoods in the area.

Table 5-1 Average weekday travel mode share for Inner West Local Government Area

LGA	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note: Inner West Council data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGAs
Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

5.2.2 Public transport services

Rail services

Figure 5-1 displays the rail network and associated stations that are close to the Wattle Street interchange and surrounds, which are serviced by the Northern, Western and Inner West and South Rail Lines. Ashfield Station is the closest rail station. To the north, North Strathfield Station is serviced by the Northern Line which provides limited stops services to the Sydney CBD. To the south, up to 10 stations are serviced by one or more of the Inner West, South, Western or Northern Lines. Additionally, limited stop express services to the Sydney CBD can be boarded at Flemington, Strathfield, Burwood, and Ashfield stations. Homebush and Croydon stations are served exclusively by the Inner West Line all stops services.

Source: Extract of Sydney train network map around the Wattle Street interchange and surrounds

Figure 5-1 Rail network around the Wattle Street interchange site

Bus services

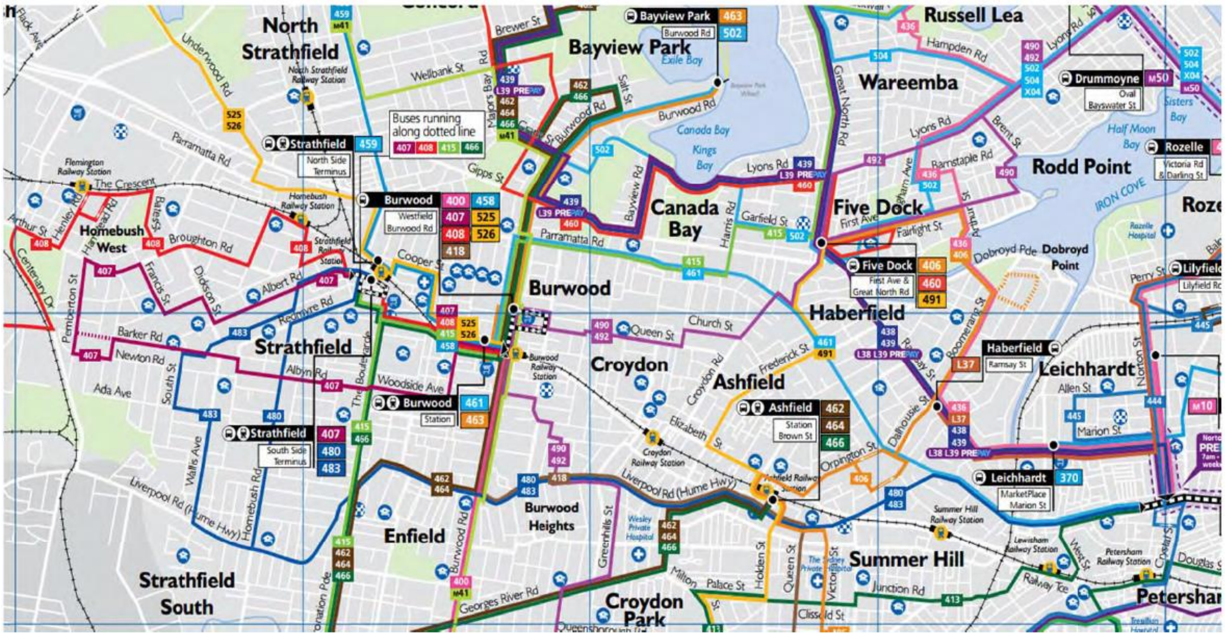
Figure 5-2 shows the bus network close to the Wattle Street interchange and surrounds, including Metrobus M41: Hurstville to Macquarie Park strategic north–south bus corridor, and Route 461: Burwood to the CBD strategic east–west bus route, which runs along Parramatta Road. The figure shows that there are several bus routes that operate within particular sections of the Wattle Street interchange and surrounding area via train station hubs, such as Strathfield, Burwood and Ashfield.

Specifically, the following bus routes utilise sections of Parramatta Road between Homebush Bay Drive and Wattle Street:

- Routes 525 and 526 travel along Parramatta Road between Underwood Road and Concord Road

- Route 461, Burwood to The Domain, operates along Parramatta Road from Burwood Road to Broadway
- Route 415, Chiswick to Burwood, which runs along Parramatta Road between Burwood Road and Harris Road
- Routes 490 and 492, Drummoyne to Hurstville and Rockdale, utilise the section of Parramatta Road between Arlington Street and Great North Road
- Route 491, Five Dock to Hurstville, utilises the section of Parramatta Road between Great North Road and Frederick Street.

There are a further six Sydney metropolitan bus region 6 routes that intersect Parramatta Road between Homebush Bay Drive and Wattle Street during peak periods.



Source: Sydney Buses, 2015

Figure 5-2 Bus network around the Wattle Street interchange site

Table 5-2 provides details of peak period bus services and frequencies for the routes within the Wattle Street interchange and surrounding area.

Table 5-2 Bus services around the Wattle Street interchange and surrounds

Route	Operator	AM peak services (7–9am)	AM peak frequency (mins)	PM peak services (4–6pm)	PM peak frequency (mins)
525 Burwood to Parramatta	Sydney Buses	6	10–25	7	10–30
526 Burwood to Sydney Olympic Park Wharf	Sydney Buses	3	30–60	6	30
461 Burwood to The Domain	Sydney Buses	11	10–20	6	10
415 Chiswick to Campsie	Sydney Buses	4	20–35	5	30
490 Drummoyne to Hurstville	Sydney Buses	4	30	4	30
492 Drummoyne to	Sydney Buses	4	25–30	4	30

Route	Operator	AM peak services (7–9am)	AM peak frequency (mins)	PM peak services (4–6pm)	PM peak frequency (mins)
Rockdale					
491 Five Dock to Hurstville	Sydney Buses	4	30	4	30
458 Burwood to Ryde	Sydney Buses	1	–	0	No PM services
459 Strathfield to Macquarie University	Sydney Buses	4	25–30	3	Last service departs Strathfield at 5.07am
M41 Marsfield to Hurstville	Sydney Buses	N/A	10	N/A	10
464 Ashfield to Mortlake	Sydney Buses	10	10–15	7	20
463 and 466 Ashfield to Cabarita Wharf	Sydney Buses	7	10–30	8	5–30
480 and 483 Strathfield Station to City	Sydney Buses	12	10–15	13	5–15 (return service only)
406 Five Dock to Hurlstone Park	Sydney Buses	2	60	2	60
418 Burwood to Bondi Junction	Sydney Buses	6	20	6	20
436 Chiswick to City	Sydney Buses	5	20–30	4	30
462 Ashfield to Mortlake	Sydney Buses	0	Weekend and off-peak service only	0	Weekend and off-peak service only
413 Campsie Station to City	Sydney Buses	8	15	4	30
439 Mortlake to City	Sydney Buses	2	30 (Service commence s at 08:13)	4	30
440 Rozelle to City	Sydney Buses	18	5–10	10	10
445 Campsie to Balmain East	Sydney Buses	0	Inter-peak service	0	Inter-peak service
444 Campsie to Balmain East	Sydney Buses	10	10–20	8	15
502 Bayview Park to City	Sydney Buses	6	10 (Services ends at 08:00)	0	0 (AM peak service only)
M10 Leichhardt to Maroubra	Sydney Buses	12	10	12	10
X25 Strathfield to Homebush Bay	Sydney Buses	12	10	10	10 (Services commence at approx. 4.30pm)
N60 City to Fairfield	Sydney Buses	5	00:45	04:45	60
N61 City to Carlingford	Sydney Buses	3	01:45	03:45	60
N70 City to Penrith	Sydney Buses	4	01:05	04:05	60

Route	Operator	AM peak services (7–9am)	AM peak frequency (mins)	PM peak services (4–6pm)	PM peak frequency (mins)
N71 City to Richmond	Sydney Buses	5	00:35	04:35	60
N80 City to Hornsby (via Strathfield)	Sydney Buses	5	00:40	04:46	60

Note: frequencies rounded to the nearest five minutes
Source: M4 East EIS, AECOM, September 2015

5.2.3 Walking and cycling facilities

Details of existing walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

5.2.4 Existing traffic volumes and patterns

Automatic traffic count (ATC) surveys were completed in 2014 to understand and analyse existing traffic volumes and patterns at the Wattle Street interchange and surrounds. Specifically, classified hourly traffic volumes at the following roadway locations were recorded over a one-week period:

- Parramatta Road west of Wattle Street
- Ramsay Road between Henley Marine Drive and Wolseley Street
- Dobroyd Parade east of Timbrell Drive
- Parramatta Road at Hawthorne Canal.

The AM peak hour, PM peak hour and average weekday traffic (AWT) volumes at each of these survey locations are summarised in **Table 5-3**.

On Parramatta Road, peak period traffic volumes show similar trends to daily figures with a fairly 'flat' profile of traffic throughout the day between the AM peak and PM peak periods. At the Hawthorne Canal, there are clear changes in peak direction between the AM peak hour and the PM peak hour, with more vehicles travelling towards the city in the AM peak hour, and more vehicles travelling away from the city in the PM peak hour.

During the AM peak hour, the traffic volume on Dobroyd Parade is similar in both directions, while during the PM peak hour, the eastbound volume is indicated as higher. This was due to congested traffic conditions. The surveyed volumes therefore only represent the satisfied demand and, due to downstream congestion and queuing at this location, underestimate the actual demand.

Table 5-3 Average peak mid-block traffic volumes at key locations around the Wattle Street interchange and surrounds (2014 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Parramatta Road, west of Wattle Street	Eastbound	2,530	6%	2,370	4%	43,500	7%
	Westbound	2,640	11%	2,790	2%	46,000	7%
Ramsay Road, between Henley Marine Drive and Wolseley Street	Eastbound	930	6%	840	2%	13,000	4%
	Westbound	830	3%	990	3%	13,000	3%
Dobroyd Parade, east of Timbrell Drive	Eastbound	1,670	9%	2,120	3%	32,500	7%
	Westbound	1,630	7%	1,820	5%	30,500	7%
Parramatta Road, at the Hawthorne Canal	Eastbound	2,380	10%	1,880	2%	33,000	7%
	Westbound	1,620	6%	2,280	5%	32,000	7%

Source: WDA traffic surveys (2014)

5.3 Wattle Street interchange to Rozelle interchange corridor

The Wattle Street interchange to Rozelle interchange corridor connects the M4 Motorway east–west to the Sydney CBD and the north. As identified in **section 3.2**, east of the Wattle Street interchange, east–west traffic movement is focused on Dobroyd Parade/City West Link and Parramatta Road. City West Link then combines with Victoria Road and links to Anzac Bridge/Western Distributor to provide the main east–west movement to the east of the Rozelle interchange. Other routes from the Wattle Street interchange area to the Sydney CBD include along Great North Road/Lyons Road, Victoria Road and Anzac Bridge.

Parramatta Road, as part of the corridor between the proposed Wattle Street interchange and the Sydney CBD, forms part of the Parramatta to the CBD via Strathfield travel demand corridor. This corridor, as presented in **section 3.1.1**, is identified as being the main corridor connecting western Sydney to the Global Economic Corridor, and as being one of the most constrained corridors in Sydney. It also forms part of the principal east–west freight transport corridor along the M4 Motorway/Parramatta Road which connects the Sydney CBD and Inner West to Parramatta, as identified in **section 3.3.1**.

Automatic traffic count surveys presented in **section 5.2.4** included locations on Parramatta Road within the Wattle Street interchange to Rozelle interchange corridor. The Parramatta Road corridor accommodates consistently high volumes of travel demand, with volumes consistent through an average weekday, both during and between the more conventional AM and PM peak periods.

Victoria Road, in this area, also forms part of the Parramatta to the Sydney CBD via Ryde travel demand corridor. As identified in **section 3.1.2**, this corridor is one of the most congested road corridors, in Sydney. It is also one of Sydney's busiest bus corridors.

5.3.1 Existing traffic volumes and patterns

Table 5-4 provides the survey count data for the AM peak hour and the PM peak hour for the key roads within the Wattle Street interchange to Rozelle interchange corridor. Count data was taken from 2014 to 2016 surveys. At some locations, only peak hour volumes were available.

The table indicates clear changes in peak direction between the AM peak hour and the PM peak hour on Victoria Road and Parramatta Road, with more vehicles travelling towards the city in the AM peak hour, and more vehicles travelling away from the city in the PM peak hour. There is also a clear change in peak direction on Lyons Road. In the AM peak hour, peak direction of travel is towards Victoria Road, this reverses to a peak direction of travel away from Victoria Road in the PM peak hour. On City West Link, while the volume of vehicles travelling towards the city decreases and the volume of vehicles travelling away from the city increases in the PM peak hour, there is no change in peak direction, with more vehicles travelling eastbound in both the AM and PM peak hours.

Table 5-4 Average peak mid-block traffic volumes at key locations within the Wattle Street interchange to Rozelle interchange corridor (2014 – 2016 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
City West Link, west of The Crescent	Eastbound	2,470	8%	2,370	3%	36,000	6%
	Westbound	1,640	5%	1,930	3%	32,000	6%
Lyons Road, west of Victoria Road	Eastbound	390	12%	390	8%	–	–
	Westbound	200	12%	450	6%	–	–
Victoria Road, north of Wellington Street	Northbound	2,080	5%	3,230	3%	–	–
	Southbound	3,340	4%	2,440	3%	–	–
Parramatta Road, east of Mallet Street	Eastbound	2,320	7%	1,530	3%	25,500	7%
	Westbound	1,230	8%	1,920	5%	25,500	6%

Source: RMS traffic surveys (2014 – 2016)

5.4 Rozelle interchange and surrounds

The proposed Rozelle interchange would be located in the vicinity of the Rozelle Rail Yards to the north of City West Link. Details on land use in the vicinity of the proposed Rozelle interchange are provided in **Chapter 12** (Land use and property) of the EIS.

The key roads in the vicinity of the site are shown in **Figure 5-3** and include (but are not limited to):

- City West Link (A4): City West Link is a major arterial road connecting Sydney's western suburbs with the Sydney CBD and Sydney Harbour Bridge. It runs from Parramatta Road in Haberfield through Lilyfield before connecting with The Crescent and Victoria Road in Rozelle, which flow onto Anzac Bridge and Western Distributor. The road generally has two lanes in each direction, flaring to accommodate turning lanes around intersections
- Victoria Road (A40): Victoria Road is an arterial road between Sydney's western and north-western suburbs and the Sydney CBD. It runs from North Parramatta to Lilyfield via Rydalmere, Ryde, Gladesville, Drummoyne and Rozelle. Victoria Road is a major transit corridor, with frequent bus services and bus lanes in certain sections during peak periods. There are generally three lanes in each direction along the length of Victoria Road in the study area, with additional lane flares at some intersections to facilitate right turns
- Western Distributor/Anzac Bridge: The Western Distributor/Anzac Bridge is a major arterial road connecting City West Link and Victoria Road to the Sydney CBD, Cross City Tunnel and Sydney Harbour Bridge. Anzac Bridge provides a key transit link for bus services operating between Victoria Road and the CBD, as well as a pedestrian and cycle link across Rozelle Bay. Anzac Bridge has four lanes in each direction, while the Western Distributor generally has three lanes in each direction, with flyover lanes connecting to the Cross City Tunnel and various CBD roads
- Lilyfield Road: Lilyfield Road runs parallel to City West Link between the western edge of Lilyfield and Victoria Road. It is a regional collector road that provides access to the local road network, while also providing the function of a major cycle link, with marked cycle lanes on some sections. Lilyfield Road has one traffic lane and one parking lane in each direction
- Catherine Street: Catherine Street provides a connection between Lilyfield Road, City West Link and Parramatta Road through Lilyfield and Leichhardt. It is a collector road with one traffic lane and one parking lane in each direction
- The Crescent/Minogue Crescent/Ross Street: This route comprises state classified roads between City West Link and Parramatta Road through Annandale and Forest Lodge. It provides access to local roads within these residential areas, in addition to providing a connection between City West Link and Parramatta Road. There is generally one traffic lane in each direction, with the exception of The Crescent between Nelson Street and Wigram Road, and intersection flaring at City West Link, Bridge Road, St Johns Road, Arundel Street and Parramatta Road. Between Johnston Street and City West Link, it is two traffic lanes in each direction, flaring to three lanes and a slip lane northbound at its intersection with City West Link
- Johnston Street: Johnston Street is a state classified road providing a connection between The Crescent (and City West Link) and Parramatta Road through Annandale. It is a collector road with generally two traffic lanes and one parking lane in each direction, with a particularly wide cross-section
- James Craig Road: James Craig Road provides access from The Crescent to the Glebe Island port, the Sydney Superyacht Marina, to private Port Authority controlled access roads and through to the White Bay Cruise Terminal. James Craig Road has one traffic lane in each direction, flaring to two lanes eastbound and three lanes westbound at its intersection with The Crescent
- Robert Street: Robert Street is a collector road that facilitates access into Rozelle from Victoria Road, north of The Crescent. East of Mullens Street, Robert Street connects to Port Authority-controlled roads in White Bay. Robert Street has one traffic lane in each direction which flares to two traffic lanes in each direction at Victoria Road, one traffic lane with one lane of parking in the AM peak period and two traffic lanes in the PM peak period. East of Mullens Street, there are parking lanes on both sides of Robert Street

- Terry Street: Terry Street is a local road that provides access into Rozelle from both eastbound and westbound traffic on Victoria Road. It connects to Darling Street (a collector road) via Wise Street. Traffic exiting Terry Street onto Victoria Road can only turn left. There is one traffic lane in each direction and generally either a kerbside parking lane or sufficient space for kerbside parking on at least one side of the street.

5.4.1 Modes of travel

The Rozelle interchange site is located within the Inner West Local Government Area (LGA), with the City of Sydney also located nearby on the eastern side of The Crescent. Travel mode share for the Inner West LGA in comparison with the Sydney GMA is shown in **Table 5-5**.

The Inner West LGA has a higher share of public transport due to the area's proximity to the Sydney CBD and frequent bus services. The largest difference to the Sydney GMA data is in 'walk only' trips, which account for 32 per cent of all trips in the Inner West LGA compared to 18 per cent in the Sydney GMA. This could be attributed to factors including the walkability of many neighbourhoods in the area.

Table 5-5 Average weekday travel mode share for Inner West Local Government Area

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note: Inner West Council data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGAs
Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

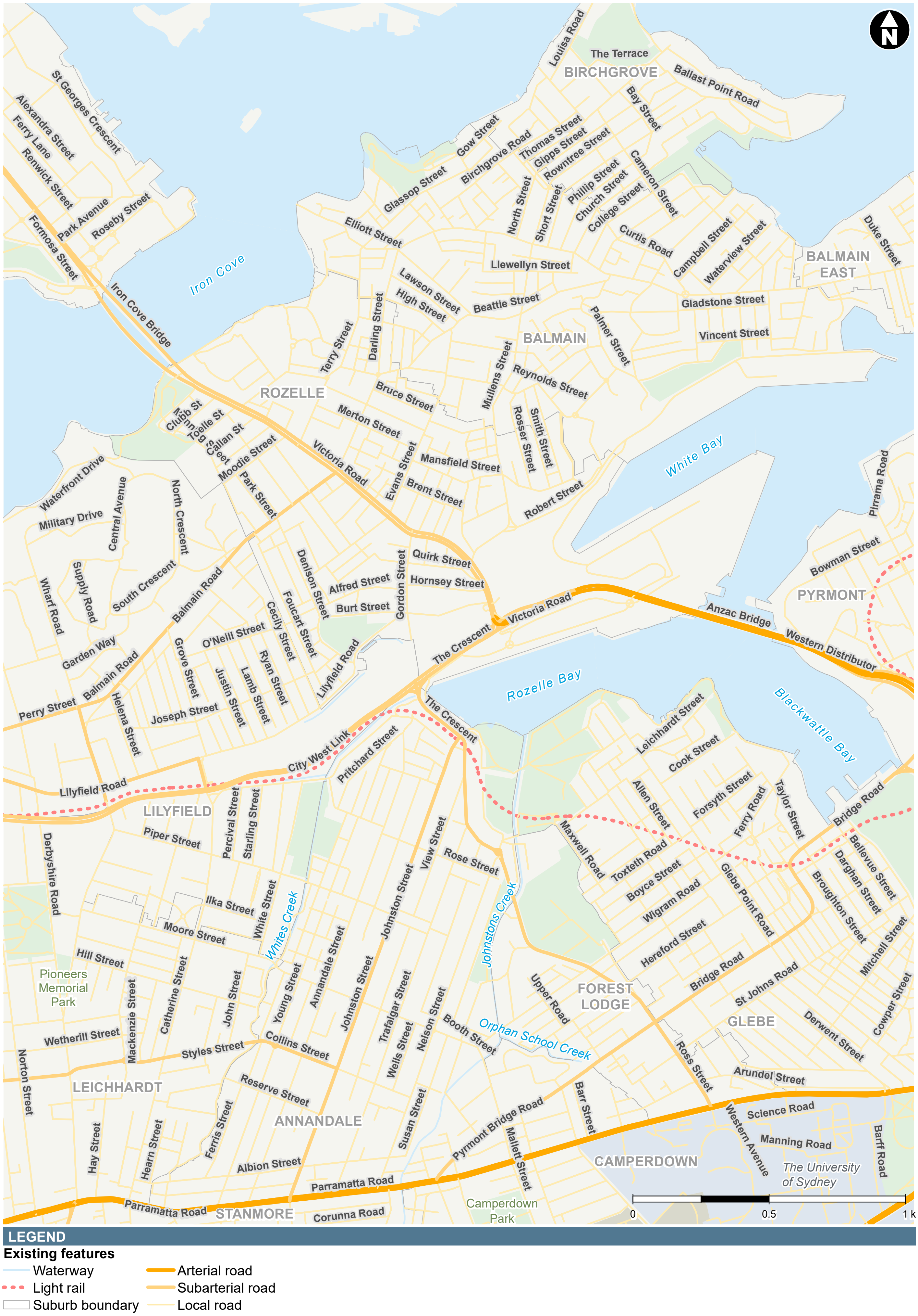


Figure 5-3 Road network around the Rozelle interchange site

5.4.2 Public transport services

The Rozelle area has access to light rail and bus services that provide frequent connections to key centres and transport nodes, but does not have access to the heavy rail network.

Light rail services

The L1 Dulwich Hill line runs from Central to Dulwich Hill via Pyrmont, Glebe, Lilyfield and Leichhardt, as shown in **Figure 5-4**. The closest stops to the Rozelle interchange are at Rozelle Bay and Lilyfield. The line runs along a former freight railway for most of its length, with a short on-street section in the southern Sydney CBD between Darling Drive and Castlereagh Street. **Table 5-6** shows the existing service frequency of light rail on the Dulwich Hill Line, with services every eight to 10 minutes during peak periods.

Table 5-6 Weekday light rail service frequency

Line	Early AM (0600–0700)	AM peak (0700–1000)	Off-peak (1000–1500)	PM peak (1500–1900)	Late PM (1900–2300)
L1 Dulwich Hill Line	15 min	8–10 min	15 min	8–10 min	15 min

Source: Transport for NSW 2016

Source: Transport for NSW 2016

Figure 5-4 L1 Dulwich Hill light rail line

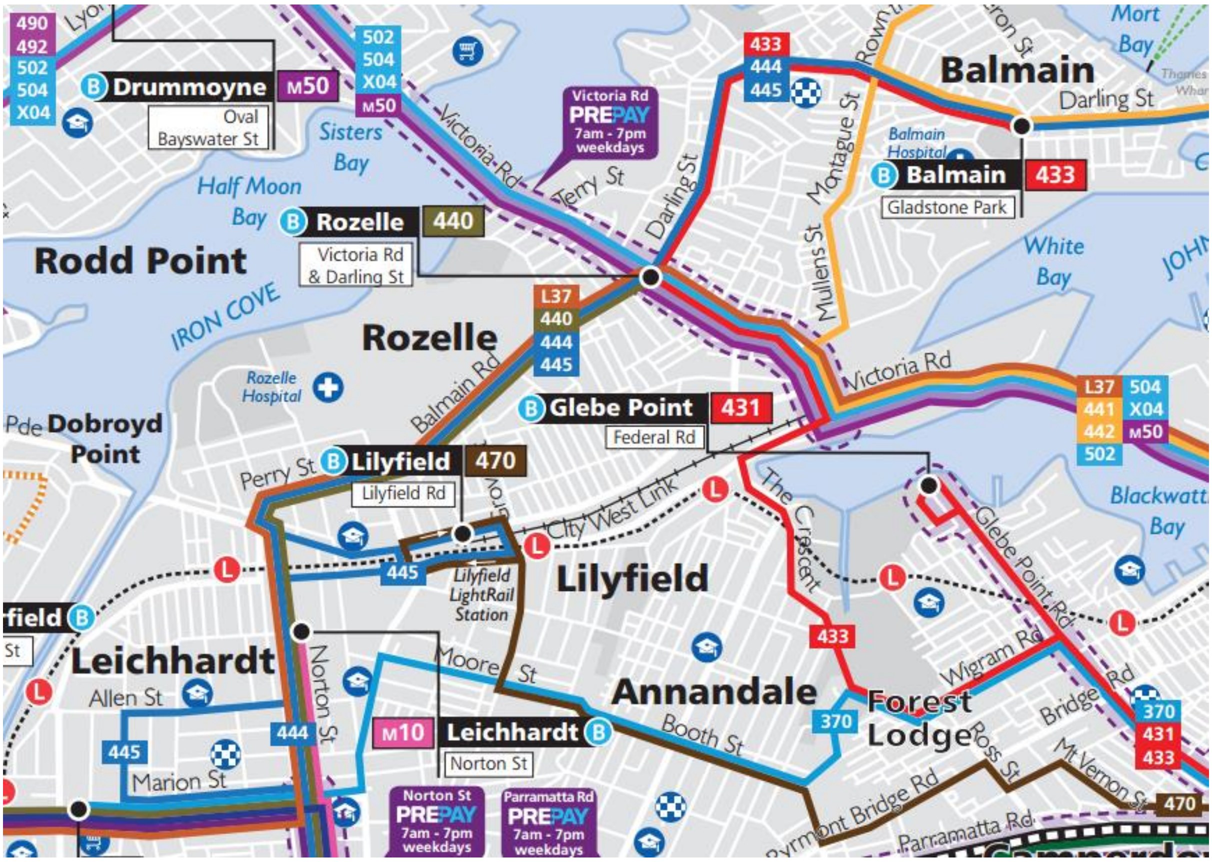
Bus services

The bus network in the area surrounding the Rozelle interchange is shown in **Figure 5-5**, while **Table 5-7** shows the bus services and frequencies. Victoria Road serves as a major transit corridor between Sydney's north-western suburbs and the Sydney CBD, with sections of bus priority. Balmain Road is also a key bus corridor linking Balmain with Rozelle and Leichhardt.

Table 5-7 Bus services around Rozelle and surrounds

Route	Operator	AM peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
502 Bayview Park to City	Sydney Buses	5	10–15 min	8	10–20 min
504 Chiswick to City	Sydney Buses	16	5 min	11	7–20 min
X04 City to Chiswick	Sydney Buses	–	–	4	15–20 min
M50 Drummoyne to Coogee via City	Sydney Buses	12	10 min	12	10 min
M52 Parramatta to City	Sydney Buses	24	5 min	15	8 min
431 Glebe Point to City	Sydney Buses	25	3–7 min	19	4–10 min
433 Balmain to Railway Square	Sydney Buses	18	9–12 min	13	5–12 min
444 Campsie to Balmain East	Sydney Buses	10	10 min	7	15 min
445 Campsie to Balmain East via Lilyfield light rail stop	Sydney Buses	1	–	–	–
L37 Haberfield to City	Sydney Buses	5	11–20 min	4	25 min
441 Birchgrove to Art Gallery NSW	Sydney Buses	6	12–35 min	6	15–25 min
442 Balmain East to City	Sydney Buses	29	4 min	24	5 min
440 Bronte to Rozelle via Central Station	Sydney Buses	21	3–10 min	14	6–10 min
500 Ryde to City	Sydney Buses	4	30 min	0	–
501 West Ryde to Central via Pyrmont and Ultimo	Sydney Buses	14	9 min	12	10 min
506 Macquarie University to City via East Ryde	Sydney Buses	18	7 min	9	13 min
507 Macquarie University to City via Putney	Sydney Buses	6	20 min	5	24 min
510 Ryde to City	Sydney Buses	15	8 min	3	40 min
515 Eastwood to City	Sydney Buses	5	24 min	1	–
518 Macquarie University to City	Sydney Buses	7	17 min	5	24 min
520 Parramatta to City via West Ryde (out of peak hours service)	Sydney Buses	1	–	–	–
X00 City to Ryde (Limited Stops)	Sydney Buses	–	–	5	24 min
X06 City to East Ryde (Express)	Sydney Buses	–	–	5	24 min
X15 City to Eastwood	Sydney Buses	–	–	3	40 min
X18 City to Denistone East (Express)	Sydney Buses	–	–	3	40 min

Notes: [1]7am-9am (higher frequency direction), [2]4pm–6pm (higher frequency direction)
Source: Sydney Buses 2016



Source: Sydney Buses 2016

Figure 5-5 Bus network around the Rozelle interchange site

5.4.3 Walking and cycling facilities

Details of existing walking and cycling infrastructure and facilities can be found in **Appendix N** Technical working paper: Active transport strategy) of the EIS.

5.4.4 Existing traffic volumes and patterns

Table 5-8 provides the 2016 AM peak hour, PM peak hour and AWT flows for key roads in the vicinity of the future interchange. Only total traffic volumes were available on the Anzac Bridge. Count data was taken from 2014 and 2016 traffic surveys. The table indicates higher traffic flows in the southbound and eastbound (citybound) direction during the AM peak and in the opposite directions during the PM peak. The proportion of heavy vehicles is not significantly high in this area compared to other arterial routes in Sydney.

Table 5-8 Average peak mid-block traffic volumes at key locations around Rozelle and surrounds (2014 and 2016 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
City West Link, between The Crescent and James Craig Road	Eastbound	3,520	6%	3,080	3%	38,500	5%
	Westbound	2,260	5%	2,940	2%	36,000	5%
The Crescent, between City West Link and	Northbound	1,040	3%	870	2%	11,500	4%
	Southbound	880	5%	950	1%	12,500	4%

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
Johnston Street							
Victoria Road, north of The Crescent	Northbound	1,660	8%	2,790	4%	34,500	5%
	Southbound	3,400	5%	2,390	3%	38,500	5%
Victoria Road, south of Gordon Street	Northbound	1,250	7%	2,060	4%	25,000	5%
	Southbound	2,820	4%	1,920	3%	30,500	4%
Victoria Road, north of Gordon Street	Northbound	1,890	5%	2,040	4%	27,000	5%
	Southbound	2,660	5%	1,840	3%	28,000	4%
Anzac Bridge	Eastbound	5,890	–	4,400	–	71,500	–
	Westbound	2,900	–	4,950	–	63,500	–

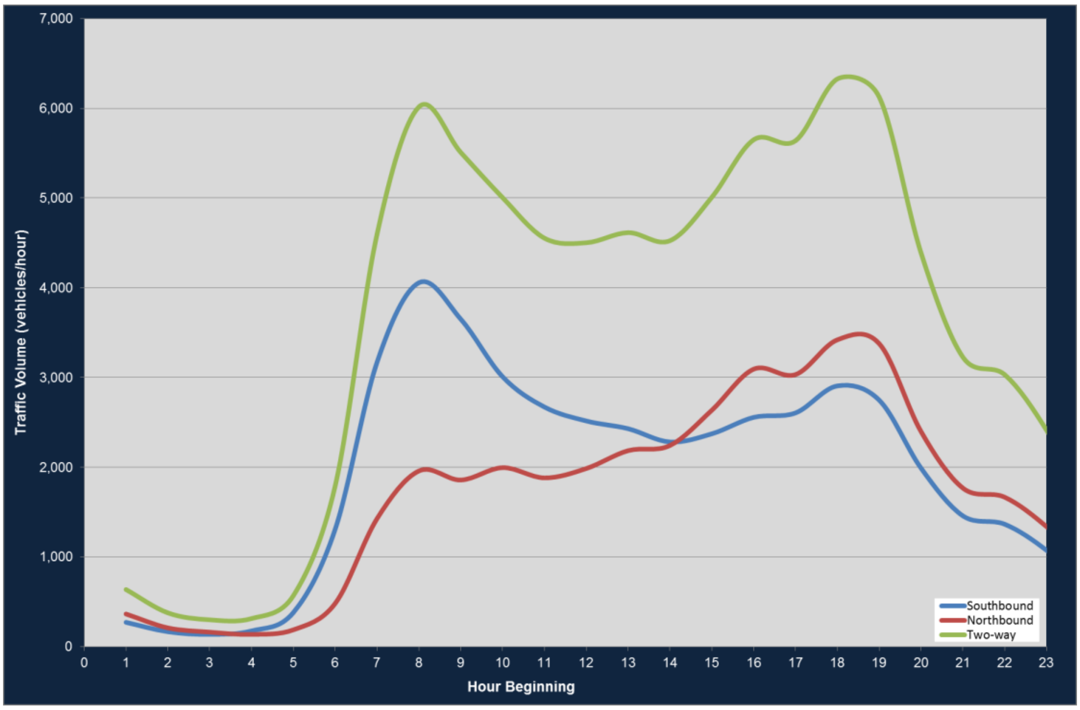
Source: RMS traffic surveys (2014 – 2016)

Table 5-9 to **Table 5-11** show details of the average peak, daily and weekly traffic volumes recorded at three key locations, by direction and in combination, namely Victoria Road, City West Link and Anzac Bridge. In addition, each table displays traffic volumes and patterns for an average daily and weekly profile based on the following key statistics:

- AM peak hour: highest one hour traffic volume recorded between midnight and midday
- PM peak hour: highest one hour vehicle traffic volume recorded between midday and midnight
- Heavy commercial vehicle per cent (HCV%): per cent of total vehicles that are heavy vehicles
- AWT) volume: daily traffic volume derived from 24 hour traffic counts recorded between Monday and Friday during the survey week
- Average daily traffic (ADT) volume: daily traffic volume derived from 24 hour traffic counts recorded between Monday and Sunday during the survey week.

Table 5-9 Victoria Road, north of The Crescent

Southbound		Northbound		Two-way	
AM peak hour total (HCV%)	4,050 (4%)	AM peak hour total (HCV%)	2,000 (8%)	AM peak hour total (HCV%)	6,010 (5%)
PM peak hour total (HCV%)	2,900 (2%)	PM peak hour total (HCV%)	3,500 (3%)	PM peak hour total (HCV%)	6,330 (3%)
AWT (HCV%):	46,000 (5%)	AWT (HCV%):	40,500 (5%)	AWT (HCV%):	86,500 (5%)
ADT:	45,000	ADT:	40,000	ADT:	85,000



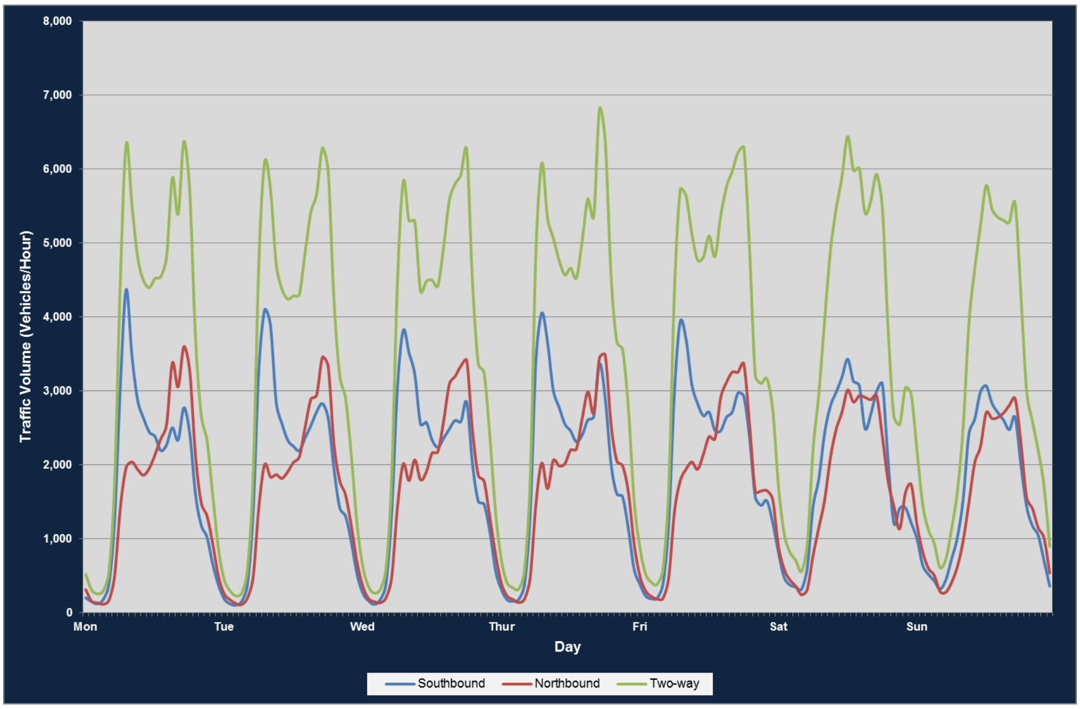
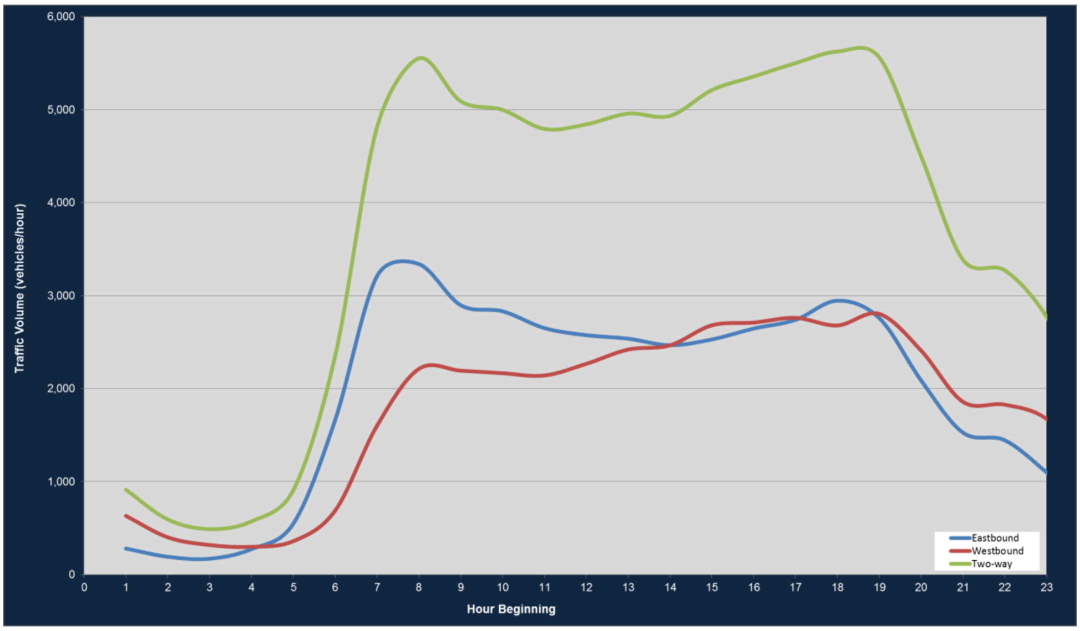


Table 5-10 City West Link, between The Crescent and James Craig Road

Eastbound		Westbound		Two-way	
AM peak hour total (HCV%)	3,340 (6%)	AM peak hour total (HCV%)	2,210 (7%)	AM peak hour total (HCV%)	5,550 (7%)
PM peak hour total (HCV%)	2,950 (3%)	PM peak hour total (HCV%)	2,680 (2%)	PM peak hour total (HCV%)	5,630 (3%)
AWT (HCV%):	46,000 (7%)	AWT (HCV%):	43,000 (7%)	AWT (HCV%):	89,000 (7%)
ADT:	45,500	ADT:	43,000	ADT:	88,500



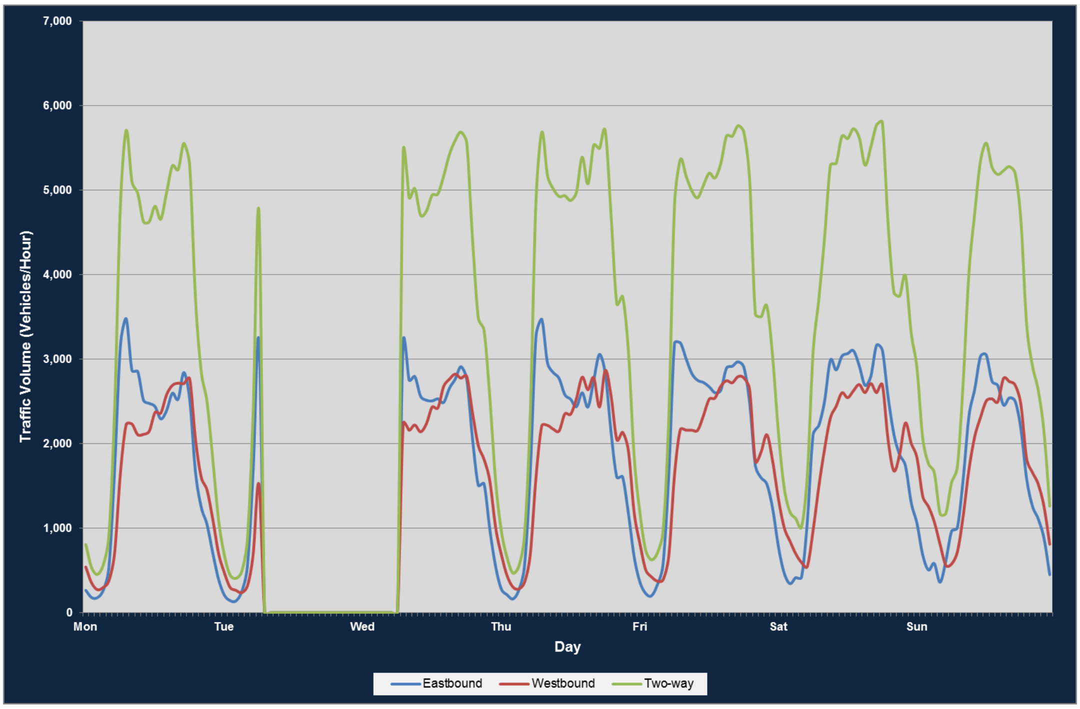
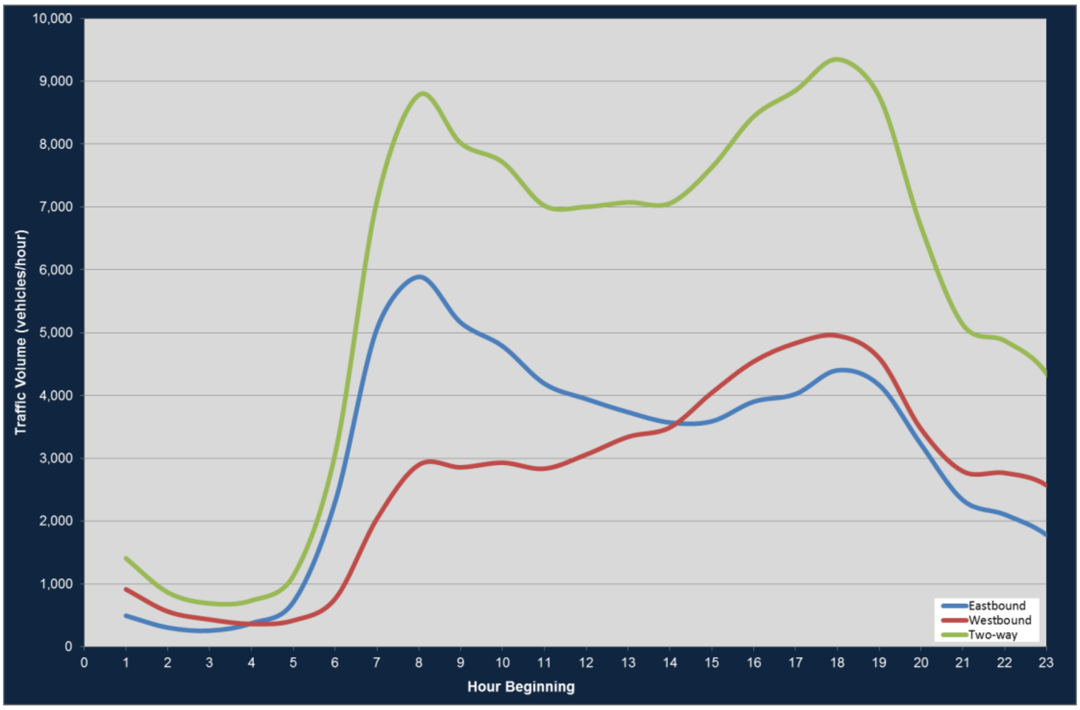


Table 5-11 Anzac Bridge

Eastbound		Westbound		Two-way	
AM peak hour total:	5,890	AM peak hour total:	3,060	AM peak hour total:	8,780
PM peak hour total:	4,400	PM peak hour total:	4,950	PM peak hour total:	9,350
AWT:	71,500	AWT:	63,500	AWT:	135,000
ADT:	70,000	ADT:	62,500	ADT:	132,500



The tables and graphs show the following key findings for the existing traffic volumes and patterns:

- AWT and ADT are similar to each other at all three locations, indicating that average daily weekend traffic is generally at similar levels to the ADT. Therefore, these roads accommodate consistently high volumes of traffic that are not biased towards weekday work related trip purposes. However, the weekday peak hour traffic flows are higher than the weekend peak hour flows
- The AM peak hour citybound traffic flows are slightly higher than the PM peak hour outbound traffic flows, indicating a sharper AM peak profile than PM peak profile, which is spread over a longer period.

5.5 Rozelle interchange to St Peters interchange corridor

The Rozelle interchange to St Peters interchange corridor connects the Sydney CBD and northern Sydney with the M5 Motorway corridor. As identified in **section 3.2**, southeast of the Rozelle interchange, north–south traffic movement is focused on the Eastern Distributor, with Abercrombie Street, Regent Street, Chalmers Street and Elizabeth Street providing supporting north–south routes. North of the St Peters interchange, north–south traffic is mainly focused on the Princes Highway, King Street and City Road, while traffic from Sydney Airport and Port Botany area also use O'Riordan Street and Botany Road.

Several of the roads identified above lie within the Sydney Airport to the Sydney CBD travel demand corridor which, as identified in **section 3.1.3**, experiences high levels of transport congestion. There are also significant heavy vehicle routes along this corridor, extending from the airport and Port Botany, through the city to areas north of Sydney Harbour.

5.5.1 Existing traffic volumes and patterns

Table 5-12 provides 2014 AM peak hour, PM peak hour and AWT flows for at key locations within the Rozelle interchange to St Peters interchange corridor.

The volumes illustrate the road functions described above. Southeast of the Rozelle interchange, the main north–south movement is focused on the Eastern Distributor, with surrounding north–south links playing a supporting role. North of the St Peters interchange, traffic is mainly focused on Princes Highway and, to a lesser degree King Street, while O'Riordan Street and Botany Road also carry a significant amount of north–south traffic.

Table 5-12 Average peak mid-block traffic volumes at key locations within the Rozelle interchange to St Peters interchange corridor (2014 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Southeast of Rozelle interchange							
Eastern Distributor, north of Cleveland Street	Northbound	3,230	6%	2,820	4%	41,500	5%
	Southbound	3,300	4%	3,310	4%	52,500	5%
Abercrombie Street, north of Cleveland Street	One-way northbound	1,560	7%	1,430	4%	21,000	7%
Regent Street, north of Cleveland Street	Northbound	930	7%	740	2%	12,000	5%
	Southbound	1,670	5%	1,930	3%	27,000	5%
Chalmers Street, north of Cleveland Street	One-way northbound	1,340	9%	1,100	7%	17,000	9%
Elizabeth Street, north of Cleveland Street	One-way southbound	980	11%	1,440	8%	18,500	9%
North of St Peters interchange							
Princes Highway, south of Railway Road	Northbound	3,500	5%	1,970	4%	37,500	8%
	Southbound	1,590	13%	3,680	6%	40,000	10%
King Street, south of Missenden Road	Eastbound	1,410	13%	890	8%	17,500	9%
	Westbound	610	11%	1,050	9%	16,000	9%
O'Riordan Street, north of Gardeners Road	Northbound	1,210	8%	1,040	6%	16,000	8%
	Southbound	890	8%	1,160	6%	15,000	8%
Botany Road, north of Gardeners Road	Northbound	1,380	11%	880	7%	14,000	13%
	Southbound	750	11%	1,180	10%	13,500	11%

Source: WDA traffic surveys (2014)

5.6 St Peters interchange and surrounds

Existing land uses in the vicinity of the St Peters interchange include an enterprise corridor along the Princes Highway, warehouses, limited residential lands, local and arterial roads, Sydney Park to the north and Alexandra Canal to the east. Surrounding land uses include the residential neighbourhoods of St Peters, Sydenham and Newtown, as well as general residential and industrial areas of Alexandria to the east. Other significant areas include commercial activity around the Bourke Road/Bourke Street/Gardeners Road intersection associated with Sydney Airport and residential development associated with Mascot town centre.

The key roads in the vicinity of the St Peters interchange and surrounds are shown in **Figure 5-6** and include:

- Princes Highway (A36) – is a significant highway in Australia, extending from Sydney, NSW to Port Augusta, South Australia, passing through NSW, Victoria and South Australia. It runs from Sydney CBD at Broadway, through Newtown and St Peters, and on beyond Kogarah. In this location, the Princes Highway has many signal controlled intersections and is frequently congested

- King Street – is a state road, part of the Princes Highway, running through the retail precinct of Newtown. It serves as one of the key connections between the Sydney CBD and areas in the south of Sydney. It is two lanes in each direction during clearway periods. King Street has a posted speed limit of 50 kilometres per hour and on-street parking in non-clearway periods
- Canal Road/Ricketty Street/Kent Road – provides a link in the state road network, connecting Princes Highway to Gardeners Road. It is two to three lanes in each direction, operating at a posted speed limit of 60 kilometres per hour. The Ricketty Street Bridge provides the only crossing of the Alexandra Canal in the area
- Gardeners Road – is a state road which runs east–west, connecting Kent Road in the west to Anzac Parade and Bunnerong Road in the east. It is two to three lanes in each direction and has a posted speed limit of 60 kilometres per hour
- Burrows Road – is a wide, local road with one lane in each direction and on-street parking on both sides of the road. The road begins at Huntley Street and end south of Canal Road. It has a posted speed limit of 50 kilometres per hour from Huntley Street to Campbell Road and the speed limit increases to 60 kilometres per hour after Campbell Road
- Campbell Road – is a wide, regional road with one lane in each direction with a posted speed limit of 60 kilometres per hour. It runs between Burrows Road and Barwon Park Road. It has on-street parking from Burrows Road to Barwon Park Road
- Campbell Street – is a regional road with one lane in each direction with a posted speed limit of 60 kilometres per hour. It runs between Barwon Park Road and Unwins Bridge Road and operates with vehicle restrictions from 10.00 pm to 6.00 am prohibiting goods vehicles weighing more than three tonnes
- Euston Road – is a wide collector road with on-street parking on both sides of the road. It connects McEvoy Street in the north and Campbell Road in the south. It has a posted speed limit of 60 kilometres per hour from McEvoy Street to Sydney Park Road. In this section, it is marked as four lanes and is a state road. From Sydney Park Road to Campbell Road, it is posted at 50 kilometres per hour and serves a light industrial precinct
- Bourke Road/Bourke Street – Bourke Road is a local road. It runs between Botany Road, Waterloo and Gardeners Road, Alexandria. North of Botany Road, it becomes Bourke Street and continues until Campbell Street, Darlinghurst. To the south of Gardeners Road, it becomes Bourke Street through Mascot town centre to Coward Street, Mascot, when it then returns to being Bourke Road until O’Riordan Street, Mascot. It is generally one lane in each direction and is posted at 50 kilometres per hour, except through Mascot town centre where it is posted at 40 kilometres per hour. It contains a major cross-regional, separated two-way cycleway.

Several of these roads are proposed to be upgraded as part of the New M5 project.

Source: New M5 EIS, AECOM, November 2015

Figure 5-6 Road network around the St Peters interchange

5.6.1 Modes of travel

The area around the St Peters interchange site is located in parts of the Sydney, Inner West and Bayside LGAs. Travel mode shares for these LGAs in comparison with the Sydney GMA are shown in **Table 5-13**. As the Sydney LGA includes the Sydney CBD and the Inner West LGA is located close to the Sydney CBD, these two LGAs have a significantly different mode share compared to the GMA, characterised by an extensive public transport network and a land use mix where residential developments are located closer to employment areas, thereby reducing the need for car travel. These two LGAs have a much lower mode share for private vehicles (30 and 49 per cent) and a high mode share for walking (49 and 30 per cent) compared to 69 per cent for private vehicles and 18 per cent for walk trips in the GMA.

The Bayside LGA, which is farther away from the Sydney CBD and where a number of industrial sites such as Sydney Airport and Port Botany are located, has a similar mode share to the GMA average. There is more reliance on private vehicles compared to the Sydney and Inner West LGAs and a lower rail mode share of two per cent compared to the Sydney and Inner West LGAs.

Table 5-13 Average weekday travel mode share for Sydney, Inner West and Bayside LGAs[1]

Area	Private vehicles			Rail	Bus	Walk only	Other modes
	Driver	Passenger	Total				
Sydney LGA	21%	9%	30%	8%	9%	49%	4%
Inner West LGA	36%	13%	49%	7%	8%	32%	5%
Bayside LGA	46%	21%	67%	2%	11%	19%	1%
Sydney GMA	47%	22%	69%	5%	6%	18%	2%

Note: Inner West Council LGA data has been derived by combining data from the former Leichhardt, Ashfield and Marrickville LGAs, while Bayside LGA data has been derived from data for the former Botany Bay LGA
Source: NSW Bureau of Transport Statistics (BTS), Household Travel Survey Report: Sydney 2012/13, Nov 2014 Release

5.6.2 Public transport services

Rail services

Sydney and Inner West LGAs are well served by several rail services while Bayside LGA has limited rail coverage. The closest stations to the St Peters interchange site are Mascot Station on the T2 Airport Line and St Peters Station on the T3 Bankstown Line. Mascot and St Peters stations are located one kilometre to the south and 750 metres to the north of the future interchange respectively. These stations in the context of the Sydney Trains network are shown in **Figure 5-7**.

Source: Sydney Trains, 2015

Figure 5-7 Extract of Sydney train network map around St Peters and surrounds

Table 5-14 shows the train services at Mascot and St Peters stations. In the AM peak, there are 18 trains from Mascot Station and 14 trains from St Peters Station travelling to the Sydney CBD. In the PM peak, the train services from the city to Mascot Station and St Peters Station are 16 and 18 respectively. The train headways at Mascot Station are less than 10 minutes at all times on a weekday including inter-peak, AM and PM peak while the headways at St Peters Station is six to 15 minutes and seven to 15 minutes during AM and PM peak respectively. During inter-peak, the train service stop at St Peters Station at a frequency of 15 minutes.

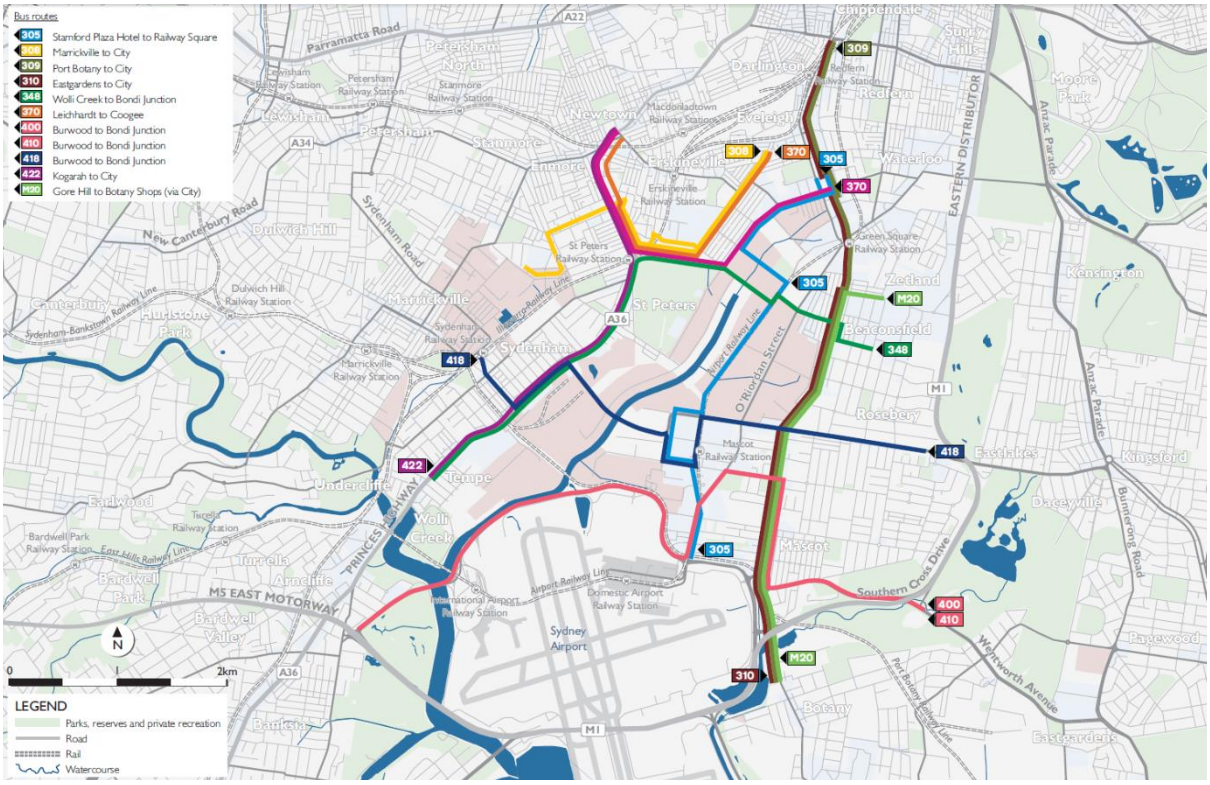
Table 5-14 Weekday rail service frequency

Station	Line	AM peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
Mascot	T2 Airport Line	18	6–9 min	16	6–9 min
St Peters	T3 Bankstown Line	14	6–15 min	18	7–15 min

Notes: [1]7.00 am–9.00 am to city, [2]4.00 pm–6.00 pm from city
Source: New M5 EIS, AECOM, November 2015

Bus services

Figure 5-8 presents the bus services map in St Peters and surrounds. Given this area is located six kilometres southwest of the Sydney CBD, this area has a comprehensive bus network providing access to its surrounding activity and employment centres.



Source: New M5 EIS, AECOM, November 2015

Figure 5-8 Bus routes around the St Peters interchange

The bus routes operated around the St Peters interchange are summarised in **Table 5-15**. All bus routes are operated by Sydney Buses. In addition to the train services from St Peters and Mascot stations, there are a number of bus routes travelling to the Sydney CBD, including routes 308, 422 and M20, with a service frequency of between seven minutes and 20 minutes in the AM and PM peaks. The other bus routes provide access to suburbs such as Wolli Creak, Bondi Junction, Marrickville and Burwood. These bus routes are less frequent than the bus routes travelling to the Sydney CBD.

Table 5-15 Bus services around St Peters and surrounds

Route	Operator	AM peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
305 Stamford Plaza Hotel to Railway Square	Sydney Buses	5	20 min	5	20 min
308 Marrickville to City	Sydney Buses	8	20 min	4	30 min
309 Port Botany to City	Sydney Buses	13	7–14 min	18	2–14 min
348 Wolli Creek to Bondi Junction	Sydney Buses	4	30 min	4	30 min
370 Leichhardt to Coogee	Sydney Buses	14	8–9 min	11	10–11 min
400 Burwood to Bondi Junction	Sydney Buses	7	17–18 min	8	15 min

Route	Operator	AM peak[1] services	AM peak frequency	PM peak[2] services	PM peak frequency
410 Burwood to Bondi Junction	Sydney Buses	4	30 min	7	17–18 min
418 Burwood to Bondi Junction	Sydney Buses	6	20 min	8	20 min
422 Kogarah to City	Sydney Buses	9	13–14 min	9	13–14 min
M20 Gore Hill to Botany Shops via City	Sydney Buses	12–17	7–10 min	12–17	7–10 min

Notes: [1]7.00 am–9.00 am (higher frequency direction), [2]4.00 pm–6.00 pm (higher frequency direction)
Source: New M5 EIS, AECOM, November 2015

5.6.3 Walking and cycling facilities

Details of existing walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

5.6.4 Existing traffic volumes and patterns

Table 5-16 provides the 2014 AM peak hour, PM peak hour and AWT flows for the key road corridors in the vicinity of the future St Peters interchange. The shading in the table groups the locations into the King Street/Princes Highway corridor, the Euston Road corridor, the Campbell Street corridor and the Ricketty Street/Gardeners Road corridor. At some locations, only peak hour volumes were available.

Roads running east–west experience higher traffic flows in the eastbound direction during the AM peak hour and in the westbound direction during the PM peak hour. The Princes Highway experiences higher traffic flows in the northbound direction during the AM peak hour and southbound direction during the PM peak hour. A number of locations have a high proportion of heavy vehicles.

Table 5-16 Average peak mid-block traffic volumes at key locations around St Peters and surrounds (2014 count data)

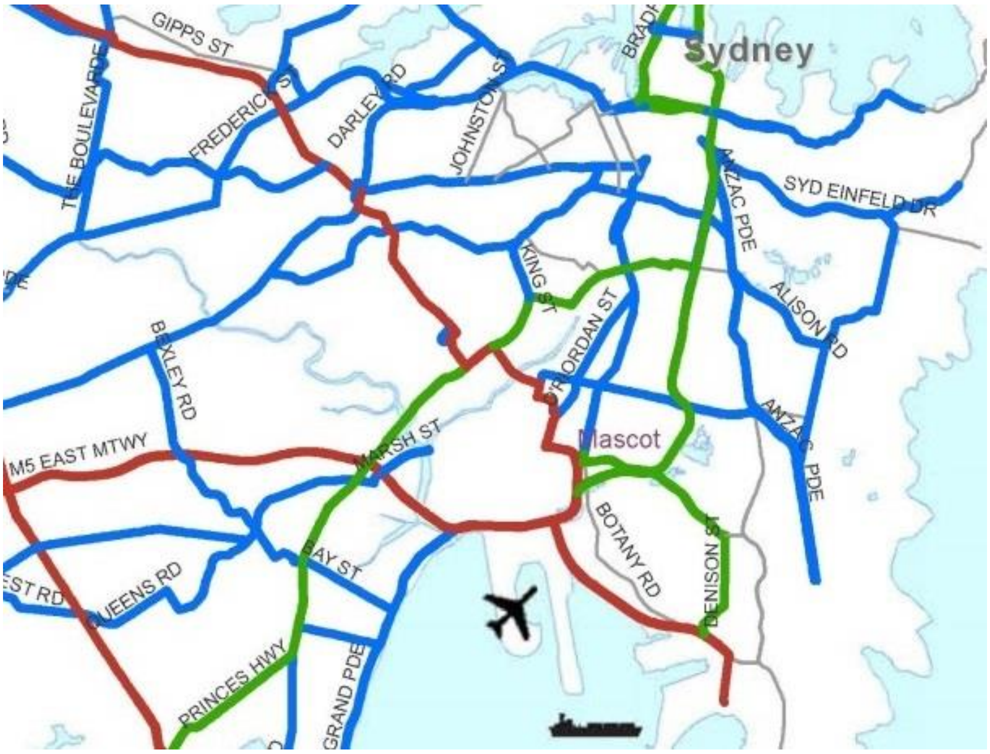
Location	Direction	AM peak hour		PM peak hour		AWT flow	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
King Street, south of Alice Street	Northbound	1,020	5%	950	2%	–	–
	Southbound	780	7%	940	3%	–	–
Princes Highway, north of Campbell Street	Northbound	1,660	5%	980	3%	19,00	6%
	Southbound	560	9%	1,600	4%	17,500	7%
Princes Highway, south of Campbell Street	Northbound	1,720	11%	1,040	6%	19,500	9%
	Southbound	610	10%	1,550	9%	18,000	10%
Railway Road, west of Princes Highway	Eastbound	630	12%	640	4%	–	–
	Westbound	390	17%	550	5%	–	–
Princes Highway, south of Railway Road	Northbound	3,370	5%	1,590	5%	27,000	15%
	Southbound	780	10%	2,610	2%	25,500	17%
Euston Road, north of Campbell Road	Northbound	410	13%	190	7%	3,000	13%
	Southbound	200	23%	190	7%	2,500	16%
Euston Road, north of	Northbound	1,220	7%	600	5%	–	–

Location	Direction	AM peak hour		PM peak hour		AWT flow	
		veh/hr	HCV%	veh/hr	HCV%	veh/day	HCV%
Sydney Park Road	Southbound	500	15%	1,330	5%	–	–
Campbell Road, west of Euston Road	Eastbound	860	9%	410	12%	7,500	11%
	Westbound	160	21%	320	13%	3,500	14%
Campbell Street, east of May Street	Eastbound	360	8%	320	8%	5,000	8%
	Westbound	140	16%	280	11%	3,000	12%
Edgeware Road, west of Edinburgh Road	Northbound	670	8%	810	3%	–	–
	Southbound	730	7%	780	1%	–	–
Ricketty Street	Eastbound	2,290	7%	1,160	9%	22,000	11%
	Westbound	960	17%	1,830	7%	20,500	12%
Gardeners Road, west of O'Riordan Street	Eastbound	1,090	13%	920	15%	14,000	14%
	Westbound	1,000	11%	1,120	12%	15,000	11%

Source: WDA traffic surveys (2014)

5.7 Wattle Street interchange to St Peters interchange corridor

The Wattle Street interchange to St Peters interchange corridor connects the M4 and M5. There is an existing primary freight route between these interchange sites that extends along Parramatta Road, Old Canterbury Road, Railway Terrace, Gordon Street, Livingstone Road, Sydenham Road, Gleeson Avenue and Railway Road until connecting to Princes Highway, as indicated in red in **Figure 5-9**. While this route is classified as a primary freight route, its use is restricted to heavy vehicles under 19 metres. An alternative route option runs along Parramatta Road, Stanmore Road and Edgeware Road. The green lines indicate secondary freight routes and the blue lines tertiary freight routes.



Source: Excerpt from Metropolitan Road Freight Hierarchy on the State Road Network Practice Note, June 2011

Figure 5-9 Excerpt from Sydney Road Freight Hierarchy

5.7.1 Existing traffic volumes and patterns

Table 5-17 provides 2012 AM peak hour, PM peak hour and AWT flows on Sydenham Road in Marrickville, along the primary freight route. The table indicates clear changes in peak direction between the AM peak hour and the PM peak hour, with more vehicles travelling eastbound in the AM peak hour, and more vehicles travelling westbound in the PM peak hour. The survey data also indicates a high heavy vehicle percentage, which is high through the day. This is consistent with the use of this route by freight vehicles, which may try and travel outside of peak traffic periods.

Table 5-17 Average peak mid-block traffic volumes at key locations within the Wattle Street interchange to St Peters interchange corridor (2012 count data)

Location	Direction	AM peak hour		PM peak hour		AWT	
		veh/hr	HCV%	veh/hr	HCV%	veh/hr	HCV%
Sydenham Road, west of Victoria Road (Marrickville)	Westbound	390	12%	920	4%	9,500	8%
	Eastbound	840	7%	500	3%	10,000	7%

Source: RMS traffic survey (2012)

6 Existing road network performance

6.1 Introduction

This section outlines the existing road network performance within the study area. These reflect conditions prior to the commencement of construction of the M4 East or the New M5.

The assessment of the existing operational performance of the road network considered the following aspects of performance:

- Network performance
- Intersection performance
- Travel times and speeds
- Traffic crashes.

6.2 Wattle Street interchange and surrounds

Network performance and intersection performance analysis for the Wattle Street interchange and surrounds is presented in **section 6.2.1** and **section 6.2.2**. It is noted that currently traffic conditions around the Wattle Street interchange are temporarily altered due to the construction of the M4 East project. To allow an assessment that reflects the unaltered road network performance, the network performance reported is for the situation prior to this construction commencing.

6.2.1 Network performance

Table 6-1 presents the performance of the modelled road network for Wattle Street and surrounds, as presented in **Figure 4-2**, for a 2015 base scenario for the AM and PM peak hours.

The Parramatta Road corridor currently functions under high levels of traffic demand, with the demand often exceeding the capacity of the road, especially eastbound during the AM peak period. This results in congested conditions and long queues and delays during peak periods.

An exception is east of Bland Street, where citybound Parramatta Road volumes in the AM peak are somewhat lower, due to congestion at the Wattle Street intersection, which acts as a gating mechanism holding back traffic flow. Northbound congestion is also evident on Dobroyd Parade reflecting citybound demand in the AM peak.

A similar pattern is evidenced in the PM peak although congestion is recorded in both directions. East of Bland Street, westbound traffic flows relatively well due to an extra lane on Parramatta Road, west of Dalhousie Street, and congestion at the Hume Highway intersection that holds back westbound traffic.

6.2.2 Intersection performance

To assess intersection performance in this assessment, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed (see **section 4.3.2**). This allows for an assessment of intersections within the modelled network, irrespective of downstream queuing that would mask the actual operation of the intersection. The assessment undertaken in the M4 East EIS used a different methodology; therefore intersection results at the Wattle Street interchange are not directly comparable.

Table 6-2 presents the modelled AM and PM peak hour LoS for key intersections in the vicinity of the Wattle Street interchange. The intersection performance results demonstrate that most of the key intersections perform acceptably in the AM peak hour, with the exception of the Parramatta Road and Wattle Street intersection. In the PM peak hour, results indicate that key intersections operate to an acceptable level under existing demand.

Table 6-1 Wattle Street interchange modelled network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	13,233	13,559
Total vehicle kilometres travelled in network (km)	25,663	27,377
Total time travelled approaching and in network (hr)	1,731	1,504
Total vehicles arrived	13,191	13,559
Total number of stops	244,016	183,725
Average per vehicle in network		
Average vehicle kilometres travelled in network (km)	1.7	1.8
Average time travelled in network (mins)	7.0	5.9
Average number of stops	14.8	11.0
Average speed (km/h)	14.9	18.3
Unreleased vehicles		
Unreleased demand (veh)	41	0
% of total traffic demand	0%	0%

Table 6-2 Wattle Street interchange: modelled key intersection performance (LoS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Parramatta Road/Sloane Street	B	B
Parramatta Road/Liverpool Road	C	B
Parramatta Road/Dalhousie Street	B	B
Parramatta Road/Bland Street	B	B
Parramatta Road/Wattle Street	E	D
Parramatta Road/Great North Road	B	B
Parramatta Road/Arlington Street	B	B
Frederick Street/Church Street	B	B
Wattle Street/Ramsay Street	C	C
Dobroyd Parade/Waratah Street	A	A
City West Link/Timbrell Drive	C	D

6.2.3 Traffic crashes

An analysis of traffic crashes was carried out for Parramatta Road between Wattle Street and City Road. The crash analysis considered relies on data recorded, with all crashes conforming to the national guidelines for reporting and classifying road vehicle crashes. The main criteria for these crashes are:

- The crash was reported to police
- The crash occurred on a public road

- The crash involved at least one moving vehicle
- The crash involved at least one person being killed or injured or at least one motor vehicle being towed away.

Unreported crashes, generally of a minor nature, are therefore not considered.

Table 6-3 summarises the crash history for the past five years (1 January 2012–31 December 2016) on Parramatta Road between Wattle Street and City Road.

Table 6-3 Parramatta Road from Wattle Street to City Road: crash statistics (Jan 2012 to Dec 2016)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Parramatta Road	Wattle Street	Broadway	539	0	404	135

Source: Summarised from crash reports, 2017

Figure 6-1 presents the crash profile over a five-year period for Parramatta Road between Wattle Street and City Road. The profile indicates that while accidents have broadly decreased since 2012, this decrease is not necessarily consistent from year to year with accidents increasing slightly in 2014.

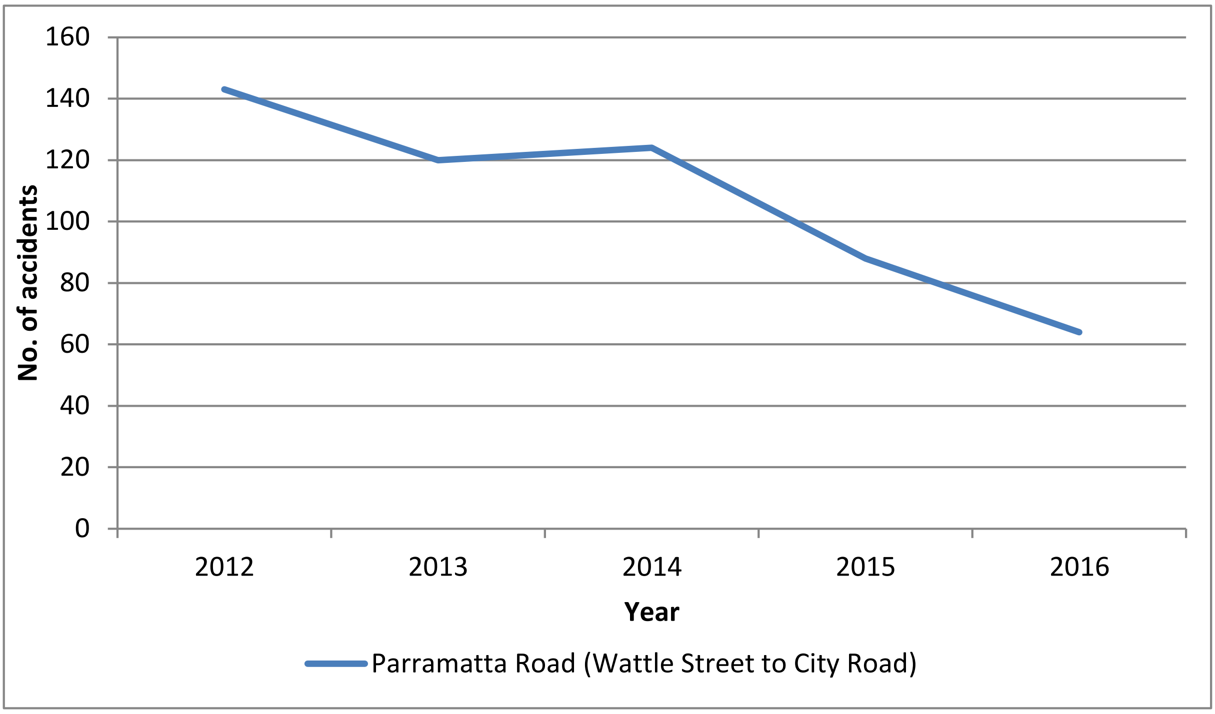


Figure 6-1 Historical crash profile for Parramatta Road between Wattle Street and City Road

Source: Summarised from crash reports, 2017

Crash severity indices provide an assessment of road safety based on the type and number of crashes occurring on a route. Fatal, injury and tow-away crashes carry different weightings; they are determined independently of absolute traffic volumes, and calculated to establish the average level of severity of crashes that occur.

The following equation is applied to calculate the crash severity indices with results presented in **Table 6-4**.

$$Crash\ Severity\ Index = \frac{[(No. of\ fatal\ crashes * 3.0) + (No. of\ injury\ crashes * 1.5) + (No. of\ non - injury\ crashes)\}}{Total\ no. of\ crashes}$$

Source: Roads and Maritime Crash Data, 2016

The average crash severity index on Parramatta Road between Wattle Street and City Road is about 1.37, which is above the average for NSW (1.24) and the Sydney Metropolitan Area (1.22), as presented in **Table 6-4**.

Table 6-4 Parramatta Road between Wattle Street and City Road: crash severity indices (Jan 2012 to Dec 2016)

Road	Section from	Section to	Crash severity index
Parramatta Road	Wattle Street	City Road	1.37
NSW | Sydney Metropolitan Averages – all roads (2010–2014)			
NSW			1.24
Sydney Metropolitan Area			1.22

Source: Summarised from crash reports, 2014 and 2017

Crash rates per 100 million vehicle kilometres travelled (100MVKT) are shown in **Table 6-5**. These crash rates are calculated using the volume of traffic and distance travelled along a route, therefore offering a measure of risk per kilometre travelled. The following formula is used to calculate this rate:

$$Crash\ rate\ per\ 100\ MVKT = \frac{(Total\ no.of\ crashes\ in\ period) * (100{,}000{,}000)}{(No.of\ years * 365 * Length\ (km) * AADT)}$$

Source: Roads and Maritime Crash Data, 2016

The latest available data (for the 12-month period ending December 2013) show average fatality and injury rates across the Sydney Metropolitan Area of 0.2 and 29.4 per 100MVKT respectively. **Table 6-5** indicates that the occurrence of injury crashes is higher on Parramatta Road between Wattle Street and City Road, compared to the Sydney Metropolitan Area average, while fatal and tow-away crashes are lower. In particular, tow-away crash rates are significantly lower, with a tow-away crash rate of about 18 crashes per 100MVKT compared with about 39 crashes per 100MVKT for the Sydney Metropolitan Area.

Table 6-5 Parramatta Road between Wattle Street and City Road: crash rates per 100MVKT (Jan 2012 to Dec 2016)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
					Total	Fatal	Injury	Tow-away
Parramatta Road	Wattle Street	City Road	6.6	61,517	72.7	–	54.5	18.2
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: Summarised from crash reports, 2017

Table 6-6 provides details of the crash costs for Parramatta Road between Wattle Street and City Road. Average crash costs based on crash severity have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009). The crash costs presented in this Appendix are based on a 'willingness to pay' approach. Willingness to pay values for road safety reflect the accumulated value the NSW community is willing to pay or forgo in exchange for a reduction in the probability of crash related injuries and deaths on NSW roads.

Table 6-6 Parramatta Road from Wattle Street to City Road: crash costs (Jan 2012 to Dec 2016)

Road	Section from	Section to	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100MVKT
Parramatta Road	Wattle Street	City Road	6.6	61,517	$58,207,728	$11,641,546	$7,891,440

Source: Summarised from crash reports, 2017

6.3 Wattle Street interchange to Rozelle corridor

Key east–west movement in this corridor is focused on City West Link, Victoria Road and Parramatta Road, which fall within the Parramatta to the Sydney CBD via Strathfield and Parramatta to the Sydney CBD via Ryde transport demand corridors. The *NSW Long Term Transport Master Plan* reported low levels of performance on these corridors. On the Parramatta to the Sydney CBD via Strathfield corridor, an average variance of up to eight minutes in the AM and PM peak periods for buses was reported, while along the Parramatta to the Sydney CBD via Ryde corridor, low average peak period speeds and high variability in bus travel times was reported.

Average speed and travel times on Wattle Street/City West Link, Parramatta Road and Victoria Road, are shown in **Table 6-7**. The low speeds and long travel times indicate the peak hour congestion currently experienced along the Wattle Street interchange to Rozelle interchange corridor.

Table 6-7 Average speed and travel times along key roads within the Wattle Street interchange to Rozelle interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Wattle Street/City West Link (Parramatta Road – Victoria Road)	Eastbound	22	36	13:30	8:20
	Westbound	27	32	8:10	9:20
Parramatta Road (Wattle Street – City Road)	Eastbound	24	28	19:10	16:30
	Westbound	31	26	15:00	17:30
Victoria Road (Lyons Road – Anzac Bridge)	Eastbound	23	27	11:40	7:10
	Westbound	27	29	10:00	9:00

6.4 Rozelle and surrounds

6.4.1 Network performance

Table 6-8 presents the performance of the modelled road network for Rozelle and surrounds, as presented in **Figure 4-3**, in the 2015 base scenario for the AM and PM peak hours.

Table 6-8 Rozelle modelled network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	19,969	22,148
Total vehicle kilometres travelled in network (km)	54,959	61,980
Total time travelled approaching and in network (hr)	4,016	3,276
Total vehicles arrived	20,298	20,714
Total number of stops	267,250	133,380

Average per vehicle in network		
Average vehicle kilometres travelled in network (km)	2.7	3.0
Average time travelled in network (mins)	9.6	8.2
Average number of stops	11.5	5.6
Average speed (km/h)	16.9	21.9
Unreleased vehicles		
Unreleased demand (veh)	357	823
% of total traffic demand	2%	4%

The above results represent the peak hour – the hour with the worst traffic performance. For the AM peak period, this is 8.00 am to 9.00 am and for the PM peak period, this is 5.00 pm to 6.00 pm. The microsimulation models include a preloading period prior to the peak hour. Due to the large model area and high level of congestion in the road network, some vehicles generated in the previous hours arrive during the peak hour. As a result, in the AM peak hour, the models report a higher number of vehicles arriving at their destinations than the AM peak hour demand.

The unreleased demand indicates about four per cent of the demand during the PM peak hour remains unreleased from the origin zones in the models. Due to high congestion levels, queues extend back into zones and vehicles are unable to enter the network. This indicates the network does not have sufficient capacity to accommodate the existing demand resulting in extensive queuing from intersections. This is not unusual and occurs across many parts of the Sydney metropolitan road network during peak hours.

During the AM peak hour, Anzac Bridge/Western Distributor eastbound capacity is affected by various operational behaviours:

- The 'zipper' merge between The Crescent underpass and Victoria Road left turn
- General weaving on Anzac Bridge deck and the Western Distributor and the general constrained nature and complexity of the Western Distributor alignment and environment, worsened by short ramps and the merge and diverge areas
- Weaving effects of traffic flows to Pyrmont Bridge Road, Allen Street and King Street exit ramps and Sydney Harbour Bridge approach
- Weaving effects of traffic flows from Pyrmont Bridge Road and Harris Street entry ramps
- Tidal operations and capacity constraints on Sydney Harbour Bridge, combined with weaving and merging on the Sydney Harbour Bridge deck and approach
- Queue back effects from downstream capacity constraints at Bathurst Street.

During the AM peak hour, the capacity constraints at Bathurst Street and Sydney Harbour Bridge have the most significant impacts on the eastbound movement on the Western Distributor with extensive congestion extending back to or across Anzac Bridge.

During the PM peak hour, the westbound traffic experiences long delays at the Victoria Road/The Crescent intersection, because the intersection does not have sufficient capacity to accommodate the large westbound demands across the intersection. Long delays and queuing is also observed eastbound on Darling Street at the Victoria Road intersection and northbound on The Crescent at the Johnston Street intersection.

6.4.2 Intersection performance

Table 6-9 presents the modelled AM and PM peak hour LoS for key intersections at Rozelle. The intersection performance results show that several intersections along Victoria Road in Rozelle experience poor levels of service during the PM peak hour. The poor level of service indicates that the intersections are at or close to capacity and small increases in demand would result in large additional delays and queuing.

Table 6-9 Rozelle: modelled key intersection performance (LoS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Victoria Road/Lyons Road	D	D
Victoria Road/Wellington Street	D	B
Victoria Road/Darling Street	F	F
Victoria Road/Robert Street	D	F
Victoria Road/The Crescent	B	F
The Crescent/James Craig Road	A	B
City West Link/The Crescent	B	D
The Crescent/Johnston Street	C	F

6.4.3 Travel times and speeds

Travel time surveys were conducted in 2014 along both Victoria Road and City West Link onto Anzac Bridge. **Table 6-10** shows the average travel time on Victoria Road and Anzac Bridge between Darling Street, Rozelle and Pyrmont Bridge ramps, Pyrmont in the AM and PM peak hours. Eastbound travel time during the AM peak hour averages about six minutes, with an average speed of about 21 kilometres per hour (km/h) on a typical weekday. The westbound travel time during the PM peak hour averages about eight minutes, with an average speed of about 18 kilometres per hour. The speed limit on Victoria Road and Anzac Bridge is 60 kilometres per hour.

The eastbound direction during the AM peak hour and the westbound direction in the PM peak hour experience the most congested conditions. This is illustrated in the longer travel times and slower speeds compared to the reverse direction during these same peak periods. It is noted that the average speed in the eastbound direction during the PM peak hour is also slow – 23 kilometres per hour compared to the speed limit of 60 kilometres per hour.

Table 6-10 Travel speed and time on Victoria Road and Anzac Bridge between Darling Street, Rozelle and Pyrmont Bridge entry and exit ramp, Pyrmont

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Victoria Road/Anzac Bridge (Darling Street – Pyrmont Bridge entry and exit ramp)	Eastbound	21	23	6:20	5:40
	Westbound	35	18	3:50	7:40

Source: Based on Matrix survey data, 2014

Table 6-11 shows the average travel time on City West Link and Anzac Bridge between Catherine Street at Lilyfield and Pyrmont Bridge ramps at Pyrmont during the AM and PM peak hours. Eastbound travel time during the AM peak hour averages about 10 minutes, with an average speed of about 16 kilometres per hour on a typical weekday. Westbound travel time during the PM peak hour averages six minutes, with an average speed of about 26 kilometres per hour. The speed limit on City West Link and Anzac Bridge is 60 kilometres per hour.

The eastbound direction in the AM peak hour and the westbound direction in the PM peak hour experience the most congested conditions. This is illustrated in the longer travel times and slower speeds compared to the reverse direction in these same peak hours. Compared to the Victoria Road surveys, the eastbound direction in the PM peak hour does not experience as much congestion.

Table 6-11 Travel speed and time on City West Link and Anzac Bridge between Catherine Street, Lilyfield and Pyrmont Bridge entry and exit ramp, Pyrmont

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
City West Link/Anzac Bridge (Catherine Street – Pyrmont Bridge entry and exit ramp)	Eastbound	16	44	10:00	3:30
	Westbound	35	26	4:30	6:00

Source: Based on Matrix survey data, 2014

6.4.4 Traffic crashes

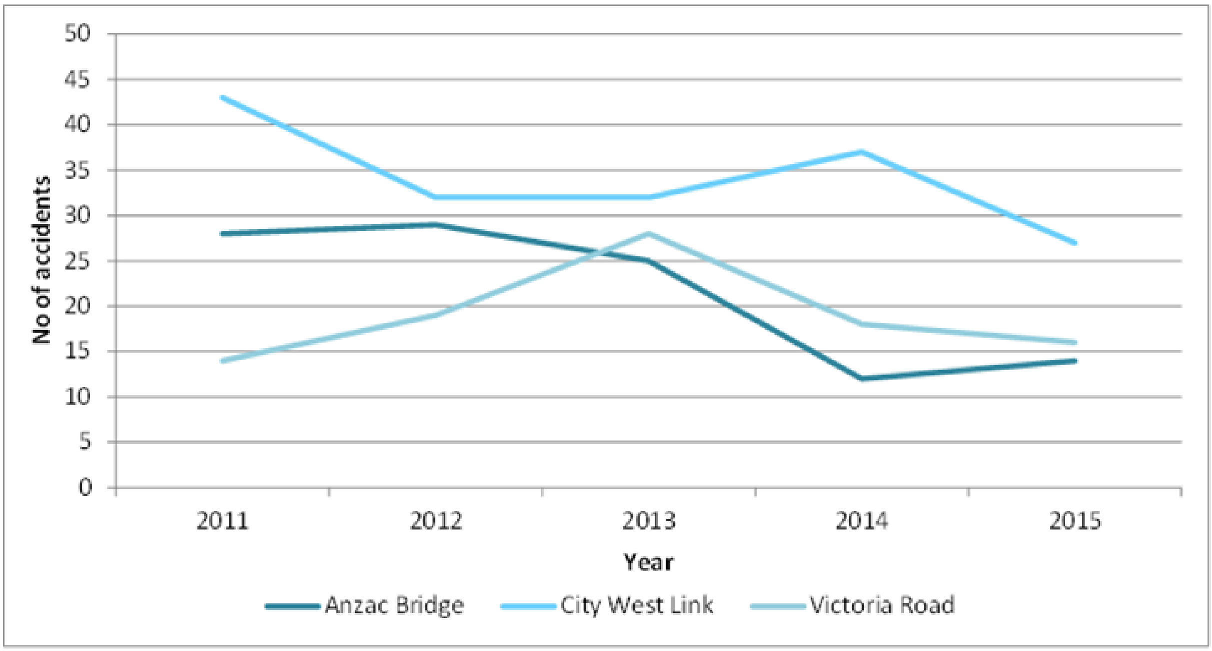
Table 6-12 summarises the crash history for five years (1 January 2011 – 31 December 2015) on the key roads around the Rozelle interchange. On key arterial roads, including Anzac Bridge and City West Link, about 60 per cent of crashes were rear-end, which is consistent with roadways approaching capacity and on which a high level of queuing occurs.

Table 6-12 Rozelle and surrounds: crash statistics (Jan 2011 to Dec 2015)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Anzac Bridge	Miller Street	Victoria Road	108	0	66	42
City West Link	James Street	Victoria Road	171	1	87	83
Victoria Road	Darling Street	The Crescent	95	1	51	43
Lilyfield Road	Victoria Road	Canal Road	41	0	28	13
The Crescent	City West Link	Wigram Road	62	0	35	27
Johnston Street	The Crescent	Parramatta Road	62	0	40	22

Source: Summarised from crash reports, 2016

Figure 6-2 presents the crash profile for the five-year period for Anzac Bridge, City West Link and Victoria Road. The profile indicates each road has a different trend, with accidents on Anzac Bridge and City West Link generally decreasing, while accidents were increasing on Victoria Road between 2011 and 2013 before decreasing between 2013 and 2015.



Source: Summarised from crash reports, 2016

Figure 6-2 Historical crash profile for Anzac Bridge, City West Link and Victoria Road

The average crash severity index on key roads in Rozelle and surrounds is about 1.29 – above the average for NSW (1.24) and the Sydney Metropolitan Area (1.22), as presented in **Table 6-13**.

Table 6-13 Rozelle and surrounds: crash severity indices (Jan 2011 to Dec 2015)

Road	Section from	Section to	Crash Severity Index
Anzac Bridge	Victoria Road	Miller Street	1.31
City West Link	James Street	Victoria Road	1.27
Victoria Road	Darling Street	The Crescent	1.29
Lilyfield Road	Victoria Road	Canal Road	1.38
The Crescent	City West Link	Wigram Road	1.28
Johnston Street	The Crescent	Parramatta Road	1.32
NSW | Sydney Metropolitan averages – all roads (2010–2014)			
NSW			1.24
Sydney Metropolitan Area			1.22

Source: Summarised from crash reports, 2014 and 2016

Table 6-14 indicates that the occurrence of fatal crashes is higher on City West Link and Victoria Road compared to the Sydney Metropolitan Area average, while crashes causing injury on Victoria Road, Lilyfield Road, The Crescent and Johnston Street are higher than the Sydney Metropolitan Area average. Injury crashes on Anzac Bridge and City West Link are lower than the Sydney Metropolitan Area average.

Table 6-14 Rozelle and surrounds: crash rates per 100MVKT (Jan 2011 to Dec 2015)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
					Total	Fatal	Injury	Tow-away
Anzac Bridge	Victoria Road	Miller Street	0.99	134,000	44.6	-	27.3	17.3
City West Link	James Street	Victoria Road	2.13	86,991	50.6	0.3	25.7	24.5
Victoria Road	Darling Street	The Crescent	0.85	83,648	73.2	0.8	39.3	33.1
Lilyfield Road	Victoria Road	Canal Road	2.48	4,301	205.5	-	143.8	66.8
The Crescent	City West Link	Wigram Road	1.32	28,010	91.9	-	51.9	40.0
Johnston Street	The Crescent	Parramatta Road	1.8	15,869	118.9	-	76.7	42.2
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: Summarised from crash reports, 2016

Table 6-15 provides details of the crash costs for the key roads surrounding the Rozelle interchange. Average crash costs based on crash severity have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009).

Table 6-15 Rozelle and surrounds: crash costs (Jan 2011 to Dec 2015)

Road	Section from	Section to	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100MVKT
Anzac Bridge	Victoria Road	Miller Street	0.99	134,000	$27,402,300	$5,480,460	$11,318,380
City West Link	James Street	Victoria Road	2.13	86,991	$41,928,450	$8,385,690	$12,399,150
Victoria Road	Darling Street	The Crescent	0.85	83,648	$26,842,450	$5,368,490	$20,686,390
Lilyfield Road	Victoria Road	Canal Road	2.48	4,301	$11,585,950	$2,317,190	$59,517,910
The Crescent	City West Link	Wigram Road	1.32	28,010	$14,570,050	$2,914,010	$21,592,910
Johnston Street	The Crescent	Parramatta Road	1.8	15,869	$16,579,300	$3,315,860	$31,803,960

Source: Summarised from crash reports, 2016

6.5 Rozelle to St Peters interchange corridor

Several of the key north–south links between the proposed Rozelle interchange and St Peters interchange areas lie within the Sydney Airport to the CBD transport demand corridor. The *NSW Long Term Transport Master Plan* reported high levels of transport congestion on this corridor, with Southern Cross Drive reported to operate at capacity during the AM peak period with low average speeds of 35 kilometres per hour, which diverted traffic onto adjacent arterial roads including O'Riordan and Bourke Streets, which were also congested.

Average speeds and travel times on key road links within the Rozelle to St Peters interchange corridor are shown in **Table 6-16**. Southern Cross Drive, posted at 80 kilometres per hour, exhibits the slow speeds described above especially in the peak directions, while conditions on Botany Road and Princes Highway/King Street, posted at 50 or 60 kilometres per hour on different sections, indicate the congestion on the surface road network in this corridor.

Table 6-16 Average speed and travel times along key roads within Rozelle to Wattle Street interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Southern Cross Drive	Northbound	28	39	8:00	5:40
(Gardeners Road – Cleveland Street)	Southbound	50	32	4:30	7:00
Botany Road	Northbound	28	23	6:20	7:40
(Gardeners Road – Raglan Street)	Southbound	24	25	7:10	7:10
Princes Highway/King Street	Northbound	24	22	11:10	12:00
(Canal Road to Broadway)	Southbound	25	24	10:50	11:30

6.6 St Peters interchange and surrounds

Network performance and intersection performance analysis around the St Peters interchange is presented in **section 6.6.1** and **section 6.6.2**. It is noted that currently traffic conditions around the St Peters interchange are temporarily altered due to the construction of the New M5 project. To allow an assessment that reflects the unaltered road network performance, the network performance reported is for the situation prior to this construction commencing.

6.6.1 Network performance

Table 6-17 presents the performance of the modelled road network for St Peters and surrounds, as presented in **Figure 4-4**, in the 2015 'base case' scenario modelled for the AM and PM peak hours. The results indicate a similar level of demand in each peak hour, with a similar level of network performance in each peak hour.

Table 6-17 St Peters interchange modelled network performance – 2015 AM and PM peak hour

Network measure	AM peak hour	PM peak hour
All vehicles		
Total traffic demand (veh)	22,080	21,390
Total vehicle kilometres travelled in network (km)	62,220	59,650
Total time travelled in network (hr)	2,350	2,370
Total vehicles arrived	21,840	21,160
Total number of stops	105,830	101,670
Average per vehicle in network		
Average vehicle kilometres travelled in network (km)	2.6	2.6
Average time travelled in network (mins)	5.8	5.9
Average number of stops	4.8	4.8

Average speed (km/h)	26.8	26.1
Unreleased vehicles		
Unreleased demand (veh)	90	250
% of total traffic demand	0%	1%

6.6.2 Intersection performance

Table 6-18 presents the AM and PM peak hour intersection average delays and LoS for the existing situation at St Peters. The intersection performance results demonstrate several intersections in the vicinity of the new St Peters interchange experience significant congestion during the AM and PM peak hours. The poor LoS indicates the local network is at capacity and vulnerable to small increases in demand without improvements to intersection layouts.

Table 6-18 St Peters interchange: modelled key intersection performance (LoS) – 2015 AM and PM peak hour

Key intersections	AM peak hour	PM peak hour
Princes Highway/Sydney Park Road	C	D
Princes Highway/May Street	D	F
Princes Highway/Canal Road	D	D
Princes Highway/Railway Road	F	D
Sydney Park Rd/Mitchell Road	C	D
Euston Road/Sydney Park Road	A	B
Unwins Bridge Road/Campbell Street	C	D
Campbell Road/Euston Road	A	A
Campbell Road/Bourke Road	C	D
Princes Highway/Campbell Street	C	C
Ricketty Street/Kent Road	A	A
Gardeners Road/Kent Road	C	D
Gardeners Road/Bourke Road	D	E

6.6.3 Traffic crashes

Table 6-19 summarises the crash history for a five-year period (1 January 2009 to 31 December 2013) for key roads around the St Peters interchange that were identified as warranting additional attention based on crash density mapping.

Table 6-19 St Peters and surrounds: crash statistics (Jan 2009 to Dec 2013)

Road	Section from	Section to	Crashes			
			Total	Fatal	Injury	Tow-away
Princes Highway	Enmore Road	Gannon Street	407	2	189	216
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	248	1	100	147
Euston Road	Sydney Park Road	Campbell Road	21	0	13	12
Bourke Road	Wyndham Street	Gardeners Road	69	0	35	34

Source: Summarised from crash reports, 2014

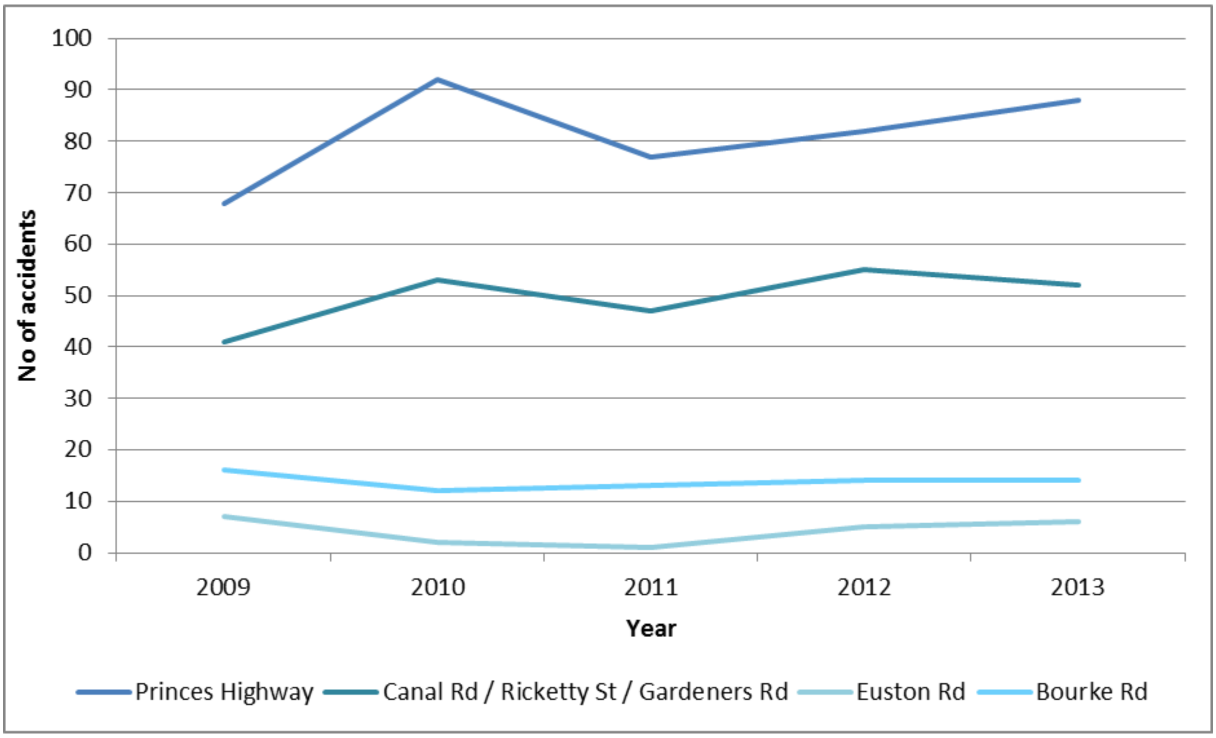
Figure 6-3 presents the crash profile for the five-year period for the four sections of roads. Bourke Road and Euston Road reflect a fairly constant accident rate over the five years, while Canal Road, Ricketty Street, Gardeners Road and the Princes Highway show an inconsistent profile.

The average crash severity indices in the St Peters area range from 1.21 to 1.50. The Princes Highway, Bourke Road and especially Euston Road have averages higher than the NSW and Sydney Metropolitan Area average, as presented in **Table 6-20**.

Table 6-20 St Peters and surrounds: crash severity indices (Jan 2009 to Dec 2013)

Road	Section from	Section to	Crash severity index
Princes Highway	Enmore Road	Gannon Street	1.24
Canal Road/ Ricketty Street/Gardeners Road	Princes Highway	Botany Road	1.21
Euston Road	Sydney Park Road	Campbell Road	1.50
Bourke Road	Wyndham Street	Gardeners Road	1.25
NSW | Sydney Metropolitan Averages – all roads (2010–2014)			
NSW (2008–2012)			1.24
Sydney Metropolitan Area (2008–2012)			1.22

Source: Summarised from crash reports, 2014



Source: Summarised from crash reports, 2014

Figure 6-3 Historical crash profile (Jan 2009 to Dec 2013)

Table 6-21 indicates the occurrence of fatal crashes and crashes causing injury on the Princes Highway, Canal Road, Ricketty Street and Gardeners Road is higher than the Sydney Metropolitan Area average, but the occurrence of crashes causing injury or tow-away on Euston Road is significantly higher than the Sydney Metropolitan Area average. Euston Road also has a very high crash rate compared to other roads in the area.

Table 6-21 St Peters and surrounds: crash rates per 100MVKT (Jan 2009 to Dec 2013)

Road	Section from	Section to	Section length (km)	ADT (veh)	Crash rates per 100MVKT			
					Total	Fatal	Injury	Tow-away
Princes Highway	Enmore Road	Gannon Street	3.8	50,981	115.1	0.6	53.5	61.1
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	39,599	143.0	0.6	57.7	84.8
Euston Road	Sydney Park Road	Campbell Road	0.9	4,810	265.8	–	164.5	151.9
Bourke Road	Wyndham Street	Gardeners Road	2.1	11,430	157.5	–	79.9	77.6
Sydney Metropolitan Area (1 Jan 2013 to 31 Dec 2013)					68.8	0.2	29.4	39.2

Source: Summarised from crash reports, 2014

Table 6-22 provides details of the crash costs for roads in the St Peters area. Average crash costs, based on crash severity, have been calculated using Roads and Maritime's Economic Analysis Manual (Economic Parameters for 2009). Again, Euston Road stands out as a section of road with a very high crash cost compared to other roads in the area.

Table 6-22 St Peters and surrounds: crash costs (Jan 2009 to Dec 2013)

Road section	Section length (km)	ADT (veh)	Total cost	Crash cost Average annual cost	Cost per 100MVKT
Princes Hwy (Enmore Rd – Gannon St)	3.8	50,981	$90,414,400	$18,082,880	$25,573,070
Canal Rd/Ricketty St/Gardeners Rd (Princes Hwy – Botany Rd)	2.4	39,599	$47,780,050	$9,556,010	$27,547,890
Euston Road (Sydney Park Rd – Campbell Rd)	0.9	4,810	$5,427,800	$1,085,560	$68,702,630
Bourke Road (Wyndham St – Gardeners Rd)	2.1	11,430	$14,627,100	$2,925,420	$33,391,030

Source: Summarised from crash reports, 2014

6.7 Wattle Street interchange to St Peters interchange corridor

As detailed in **section 5.7**, a primary freight route exists between the Wattle Street interchange and St Peters interchange via Parramatta Road, Old Canterbury Road, Railway Terrace, Gordon Street, Livingstone Road, Sydenham Road, Gleeson Avenue and Railway Road. An alternative route option runs along Parramatta Road, Stanmore Road and Edgeware Road. Roads identified on these routes perform a mix of functions (mobility and access), which consequently conflict during peak periods resulting in a drop in the operational performance.

Average speeds and travel times on the primary freight route, described above, within the Wattle Street interchange to St Peters interchange corridor are shown in **Table 6-23**. The low speeds and long travel times indicate the peak hour congestion currently experienced along this route.

Table 6-23 Average speed and average travel time along key roads within the Wattle Street interchange to St Peters interchange corridor (2016 survey data)

Location	Direction	Average speed (km/hr)		Average travel time (min:sec)	
		AM peak	PM peak	AM peak	PM peak
Railway Terrace/Livingstone Road/Sydenham Road/Railway Road (Old Canterbury Rd – Princes Highway)	Northbound	18	19	13:10	12:40
	Southbound	22	23	11:20	11:10

7 Assessment of construction impacts

7.1 Construction overview

Surface areas would be required to support tunnelling activities, construct the tunnel portals, the Rozelle interchange and Iron Cove Link, works at the Wattle Street interchange and St Peters interchange, surface roadworks to the local network, ventilation facilities, tunnel support facilities and other ancillary operations buildings and facilities.

Construction of the project is expected to be around five years (2018 to 2023), which includes commissioning that would occur concurrently with the final stages of construction, and would include (but not be limited to) the following:

- Enabling and temporary works, including provision of construction power and water supply, ancillary site establishment including establishment of acoustic sheds and construction hoarding, demolition works, property and utility adjustments and public and active transport modifications (if required)
- Construction compound establishment, including erection of acoustic sheds, intersection adjustments and provision of site access
- Construction of the road tunnels, interchanges, intersections, and roadside and ancillary infrastructure
- Haulage of spoil generated during tunnelling and excavation activities
- Fitout of the road tunnels and support infrastructure, including ventilation and emergency response systems
- Construction and fitout of the motorway operations complexes
- Realignment, modification or replacement of surface roads, bridges and/or underpasses
- Environmental management and pollution control facilities for the project.

Civil works including earthworks and construction of underpasses and retaining structures would be required at multiple locations along the project. Associated surface road works may require temporary traffic and/or cyclist and pedestrian detours, road occupation, temporary changes to road markings or temporary road closures. These would be undertaken in accordance with approvals required by Roads and Maritime or relevant road authority, as required. Following exhibition of the EIS, the Response to Submissions and Preferred Infrastructure Report would likely describe some changes to the indicative construction plans reported in this section and the resultant traffic, safety and construction management plans would then form part of the road occupancy licences for the construction works.

Temporary works are proposed at various stages of construction, such as temporary diversions for road, cycle and pedestrian traffic near work areas, and alternative arrangements where property accesses may be temporarily disrupted.

Tunnelling and associated above-ground tunnelling support activities are proposed to operate 24 hours a day, seven days a week. Other activities that would potentially impact on the performance of the road network would be scheduled for periods of typically lower traffic volumes, where feasible and reasonable, to minimise potential disruption to the regional and local traffic network.

Heavy vehicles would be required to deliver and remove construction plant, equipment and materials as well as remove waste from the project sites. Waste removal would include general construction waste, office waste and spoil from tunnelling activities. The construction period would also result in increased use of light vehicles on the surrounding road network to cater for the construction workforce, including shift workers for tunnelling activities.

Twelve construction ancillary facilities are described and assessed in this EIS. This includes two options for construction ancillary facilities around Haberfield that have been grouped together in this EIS and are denoted by the prefix *a* (for Option A) or *b* (for Option B) (eg C1a Wattle Street civil and tunnel site, which is part of Option A). Although both of these options have been assessed in this EIS, only one of these options would be used during construction. The construction ancillary facilities required to support construction of the project include:

- Construction ancillary facilities at Haberfield (Option A), comprising:
  - Wattle Street civil and tunnel site (C1a)
  - Haberfield civil and tunnel site (C2a)
  - Northcote Street civil site (C3a)
- Construction ancillary facilities at Ashfield and Haberfield (Option B), comprising:
  - Parramatta Road West civil and tunnel site (C1b)
  - Haberfield civil site (C2b)
  - Parramatta Road East civil site (C3b)
- Darley Road civil and tunnel site (C4)
- Rozelle civil and tunnel site (C5)
- The Crescent civil site (C6)
- Victoria Road civil site (C7)
- Iron Cove Link civil site (C8)
- Pyrmont Bridge Road tunnel site (C9)
- Campbell Road civil and tunnel site (C10).

Surface construction works (such as for ancillary infrastructure, portal works, and integrations to the M4 East and New M5 Motorway and surface roads) and the establishment of construction sites with their associated entry/exit points may result in a number of traffic related impacts including temporary alterations to:

- Existing property access
- Existing pedestrian and cyclist access and movements
- Location of existing bus stops
- Local traffic environment.

Temporary road closures associated with the works are detailed in **section 7.4.4**, while temporary impacts on bus stop locations are detailed in **section 7.4.6**. Temporary changes to pedestrian and cyclist access and movements are summarised in **section 7.4.7**.

Site management works would also occur within the Rozelle Rail Yards at Rozelle before the commencement of construction of the M4-M5 Link. Site management works have commenced, with completion planned for 2018 and would be carried out in accordance with a separate planning approval issued in April 2017.

7.2 Construction ancillary facilities

The construction ancillary facilities would be used for a mix of civil surface works, tunnelling support and administrative purposes. The project footprint and construction ancillary facilities are shown in overview in **Figure 7-1**. Details of each of these facilities are provided in the following sections.

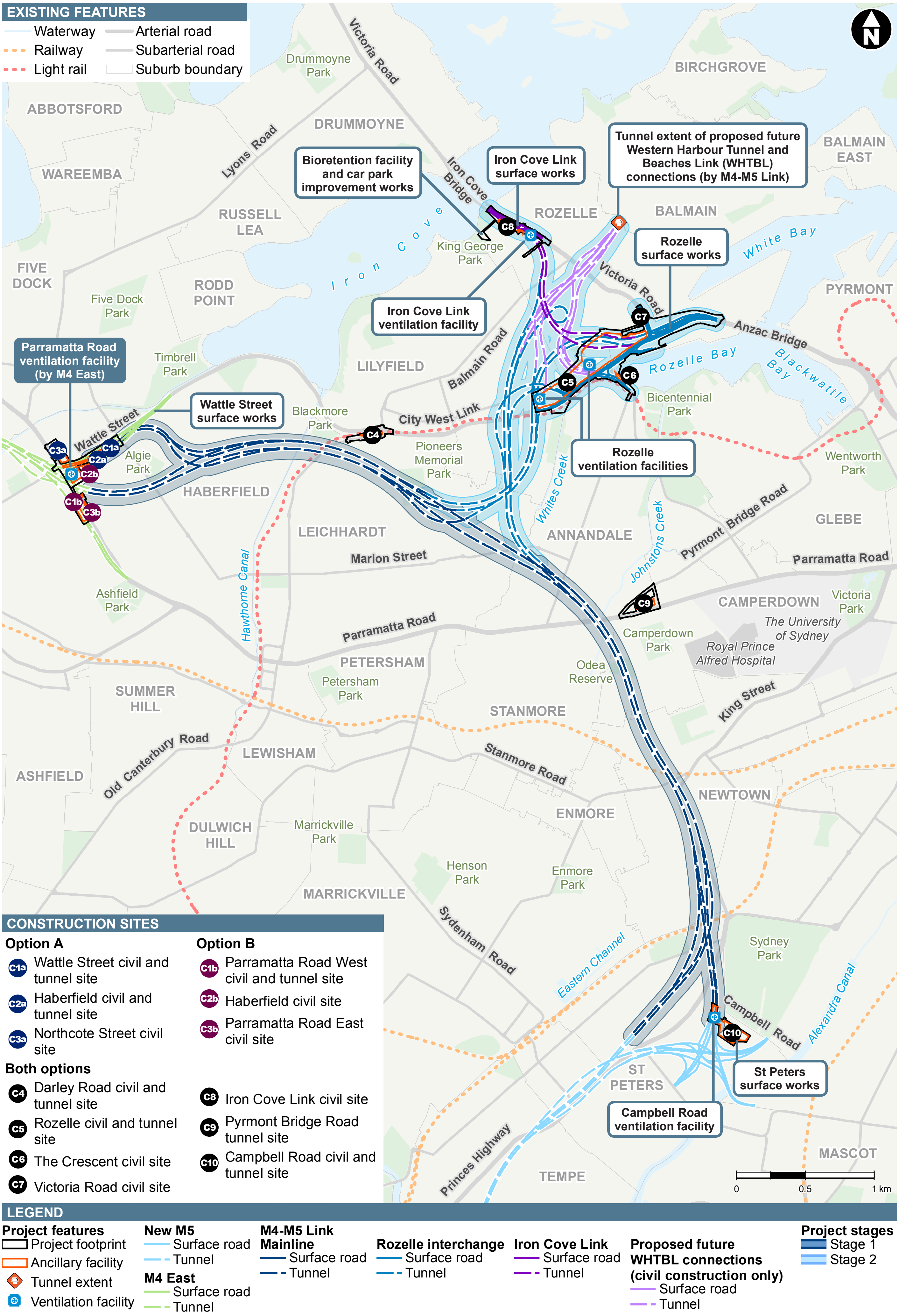


Figure 7-1 Project footprint and overview of construction ancillary facilities

7.2.1 Haberfield Option A – Wattle Street civil and tunnel site (C1a)

Location and construction activities

The Wattle Street civil and tunnel site would be located above and below ground along Wattle Street at Haberfield between Parramatta Road and Ramsay Street. This construction ancillary facility would use land above ground that is currently being used as a construction zone for the M4 East project.

Roadheaders would be launched below ground from this site to excavate the tunnels that would connect the Wattle Street entry and exit ramps with the M4-M5 Link mainline tunnels. Works at this site would also be supported by the facilities at Haberfield civil and tunnel site (C2a) and car parking and laydown at Northcote Street civil site (C3a).

Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonably practical management strategies would be investigated to minimise the volume of heavy vehicle movements at night.

An indicative construction site layout for the Wattle Street civil and tunnel site is shown in **Figure 7-2** and an indicative cross-section showing how spoil would be managed within the entry and exit ramps is shown in **Figure 7-3**. The construction activities program relevant to the site is outlined in **Table 7-1**.

Table 7-1 Wattle Street civil and tunnel site indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Below ground site set up					■	■										
Tunnelling					■	■	■	■	■	■						
Civil and mechanical fitout										■	■	■				
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	■

Entry and exit

The Wattle Street interchange entry and exit ramps that will be constructed as part of the M4 East project would be used for spoil removal. Heavy vehicles would enter the site via the eastbound entry ramp, be loaded with spoil underground within the tunnels, and then exit the site to Wattle Street via the westbound exit ramp. Light vehicles would enter and exit the site via a left-in/left-out arrangement off the eastbound Wattle Street carriageway.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from Wattle Street.

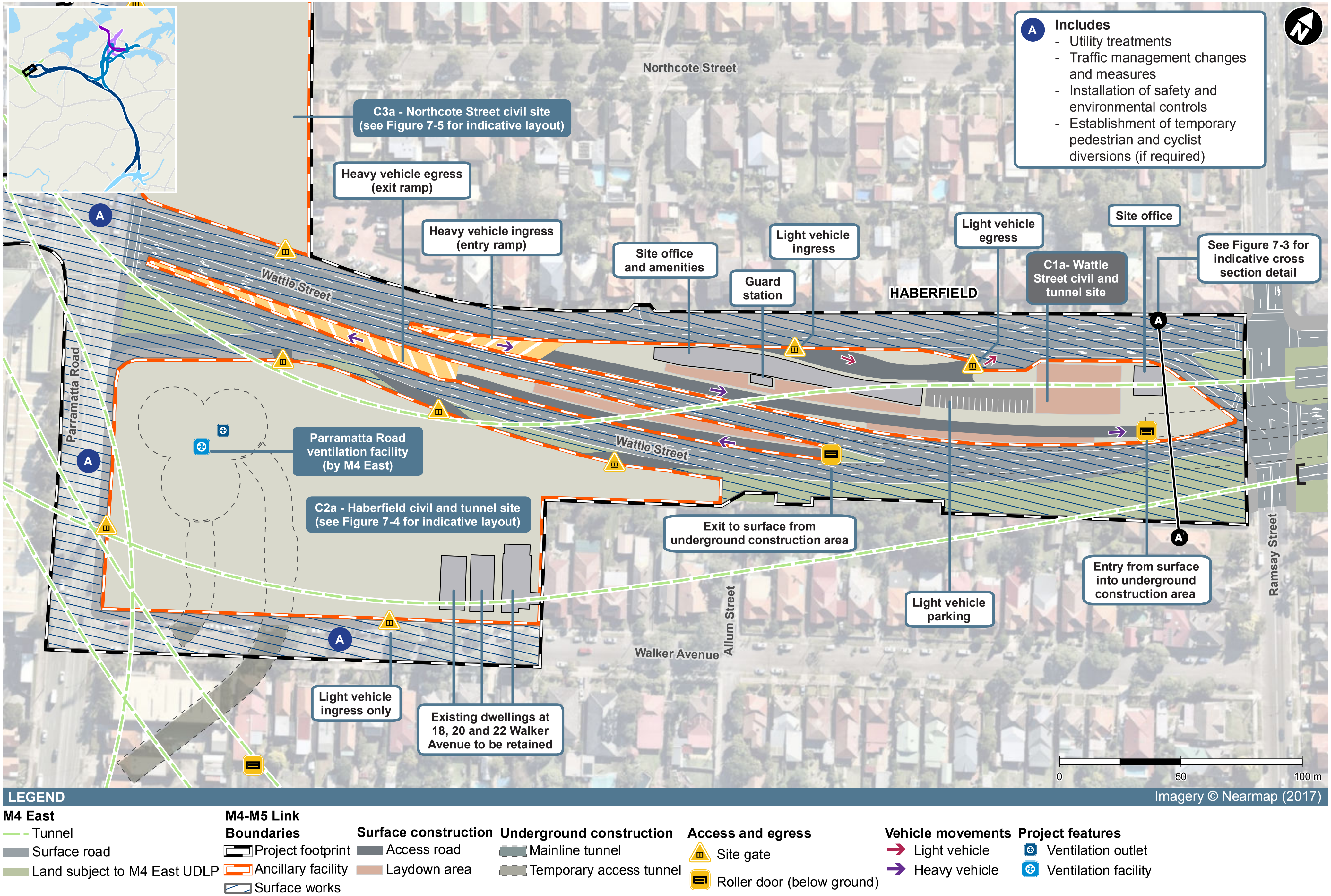
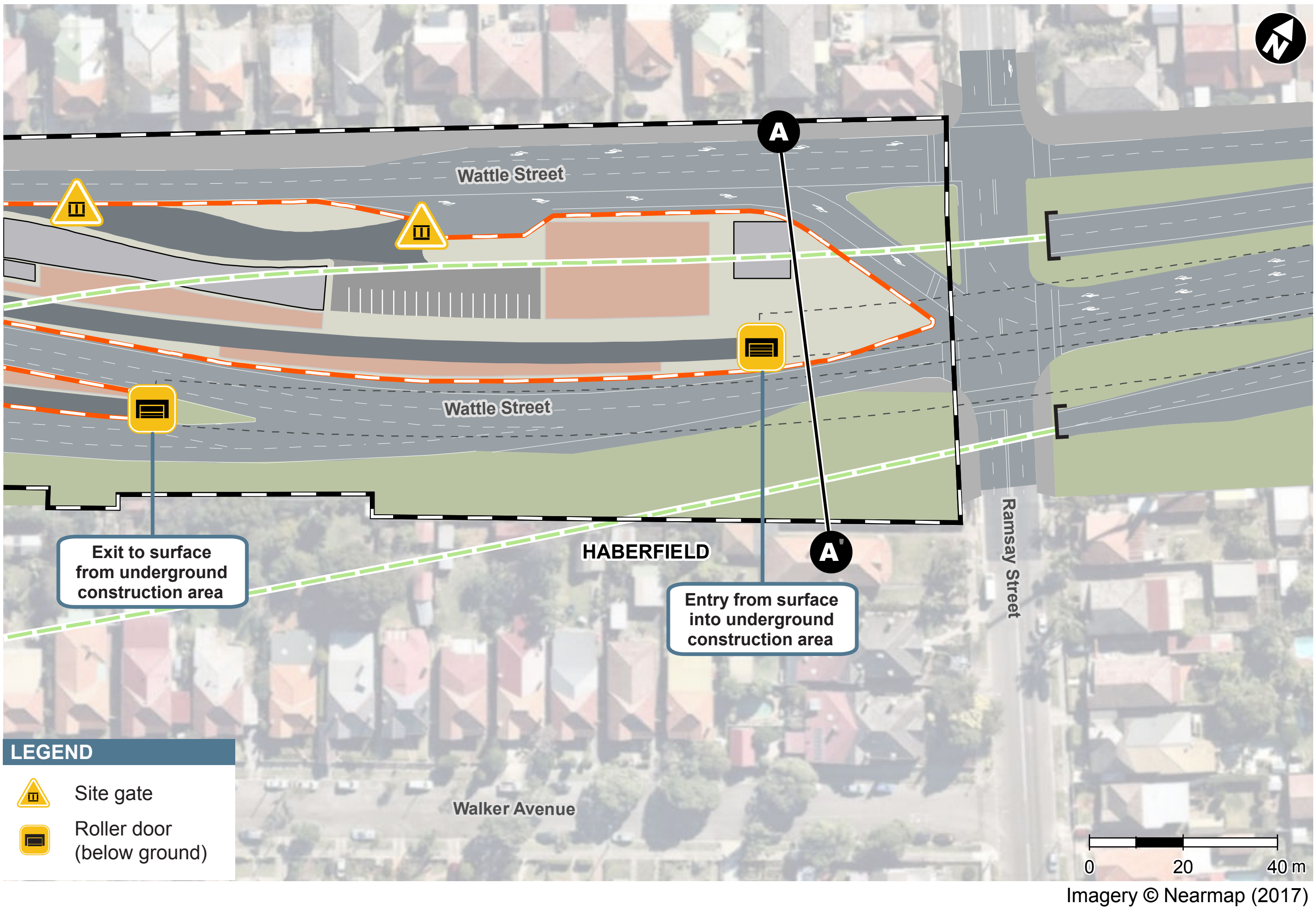


Figure 7-2 Indicative Wattle Street civil and tunnel site (C1a) layout



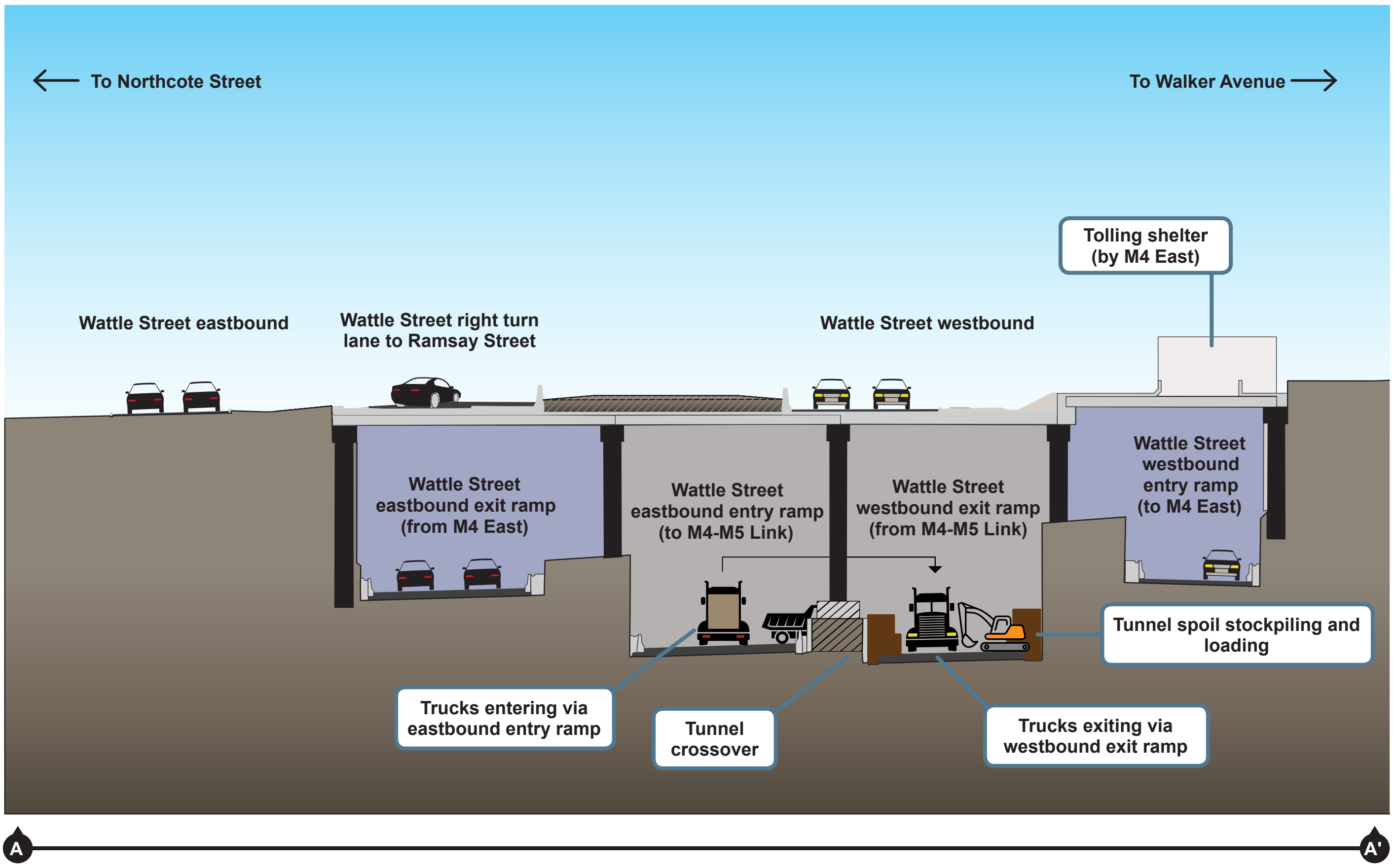


Figure 7-3 Indicative Wattle Street civil and tunnel site (C1a) cross section

7.2.2 Haberfield Option A – Haberfield civil and tunnel site (C2a)

Location and construction activities

The Haberfield civil and tunnel site would be located above and below ground around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue. This construction ancillary facility would use land above ground that is currently being used as a construction ancillary facility for the M4 East project.

The below ground section of the Haberfield civil and tunnel site would be within the M4 East tunnel stubs being built by the M4 East project and would support tunnelling of the mainline tunnels. The above ground section of the site would be used to support civil construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed as part of the M4 East project).

Roadheaders would be launched from this site below ground to excavate the mainline tunnels. Spoil handling on the site would occur 24 hours a day, seven days a week. Excavated spoil from tunnelling would only be stockpiled within the M4 East tunnel stubs. An indicative construction site layout for the Haberfield civil and tunnel site is shown in **Figure 7-4** and a construction activities program relevant to the site is outlined in **Table 7-2.**

Table 7-2 Haberfield civil and tunnel site indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Below ground site set up				■	■	■										
Establish temporary ventilation systems for Wattle Street and mainline				■	■											
Fitout of ventilation station and substation						■	■	■	■	■	■	■				
Tunnelling					■	■	■	■	■	■						
Civil and mechanical fitout										■	■	■				
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	■

Entry and exit

Trucks would enter the eastbound stub tunnel from the M4 East mainline tunnels, be loaded with spoil, and exit to the westbound M4 East mainline tunnels. No tunnel spoil would be removed to the surface via the Haberfield civil and tunnel site – all spoil would be transported below ground via the M4 East mainline tunnels.

Heavy vehicles delivering materials and equipment would enter and exit the surface section of the Haberfield civil and tunnel site via the westbound Wattle Street carriageways. Light vehicles would enter and exit the site via the westbound Wattle Street carriageways, the southbound Parramatta Road carriageways, and via Walker Avenue.

Local road impacts

While Walker Avenue is a local road, only 90 daily light vehicle trips are expected to access the site, and these trips are distributed between three accesses. The impact on Walker Avenue is expected to be minor. The majority of workforce car parking for this area would be located at the Northcote Street civil site (C3a).

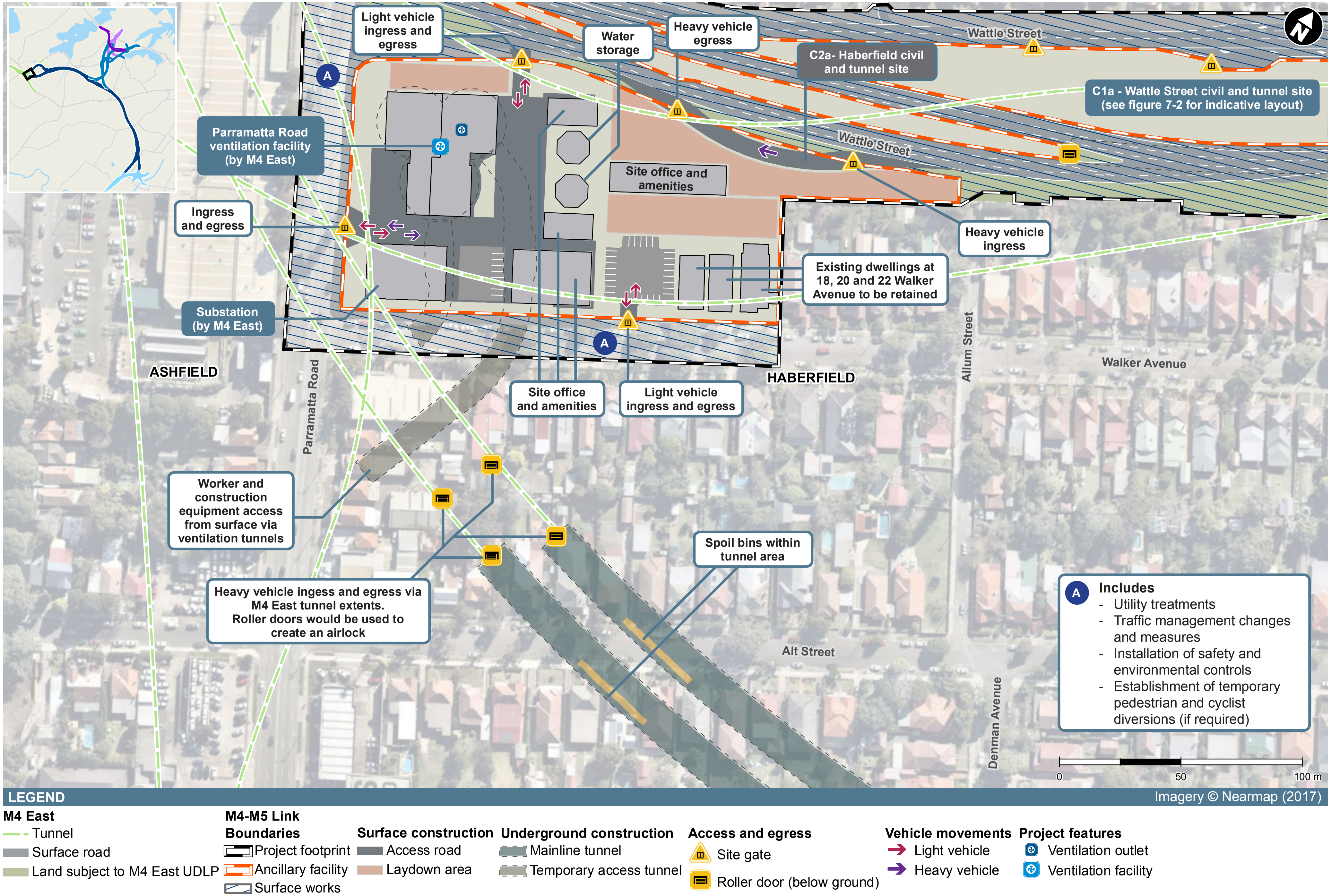


Figure 7-4 Indicative Haberfield civil and tunnel site (C2a) layout

7.2.3 Haberfield Option A – Northcote Street civil site (C3a)

Location and construction activities

The Northcote Street civil site at Haberfield would be located between Wattle Street and Wolseley Street at Haberfield. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project. The site would be used for construction workforce parking and to support construction activities at the nearby civil and tunnel sites, including laydown and storage of materials.

The use of the laydown area and light vehicle parking would occur 24 hours a day, seven days a week. Reasonable practical management strategies would be investigated to minimise the volume of heavy vehicles using the laydown area at night.

An indicative construction site layout for the site is shown in **Figure 7-5** and an indicative program for works to be carried out within the Northcote Street civil site is provided in **Table 7-3**.

Table 7-3 Northcote Street civil site indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Site establishment and utility works				■	■	■										
Construct car park				■	■											
Construct laydown area				■	■											
Operation of car park and laydown area					■	■	■	■	■	■	■	■	■	■		
Site rehabilitation and landscaping															■	■

Entry and exit

Heavy vehicles would enter and exit the site to and from Parramatta Road. Light vehicles would enter the site via Wolseley Street and an egress only point for light vehicles would be provided on to Wattle Street. During construction, Northcote Street would be closed at the intersection with Parramatta Road and the site would occupy around 100 metres of Northcote Street east of Parramatta Road. Northcote Street would be reopened to Parramatta Road when construction is complete.

Local road impacts

Wolseley Street is a local road and 150 daily light vehicle trips are expected to be accessing the site. While these trips would only be accessing from Wolseley Street with egress onto Wattle Street, there is likely to be a minor impact on Wolseley Street. No heavy vehicle impacts are expected on local roads with heavy vehicle access and egress taken directly to and from Parramatta Road.

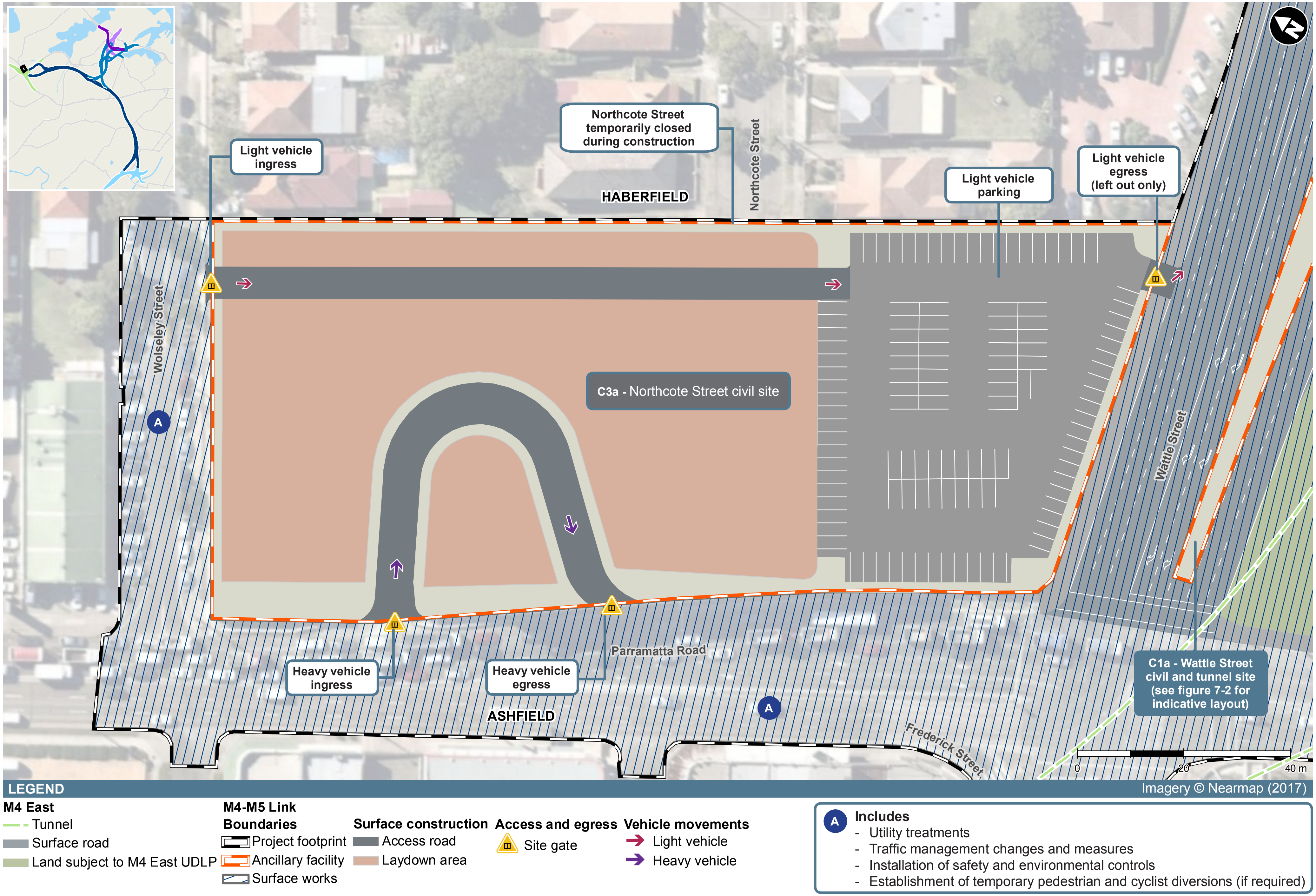


Figure 7-5 Indicative Northcote Street civil site (C3a) layout

7.2.4 Haberfield and Ashfield Option B – Parramatta Road West civil and tunnel site (C1b)

Location and construction activities

The Parramatta Road West civil and tunnel site (C1b) would be used where Option B is selected as the preferred construction option at Haberfield. This site would not be used if Option A is selected as the preferred option.

The Parramatta Road West civil and tunnel site (C1b) would be located west of Parramatta Road between Alt Street and Bland Street at Ashfield. The site is currently occupied by several commercial properties. Residential properties including single dwelling and apartment blocks are located to the immediate west and north. A construction site for the M4 East project is located to the south. Spoil handling on the site would occur 24 hours a day, seven days a week, within an acoustic shed.

An indicative construction site layout for the site is shown in **Figure 7-6** and an indicative program for works to be carried out within the site is provided in **Table 7-4**.

Table 7-4 Parramatta Road West civil and tunnel site indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works				■	■	■														
Construction of temporary access tunnel						■	■													
Tunnelling								■	■	■	■	■	■							
Civil and mechanical fitout													■	■	■	■	■			
Testing and commissioning																	■	■		
Site rehabilitation																		■		

Entry and exit

Construction traffic would enter and exit the site to and from the western (northbound) carriageway of Parramatta Road via new driveways. There will also be cross-over on Alt Street.

Local road impacts

It is expected that heavy vehicle impacts on local roads will be minimised with heavy vehicle access and egress taken directly from and to Parramatta Road. The cross-over on Alt Street is likely to cause minor impacts on Alt Street. Due to existing property driveways, there would be no loss of on-street parking on Alt Street or Bland Street, west of Parramatta Road.

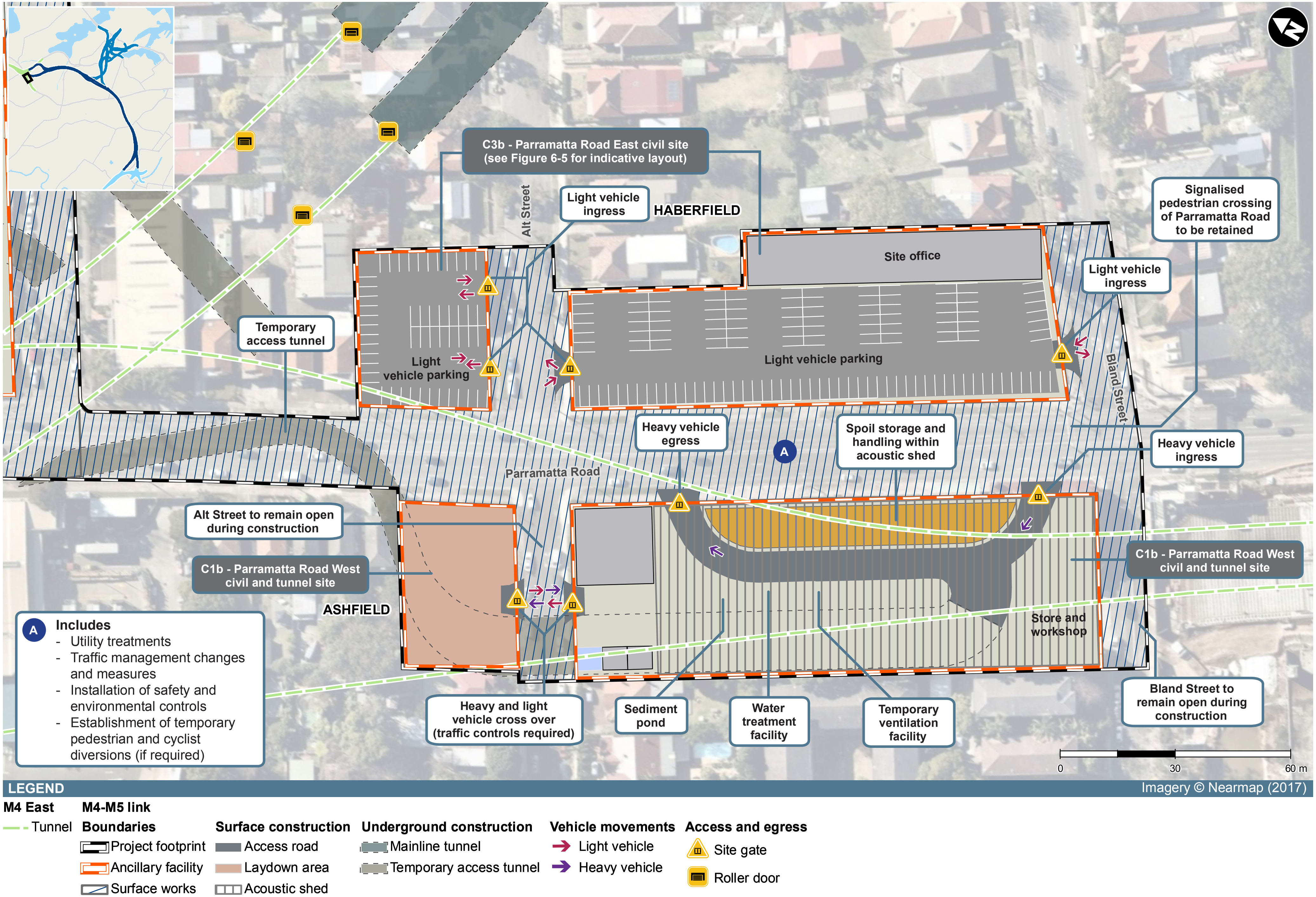


Figure 7-6 Indicative Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b) layout

7.2.5 Haberfield and Ashfield Option B – Haberfield civil site (C2b)

Location and construction activities

The Haberfield civil site (C2b) would be used for civil construction where Option B is selected as the preferred construction option at Haberfield. If Option A is selected as the preferred option, the Haberfield civil and tunnel site (C2a) would be used.

The Haberfield civil site would be located around the south-eastern corner of the Parramatta Road and Wattle Street intersection, extending along Parramatta Road between Wattle Street and Walker Avenue. This construction ancillary facility would use land that is currently being used as a construction ancillary facility for the M4 East project.

The Haberfield civil site (C2b) would be used to support civil construction of a substation, and fitout of permanent operational infrastructure including the Parramatta Road ventilation facility (being constructed as part of the M4 East project).

An indicative construction site layout for the Haberfield civil site is shown in **Figure 7-7** and an indicative program for works to be carried out within the site is provided in **Table 7-5**.

Table 7-5 Haberfield civil site indicative construction program

Construction activity	Indicative construction timeframe															
	2019				2020				2021				2022			
Initial road works and traffic management			■													
Site establishment and utility works			■	■	■	■										
Fitout of Parramatta Road ventilation facility and substation						■	■	■	■	■	■	■				
Civil and mechanical fitout										■	■	■	■			
Testing and commissioning												■	■	■	■	
Site rehabilitation and landscaping															■	

Entry and exit

Heavy vehicles delivering materials and equipment would enter and exit the site via the westbound Wattle Street carriageways. Light vehicles would enter and exit the site via Wattle Street and Walker Avenue.

Local road impacts

While Walker Avenue is a local road, only 90 daily light vehicle trips are expected to be accessing the site, and these trips are distributed between three accesses. The impact on Walker Avenue is therefore expected to be minor. The majority of workforce car parking for this area would be located at the Parramatta Road East civil site (C3b).

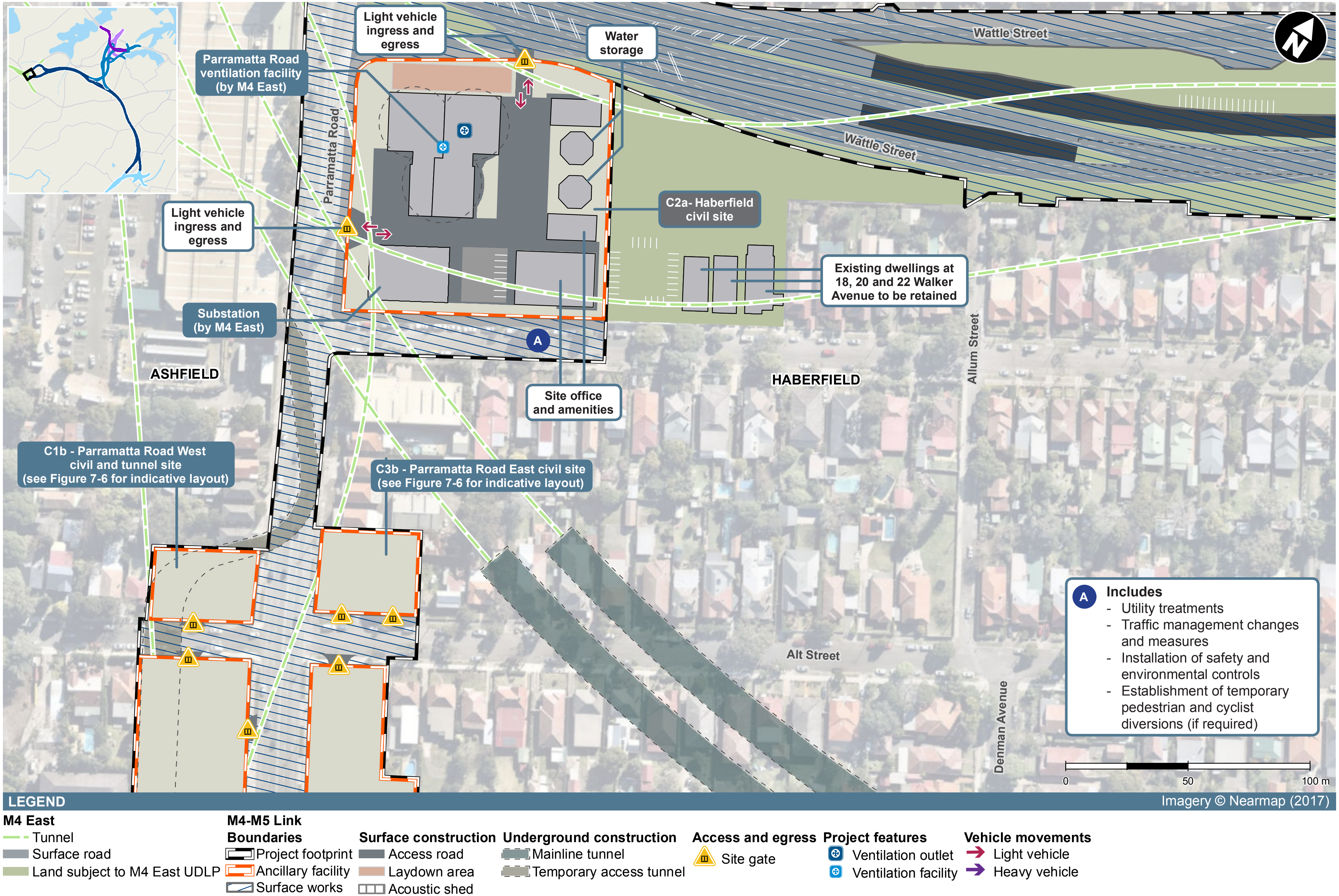


Figure 7-7 Indicative Haberfield civil and tunnel site (C2b) layout

7.2.6 Haberfield and Ashfield Option B – Parramatta Road East civil site (C3b)

Location and construction activities

The Parramatta Road East civil site (C3b) would be used where Option B is selected as the preferred construction option at Haberfield. This site would not be used if Option A is selected as the preferred option.

The Parramatta Road East civil site (C3b) would be located east of Parramatta Road at Haberfield between around Alt Street and Bland Street. The site is currently occupied by the Muirs car dealership. Residential properties are located to the immediate east and north. A construction site for the M4 East project is located to the south.

The Parramatta Road East civil site (C3b) would be used to support tunnelling construction activities that would occur at the Parramatta Road West civil and tunnel site (C1b) and to provide construction workforce parking.

An indicative construction site layout for the Parramatta Road East civil site is shown in **Figure 7-8** and an indicative program for works to be carried out within the site is provided in **Table 7-6**.

Table 7-6 Parramatta Road East civil site indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■																		
Use of car park and site amenities during construction						■	■	■	■	■	■	■	■	■	■	■	■	■	■					
Demobilisation																			■					

Entry and exit

Heavy vehicles delivering materials and equipment would enter and exit via the southbound Parramatta Road carriageways. In addition to using the Parramatta Road access, light vehicles would enter and exit the site using Alt Street and Bland Street accesses.

Local road impacts

With 150 daily light vehicle trips expected split between the three accesses, the potential impact on Alt Street and Bland Street is expected to be minor. Due to existing property driveways, there would be no loss of on-street parking on Alt Street or Bland Street, east of Parramatta Road.

7.2.7 Darley Road civil and tunnel site (C4)

Location and construction activities

The Darley Road civil and tunnel site would be located between the Inner West light rail corridor to the north and Darley Road to the south. The site is currently occupied by a commercial property. Immediately adjacent in the northeast corner of the site is the Leichhardt North light rail stop.

Spoil handling on the site would occur 24 hours a day, seven days a week, within an acoustic shed. Spoil removal would occur between 7.00 am and 6.00 pm Monday to Friday, and between 8.00 am and 1.00 pm on Saturdays. Where practical, spoil would be removed during the day, outside of peak periods. The location of the construction ancillary facility and an indicative layout of the site are shown in **Figure 7-8**. An indicative program for works to be conducted within the Darley Road civil and tunnel site is provided in **Table 7-7**.

Table 7-7 Darley Road civil and tunnel site indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works			■	■	■															
Construction of temporary access tunnel				■	■															
Tunnelling					■	■	■	■	■	■	■	■	■							
Civil and mechanical fitout											■	■	■	■	■					
Testing and commissioning															■	■	■	■	■	
Site rehabilitation and landscaping																		■	■	■

Entry and exit

It is anticipated that the majority of construction traffic would enter the site from the southern (westbound) carriageway of Darley Road via new driveways. Heavy vehicles associated with spoil haulage would travel eastbound on City West Link and turn right into Darley Road. A temporary right turn lane at the intersection of City West Link and Darley Road would be provided for use by construction vehicles. Heavy vehicles would exit the site by turning left onto Darley Road before turning left onto City West Link.

The southern approach of the City West Link/James Street intersection has a blind corner and a steep approach, which could cause difficulties for trucks departing the Darley Road civil and tunnel site and turning left onto City West Link Road westbound. Traffic signal phasing and timing would need to consider this to allow loaded trucks to safely traverse the intersection and these signal phasing and timing changes were included in the construction traffic assessment.

Local road impacts

Temporary changes to Darley Road to enable access to and from the ancillary facility would likely be required, including changes to lane marking to provide a temporary turning lane for construction traffic and temporary diversions to the pedestrian path on the northern side of Darley Road. These would be confirmed following the appointment of a design and construction contractor and in consideration of the safety and function of the road network, maintaining access to the Leichhardt North light rail stop and providing for continued pedestrian and cyclist movement.

On-street parking along the eastbound carriageway of Darley Road between around Francis Street and Charles Street would be removed (about 20 spaces) during construction. Impacts on the kiss and ride parking for the light rail stop would need to be considered in the Construction Traffic and Access Management Plan (CTAMP).

Heavy vehicle movements outside of standard construction hours associated with the removal of spoil from tunnelling would occur via access and egress directly to and from Darley Road and City West Link. Reasonably practical management strategies would be investigated to minimise the volume of heavy vehicle movements outside standard construction hours.

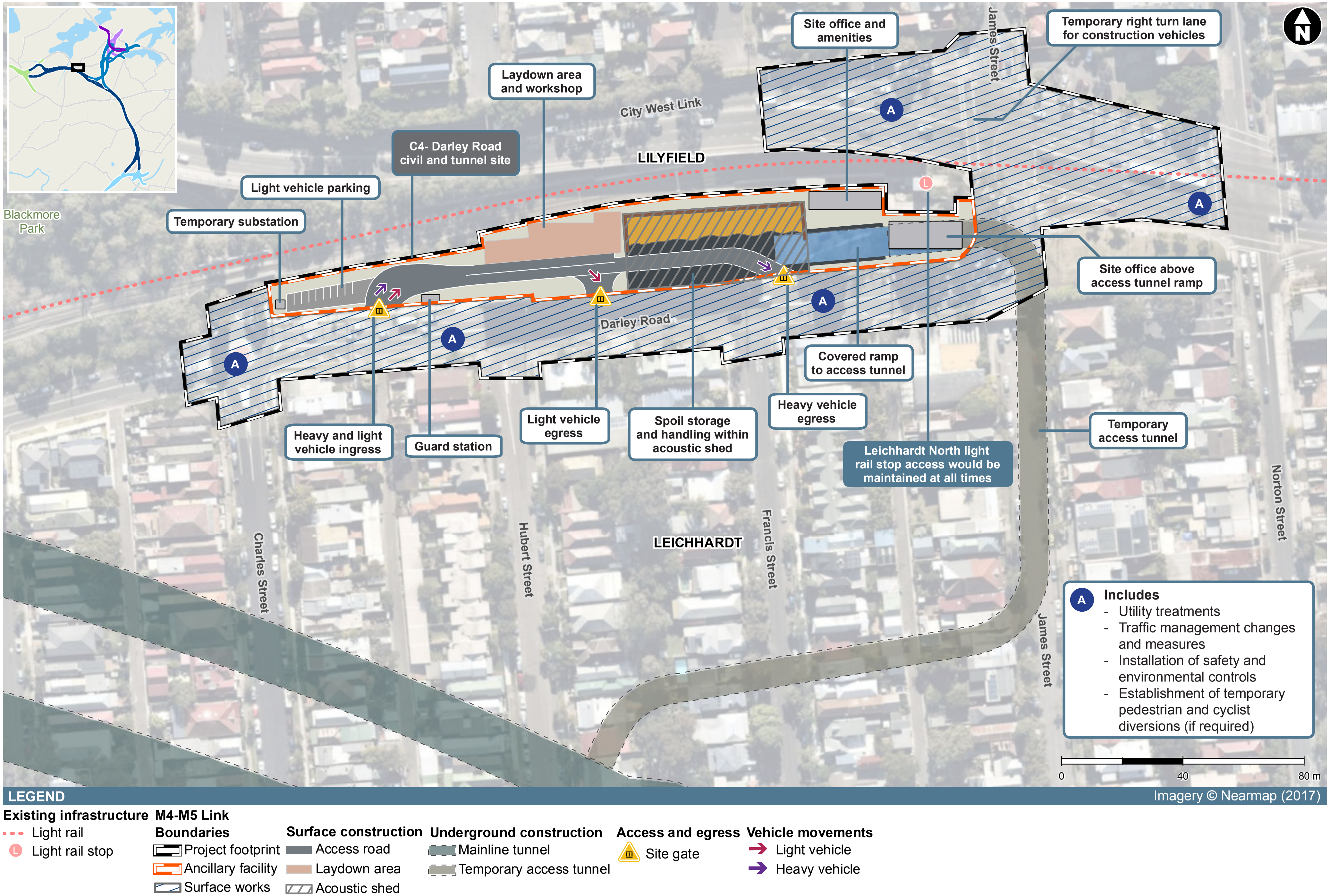


Figure 7-8 Indicative Darley Road civil and tunnel site (C4) layout

7.2.8 Rozelle civil and tunnel site (C5)

Location and construction activities

The Rozelle civil and tunnel site would be located within the Rozelle Rail Yards between Lilyfield Road to the north, City West Link to the south, Victoria Road to the east and the CBD and South East Light Rail Rozelle maintenance depot to the west.

Roadheaders would be launched from this site to excavate the Rozelle interchange, the Iron Cove Link and the stub tunnels that would enable connections to the proposed future Western Harbour Tunnel and Beaches Link. Acoustic sheds would be built to minimise noise from out of hours tunnelling and spoil handling. Tunnelling and spoil management would also be carried out within the cut-and-cover sections of the tunnels at the eastern end of the site. These cut-and-cover sections would be acoustically lined to minimise noise from out of hours tunnelling and spoil handling. Tunnel spoil would be transported to a stockpile within the cut-and-cover structures, with sufficient space for about two heavy vehicles to be loaded with spoil. Spoil handling on the site would occur 24 hours a day, seven days a week.

An indicative site layout for the Rozelle civil and tunnel site is shown in **Figure 7-9**. The construction activities program relevant to the site is outlined in **Table 7-8**.

Table 7-8 Rozelle civil and tunnel site indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■	■	■																
Traffic diversions and intersection works						■	■	■																
Construction of cut-and-cover and tunnel portals						■	■	■	■															
Tunnelling									■	■	■	■	■	■	■	■	■	■						
Construction of motorway operational ancillary infrastructure									■	■	■	■	■	■	■	■	■	■						
Civil and mechanical fitout													■	■	■	■	■	■	■					
Establishment of tolling facilities																		■	■					
Site rehabilitation and landscaping																			■	■	■			
Demobilisation and rehabilitation																						■	■	
Testing and commissioning																			■	■	■	■	■	

Entry and exit

Heavy vehicle access would be via City West Link. Vehicles would enter the site from the eastbound carriageway of City West Link via new slip lanes and driveways. A temporary signalised intersection would be built along City West Link and a new northern leg added to the intersection with The Crescent to enable vehicles to exit the site and turn right at both these locations to head westbound on City West Link. Five light vehicle access points would be constructed along Lilyfield Road to enable light vehicle access and egress.

Local road impacts

The main local road impacts would be on Lilyfield Road. While 350 daily light vehicle trips are expected to access the site, the impact would be spread out through the use of five access and egress points along Lilyfield Road, depending on where the vehicles are required and where they are coming from. As a worst case, this would equate to an increase in two-way weekday daily vehicles of 10 to 15 per cent depending on the location on Lilyfield Road.

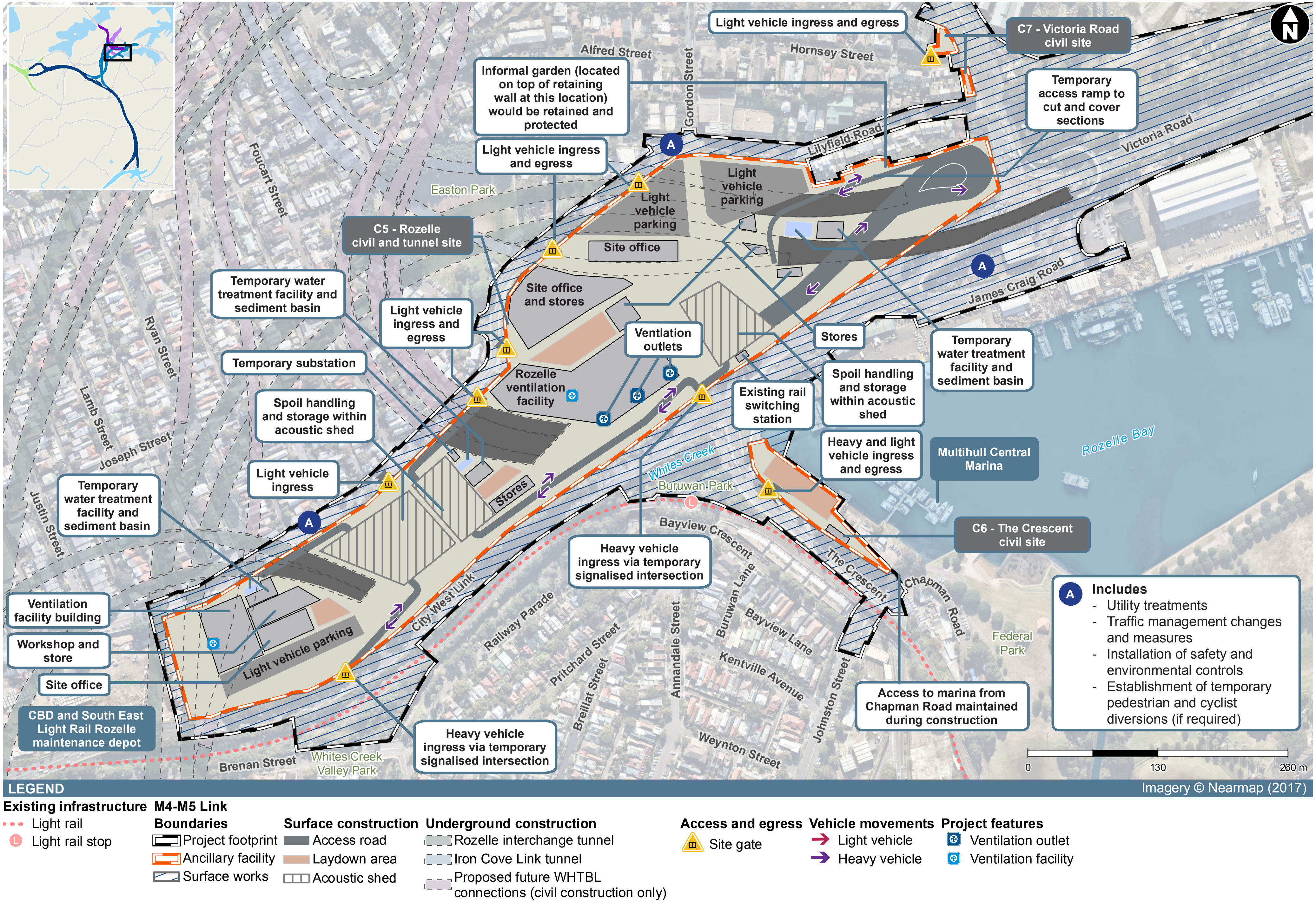


Figure 7-9 Indicative Rozelle civil and tunnel site, The Crescent civil site and Victoria Road civil site (C5, C6 and C7) layout

7.2.9 The Crescent civil site (C6)

Location and construction activities

The Crescent civil site (C6) would be located between The Crescent and Rozelle Bay on land owned by Roads and Maritime. The site would be used to support the realignment of The Crescent, including the construction of the new bridge over Whites Creek, widening and improvement works to Whites Creek, and construction of the drainage outfall and culvert that would direct flows through and from the Rozelle Rail Yards to Rozelle Bay.

The location of The Crescent civil site and an indicative layout are shown in **Figure 7-10** and the construction activities program relevant to the site is outlined in **Table 7-9**.

Table 7-9 The Crescent civil site indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works					■	■	■																	
Surface road and intersection works					■	■																		
Whites Creek widening and improvement works						■	■	■	■															
Drainage works including construction of the culvert below City West Link and upgrades to the drainage outfall to Rozelle Bay						■	■	■	■	■														
Construction of Whites Creek Bridge and demolition of existing bridge									■	■	■	■	■											
Rehabilitation and landscaping													■	■	■	■								

Entry and exit

It is anticipated that heavy vehicles would enter the site via a left-in from The Crescent (southbound). They would then travel through the site, turn around and exit back onto The Crescent northbound via a right hand turn. Temporary traffic management measures would be established to enable access and egress arrangements.

Heavy vehicle movements would be carried out during non-peak periods where feasible and reasonable. Light vehicles would enter via the same arrangement, but may also exit southbound along The Crescent towards Johnston Street.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress directly to and from The Crescent.

7.2.10 Victoria Road civil site (C7)

Location and construction activities

The Victoria Road civil site (C7) would be located on the western side of Victoria Road between Quirk Street and Lilyfield Road on land currently occupied by commercial and residential properties. The existing buildings and other structures on the site would be demolished to facilitate establishment of temporary site offices, a laydown area, workforce amenities and car parking. A portion of this site would be occupied by operational road infrastructure during operation.

The location of the Victoria Road civil site and an indicative layout of the site are shown in **Figure 7-10** and the construction activities program relevant to the site is outlined in **Table 7-10**.

Table 7-10 Victoria Road civil site indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Site establishment and utility works					■	■	■													
Support for the reconstruction of Victoria Road including construction of the new bridge						■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Site rehabilitation and landscaping																				■

Entry and exit

Heavy vehicles would enter and exit the site via left-in/left-out accesses off the northbound Victoria Road carriageway.

Local road impacts

Minor vehicle impacts are expected to the eastern end of Hornsey Street. On-street parking along the eastbound carriageway would be removed (about four spaces) during construction, although this would be lessened by the removal of the traffic to and from the commercial properties that would be replaced by the Victoria Road civil site.

7.2.11 Iron Cove Link civil site (C8)

Location and construction activities

The Iron Cove Link civil site (C8) would be located along the southern side of Victoria Road at Rozelle between Byrnes Street and Springside Street. The site would be located on land currently occupied by Victoria Road and residential and commercial properties that are to be acquired.

The site would be mainly used to support construction of the Iron Cove Link surface works, including tunnel entry and exit ramps and upgrades and modifications to the eastbound and westbound carriageways of Victoria Road. There is no provision at this site to operate roadheaders, however the site may be used to support limited excavation of the initial sections of the Iron Cove Link tunnels.

During operation, a portion of the site would be occupied by the Iron Cove Link motorway operations complex (MOC4) including the Iron Cove Link ventilation facility.

The location of the Iron Cove Link civil site and an indicative layout of the site is shown in **Figure 7-10**. The construction activities program relevant to the site is outlined in **Table 7-11**.

Table 7-11 Iron Cove Link civil site indicative construction program

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Site establishment and utility works				■	■	■	■	■	■	■	■	■												
Traffic diversions and intersection works						■	■	■																
Construction of cut-and-cover and tunnel portals									■	■	■	■	■	■	■	■	■	■	■	■				
Construction of motorway operational infrastructure									■	■	■	■	■	■	■	■	■	■	■	■				
Site rehabilitation and landscaping																			■	■	■			
Testing and commissioning																			■	■	■	■	■	

Entry and exit

Heavy and light vehicles would enter and exit the site via left-in/left-out accesses off the northbound Victoria Road carriageway.

Local road impacts

Temporary changes to the local road network would be required to enable construction of the permanent design and the operation of the Iron Cove Link civil site during construction. The Clubb Street/Victoria Road intersection would also be permanently closed before the start of construction.

The Toelle Street and Callan Street intersections with Victoria Road would generally remain open during construction. There would be instances where one of these intersections would be closed temporarily to construct the permanent design, however these works would be short term and conducted during non-peak times, where practical, especially as these roads would be carrying additional traffic from the closure of Clubb Street. Regard would also be given to the peak periods of use of King George Park when considering temporary closures. When construction is complete, these intersections would be reopened in the same arrangement as existing (ie left-in, left-out).

There would be loss of limited on-street parking spaces on Clubb Street, Toelle Street and Callan Street, west of Victoria Road. This would be confirmed following the appointment of a design and construction contractor. These parking spaces are adjacent to properties being acquired and so the impact of their loss would be reduced.

Further detail on the temporary and permanent changes to the surface road network around the Iron Cove Link civil site are provided in **Chapter 5** (Project description) and **Chapter 6** (Construction work) of the EIS.

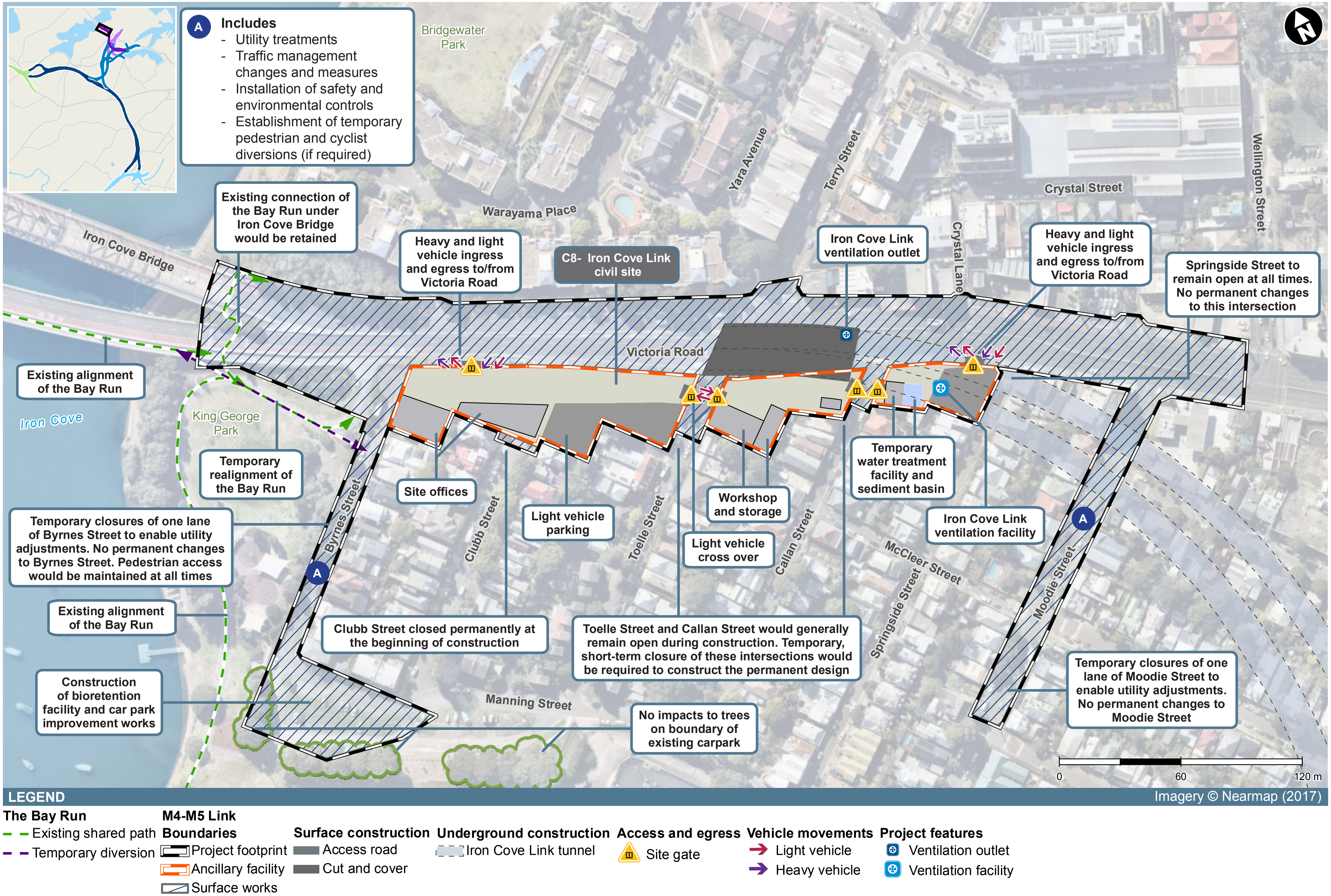


Figure 7-10 Indicative Iron Cove Link civil site (C8) layout

7.2.12 Pyrmont Bridge Road tunnel site (C9)

Location and construction activities

The Pyrmont Bridge Road tunnel site would be located between Parramatta Road and Pyrmont Bridge Road at Annandale on land currently occupied by commercial and light industrial businesses. The construction ancillary facility would be mainly used to support tunnelling construction activities.

Roadheaders would be launched from this site and would initially excavate the temporary access tunnel and the mainline tunnels. Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonably practical management strategies would be investigated to minimise the volume of heavy vehicle movements at night.

The location of the Pyrmont Bridge Road tunnel site and an indicative layout of the site are shown in **Figure 7-11**. An indicative program for works to be conducted within the Pyrmont Bridge Road tunnel site is provided in **Table 7-12**.

Table 7-12 Pyrmont Bridge Road tunnel site indicative construction program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Initial road works and traffic management																				
Site establishment and utility works																				
Construction of temporary access tunnel																				
Tunnelling																				
Civil and mechanical fitout																				
Testing and commissioning																				
Site rehabilitation																				

Entry and exit

Heavy vehicle access to the site would be from the northern (eastbound) carriageway of Parramatta Road. Vehicles would enter via a new driveway, travel in an anti-clockwise direction via an internal access road and exit onto Pyrmont Bridge Road via a new temporary signalised intersection. Light vehicle access would be from Pyrmont Bridge Road, either via the temporary signalised intersection or a separate give-way access.

Local road impacts

No vehicle impacts are expected on local roads with heavy and light vehicle access and egress taken directly to and from Parramatta Road and Pyrmont Bridge Road.

Works would be carried out to realign Bignell Lane between Mallett Street and Pyrmont Bridge Road. Short-term, temporary closure of Bignell Lane would be required during construction to allow for the realignment works, but rear-access to commercial properties along Bignell Lane would be maintained during construction.

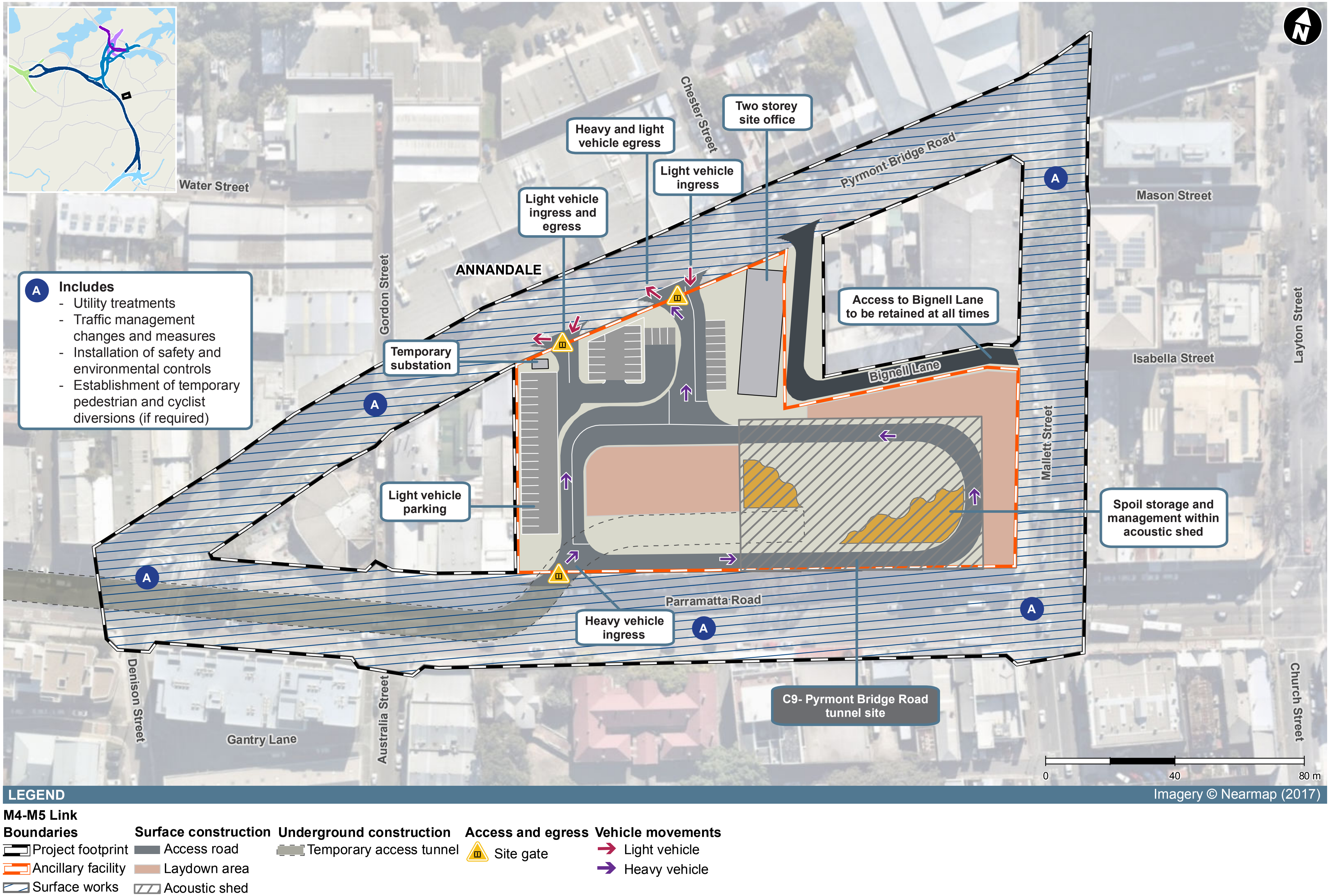


Figure 7-11 Indicative Pyrmont Bridge Road tunnel site (C9) layout

7.2.13 Campbell Road civil and tunnel site (C10)

Location and construction activities

The Campbell Road civil and tunnel site would be located within the St Peters interchange site on the southern side of Albert Street and Campbell Road in St Peters. The site would be used to support tunnelling of the mainline tunnels and the entry and exit ramps that would connect the St Peters interchange with the M4-M5 Link mainline tunnels. A portion of the site would be used for the Campbell Road motorway operations complex (MOC5) during operation, including the Campbell Road ventilation facility.

Roadheaders would be launched from this site and would excavate the entry and exit ramps and mainline tunnels, travelling in a northerly direction. Spoil handling would occur within the cut-and-cover structure below Campbell Road being built as part of WestConnex New M5 and within an acoustic shed. Spoil handling on the site would occur 24 hours a day, seven days a week. Where practical, spoil would be removed during the day, outside of peak periods. Reasonably practical management strategies would be investigated to minimise the volume of heavy vehicle movements at night. Heavy vehicle movements outside of standard construction hours associated with the removal of spoil from tunnelling would only occur via access and egress directly to and from Campbell Road.

The location of the construction ancillary facility and an indicative layout of the site are shown in **Figure 7-12**. An indicative program for works to be conducted within the Campbell Road construction ancillary facility is provided in **Table 7-13**.

Table 7-13 Campbell Road civil and tunnel site indicative program

Construction activity	Indicative construction timeframe																			
	2018				2019				2020				2021				2022			
Initial road works and traffic management				■																
Site establishment and utility works				■	■	■														
Tunnelling						■	■	■	■	■	■	■	■							
Civil and mechanical fitout													■	■	■	■				
Construction of motorway operations complex (MOC5)												■	■	■	■	■	■			
Testing and commissioning																■	■	■	■	■
Site demobilisation and rehabilitation																			■	■

Entry and exit

Vehicles would enter and exit the site from Albert Street via the signalised intersection on Campbell Road that is being built as part of the New M5 local road upgrade works. Within the site, an access driveway would provide access between Albert Road and the acoustic shed and cut-and-cover structure.

Local road impacts

Negligible impacts on local roads are expected. Heavy and light vehicles would need to cross over Albert Street to access Campbell Road, however traffic volumes along this section of Albert Street are expected to be low, and standard construction traffic management and measures would be used to minimise potential disruptions.

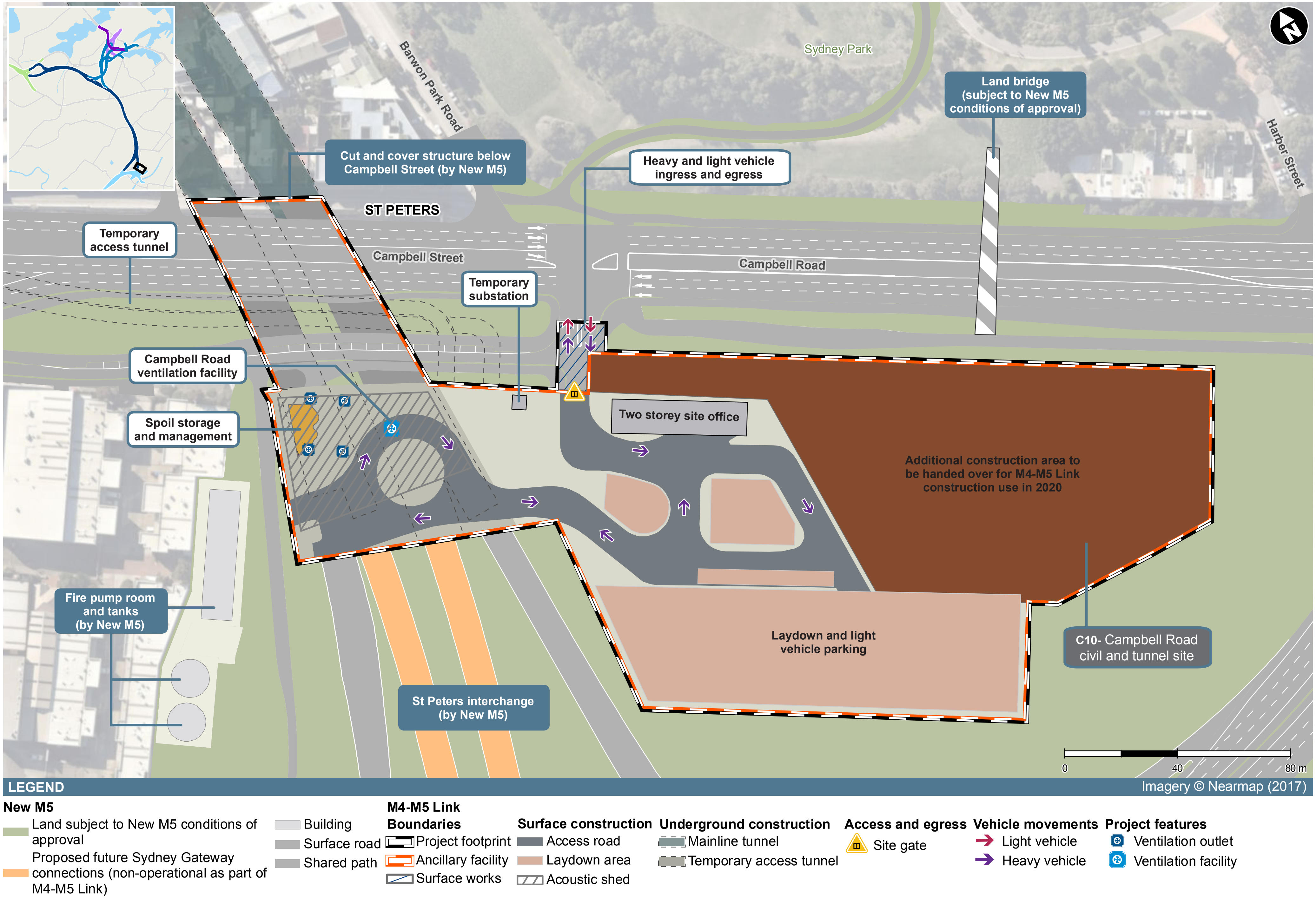


Figure 7-12 Indicative Campbell Road civil and tunnel site (C10) layout

7.3 Construction traffic management and access

This section identifies the route and scheduling of construction movements, and the number, frequency and size of construction-related vehicles, including for spoil removal and construction worker parking.

7.3.1 Construction traffic generation and distribution

The project would generate around four million cubic metres of spoil, the majority of which would be generated from excavation of the tunnels. As such, the primary facilities for receipt and dispatch of spoil would be the tunnel construction sites.

The project would seek to reuse at least 95 per cent of uncontaminated spoils, either within the project or at other locations. Where feasible and reasonable, spoil would be managed according to the following hierarchy:

- Minimisation of spoil generation through design and management
- Reuse of spoil within the project
- Beneficial reuse of spoil outside the project
- Where reuse is not possible, disposal of spoil would be the last resort.

Five potential sites have been identified for receiving excess spoil from the project, as summarised in **Table 7-14**. Negotiations for the final destination(s) for excess spoil would be undertaken during detailed design, and may include one or more of the sites listed in **Table 7-14** or other alternatives.

Table 7-14 Potential spoil management sites

Spoil management site	Location	Distance from the project (kilometres)	Capacity for site to accept spoil (m^3)
Horsley Park (manufacturing facility)	Wallgrove Road at Horsley Park	About 40	Capacity for entirety of project spoil generation
Blacktown Waste Services (landfill)	920 Richmond Road at Marsden Park	About 45	250,000
Sakkara Development (industrial estate)	Riverstone Parade at Riverstone	About 45	3,500,00
Kurnell Landfill	330 Captain Cook Drive at Kurnell	About 20	7,000,000
Moorebank Intermodal Terminal Precinct	Moorebank Avenue, Moorebank	About 30	2,500,000

The haulage routes from construction ancillary facilities to the arterial road network are shown in **Figure 7-13** to **Figure 7-18**. Depending on final spoil management sites, spoil haulage routes may be subject to change. Delivery of concrete to support tunnel construction would originate from batching plants close to the project region, although other sources may also be required. Other materials required for construction would, where available, originate from within the Sydney region and surrounds and would generally use the arterial road network to access the various construction sites.

Table 7-15 provides details of light and heavy vehicle volumes predicted to arrive and depart from construction ancillary facilities during the typical AM peak hour, PM peak hour and daily period. While these peak hours are slightly different to the surrounding road network peak hours, for a conservative assessment they have been assumed to occur in the modelled road network peak hour. With a shift start time of 7.00 am, the majority of light vehicle arrivals would occur before the road network AM peak hour. The end of the shift is more likely to impact on the road network PM peak hour, and although some vehicles would leave before the modelled peak hour, they have been assessed in the PM peak hour. **Table 7-15** shows that the highest volumes of heavy and light construction vehicles are forecast at the Rozelle civil and tunnel site (C5). Construction vehicles would use the M4 East and New M5 tunnels at Haberfield and St Peters rather than the surface road network, wherever possible.

Table 7-15 Indicative daily and peak period construction traffic volumes

Location		Daily vehicles (one way)		AM peak hour (7.30–8.30 am)				PM peak hour (4.15–5.15 pm)			
		Heavy vehicles	Light vehicles	Heavy vehicles		Light vehicles		Heavy vehicles		Light vehicles	
				Arrive	Depart	Arrive	Depart	Arrive	Depart	Arrive	Depart
Option A											
C1a	Wattle Street civil and tunnel site	133	50	7	7	10	–	7	7	–	50
C2a	Haberfield civil and tunnel site	136	90	7	7	30	–	7	7	–	90
C3a	Northcote Street civil site	100	150	5	5	50	–	5	5	–	150
Option B											
C1b	Parramatta Road West civil and tunnel site	140	10	7	7	10	–	7	7	–	10
C2b	Haberfield civil site	10	20	2	2	10	–	2	2	–	10
C3b	Parramatta Road East civil site	30	150	3	3	50	–	3	3	–	150
Both options											
C4	Darley Road civil and tunnel site	100	70	7	7	10	–	7	7	–	70
C5	Rozelle civil and tunnel site	517	350	23	23	100	–	23	23	–	350
C6	The Crescent civil site	10	20	2	2	0		2	2		5
C7	Victoria Road civil site	42	140	2	2	0	–	2	2	–	0
C8	Iron Cove Link civil site	42	140	2	2	15	–	2	2	–	140
C9	Pyrmont Bridge Road tunnel site	133	70	7	7	20	–	7	7	–	70
C10	Campbell Road civil and tunnel site	133	70	7	7	20	–	7	7	–	70
WHT	Proposed future Western Harbour Tunnel and Beaches Link site (cumulative impact assessment scenario only)	200	24	10	10	24	–	10	10	–	24

Figure 7-13 Indicative spoil haulage route – Wattle Street and Haberfield civil and tunnel sites (C1a and C2a)

Figure 7-14 Indicative spoil haulage route – Parramatta Road West civil and tunnel site (C1b)

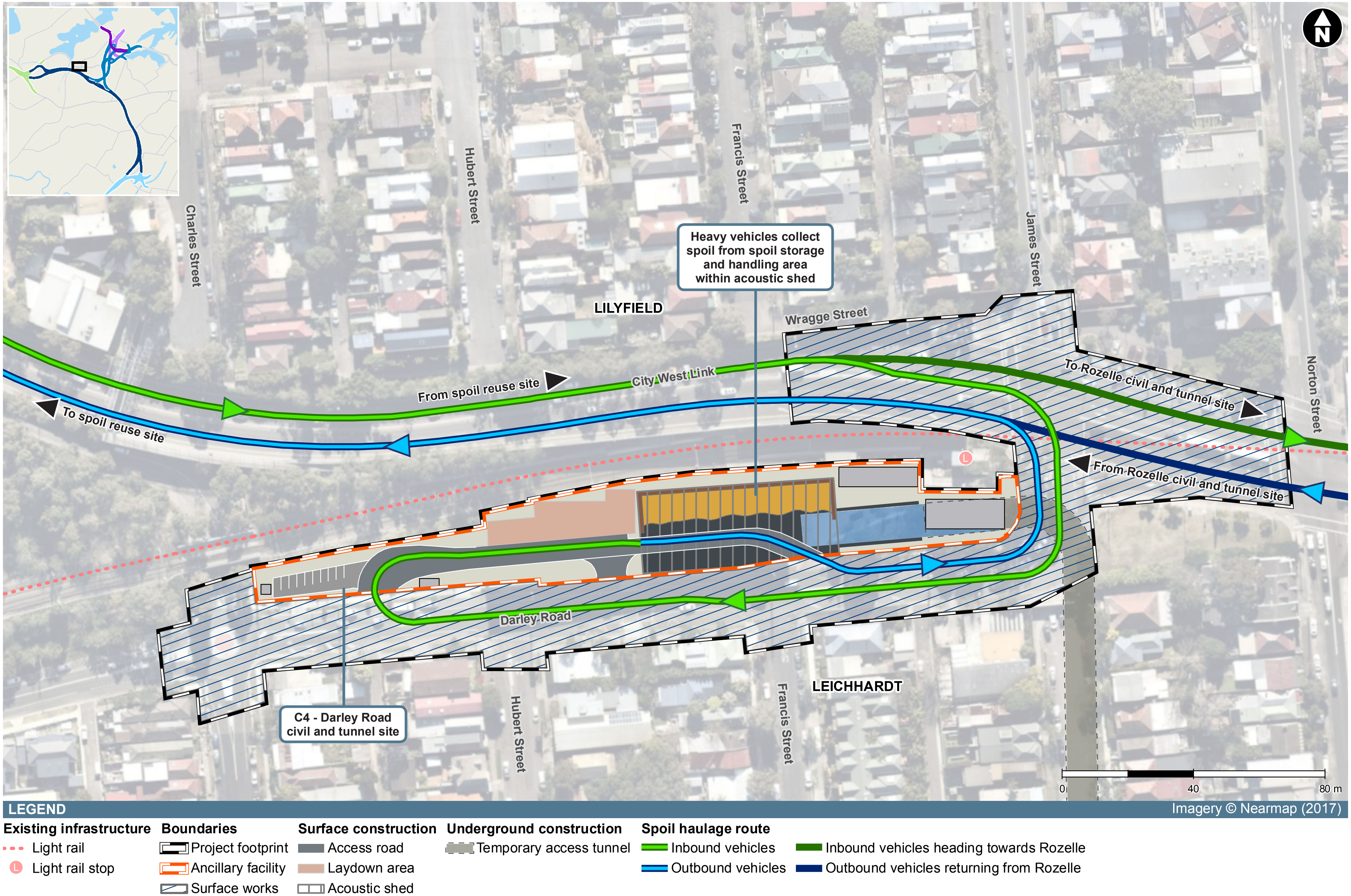


Figure 7-15 Indicative spoil haulage route – Darley Road civil and tunnel site (C4)

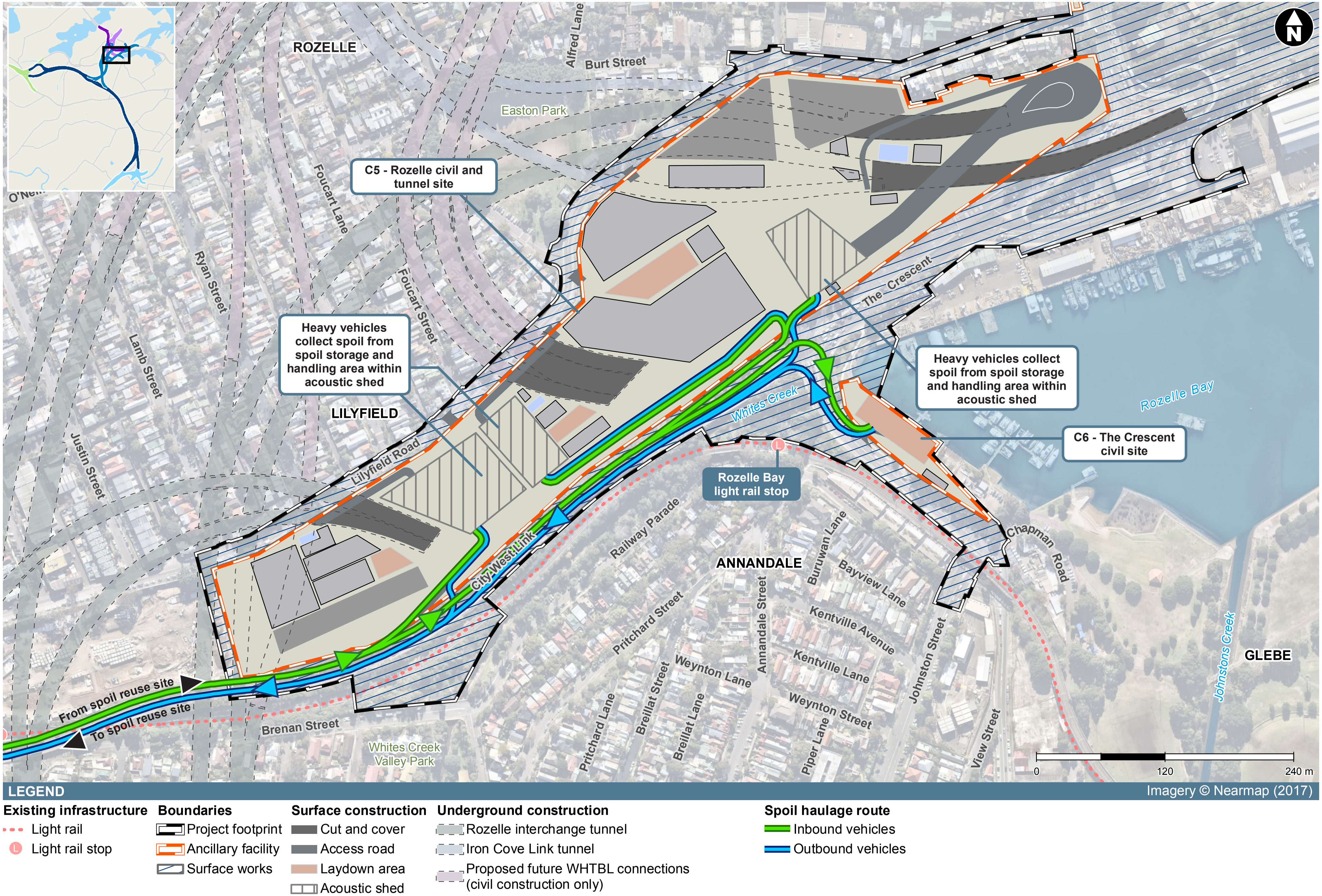


Figure 7-16 Indicative spoil haulage route – Rozelle civil and tunnel sites (C5)

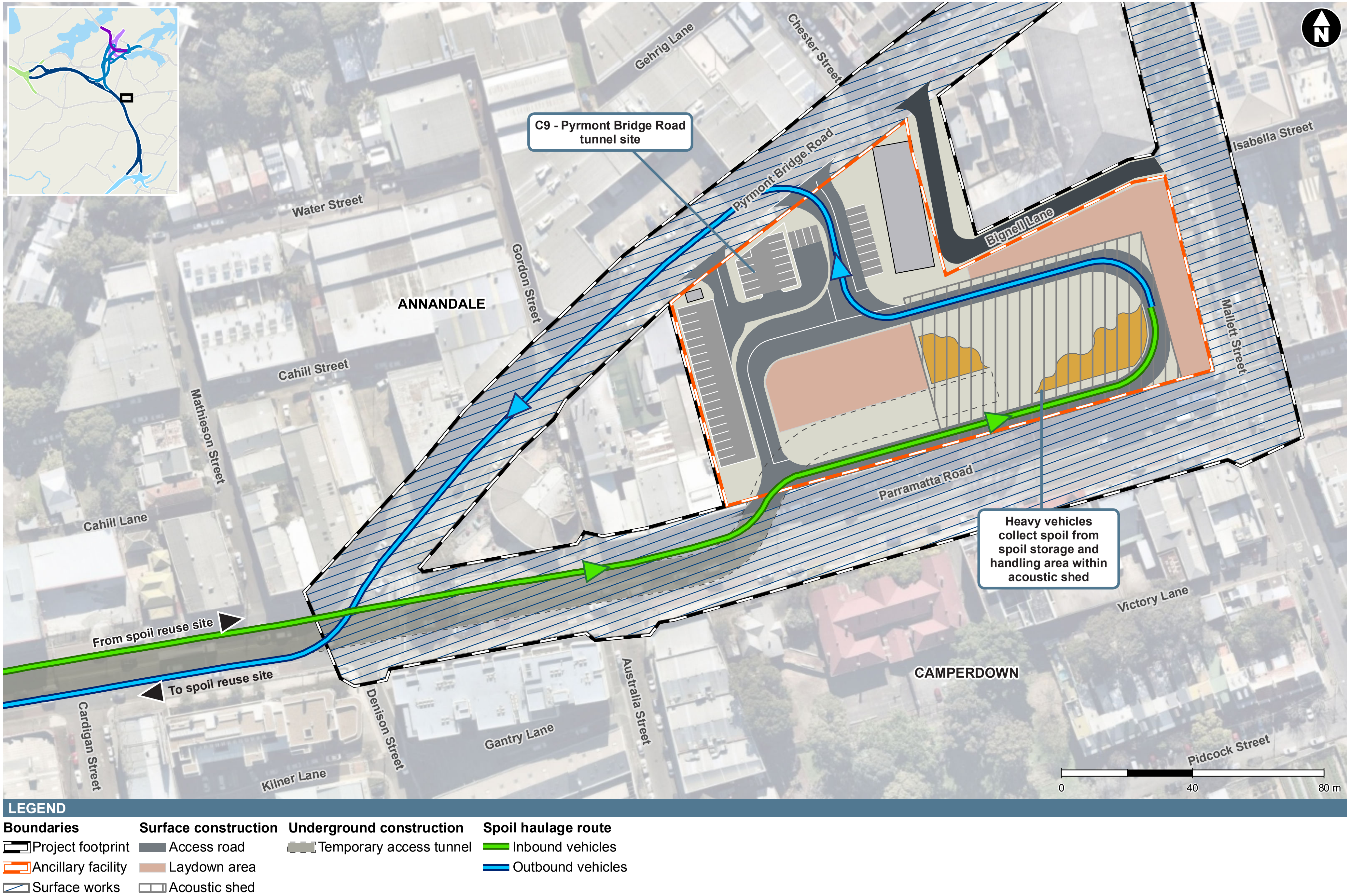


Figure 7-17 Indicative spoil haulage route – Pyrmont Bridge Road civil and tunnel site (C9)

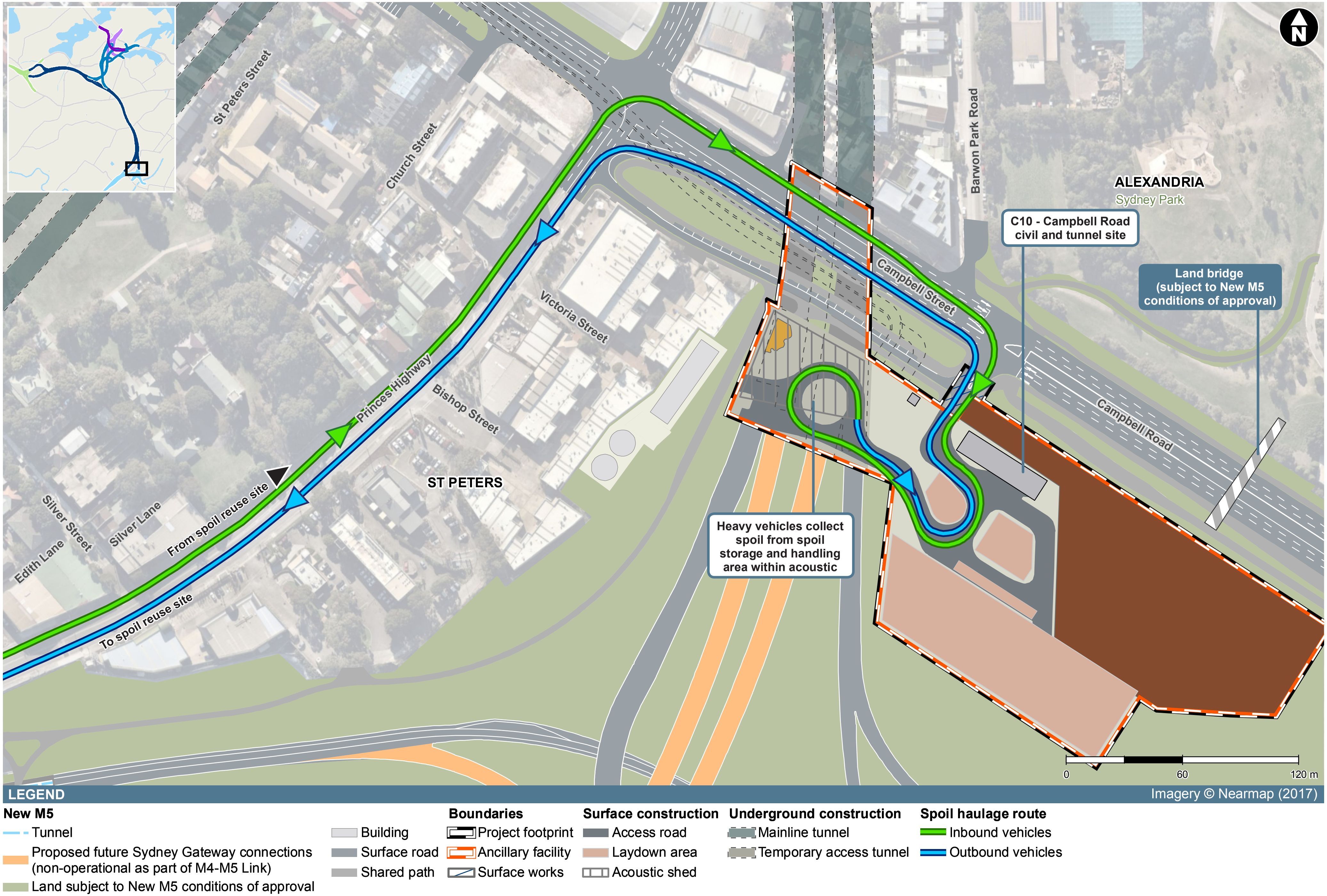


Figure 7-18 Indicative spoil haulage route – Campbell Road civil and tunnel site (C10)

The daily and peak hour volumes shown in **Table 7-15** are based on targeted spoil haulage between 7.00 am and 6.00 pm. However, 24 hour spoil haulage would be required during tunnelling at five construction ancillary facilities, and the table shows indicative heavy vehicle volumes for these sites. The peak hour identified is representative of highest estimated construction volumes and falls within the broader peak periods experienced on the network. Spoil haulage from the Darley Road construction facility would be limited to occurring between 7.00 am and 6.00 pm Monday to Friday, and between 8.00 am and 1.00 pm on Saturdays.

Where spoil haulage is carried out outside of the standard daytime construction hours, reasonable and feasible work practices and mitigation measures would be implemented to manage potential noise impacts, especially late night vehicle movements, to be less than significant. This is discussed further in **Chapter 10** (Noise and vibration) of the EIS.

The construction ancillary facilities are located to allow vehicles (heavy vehicles in particular) to access and egress via the arterial road network to avoid or minimise the impacts on the local road network. Light vehicles (predominantly workers accessing car parking areas on site) would distribute across the road network at their discretion.

Table 7-16 provides details of indicative heavy vehicle construction volumes on key roads during the AM peak and PM peak hours. The table shows that 24 construction heavy vehicles per hour are predicted to travel on Parramatta Road, north of Wattle Street (two-way) during the AM and PM peak hours. Additionally, it is anticipated that volumes on City West Link, west of James Street (two-way) would increase by a maximum of about 68 construction heavy vehicles during the AM and PM peak hours. Less heavy construction vehicles are expected on other roads.

Table 7-16 Indicative peak period distribution of heavy vehicle construction vehicles (two-way)

Road location	AM peak hour	PM peak hour
Parramatta Road, north of Wattle Street	24	24
City West Link, west of James Street	68	68
City West Link, west of The Crescent	32	32
Victoria Road, east of Darling Street	4	4
Pyrmont Bridge Road, east of Parramatta Road	7	7
Princes Highway, south of Campbell Street	14	14

7.3.2 Construction workforce parking

A number of the project's staff and labour force would be expected to drive to construction sites and would therefore require car parking. The number of construction personnel requiring parking would vary over the duration of the construction program.

It is anticipated that construction workforce parking would be primarily provided at the following sites:

- Northcote Street civil site (C3a) – around 150 car parking spaces (Option A)
- Parramatta Road East civil site (C3b) – around 140 car parking spaces (Option B)
- Rozelle civil and tunnel site (C5) – around 400 car parking spaces
- Campbell Road civil and tunnel site (C10) – around 150 car parking spaces.

These facilities would be used to provide worker parking and shuttle bus transfers to other nearby construction sites.

Due to the generally constrained nature of the other construction sites, only minimal car parking for construction workers would be provided at these locations. Typically, these sites would provide between four to 20 parking spaces intended to be used by engineers and other construction management staff. Parking of construction-related vehicles in adjacent local roads would be required, particularly during site establishment.

The construction workforce would be encouraged to use public transport, where appropriate. Victoria Road and Parramatta Road are major transport corridors that have multiple bus routes. The Inner West Light Rail runs along the southern side of City West Link with stops near the Rozelle Rail Yards at Rozelle Bay and Lilyfield, and at the Darley Road civil and tunnel site (Leichhardt North light rail stop). The T3 Bankstown Line stops at St Peters Station around 800 metres north of the Campbell Road civil and tunnel site. However, workers starting or ending shifts very early or very late would be more likely to use private vehicles.

A car parking strategy would be developed as part of the CTAMP to limit impacts on parking for the surrounding communities. The strategy would be developed in consultation with local councils and stakeholders associated with public facilities adjacent to project sites, as well as with the M4 East and New M5 contractors (where relevant) to identify opportunities to access parking during their respective construction periods and once those periods are completed.

The car parking strategy would include items such as forecasting of construction parking demand, review of existing parking supply and use on local streets in the area, impact on existing parking, consultation activities and proposed mitigation measures, such as management of workforce parking and transport, alternative parking arrangements and communication and engagement. This would include the identification of areas where there are high levels of existing parking demand around the construction ancillary facilities and works sites and identifying alternative car parking sites for use by the construction workforce. Processes for monitoring, reporting and corrective actions would also be part of the strategy.

7.3.3 Access routes

The proposed access routes to the construction ancillary facilities are summarised in **Table 7-17**. These would be confirmed through the CTAMP, in consultation with the relevant road authorities.

Heavy vehicle access is proposed to be gained from the motorway network (M4 and M5 motorways) and major arterial roads (Parramatta Road, Wattle Street, City West Link, Victoria Road, Princes Highway). Most construction ancillary facilities are accessible from these roads.

The distribution of light vehicles across the road network is more varied. These vehicles are generally dispersed through the network, and could be considered to replace existing trips. However, for the purposes of this assessment, light vehicles have been considered on top of background traffic and distributed accordingly. For all sites, except the Campbell Road civil and tunnel site (C10), the distribution of access is assumed to be via the M4 Motorway, City West Link, Victoria Road, Anzac Bridge and Parramatta Road, with the proportion via each varying for each site. For the Campbell Road civil and tunnel site (C10), access for light vehicles is assumed to be divided equally between access from the Princes Highway from the north and the south.

Table 7-15 sets out estimated daily vehicle numbers in the peak construction period at each site, ie a worst case scenario. Construction traffic management plans for each site would be submitted to the relevant roads authority for review before work starts.

Table 7-17 Indicative access routes to and from construction ancillary facilities

Site	Access and egress points (heavy vehicles)[1]	Access and egress points (light vehicles)
Wattle Street civil and tunnel site (C1a)	• Parramatta Road then Wattle Street via M4-M5 Link entry and exit ramps	• Parramatta Road then Wattle Street northern (eastbound) carriageway (right in, right out)
Haberfield civil and tunnel site (C2a)	• Below ground: via the WestConnex M4 East tunnels • Above ground: Wattle Street (left-in, left-out)	• Wattle Street southern westbound) carriageway (left-in, left-out) • Walker Avenue • Parramatta Road
Northcote Street civil	• Parramatta Road (left-in, left-out)	• Wolseley Street

Site	Access and egress points (heavy vehicles)[1]	Access and egress points (light vehicles)
site (C3a)		• Wattle Street (left-out)
Parramatta Road West civil and tunnel site (C1b)	• Parramatta Road (left-in, left-out) • Alt Street (crossover between sites only)	• Parramatta Road (left-in, left-out) • Alt Street
Haberfield civil site (C2b)	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out)	• Wattle Street (left-in, left-out) • Parramatta Road (left-in, left-out) • Walker Avenue (left-in, left-out)
Parramatta Road East civil site (C3b)	• Parramatta Road (left-in, left-out)	• Parramatta Road (left-in, left-out) • Alt Street • Bland Street
Darley Road civil and tunnel site (C4)	• City West Link then Darley Road[2]	• City West Link then Darley Road
Rozelle civil and tunnel site (C5)	• City West Link (left-in from eastbound carriageway, right-out to westbound carriageway)	• Lilyfield Road
The Crescent civil site (C6)	• The Crescent (left-in, right-out)	• The Crescent
Victoria Road civil site (C7)	• Victoria Road (left-in, left-out)	• Victoria Road (left in, left out) • Hornsey Street
Iron Cove Link civil site (C8)	• Victoria Road (left-in, left-out)	• Victoria Road (left-in, left-out)
Pyrmont Bridge Road tunnel site (C9)	• Parramatta Road (left-in) • Pyrmont Bridge Road (left-out)	• Pyrmont Bridge Road
Campbell Road civil and tunnel site (C10)	• Albert Road via Campbell Road and Princes Highway	• Albert Road via Campbell Road

Notes:

[1] Some use of local roads by heavy vehicles delivering materials and/or equipment may also be required, however this would be minimised as far as practicable

[2] Spoil haulage vehicles would enter and exit the Darley Road civil and tunnel site (C4) via City West Link

7.4 Construction impact assessment – Option A

This section presents the impact assessment of the construction activities on proposed access routes, public transport, pedestrians and cyclists for the Option A construction scenario. An indication of the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network is also presented and assessed. An assessment of the cumulative traffic impact of other key infrastructure projects is discussed.

7.4.1 Background traffic volumes and patterns

Based on the construction program, 2021 has been used as the assessment year for construction impacts, as this is when peak construction traffic volumes are expected. M4 East and New M5 are expected to be operational by 2019/20. Therefore their construction would not overlap in the 2021 assessment year. In the overlapping years prior to this, it is expected that the main construction works for the M4 East and the New M5 would be completed and the main construction works for the M4-M5 Link would not have commenced. Therefore, the impact is not expected to be as large.

As shown in **Table 7-18**, between the 2015 base case and 2021 there are significant changes to forecast traffic volumes on some key arterial roads close to the construction ancillary facilities. Close to the intersection of Parramatta Road and Wattle Street, traffic decreases by about 40 per cent in both the AM and PM peak hours as traffic shifts off Parramatta Road and onto the M4 East. There are also substantial increases in background traffic on Parramatta Road, east of the Haberfield interchange. This increase reflects both the increase in background traffic growth from 2015 to 2021, and the increase in vehicles using the M4 East at Haberfield.

There are substantial increases in forecast traffic near the St Peters interchange. These forecast changes are reflective of the increase in traffic accessing or exiting the New M5 and the forecast land use changes in the area.

Table 7-18 Construction year (2021) background traffic growth^

Road location	Direction	AM peak hour (veh/hr)			PM peak hour (veh/hr)		
		2015 Base	2021	% Change	2015 Base	2021	% Change
Parramatta Road north of Wattle Street – Haberfield	EB	2,670	1,840	-31%	3,170	2,080	-34%
	WB	2,410	1,310	-46%	2,440	1,310	-46%
Wattle Street east of Parramatta Road – Haberfield	EB	1,260	740	-41%	1,610	1,110	-31%
	WB	1,280	860	-33%	1,380	730	-47%
City West Link west of Darley Road – Rozelle	EB	2,090	2,120	1%	2,170	2,230	3%
	WB	1,810	1,940	7%	2,040	2,110	3%
Darley Road west of James Street – Haberfield	EB	670	680	1%	530	540	1%
	WB	350	480	37%	650	660	0%
City West Link west of The Crescent – Rozelle	EB	2,470	2,520	2%	2,340	2,440	4%
	WB	1,640	1,800	10%	1,930	1,850	-4%
City West Link east of The Crescent – Rozelle	EB	3,520	3,520	0%	3,080	3,210	4%
	WB	2,260	2,560	13%	2,940	3,000	2%
Victoria Road east of Darling Street – Rozelle	EB	3,260	3,570	10%	2,420	2,470	2%
	WB	1,580	1,740	10%	2,770	3,010	9%
Parramatta Road west of Pyrmont Bridge Road – Camperdown	EB	2,720	2,860	5%	1,740	2,060	18%
	WB	1,490	1,800	21%	2,470	2,670	8%
Pyrmont Bridge Road east of Parramatta Road – Camperdown	EB	490	540	10%	280	310	9%
	WB	290	360	24%	660	730	11%
Princes Highway south of Campbell Street – St Peters	NB	1,800	2,270	26%	1,050	1,100	5%
	SB	570	890	56%	1,750	1,890	8%

^Traffic volume rounded to nearest 10

Source: Based on WRTM v2.3 outputs, 2017

7.4.2 Roadway level of service

An analysis of the existing roadway levels of service was undertaken to determine the impact of construction traffic in 2021. The assessment considers the spoil reuse sites shown in **Table 7-14**.

Mid-block traffic level of service demonstrates the impact of construction traffic in 2021 for construction activities. Theoretical mid-block roadway capacities were based on Austroads *Guide to Traffic Management* and these capacities and assessment results are shown in **Table 7-19** for the AM peak and PM peak hours. In highly congested networks, single-point assessment criteria, such as mid-block levels of service, do not present a complete picture of traffic operations. In reality, some roads may carry more traffic than the theoretical capacity or, if a link is over capacity, this would result in queuing further back in the network, reducing the capacity of the links. However, this assessment provides a high level indication of the effect construction vehicles would have on roadway levels of service, compared to the background traffic.

Table 7-19 shows that several locations are forecast to exceed the theoretical roadway capacity with the increased background traffic and construction traffic in the 2021 AM and PM peak hours. However, traffic on the majority of these roads would exceed their theoretical capacity even without the construction traffic, simply due to forecast growth in background traffic.

The 2021 without construction traffic demand is forecast to exceed capacity on:

- City West Link in the eastbound direction during both the AM and PM peak hour
- Victoria Road in the eastbound direction during the AM peak hour
- Parramatta Road at Camperdown in the peak direction during the AM and PM peak hours
- Princes Highway at St Peters in the eastbound direction in the AM peak hour.

Construction traffic is forecast to change the mid-block level of service at four locations:

- At two locations – Wattle Street, east of Parramatta Road, and Darley Road, west of James Street – the mid-block level of service drops but remains at an acceptable LoS C or LoS D
- On City West Link, west of Darley Road, the eastbound mid-block level of service is forecast to decrease from LoS E to LoS F in the PM peak hour
- On City West Link, west of The Crescent, the westbound mid-block level of service is forecast to decrease from LoS D to LoS E in the PM peak hour.

Mitigation measures for construction impacts are discussed in **section 11.1**. It is noted that this is a worst-case assessment, based on peak construction traffic levels, and adverse mid-block impacts would be expected to reduce once peak construction is complete.

Table 7-19 Option A – 2021 mid-block operational performance summary^

Location and direction		Mid-block capacity	2021 AM peak hour (veh/hr)						2021 PM peak hour (veh/hr)					
			Without construction			With construction			Without construction			With construction		
			Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS
Parramatta Road north of Wattle Street – Haberfield	EB	3,300	1,840	0.56	C	1,890	0.57	C	2,080	0.63	D	2,240	0.68	D
	WB	3,300	1,310	0.40	C	1,330	0.40	C	1,310	0.40	C	1,370	0.41	C
Wattle Street east of Parramatta Road – Haberfield	EB	2,000	740	0.37	B	760	0.38	B	1,110	0.55	C	1,260	0.63	D
	WB	2,000	860	0.43	C	880	0.44	C	730	0.37	B	790	0.39	C
City West Link west of Darley Road – Rozelle	EB	2,300	2,120	0.92	E	2,180	0.95	E	2,230	0.97	E	2,320	1.01	F
	WB	2,300	1,940	0.84	E	1,990	0.86	E	2,110	0.92	E	2,240	0.97	E
Darley Road west of James Street – Haberfield	EB	1,000	680	0.68	D	680	0.68	D	540	0.54	C	610	0.61	D
	WB	1,000	480	0.48	C	490	0.49	C	660	0.66	D	660	0.66	D
City West Link west of The Crescent – Rozelle	EB	2,300	2,520	1.10	F	2,560	1.11	F	2,440	1.06	F	2,460	1.07	F
	WB	2,300	1,800	0.78	D	1,810	0.79	D	1,850	0.80	D	2,030	0.88	E
City West Link east of The Crescent – Rozelle	EB	3,400	3,520	1.04	F	3,530	1.04	F	3,210	0.94	E	3,210	0.95	E
	WB	3,400	2,560	0.75	D	2,580	0.76	D	3,000	0.88	E	3,010	0.89	E
Victoria Road east of Darling Street – Rozelle	EB	3,250	3,570	1.10	F	3,570	1.10	F	2,470	0.76	D	2,510	0.77	D
	WB	3,200	1,740	0.54	C	1,740	0.54	C	3,010	0.94	E	3,040	0.95	E
Parramatta Road west of Pyrmont Bridge Road – Camperdown	EB	2,300	2,860	>1.2	F	2,870	>1.2	F	2,060	0.90	E	2,070	0.90	E
	WB	2,300	1,800	0.78	E	1,810	0.78	E	2,670	1.16	F	2,710	1.18	F
Pyrmont Bridge Road, east of Parramatta Road – Camperdown	EB	1,800	540	0.30	B	550	0.31	B	310	0.17	A	310	0.17	A
	WB	1,800	360	0.20	A	370	0.21	A	730	0.41	C	780	0.43	C
Princes Highway south of Campbell Street – St Peters	EB	2,200	2,270	1.03	F	2,290	1.04	F	1,100	0.50	C	1,100	0.50	C
	WB	3,300	890	0.27	B	890	0.27	B	1,890	0.57	D	1,930	0.59	D

^Traffic volume rounded to nearest 10

7.4.3 Intersection level of service

The intersection performance results for the road network under the 2021 'without construction' and 'with construction' forecast volumes are summarised in **Table 7-20** and **Table 7-21** for the AM and PM peak hours respectively. These intersection levels of service are not directly comparable to those presented in the operational modelling results, as those had exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, removed (see **section 4.3.2**).

The construction impact assessment was undertaken where construction traffic is passing through the network in significant volumes. The intersections assessed were grouped into six corridors or clusters:

- Cluster 1: Parramatta Road and Wattle Street corridors in Haberfield
- Cluster 2: City West Link in Leichhardt
- Cluster 3: City West Link and The Crescent in Lilyfield
- Cluster 4: Victoria Road in Rozelle
- Cluster 5: Parramatta Road in Camperdown
- Cluster 6: Princes Highway in St Peters.

Cluster 1

Cluster 1 consists of the following intersections:

- Parramatta Road/Harris Road
- Parramatta Road/Croydon Road/Arlington Street
- Parramatta Road/Great North Road
- Parramatta Road/Frederick Street/Wattle Street
- Parramatta Road/Bland Street
- Wattle Street/Ramsay Street
- Dobroyd Parade/Waratah Street
- Dobroyd Parade/Timbrell Drive/Mortley Avenue.

The construction modelling forecasts a number of intersections to operate with high levels of delay (LoS E or F) in the 'without construction' scenario. During the AM peak hour, the Parramatta Road/Bland Street and Dobroyd Parade/Timbrell Drive intersections are forecast to both operate at LoS F. High levels of delay at the Parramatta Road/Bland Street intersection can be attributed to the downstream exit blocking along Parramatta Road, resulting in significant exit blocking for the southbound movement (represented as reduced saturation flows in the model). In the PM peak, the Parramatta Road/Frederick Street/Wattle Street intersection is forecast to operate at LoS E, while the Parramatta Road/Great North Road and Dobroyd Parade/Timbrell Drive intersections is forecast to operate at LoS F.

In the 'with construction' scenario, about 335 passenger car units (PCU) and 715 PCU are added to the network in the AM and PM peaks respectively. It is noted that in the AM peak, about 50 per cent of this additional traffic is via the M4 East tunnels east of Ramsay Street, to access construction sites along City West Link and Victoria Road. In the PM peak, this proportion is about 35 per cent. The additional traffic due to construction is predominantly eastbound in the AM peak and westbound in the PM peak.

As a result, the performance at most intersections along Parramatta Road is impacted, with larger impacts forecast to occur at the intersections along Wattle Street and Dobroyd Parade. Mitigation measures for construction impacts are discussed in **section 11.1**.

During the AM peak hour, there is an increase in traffic of up to 130 PCU along Parramatta Road, resulting in relatively small impacts – the level of service is forecast to worsen slightly at the Parramatta Road/Harris Road intersection, from LoS B to LoS C. At the eastern end of Cluster 1, it is estimated that an additional 100 PCU emerge from the M4 East eastbound tunnels, and 65 PCU enter the M4 East westbound tunnels. This additional traffic impacts mostly on the Dobroyd Parade/Timbrell Drive intersection, which already operates at LoS F in the 'without construction' scenario.

During the PM peak hour, there is an increase in traffic of up to about 250 PCU along Parramatta Road, however the impacts on intersections along Parramatta Road are again relatively small – the level of service is forecast to worsen from LoS B to LoS C at the Parramatta Road/Harris Road intersection, and from LoS D to LoS Eat the Parramatta Road/Croydon Road/Arlington Street intersection.

The M4 East tunnels are expected to accommodate an additional 75 PCU eastbound and 185 PCU westbound. This subsequently impacts on the Wattle Street/Ramsay Street and the Dobroyd Parade/Timbrell Drive intersection. The level of service at Wattle Street/Ramsay Street is forecast to worsen from LoS D to LoS E, while the level of service at the Dobroyd Parade/Timbrell Drive intersection is forecast to remain at LoS F.

Cluster 2

Cluster 2 consists of the following intersections:

- City West Link/James Street
- City West Link/Norton Street
- Darley Road/Darley Road civil and tunnel site (C4) access.

The modelling indicates that City West Link/James Street intersection is forecast to operate at LoS F in the 'without construction' scenario and City West Link Road/Norton Street intersection is forecast to operate at LoS C during both peaks.

In the 'with construction' scenario, in addition to about 195 PCU and 340 PCU being added to the network in the AM and PM peak hour respectively, the rightmost through lane from City West Link eastbound would be temporarily converted into a turning lane to allow construction vehicles to turn right into James Street. A new traffic signal phase is required to operate this movement safely, which would impact the performance of this intersection. The forecast volume is not large and so this phase would only be required to run once every two cycles. The level of service is forecast to remain at LoS F and average delays at the intersection are expected to increase during the AM and PM peak hours in the 'with construction' scenario.

The left turn movement from James Street into City West Link westbound is allocated a green time of at least 30 seconds in each cycle in both peaks, to accommodate what may be a difficult turn for construction heavy vehicles to make, given the blind corner and steep approach on James Street (see **section 7.2.7**).

The impact on City West Link Road/Norton Street intersection is not expected to be significant, with level of service forecast to remaining at LoS C in both AM and PM peak hours in both 'without construction' and 'with construction' scenarios.

The Darley Road/Charles Street intersection located on the southwest corner of the Darley Road civil and tunnel site (C4) construction ancillary facility is proposed to be upgraded to a signalised intersection. It is also proposed to signalise the right turn for heavy vehicles entering the site off Darley Road about 30 metres east of this intersection. The phasing and timing of this signalised right turn would be coordinated with the corresponding right turn at the Darley Road/Charles Street intersection, to minimise delay to eastbound through traffic on Darley Road. This intersection is forecast to operate satisfactorily at LoS A in both peaks.

Cluster 3

Cluster 3 consists of the following intersections:

- City West Link/The Crescent
- The Crescent/James Craig Road

- City West Link/Rozelle civil and tunnel site (C5) western access.

The modelling indicates that in the 'without construction' scenario, City West Link/The Crescent and The Crescent/James Craig Road intersections are forecast to operate satisfactorily at LoS D or better in both peaks. With about 135 PCU and 325 PCU added to the network in the AM and PM peaks respectively in the 'with construction' scenario, the operational performance at the intersections is forecast to worsen.

In the 'with construction' scenario, the new eastern access road to the Rozelle civil and tunnel site (C5) is accommodated as the northern approach to City West Link/The Crescent intersection. Construction vehicles are only permitted to turn right out of this access road onto City West Link westbound. However, safe operation requires a new traffic signal phase. It is expected that this phase would only be required to run once every three cycles. In the AM peak, City West Link/The Crescent intersection level of service is forecast to drop from LoS D to LoS E with an increase in average delay of about 15 seconds. In the PM peak, the level of service is forecast to remain at LoS C.

A new temporary signalised intersection is also proposed on City West Link about 400 metres west of The Crescent, accommodating a second (western) site access to the Rozelle civil and tunnel site (C5). Construction vehicles are similarly only permitted to turn right out of this access road, with a traffic signal phase required to safely accommodate this movement. This intersection is forecast to operate at LoS A in both AM and PM peak hours.

There is no adverse impact expected on The Crescent/James Craig Road intersection, with LoS B forecast in both 'without construction' and 'with construction' scenarios in both peaks.

Cluster 4

Cluster 4 consists of the following intersections:

- Victoria Road/Wellington Street
- Victoria Road/Darling Street
- Victoria Road/Evans Street.

The modelling indicates the Victoria Road/Wellington Street intersection in the AM peak and the Victoria Road/Darling Street intersection in the PM peak are forecast to operate at LoS F in the 'without construction' scenario.

About 60 PCU and 200 PCU are added to the networks in the AM and PM peak hours respectively in the 'with construction' scenario. The performance of the intersections would be impacted, however the levels of service are expected to remain at the same level as in the 'without construction' scenario, except for the Victoria Road/Wellington Street intersection, which is forecast to worsen slightly from LoS B to LoS C in the PM peak hour. The impact on the Victoria Road/Evans Street intersection is expected to be minimal in the AM peak hour; however, the level of service is forecast to worsen from LoS C to LoS E in the PM peak hour.

Cluster 5

Cluster 5 consists of the following intersections:

- Parramatta Road/Pyrmont Bridge Road
- Pyrmont Bridge Road/ Pyrmont Bridge Road tunnel site (C9) access
- Pyrmont Bridge Road/Booth Street/Mallett Street.

About 60 PCU and 100 PCU are added to the network in the AM and PM peaks respectively in the 'with construction' scenario. This is shown to have minimal impact on the operation of the intersections, with levels of service at both the Parramatta Road/Pyrmont Bridge Road and Pyrmont Bridge Road/Booth Street/Mallett Street intersections forecast to operate at the same level of service as the 'without construction' scenario.

The Pyrmont Bridge Road/Pyrmont Bridge Road tunnel site (C9) access intersection is forecast to operate at LoS A in both peaks.

Cluster 6

Cluster 6 consists of the following intersections:

- Princes Highway/Campbell Street
- Princes Highway/Mary Street/Canal Road
- Princes Highway/Railway Road
- Campbell Street/Albert Street.

The analysis is based on the upgrade of the Princes Highway/Campbell Street intersection, as part of the New M5 project. The upgrade involves widening the Campbell Street southeast leg to three lanes in each direction and the Campbell Street northwest leg to two lanes in each direction, as well as localised widening to accommodate turn pockets. The upgrade will be operational by 2021.

The modelling shows significant congestion on the Princes Highway corridor with all three Princes Highway intersections forecast to operate at LoS F in the 'without construction' scenario during both AM and PM peak hours.

In the 'with construction' scenario, 50 PCU and 75 PCU are added to the network during the AM and PM peaks respectively. The average level of delay at the intersections is forecast to increase, but the level of service is forecast to remain the same as in the 'without construction' scenario.

At some intersections, stable or minor improvements in performance (with the addition of construction volumes) can occur as a result of upstream intersections operating over capacity and/or cluster optimisation effects which distribute delay. When capacity is reached, upstream intersections can behave as bottlenecks, reducing traffic flow at downstream intersections, though delays are increased at the upstream intersections.

Summary

The biggest impacts are forecast to be at the western end of the project, as spoil trucks travel to the potential spoil management sites to the west of the project from the construction facilities and back, along with light construction vehicle traffic, although these use more dispersed routes. Intersections that are most impacted include the Wattle Street intersections at Ramsay Street and Timbrell Drive, City West Link/James Street intersection, which includes the introduction of the right-hand-turn from City West Link, and the City West Link/The Crescent intersection, due to the additional site entry/exit added to the intersection.

Traffic impacts on City West Link during construction could be mitigated or managed to some degree through corridor management of City West Link traffic. Mitigation measures will be developed as part of the CTAMP, and could include:

- Restriction of heavy vehicle right turns at City West Link/James Street and City West Link/The Crescent intersections during peak hours
- Staggering or re-timing shift times to avoid a large generation of light vehicles in the peak hours.

More detail on potential construction mitigation is provided in **section 11.1**. It is noted that this is a worst-case assessment, based on peak construction traffic levels, and adverse mid-block impacts would be expected to reduce once peak construction is complete.

Table 7-20 Option A – 2021 AM peak hour intersection operational performance summary^

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)	LoS	Volume (PCU)	LoS
1	Parramatta Road | Harris Road	2,550	B	2,650	C
	Parramatta Road | Croydon Road | Arlington Street	3,280	B	3,370	B
	Parramatta Road | Great North Road	3,810	C	3,940	C
	Parramatta Road | Frederick Street | Wattle Street	4,880	D	4,960	D
	Parramatta Road | Bland Street	2,870	F	2,870	F
	Wattle Street | Ramsay Street	3,260	C	3,280	C
	Dobroyd Parade | Waratah Street	3,470	B	3,650	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,530	F	5,720	F
2	City West Link | James Street	5,530	F	5,720	F
	City West Link | Norton Street	5,290	C	5,450	C
	Darley Road | C4 site access	–	–	1,200	A
3	The Crescent | James Craig Road	6,730	B	6,760	B
	City West Link | The Crescent	6,800	D	6,880	E
	City West Link | C5 site access	–	–	4,780	A
4	Victoria Road | Wellington Street	6,510	F	6,600	F
	Victoria Road | Darling Street	6,980	E	7,030	E
	Victoria Road | Evans Street	5,850	B	5,870	B
5	Parramatta Road | Pyrmont Bridge Road	5,050	C	5,090	C
	Pyrmont Bridge Road | Booth Street | Mallett Street	1,970	B	1,990	B
	Pyrmont Bridge Road | C9 site access	–	–	950	A
6	Princes Highway | Railway Road	5,370	F	5,400	F
	Princes Highway | Mary Street | Canal Road	4,910	F	4,940	F
	Princes Highway | Campbell Street	5,260	F	5,290	F
	Campbell Street | Albert Street	5,090	A	5,130	A

^Traffic volume rounded to nearest 10

Table 7-21 Option A – 2021 PM peak hour intersection operational performance summary^

Cluster	Intersection	Without construction		With construction	
		Volume (PCU)	LoS	Volume (PCU)	LoS
1	Parramatta Road | Harris Road	3,040	B	3,240	C
	Parramatta Road | Croydon Road | Arlington Street	3,610	D	3,710	E
	Parramatta Road | Great North Road	3,820	F	3,920	F
	Parramatta Road | Frederick Street | Wattle Street	4,950	E	5,200	E
	Parramatta Road | Bland Street	2,500	B	2,520	B
	Wattle Street | Ramsay Street	3,080	D	3,330	E
	Dobroyd Parade | Waratah Street	2,960	B	3,240	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,450	F	5,770	F
2	City West Link | James Street	5,640	F	5,990	F
	City West Link | Norton Street	5,700	C	5,970	C
	Darley Road | C4 site access	–	–	1,210	A
3	The Crescent | James Craig Road	6,500	B	6,720	B
	City West Link | The Crescent	6,690	C	6,970	C
	City West Link | C5 site access	–	–	4,740	A
4	Victoria Road | Wellington Street	6,780	B	6,980	C
	Victoria Road | Darling Street	7,180	F	7,380	F
	Victoria Road | Evans Street	6,210	C	6,280	E
5	Parramatta Road | Pyrmont Bridge Road	4,970	F	5,040	F
	Pyrmont Bridge Road | Booth Street | Mallett Street	2,110	B	2,150	B
	Pyrmont Bridge Road | C9 site access	–	–	1,120	A
6	Princes Highway | Railway Road	5,730	F	5,780	F
	Princes Highway | Mary Street | Canal Road	5,090	E	5,140	F
	Princes Highway | Campbell Street	5,510	F	5,590	F
	Campbell Street | Albert Street	5,110	A	5,100	A

^Traffic volume rounded to nearest 10

7.4.4 Temporary road network changes, closures and diversions

Certain road network modifications would be required to facilitate construction of the project. These modifications are outlined in **Table 7-22**. Impacts from construction traffic and associated temporary network changes are considered above.

Indicative traffic staging plans to facilitate the Rozelle and Iron Cove Link surface works are described in **Table 7-23**. Road network modifications and traffic staging would be reviewed by the construction contractor during preparation of the CTAMP, with the objective of minimising disruptions to the road network. At locations where road closures are required, access to retained properties would be maintained throughout the construction period. Appropriate signage for road closures or detours would be installed.

Table 7-22 Indicative temporary road network modifications during construction – Option A

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Wattle Street interchange	• Northcote Street would be closed at the intersection with Parramatta Road for the duration of construction. This would be a continuation of the current closure of this section of Northcote Street to facilitate construction of the M4 East project	• Until completion of tunnel works in 2022	Once construction is complete, the Northcote Street/Parramatta Road intersection would be reinstated
Darley Road civil and tunnel site (C4)	• Works would be carried out to facilitate access to the Darley Road civil and tunnel site (C4) including establishment of a temporary right hand turn lane for construction traffic to access Darley Road from City West Link • Temporary diversions along Darley Road may be required during construction (to enable establishment of construction vehicle access provisions) • One lane in each direction along Darley Road (between around Francis Street and Charles Street at Leichhardt) would generally be maintained, with temporary closures of one lane required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • On-street parking along the northern (eastbound) carriageway of Darley Road between around Francis Street and Charles Street would be removed (around 20 spaces) during construction. Impacts on the kiss and ride parking for the Leichhardt North Light Rail stop would need to be considered in the CTAMP	• Q3 2018 to Q1 2019 to complete road modifications • Q3 2018 to Q4 2022 including construction duration and reinstatement of roads	Once road modification works are complete, Darley Road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement Kerbside parking along Darley Road would be reinstated at the end of construction

Location	Indicative road network modifications	Indicative duration	Road reinstatement
City West Link at Lilyfield and Rozelle) (also refer to indicative staging plans in **Table 7-23**)	• Works would be carried out to facilitate ingress and egress for the Rozelle civil and tunnel site (C5) including establishment temporary intersections, slip lanes and driveways • Works would be carried out to upgrade and improve the eastbound and westbound carriageways of City West Link and The Crescent • Temporary diversions would be put in place to allow for construction along the existing alignment • Under existing and diverted arrangements, all traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences	• Q4 2018 to Q2 2019 to complete road modifications • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	When construction is complete, the road would be reinstated as per the permanent design
The Crescent at Annandale and Rozelle	• Works would be carried out to establish a new driveway for ingress and egress for The Crescent civil site (C6) • Works would be carried out to realign The Crescent and reconstruct the intersection with City West Link • The new alignment of The Crescent would be constructed 'offline' (that is, next to the existing alignment). Traffic would be switched onto the new alignment when ready, and the old alignment of The Crescent would be demolished • All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary changes to the intersection of The Crescent/Chapman Road may be required. Access to the commercial premises, including the Multihull Central Marina, that use Chapman Road as well as the Glebe Foreshore Parklands would be protected and maintained at all times • Traffic signal modifications at the intersection with City West Link in line with the temporary and permanent design	• Q1 2019 to Q2 2019 to complete road modifications • Q1 2019 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	Once road modification works are complete, the road would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design
Victoria Road at Rozelle (also see	• All traffic lanes in each direction would generally be maintained with some short-term lane closures (outside of peak periods where feasible and	• Q4 2018 to Q2 2019 to complete road modifications	Once road modification works are complete, the road would be

Location	Indicative road network modifications	Indicative duration	Road reinstatement
indicative staging plans in **Table 7-23**)	reasonable) subject to road occupancy licences • Traffic signal modifications at the intersection with The Crescent in line with the permanent design • Temporary diversions would be put in place at the intersection with The Crescent to allow for construction of the new bridge in line with the permanent design. This could include the construction a temporary bridge next to the existing bridge, onto which traffic would be switched during construction of the new bridge. When complete, traffic would be switched onto the new bridge and the temporary bridge would be removed	• Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	reopened in line with temporary design. When construction is complete, the road would be reinstated as per the permanent design
Gordon Street south of Lilyfield Road at Rozelle	• Gordon Street between Lilyfield Road and the Rozelle Rail Yards would be permanently closed as part of the project	N/A	Gordon Street would be permanently closed
Lilyfield Road at Rozelle	• Temporary closures to one lane would be required for short periods of time to allow for construction of the construction access driveways, utility works and construction of the cut-and-cover structures • Access to Lilyfield Road from Victoria Road may be temporarily restricted to allow for integration with the revised Victoria Road alignment. Closures would be outside of peak periods where feasible and reasonable. During these periods, alternate access to Lilyfield Road would be available from Hornsey Street and Gordon Street	• Q4 2018 to Q2 2019 to complete road modifications • Q2 2019 to Q4 2019 for utility relocations • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	Once works during this stage is completed, the road would be reopened in line with permanent design
Hornsey Street at Rozelle	• One lane in each direction would generally be maintained during construction • Access to Hornsey Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternate access to Hornsey Street would be available from Lilyfield Road and Gordon Street • On-street parking along the eastbound carriageway west of Victoria Road would be removed (about four spaces) during construction	• Q4 2018 to Q2 2019 to complete road modification • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	Once works during this stage is completed, the road would be reopened in line with permanent design
Quirk Street	• One lane in each direction would generally be maintained during	• Q4 2018 to Q2 2019 to	Once works during this stage is

Location	Indicative road network modifications	Indicative duration	Road reinstatement
at Rozelle	construction • Access to Quirk Street from Victoria Road would require full closure for short periods of time during realignment and upgrade works to Victoria Road • Alternate access to Quirk Street would be available from Hornsey Street and Gordon Street	complete road modifications • Q4 2018 to Q3 2023 including construction duration staging and reinstatement of roads	completed, the road would be reopened in line with permanent design
Iron Cove Link civil site (C8) and Victoria Road (also refer to indicative staging plans in **Table 7-23**)	• Works would be carried out along Victoria Road to facilitate ingress and egress for the Iron Cove Link civil site (C8) • All traffic lanes in each direction would generally be maintained with some short-term lanes closures (outside of peak periods where feasible and reasonable) subject to road occupancy licences • Temporary diversions would be put in place to allow for construction along the existing alignment	• Q4 2018 to Q2 2019 to complete road modifications for ingress and egress • Q4 2018 to Q3 2023 including construction duration staging, temporary roads and reinstatement of roads	Once works are complete, the road would be reopened in line with temporary construction design. When construction is complete, the road would be reinstated as per the permanent design
Moodie Street at Rozelle	• Short-term, temporary closure of one lane of Moodie Street may be required during construction to facilitate utility works	• Q4 2018 to Q3 2023	Once construction is completed, Moodie Street would be reopened as per the existing design
Callan Street at Rozelle	• Access to Callan Street from Victoria Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Callan Street would be available from Springside Street and McCleer Street at Rozelle. Regard would also be given to the days/times of use of King George Park when considering temporary closures • Limited on-street parking, west of Victoria Road, would be removed during construction. These are adjacent to properties being acquired and so the impact of their loss would be reduced.	• Q4 2018 to Q3 2023	Once works are completed, the road would be reopened in line with permanent design
Toelle Street	• Access to Toelle Street from Victoria	• Q4 2018 to	Once works are

Location	Indicative road network modifications	Indicative duration	Road reinstatement
at Rozelle	Road would generally remain open during construction • Temporary closures at the intersection with Victoria Road to allow for integration with the revised Victoria Road alignment may occur. Closures would be outside of peak periods where feasible and reasonable subject to road occupancy licences • During these periods, alternative access to Toelle Street would be available from Springside Street, McCleer Street, Callan Street and Manning Street at Rozelle. Regard would also be given to the days/times of use of King George Park when considering temporary closures • Limited on-street parking, west of Victoria Road, would be removed during construction. These are adjacent to properties being acquired and so the impact of their loss would be reduced.	Q3 2023	completed, the road would be reopened in line with permanent design
Clubb Street at Rozelle	• Access between Clubb Street and Victoria Road would be permanently closed and a cul-de-sac established to accommodate the revised alignment of Victoria Road • Alternate access to Clubb Street would be available from Manning Street via Toelle Street or from Callan Street and McCleer Street via Springside Street • Limited on-street parking, west of Victoria Road, would be removed during construction. These are adjacent to properties being acquired and so the impact of their loss would be reduced.	• N/A (closed at the start of construction)	Access to Clubb Street from Victoria Road would be permanently closed
Byrnes Street at Rozelle	• Short-term, temporary closure of one lane of Byrnes Street may be required during construction to facilitate utility works • Works would also be carried out to move the terminus near Victoria Road south to accommodate the revised design	• Q1 2019 to Q4 2019	Once utility works are completed, Byrnes Street would be reopened as per the existing layout. Once works on the cul de sac of Byrnes Street are complete, this section of the road would be reopened in line with the permanent design

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Pyrmont Bridge Road tunnel site (C9)	• Works would be carried out along Parramatta Road and Pyrmont Bridge Road to facilitate ingress and egress for construction traffic • Works would be carried out to realign Bignell Lane between Mallett Street and Pyrmont Bridge Road at Annandale • Short-term, temporary closure of Bignell Lane would be required during construction to allow for the realignment works • Rear-access to commercial properties along Bignell Lane would be maintained during construction	• Q3 2018 to Q4 2018 to complete road modifications • Q3 2018 to Q4 2022 including construction duration and reinstatement of roads	Once construction is completed, roads would be reopened in line with the permanent design (ie realigned Bignell Lane)

The construction of major infrastructure in constrained urban environments requires detailed consideration of the staging of construction works. There are three key areas of the project which will require the preparation of detailed traffic staging plans during construction:

- Victoria Road/City West Link/Anzac Bridge approach intersection – reconstructing the intersection to accommodate existing connectivity, the M4 East Motorway/Iron Cove Link to Anzac Bridge connections and construction of a new bridge at Victoria Road
- City West Link/The Crescent intersection – realigning The Crescent to the west, building a new bridge over Whites Creek and modifying the intersection
- Victoria Road at Iron Cove – realigning the westbound (southern) carriageway of Victoria Road to create sufficient space to build new tunnel portals and entry and exit ramps for the Iron Cove Link.

Indicative staging is summarised in **Table 7-23**. Detailed traffic staging plans along key roads would be developed during detailed design, in consultation with relevant traffic and transport stakeholders (eg the Transport Management Centre), and in accordance with the following principles:

- Provision of early notifications via Variable Message Signs or media announcements
- Undertaking the works in a staged manner to reduce traffic impacts
- Implementation of temporary speed restrictions within construction work zones
- Reduced shoulder widths and erection of traffic barriers along construction work zones, ensuring that any impacted pedestrian and cyclist facilities are adequately and safely replaced, and other road user facilities, such as bus stops and loading zones are adequately and safely relocated
- Provision of appropriate warning and advisory signposting
- Provision of temporary access arrangements with private landowners whose property is adjacent to construction activities
- Provision for public transport and emergency services to ensure disruption is minimised.

Table 7-23 Indicative traffic staging

Stage	Indicative traffic staging
City West Link and Victoria Road at Rozelle	
1	• Construct a temporary deviation for the existing City West Link to Anzac Bridge bypass and underpass. This includes a portion of the permanent M4 citybound off ramp approaching Anzac Bridge • Commence construction of temporary Victoria Road bridge and approach earthworks • Switch City West Link to Anzac Bridge bypass traffic to temporary deviation • Complete construction of temporary bridge • Demolish existing Victoria Road pedestrian overpasses (may require night closures). See **section 7.4.7** for provision for active transport during this period • Construct a temporary deviation for traffic from City West Link to Victoria Road to tie into the deviation on Victoria Road to Anzac Bridge • Construct a temporary signalised intersection for City West Link/James Craig Road intersection.
2	• Switch Victoria Road to Anzac Bridge traffic onto the temporary deviation constructed in the previous stage • Switch City West Link to Victoria Road traffic onto the temporary deviation constructed in the previous stage • Demolish the existing Victoria Road bridge • Construct a temporary deviation for traffic from Anzac Bridge to City West Link and Victoria Road.
3	• Switch westbound traffic from Anzac Bridge to City West Link onto the deviation constructed in the previous stage • Start construction of the new Victoria Road bridge • Construct the permanent roadway for traffic westbound from Anzac Bridge to Victoria Road • Construct the permanent roadway for traffic between Victoria Road and City West Link.
4	• Realign the western end of the deviation for City West Link to Anzac Bridge bypass intersection between City West Link and James Craig Road • Switch traffic westbound from Anzac Bridge to Victoria Road onto the permanent roadway • Switch traffic from City West Link to Victoria Road onto the permanent roadway • Demolish the temporary deviation for traffic from City West Link to Victoria Road • Continue with the construction of the new Victoria Road bridge, roadway, traffic islands and road furniture • Clear and rehabilitate the entry to the existing City West Link to Anzac Bridge underpass • Construct the permanent roadway for traffic eastbound from Victoria Road to Anzac Bridge.
5	• Switch the northbound traffic on Victoria Road onto the permanent roadway • Complete all island and road furniture works connecting southbound traffic on Victoria Road to City West Link east and westbound at the Victoria Road intersection • Switch the south and eastbound traffic on Victoria Road to Anzac Bridge onto the permanent alignment • Clear, realign and rehabilitate the exit from the existing City West Link to Anzac Bridge underpass • Start demolition of the temporary deviation for Victoria Road north • Construct Anzac Bridge to Victoria Road shared path bridge structure and approaches.
6	• Switch the eastbound bypass traffic from City West Link to Anzac Bridge onto the permanent roadway • Complete demolition of the temporary deviation and bridge for Victoria Road • Complete the M4 eastbound exit ramp tunnel connection though beneath the new Victoria Road bridge • Complete the M4 westbound entry ramp tunnel connection to the new cut-and-cover underpass.

Stage	Indicative traffic staging
Iron Cove Link connections at Victoria Road	
1	• Construct a temporary deviation for the existing northbound lanes on Victoria Road • Switch northbound traffic on Victoria Road to the temporary deviation constructed in the previous stage • Construct a temporary deviation for the existing southbound lanes on Victoria Road and a deviation for northbound turning traffic crossing the future construction area to Terry Street.
2	• Switch southbound traffic on Victoria Road to the temporary deviation constructed in the previous stage • Install sewer submain diversion • Construct the Iron Cove Link southbound entry retaining and upper barrier • Construct the southern end of the Iron Cove Link northbound exit right hand side retaining and upper barrier • Construct permanent southbound traffic lanes • Construct the permanent bus lanes north of Terry Street between the new barriers • Construct a temporary deviation between the new barriers over the proposed M5 southbound entry slot for a single lane southbound • Construct a temporary link northbound to the permanent bus lane southbound south of Terry Street • Sites for micro tunnelling of the sewer main diversion on Moodie Street at the intersections of Victoria Road and McCleer Street would require closures on Moodie Street.
3	• Switch southbound traffic onto the permanent southbound lanes and the temporary alignment over the Iron Cove Link southbound slot • Switch one lane northbound onto a temporary alignment using the southbound permanent bus lane north of Terry Street and link to turning lane to Terry Street • Construct the Iron Cove Link northbound exit left hand side retaining and upper barrier • Construct a temporary deviation between the new barriers over the proposed M5 northbound exit slot for two lanes southbound.
4	• Switch the northbound lane switched in the last stage back to the three lane northbound diversion and reconnect the turning lane to Terry Street • Switch two lanes of southbound traffic on Victoria Road onto the deviation constructed in the previous stage • Excavate the Iron Cove Link southbound exit slot and start the cut-and-cover tunnel • Construct a temporary deviation from the temporary northbound lanes on Victoria Road to Terry Street over the new cut-and-cover tunnel.
5	• Switch turning traffic from Victoria Road to Terry Street to the deviation constructed in the previous stage • Complete the Iron Cove Link southbound slot and cut-and-cover tunnel • Construct a temporary connection from the bus lanes south of Terry Street • Construct a temporary two lane deviation over the new cut-and-cover tunnel on Victoria Road southbound from the existing Victoria Road to the temporary deviation in place • Reconfigure the deviation for turning traffic from Victoria Road to Terry Street.
6	• Switch northbound traffic on Victoria Road onto the deviations constructed in the previous stage • Switch one lane of southbound traffic on Victoria Road onto the permanent southbound bus lane and temporary bus lane deviation constructed in the previous stage • Switch one lane of southbound traffic back to the permanent southbound lane • Sever the connection to Callan Street • Start the Iron Cove Link northbound cut-and-cover tunnel from the southern (driven tunnel portal) end • Reinstate the northbound deviation constructed over the new cut-and-cover tunnel.

Stage	Indicative traffic staging
7	• Switch two lanes of the northbound traffic on Victoria Road back to the northbound deviation previously constructed • Construct another section of Iron Cove Link northbound cut-and-cover tunnel • Construct permanent pavement on Victoria Road northbound to the new cut-and-cover tunnel • Start excavation of the Iron Cove Link northbound exit slot.
8	• Switch the northbound lane on the permanent bus lane temporary alignment back to the northbound deviation previously constructed • Reconfigure the northbound right hand turn from Victoria Road to Terry Street. • Complete the Iron Cove Link northbound exit right hand side retaining and upper barrier • Complete excavation of the Iron Cove Link northbound exit slot • Complete the Iron Cove Link northbound slot and cut-and-cover tunnel.
9	• Switch one lane of northbound traffic on Victoria Road to the permanent roadway • Switch one lane of northbound traffic onto the permanent northbound bus lane and temporary link south of Terry Street • Open the Iron Cove Link entry and exit • Construct the permanent left hand side kerb and channel and shared path on Victoria Road northbound • Reconfigure the permanent intersections with Toelle and Callan streets • Construct cul-de-sacs on Byrnes and Clubb streets • Construct the permanent right hand turning lane from Victoria Road to Terry Street.
10	• Switch northbound traffic on Victoria Road to the permanent roadway • Close the new bus lanes north of Terry Street • Complete the transitway station and bus lanes south of Terry Street • Complete the permanent bus lane pavement and barrier approaching Iron Cove Bridge.

7.4.5 Traffic crashes

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facility locations. The greatest increase is forecast to occur on City West Link west of City West Link/James Street intersection where, as a worst case scenario, construction would generate around 110 vehicles during the AM peak hour and around 220 vehicles during the PM peak hour. Compared to existing traffic volumes, total construction traffic would be the equivalent of around three per cent of peak hour traffic on City West Link at this location during the AM peak hour and five per cent of existing peak hour volumes during the PM peak hour.

As the volume of traffic generated by construction is expected to be low compared to existing traffic, the effects of this short-term increase on the existing road network is not expected to substantially impact road safety in the study area. There is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. Any foreseen impacts on road safety for all users during construction would be mitigated as much as possible through the provision of tailored traffic management plans and other measures detailed in **section 11.1**.

7.4.6 Public transport services

An increase in vehicles on the road network during the construction period would result in some increased delays at certain intersections. Heavy vehicle volumes would increase along major roads. The following impacts on public transport services in these areas would potentially be experienced:

Buses

- As with general traffic, an increase in bus travel times due to slower travel speeds and increased intersection delays. This would be somewhat mitigated by the presence of bus lanes along Parramatta Road to be installed as part of Condition B34 of the M4 East Conditions of Approval, which requires at least two lanes of Parramatta Road, from Burwood Road to Haberfield to be solely dedicated for the use of public transport

- Longer travel times to and from bus stops by supplementary travel modes (eg car passenger, walking to/from bus stops) due to an increase in traffic volumes, slower travel speeds and increased intersection delays
- Reduced amenity for bus users waiting at stops
- Initial assessments have identified that seven bus stops would require relocation during construction for safety. As the detailed design develops, additional bus stops requiring relocation may be identified
- Local residents, business owners and bus passengers would be notified of traffic management procedures and ongoing consultation would be undertaken to provide information on planned construction activities and changes to any bus stop or access arrangements.

Table 7-24 outlines the indicative changes to bus stop locations during construction. The modifications and proposed temporary locations of the bus stops would be reviewed during detailed design with the objective of minimising disruptions to public transport services. Any bus stop relocations would be agreed with Transport for NSW and all affected bus operators, and would need to consider proposed pedestrian diversions during construction.

Table 7-24 Indicative bus stop relocations

Location	Details of relocation
Rozelle surface works	Relocation of the bus stop at The Crescent northbound carriageway at Annandale around 150 metres north of Johnston Street.
	Relocation of the bus stop at The Crescent southbound carriageway at Annandale around 100 metres north of Johnston Street.
	Relocation of the bus stop at Victoria Road northbound carriageway at Rozelle around 20 metres south of Lilyfield Road.
	Relocation of the bus stop at Victoria Road northbound carriageway at Rozelle between Lilyfield Road and Hornsey Street.
	Relocation of the bus stop at Victoria Road southbound carriageway at Rozelle around 100 metres south of Robert Street.
Iron Cove Link surface works	Relocation of the bus stop at Victoria Road westbound carriageway at Rozelle between Toelle Street and Clubb Street.
	Relocation of the bus stop at Victoria Road eastbound carriageway at Rozelle between Terry Street and Crystal Lane.

Rail services

Bus service connections to railway stations may be affected due to a reduction in the reliability of bus services during the construction period, but there would generally be minimal impacts on rail services.

Light rail

Bus service connections to light rail stops may be affected due to a reduction in the reliability of bus services during the construction period. Access to the Leichhardt North light rail stop at Leichhardt and the Rozelle Bay light rail stop at Annandale would be maintained during construction. Temporary impacts to the operation or access to Leichhardt North light rail stop, due to the Darley Road civil and tunnel site (C4), or to the Rozelle Bay light rail stop, due to the construction of Rozelle surface works or the Rozelle civil and tunnel site (C5) and The Crescent civil site (C6), would be managed through the CTAMP.

7.4.7 Walking and cycling

An increase in the number of heavy vehicles during the construction period would potentially impact walking and cycling amenity. Pedestrian footways and cycling paths would also need to be closed or diverted during construction. The impacts on pedestrians and cyclists were assessed based on broad criteria outlined in **Table 7-25**, which were developed to determine the potential impact and corresponding management and mitigation measures.

Construction would be carried out in stages resulting in changing impacts over the course of the construction program. A key objective of the construction program would be to minimise disruption to pedestrians and cyclists and enable the use of the final active transport links as soon as possible.

Table 7-25 Active transport – impact severity

Severity	Impact
Negligible	• The impacts result in an undetectable change (other than very minor increase in traffic volumes) and do not require any mitigation.
Minor	• Diversion of less than 200 metres on key routes • Negligible safety impact.
Moderate	• Diversion of more than 200 metres but less than 500 metres on key routes • Negligible safety impact.
High	• Diversion of more than 500 metres on key routes • Potential safety impact.

Wattle Street interchange construction ancillary facilities (C1a, C2a and C3a)

Construction is planned for between 2019 and 2022 at these sites. There are limited changes to the surface network proposed at the Wattle Street interchange other than some local restrictions described in **section 7.4.4**. The key effects of construction on pedestrians and cyclists around the Wattle Street interchange would be:

- The provision of new footpaths along the revised Wattle Street alignment (being delivered as part of the M4 East project)
- Interactions between construction vehicles and pedestrians using footpaths, particularly along Parramatta Road near the Northcote Street civil site (C3a), where heavy and light vehicles would be moving in and out of the site, and along Walker Avenue at Haberfield, where light vehicles would be using the construction driveway to enter and exit the site.

The generation of heavy and light vehicles associated with construction would be limited to those associated with the adjacent sites (C1a, C2a and C3a), as the east-facing portals to the M4 East would provide a bypass of the Wattle Street/Parramatta Road intersection for construction vehicles from other construction sites, such as the Rozelle civil and tunnel site to the east.

These factors, combined with relatively limited use of the interchange by cyclists due to it not being part of key cycle commuter routes (refer to **Appendix N** (Technical working paper: Active transport strategy) of the EIS), and no required diversions, would mean that impacts on active transport would be Negligible.

Darley Road civil and tunnel site (C4)

Construction is planned for between 2018 and 2022 at this site. Changes to the surface road network as a result of the Darley Road site would be restricted to local roads on the southern side of City West Link, with the exception of a temporary right turn lane for heavy vehicles from City West Link to James Street and then Darley Road.

There is an on-road cycle route on Darley Road that connects to the Lilyfield Road commuter route via the City West Link/James Street intersection (shown on **Figure 7-19**). A separated cycle path connection along this section of City West Link between the Bay Run at Canal Street and the Lilyfield Light Rail Depot is also proposed. This proposed cycle link does not form part of the project.

An existing pedestrian overpass links Charles Street, north of City West Link, with Canal Road, south of City West Link. This overpass also connects to a pedestrian path that runs along the southern side of City West Link, connecting with the Leichhardt North light rail stop at the corner of City West Link and Darley Road.

The key effects on pedestrians and cyclists as a result of construction at the Darley Road civil and tunnel site would be interactions between construction vehicles entering and exiting the site and:

- Pedestrians using the northern footpath along Darley Road between Charles Street and City West Link
- Cyclists using the on-road cycle route along Darley Road.

Traffic management measures would be implemented at the entry and exit driveways to manage potential interactions between construction traffic and pedestrians and cyclists.

Minor impacts are anticipated during construction as, while no diversions are required, there may be a safety impact and turning lanes would be provided for heavy vehicles to improve safety. The project would not affect the pedestrian overpass and/or path linking the northern side of City West Link with the Leichhardt North light rail stop.

Rozelle interchange construction ancillary facilities (C5, C6 and C7)

Construction at these sites is planned to occur between 2018 and 2023. Key regional active transport routes pass through the Rozelle interchange area. These are shown on **Figure 7-20** and include:

- Lilyfield Road to Anzac Bridge (east–west)
- Johnston Street to Victoria Road and Anzac Bridge.

Construction activities associated with the Rozelle interchange would result in temporary diversions and permanent realignment of parts of these routes. These temporary and permanent changes are described and assessed in the following sections.

Lilyfield Road to Anzac Bridge (east–west)

This route provides a key east–west link for cyclists and pedestrians from Lilyfield Road to Anzac Bridge via the existing Victoria Road pedestrian bridge. The Victoria Road pedestrian bridge is narrow and has steep gradients with sharp 180 degree bends. It is therefore of low quality from a cycling perspective relative to its use and importance.

The Victoria Road pedestrian bridge would be replaced at the start of construction with an underpass below Victoria Road. The new pedestrian and cyclist route would connect to the existing Lilyfield Road commuter link and Anzac Bridge shared path. As part of the project, a shared cycle and pedestrian path would also be provided on the western side of Victoria Road that would link the Rozelle Rail Yards to Victoria Road.

During construction, the section of this path between Victoria Road and Anzac Bridge would be temporarily diverted to the north (by around 50 metres) to travel around the northern boundary of the construction area. This path would be reinstated at the completion of construction in generally the same alignment as existing.

Impacts on pedestrians and cyclists using the Lilyfield Road to Anzac Bridge route would be avoided through the provision of the new connection below Victoria Road as a replacement to the existing Victoria Road pedestrian bridge prior to it being removed. This would enable east–west trips to continue without disruption. Although this would mean a permanent change to the alignment of this route, the impact of this alignment change would be negligible and likely beneficial, as the distance of the route would be similar and the quality of the connection would be improved compared to the existing condition.

Johnston Street to Victoria Road and Anzac Bridge

The pedestrian and cycle bridge that spans City West Link and connects Anzac Bridge and Victoria Road with The Crescent and Johnston Street would be removed early in the construction program.

The existing at-grade connection between the western side of Victoria Road and The Crescent would be retained.

The removal of the bridge that spans City West Link would potentially affect pedestrians and cyclists travelling between Johnston Street, Victoria Road and Anzac Bridge. Potential alternatives and diversions being considered for implementation during construction are shown in **Figure 7-21** and include:

- The existing at-grade crossing between The Crescent and the western side of Victoria Road. This route would also allow for onward connection to the eastern side of Victoria Road and Anzac Bridge via the new pedestrian and cyclist underpass that would be provided below Victoria Road (see description of this underpass above). The diversion would be less than 200 metres and there would be negligible safety impact. However, there could be a minor increase in travel times due to delays waiting for the traffic signals to change. The impact of this change would therefore be Minor
- From Anzac Bridge to Somerville Road at Rozelle via the existing pedestrian and cycle ramp, then southwest along Somerville Road and James Craig Road (using the shared path) towards the footpath on the southern side of The Crescent. This would result in a similar travel distance to the current route and would be a Negligible impact.

Periodic, short-term closures of the footpath on one side of James Craig Road at Rozelle may be required during construction. During these instances, the footpath on the other side of James Craig Road would be used as an alternative route. Periodic, temporary closures of the footpath on the eastern and western side of The Crescent at Annandale between City West Link and Johnston Street at Annandale would also be required during construction. Works would be staged so that the shared path on one side of The Crescent would remain open at all times.

The project would also require permanent closure of the shared path through Buruwan Park connecting The Crescent with Bayview Crescent at Annandale (see **Figure 7-21**). Alternative access for pedestrians to the Rozelle Bay light rail stop from The Crescent, Johnston Street and Bayview Crescent at Annandale would be provided at all times during construction. Cyclists travelling between The Crescent and Bayview Crescent/Railway Parade at Annandale would be diverted via Johnston Street.

The Johnston Street to Victoria Road and Anzac Bridge connection would be permanently upgraded as part of the project through the provision of a new pedestrian and cycle bridge that would connect Victoria Road and the Rozelle Rail Yards with The Crescent, as well as the Rozelle Bay light rail stop and Bayview Crescent at Annandale. Further details on the permanent walking and cycling connections that would be provided at the Rozelle interchange are provided in **Chapter 5** (Project description) and **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

Iron Cove Link civil site (C8)

Construction at this site is planned for between 2018 and 2023. The key pedestrian and cycle route in this area connects Iron Cove Bridge shared path (southern side), the shared paths on either side of Victoria Road and the Bay Run south of Victoria Road, which extends around Iron Cove.

A detour route would be provided for cyclists on the southern side of Victoria Road via Springside Street, McCleer Street, Callan Street, Manning Street and Byrnes Street. This route is shown on **Figure 7-22** and would represent a travel distance of about 700 metres, about 400 metres longer than the existing 300 metre section along Victoria Road. The diversion route would be primarily on local roads with low traffic volumes, however given the length of the diversion and the corresponding increase in travel times for pedestrians and cyclists, the impact would be classed as Moderate.

A temporary link would be provided that would connect the Bay Run and Iron Cove Bridge. To minimise potential disruption to pedestrians and cyclists that use this link, a temporary ramp to Iron Cove Bridge shared path would be provided to connect the Bay Run and Iron Cove Bridge (westbound) and Byrnes Street (eastbound, to connect with the diversion described above). This temporary link is shown indicatively on **Figure 7-22**. This temporary diversion would not change the distance or travel times for users of the Bay Run and Iron Cove Bridge and would not result in additional safety impacts, and would therefore have a Negligible impact.

The existing link underneath Iron Cove Bridge that connects Iron Cove Bridge southern shared path with the Victoria Road northern shared path would not be impacted by the project.

Pyrmont Bridge Road tunnel site (C9)

Construction at this site is planned for between 2018 and 2022. The Pyrmont Bridge Road tunnel site is generally bound by Parramatta Road to the south, Pyrmont Bridge Road to the north and Mallett Street to the east. No significant changes to the surrounding road network are proposed with heavy vehicle ingress via Parramatta Road and egress via Pyrmont Bridge Road, and all light vehicle ingress and egress via Pyrmont Bridge Road.

The Inner City Regional Route for cyclists runs along Pyrmont Bridge Road at this location (identified as a 'bicycle friendly road') with connections via Parramatta Road (west) and Booth Street (northern continuation of Mallett Street). There are pedestrian footpaths on both sides of Parramatta Road and Pyrmont Bridge Road.

Minor impact is anticipated for pedestrians and cyclists at this location. Although there would be no requirement for diversions, there is the potential for interactions with construction vehicles, particularly where heavy vehicles enter the site from Parramatta Road and leave the site onto Pyrmont Bridge Road. Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road and Pyrmont Bridge Road to manage potential interactions between construction traffic and pedestrians and cyclists.

Campbell Road civil and tunnel site (C10)

Construction at this site is planned for between 2018 and 2022. The Campbell Road civil and tunnel site would be accessed from Albert Street, via the new signalised intersection on Campbell Road near Barwon Park Road (being constructed as part of the New M5 project). This signalised intersection would provide signalised crossing for pedestrians and cyclists using the new pedestrian and cycle paths along the southern side of Campbell Road at St Peters.

Campbell Road is currently used as a local route by cyclists due to low traffic volumes. The New M5 project would upgrade Campbell Road, and there is a forecast increase in traffic volumes. Delivery of the New M5 project would include construction of a separated cycle path along Campbell Road (forming part of the Bourke Street Link), connecting Newtown to the Bourke Street Cycleway, Green Square and the Sydney CBD, as shown in **Figure 7-23**.

For pedestrians and cyclists using the new separated cycle path along Campbell Road, there would be the potential for interactions with construction vehicles entering and leaving the Campbell Road civil and tunnel site (C10). However, these would be minimised through the implementation of traffic management measures. No diversions would be required and the impact on pedestrians and cyclists at this location is therefore Negligible.

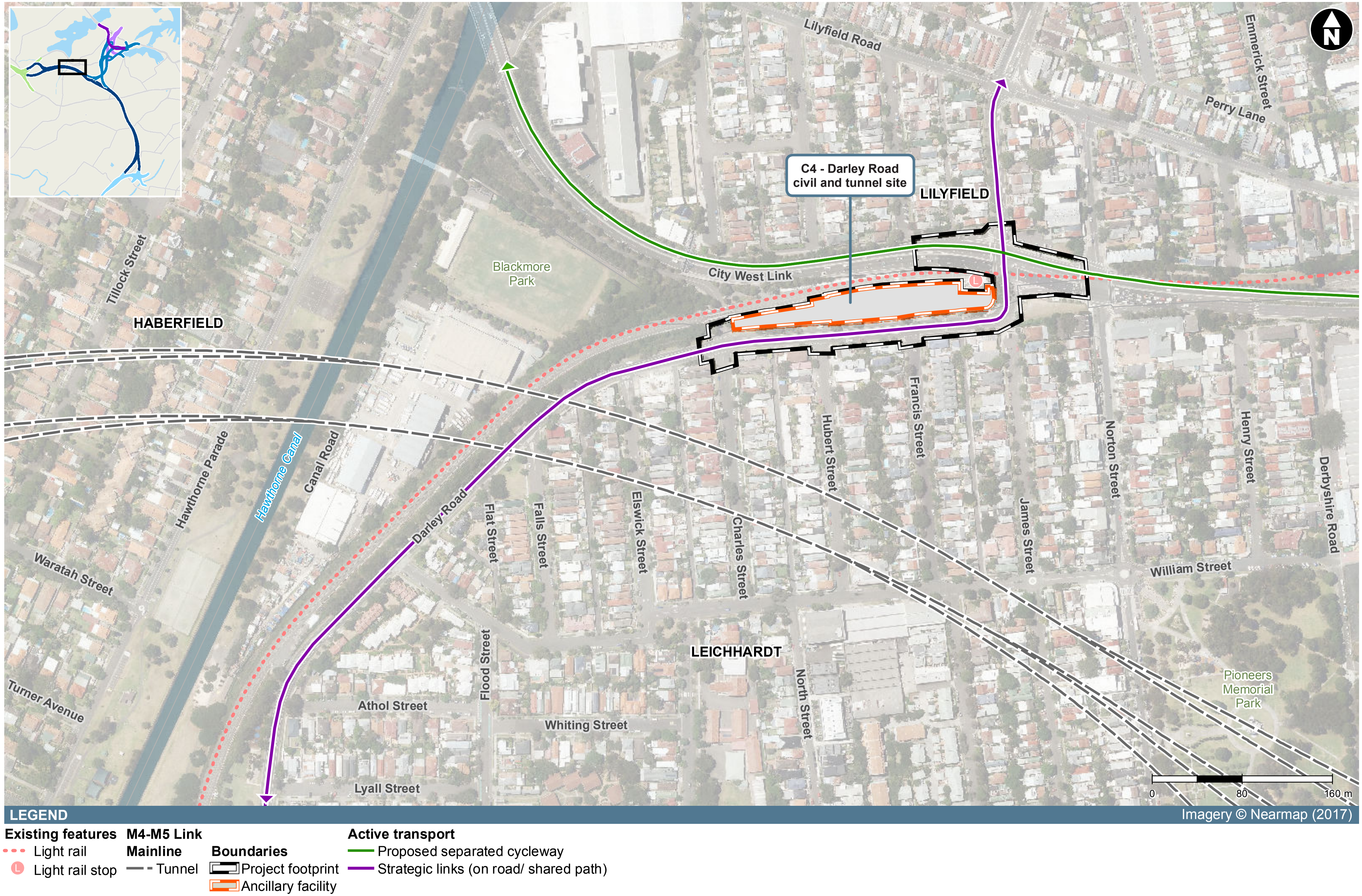


Figure 7-19 Active transport impacts: Darley Road civil and tunnel site (C4)

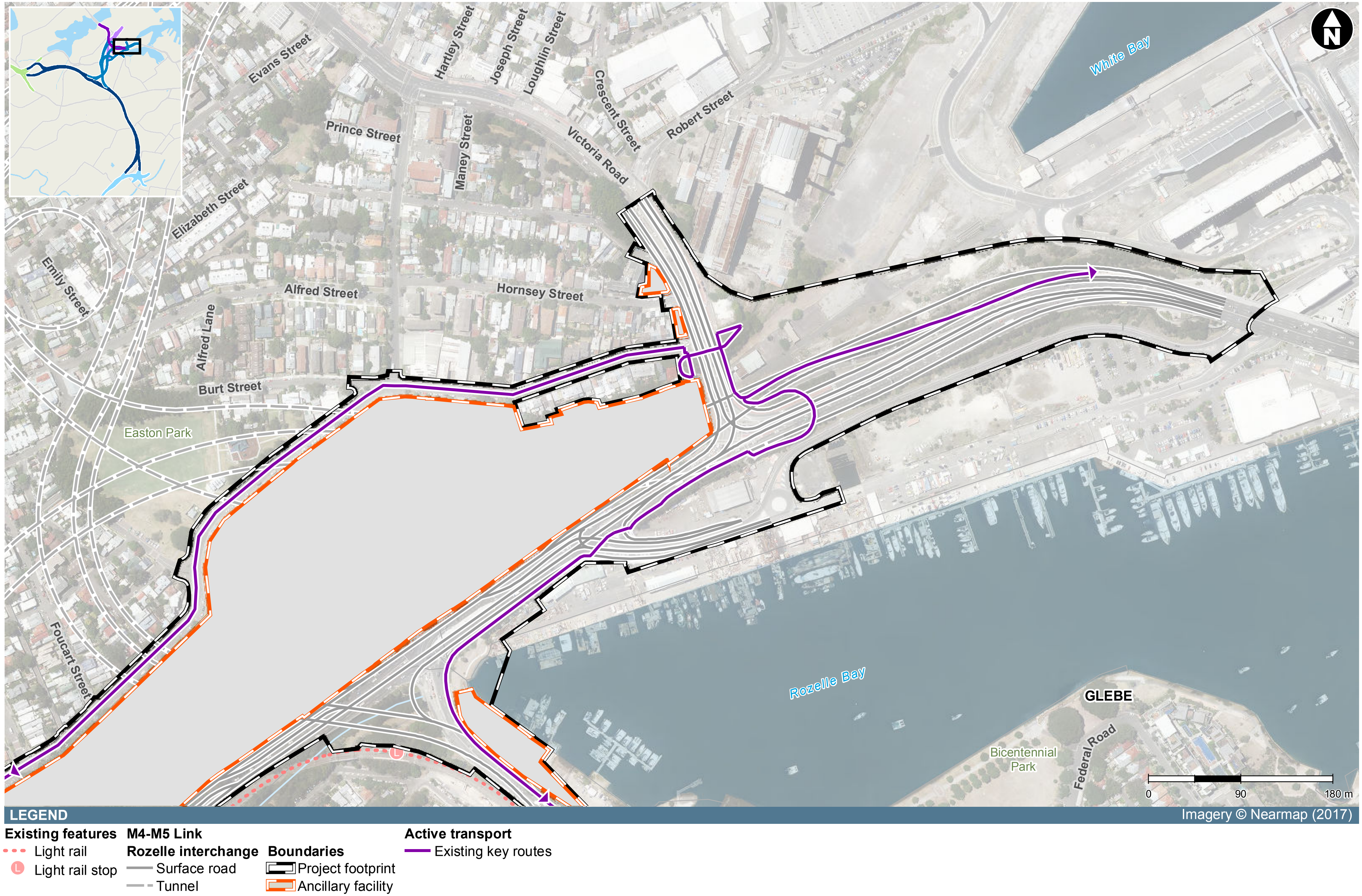


Figure 7-20 Existing active transport links in the vicinity of the Rozelle interchange construction compounds (C5, C6 & C7)

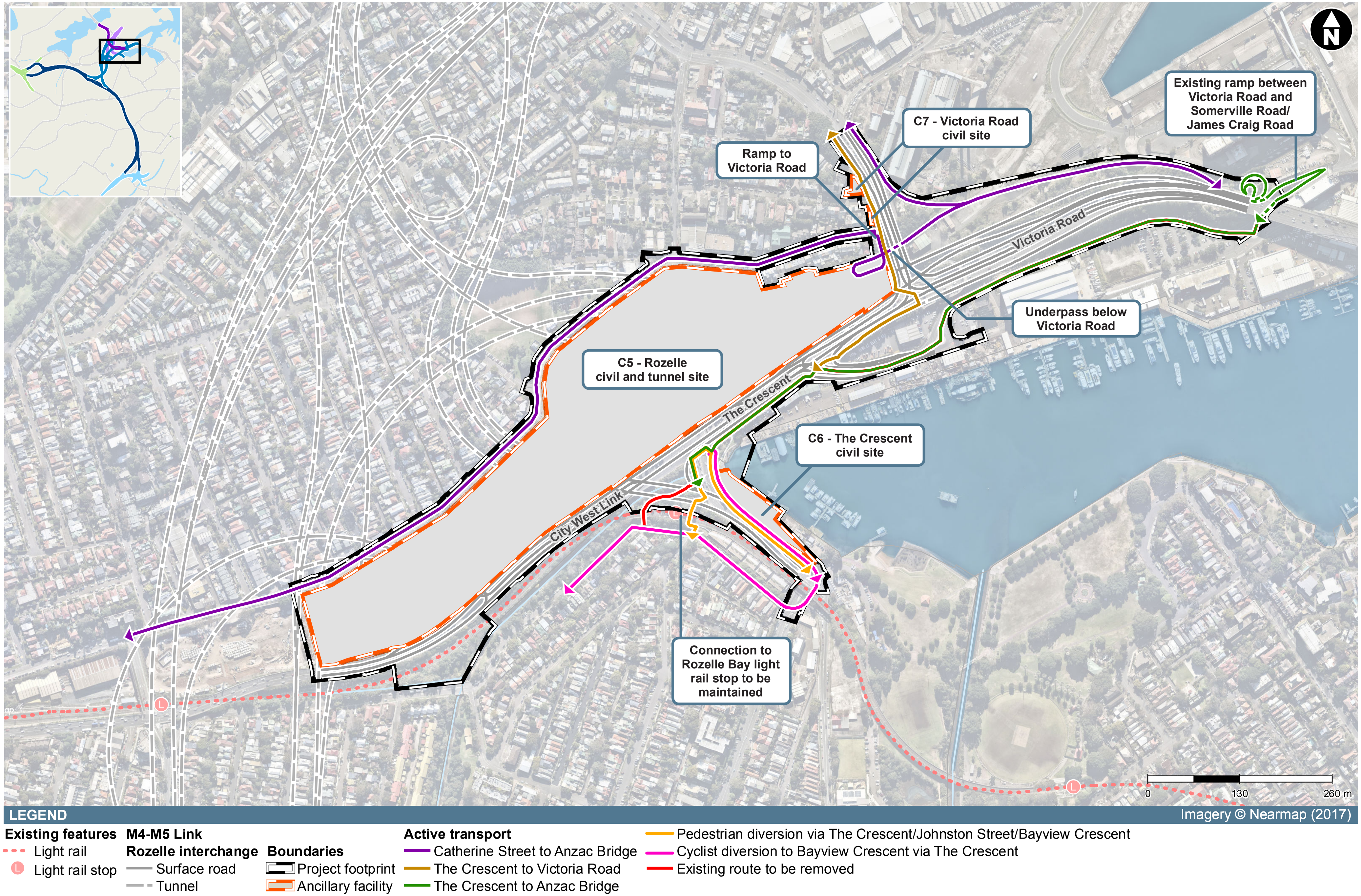


Figure 7-21 Active transport impacts: Rozelle interchange construction ancillary facilities (C5, C6 & C7)

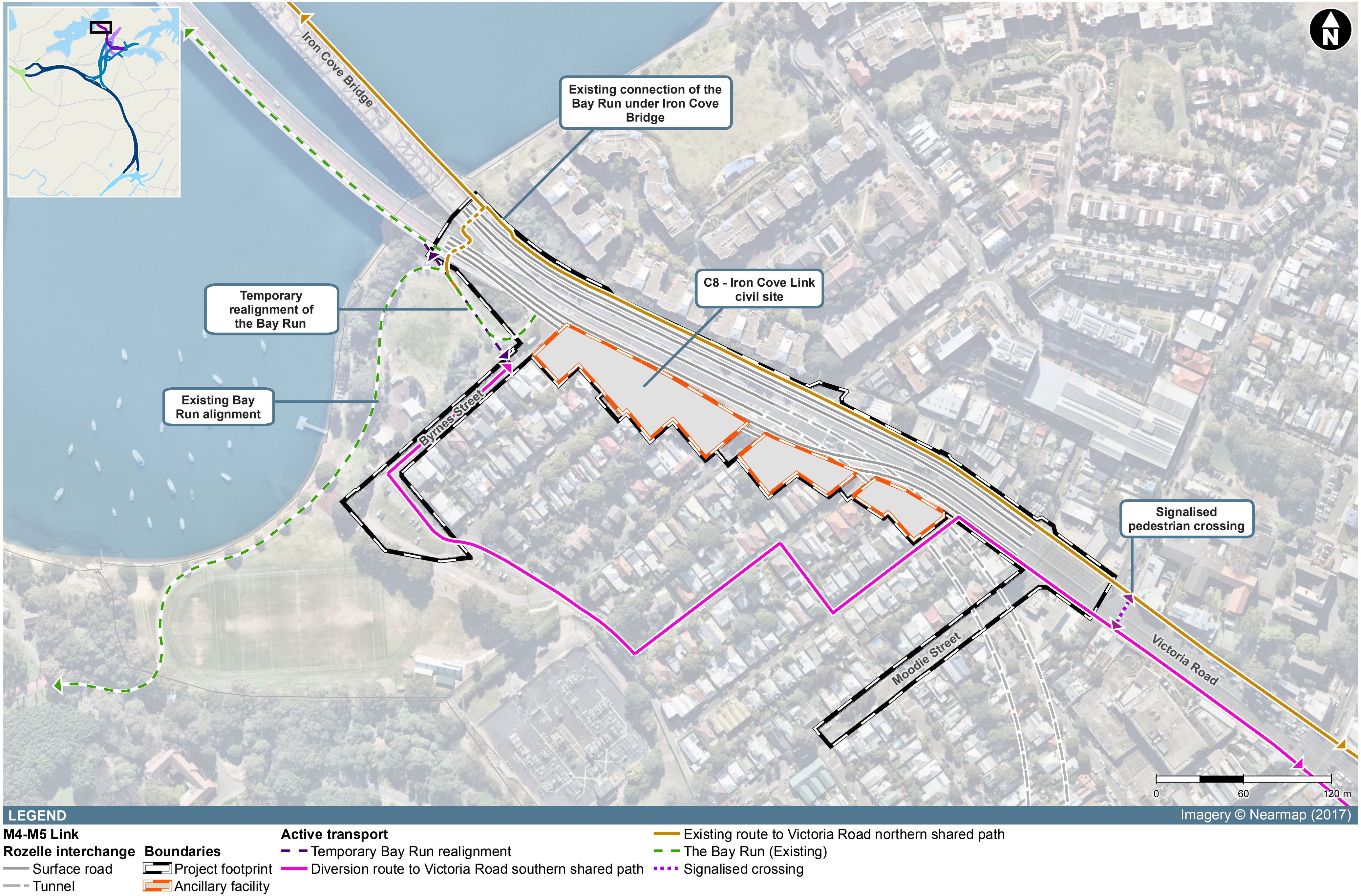


Figure 7-22 Active transport impacts: Iron Cove Link civil site (C8)

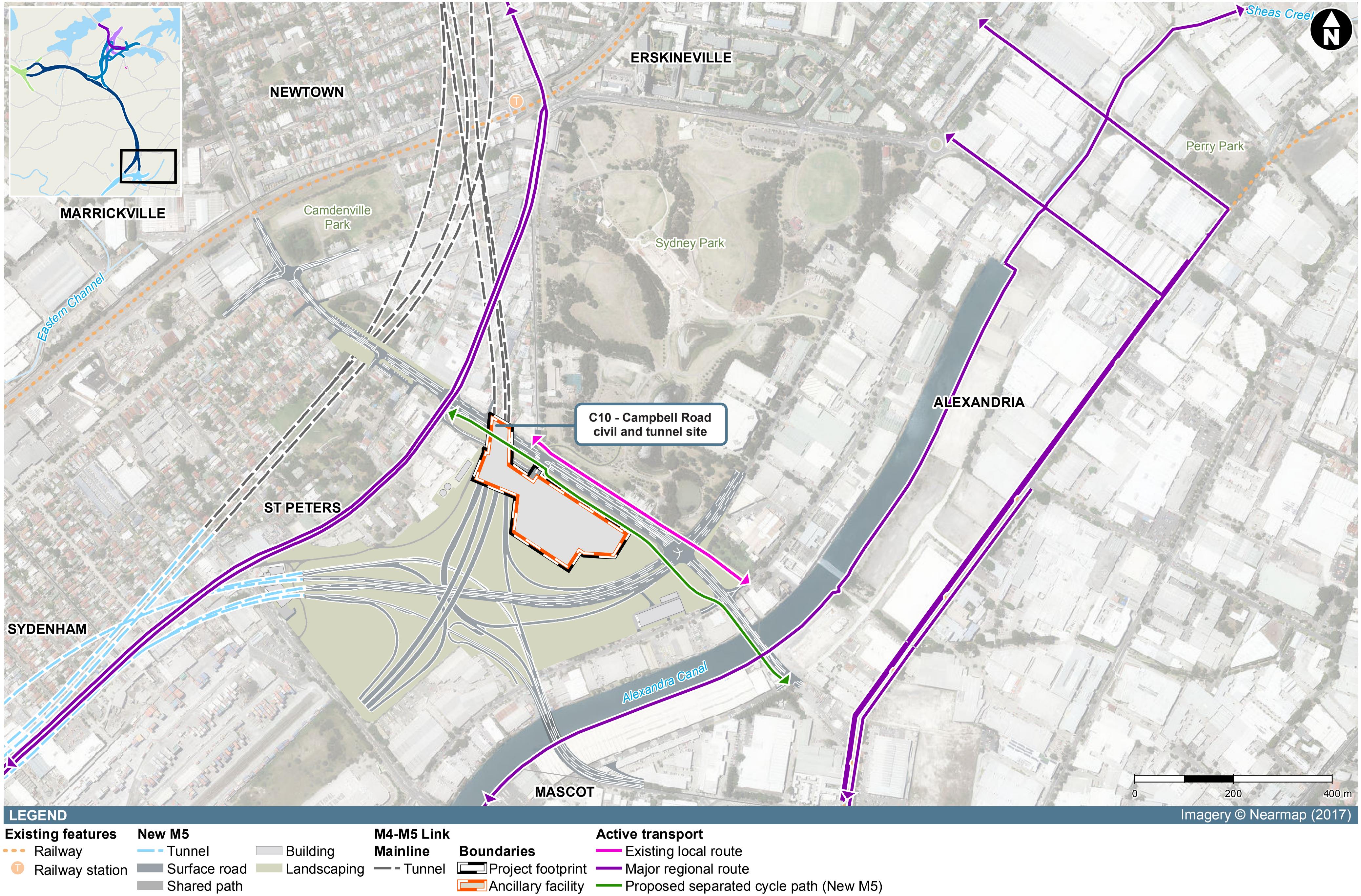


Figure 7-23 Active transport impacts: Campbell Road civil and tunnel site (C10)

7.5 Construction impact assessment – Option B

This section presents the impact assessment of the construction activities on proposed access routes, public transport, pedestrians and cyclists for the Option B construction scenario at Haberfield.

The results presented in this section refer to impacts around the Parramatta Road and Wattle Street corridors at Haberfield, the City West Link corridor at Leichhardt and City West Link and The Crescent at Lilyfield. The construction impacts at other locations assessed as part of the Option A assessment would also apply (including impacts on public and active transport).

7.5.1 Roadway level of service

An analysis of roadway service levels was undertaken to determine the impact of the Option B construction traffic in 2021. The assessment considers the spoil reuse sites shown in **Table 7-14**.

Theoretical mid-block roadway capacities were based on Austroads *Guide to Traffic Management* and these capacities and assessment results are shown in **Table 7-26** for the AM peak and PM peak hours. The assessment results are shown only for the mid-block locations where Option B mid-block volumes differ to the Option A mid-block volumes. All other mid-block locations can be referred to in **section 7.4.2**.

The analysis shows that construction traffic generated by Option B has a minimal impact on roadway service levels, with one change in the mid-block level of service between the 'without construction' and 'with construction' scenarios to less than LoS D, with City West Link, west of The Crescent, forecast to decrease from LoS D to LoS E in the westbound direction in the PM peak hour.

In highly congested networks, singe-point assessment criteria, such as mid-block levels of service, do not present a complete picture of traffic operations. In reality, if a link is over capacity, this would result in queuing further back in the network. However, this assessment provides a high level indication of the effect of construction vehicles on roadway service levels compared to the background traffic.

7.5.2 Intersection level of service

The Option B construction impact assessment is the same as Option A for Cluster 4: Victoria Road in Rozelle, Cluster 5: Parramatta Road in Camperdown, and Cluster 6: Princes Highway in St Peters. The analysis for the Option B construction impact assessment is therefore only Cluster 1: Parramatta Road and Wattle Street corridors in Haberfield, Cluster 2: City West Link corridor in Leichhardt, and Cluster 3: City West Link and The Crescent in Lilyfield.

Cluster 1

Cluster 1 consists of the following intersections:

- Parramatta Road/Harris Road
- Parramatta Road/Croydon Road/Arlington Street
- Parramatta Road/Great North Road
- Parramatta Road/Frederick Street/Wattle Street
- Parramatta Road/Bland Street
- Wattle Street/Ramsay Street
- Dobroyd Parade/Waratah Street
- Dobroyd Parade/Timbrell Drive/Mortley Avenue.

Table 7-26 Option B – 2021 mid-block operational performance summary^

Location and direction		Mid-block capacity	2021 AM peak hour (veh/hr) Without construction			2021 AM peak hour (veh/hr) With construction			2021 PM peak hour (veh/hr) Without construction			2021 PM peak hour (veh/hr) With construction		
			Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS	Flow	V/C	LoS
Parramatta Road north of Wattle Street – Haberfield	EB	3,300	1,840	0.56	C	1,890	0.57	D	2,080	0.63	D	2,090	0.63	D
	WB	3,300	1,310	0.40	C	1,330	0.40	C	1,310	0.40	C	1,410	0.43	C
Wattle Street east of Parramatta Road – Haberfield	EB	2,000	740	0.37	B	740	0.37	B	1,110	0.55	C	1,110	0.56	C
	WB	2,000	860	0.43	C	870	0.43	C	730	0.37	B	740	0.37	B
City West Link west of Darley Road – Rozelle	EB	2,300	2,120	0.92	E	2,180	0.95	E	2,230	0.97	E	2,300	1.00	E
	WB	2,300	1,940	0.84	E	1,980	0.86	E	2,110	0.92	E	2,240	0.97	E
City West Link west of The Crescent – Rozelle	EB	2,300	2,520	1.10	F	2,550	1.11	F	2,440	1.06	F	2,460	1.07	F
	WB	2,300	1,800	0.78	D	1,810	0.79	D	1,850	0.80	D	2,000	0.87	E
City West Link east of The Crescent – Rozelle	EB	3,400	3,520	1.04	F	3,530	1.04	F	3,210	0.94	E	3,210	0.95	E
	WB	3,400	2,560	0.75	D	2,570	0.76	D	3,000	0.88	E	3,010	0.89	E

^Traffic volume rounded to nearest 10

As previously noted, the construction modelling forecasts a number of intersections operating with high levels of delay (LoS E or F) in the ‘without construction’ scenario. During the AM peak hour, the Parramatta Road/Bland Street and Dobroyd Parade/Timbrell Drive intersections are forecast to both operate at LoS F. High levels of delay at the Parramatta Road/Bland Street intersection can be attributed to the downstream exit blocking along Parramatta Road, resulting in significant exit blocking for the southbound movement (represented as reduced saturation flows in the modelling). During the PM peak hour, the Parramatta Road/Frederick Street/Wattle Street intersection is forecast to operate at LoS E, while the Parramatta Road/Great North Road and Dobroyd Parade/Timbrell Drive intersections are forecast to operate at LoS F.

In the ‘with construction’ scenario, about 320 PCU and 510 PCU would be added to the network in the AM and PM peaks respectively. During both the AM and PM peak hours, about 50 per cent of this additional traffic is via the M4 East tunnels east of Ramsay Street, to access construction sites along City West Link and Victoria Road. The additional traffic due to construction is predominantly eastbound in the AM peak hour and westbound in the PM peak hour. As a result, the performance at most intersections along Parramatta Road would likely be impacted, with larger impacts at the intersections along Wattle Street and Dobroyd Parade.

During the AM peak hour, there would be an increase in traffic of up to about 105 PCU along Parramatta Road, resulting in relatively small impacts – the level of service is not forecast to worsen at any of the intersections. At the eastern end of Cluster 1, it is estimated that an additional 100 PCU would emerge from the M4 East eastbound tunnels, and 65 PCU enter the M4 East westbound tunnels. This would impact mostly on the Dobroyd Parade/Timbrell Drive intersection, which is already forecast to operate at LoS F in the ‘without construction’ scenario.

During the PM peak hour, there would be an increase in traffic of up to about 145 PCU along Parramatta Road, however the impacts on intersections along Parramatta Road are forecast to be relatively small. The level of service at two intersections are forecast to worsen compared to the ‘without construction’ scenario – the Parramatta Road/Harris Road intersection is forecast to worsen slightly from LoS B to LoS C and the Parramatta Road/Croydon Road/Arlington Street intersection from LoS D to LoS E.

The M4 East tunnels are forecast to accommodate an additional 75 PCU eastbound and 185 PCU westbound. This would subsequently impact on the Dobroyd Parade/Timbrell Drive intersection in particular, however this intersection is forecast to already operate at LoS F in the ‘without construction’ scenario.

Cluster 2

Cluster 2 consists of the following intersections:

- City West Link/James Street
- City West Link/Norton Street
- Darley Road/ Darley Road civil and tunnel site (C4) access.

The modelling indicates City West Link/James Street intersection is forecast to operate at LoS F in the ‘without construction’ scenario and City West Link Road/Norton Street intersection is forecast to operate at LoS C during both peaks.

In the ‘with construction’ scenario, in addition to about 190 PCU and 320 PCU being added to the network in the AM and PM peak hours respectively, the rightmost through lane from City West Link eastbound would be temporarily converted into a turning lane to allow construction vehicles to turn right into James Street. A new traffic signal phase would be required to operate this movement safely, which would impact the performance of this intersection. The forecast volume is not large therefore this phase will only be required to run once every two cycles. The level of service is forecast to remain at LoS F, and average delays at the intersection are forecast to increase in the AM and PM peak hours in the ‘with construction’ scenario.

The left turn movement from James Street into City West Link westbound is allocated a green time of at least 30 seconds in each cycle in both peaks, to accommodate what may be a difficult turn for construction heavy vehicles to make, given the blind corner and steep approach on James Street (see **section 7.2.7**).

The impact on City West Link Road/Norton Street intersection is not forecast to be significant, with the level of service forecast to remain at LoS C in both peaks in both ‘without construction’ and ‘with construction’ scenarios.

The Darley Road/Charles Street intersection located on the southwest corner of the Darley Road civil and tunnel site (C4) construction ancillary facility is proposed to be upgraded to a signalised intersection. It is also proposed to signalise the right turn for heavy vehicles entering the site off Darley Road about 30 metres east of this intersection. The phasing and timing of this signalised right turn would be coordinated with the corresponding right turn at the Darley Road/Charles Street intersection, to minimise delay to eastbound through traffic on Darley Road. This intersection is forecast to operate satisfactorily at LoS A in both AM and PM peak hours.

Cluster 3

Cluster 3 consists of the following intersections:

- City West Link/The Crescent
- The Crescent/James Craig Road
- City West Link/Rozelle civil and tunnel site (C5) western access.

The modelling indicates that in the ‘without construction’ scenario, City West Link/The Crescent and The Crescent/James Craig Road intersections are forecast to operate satisfactorily at LoS D or better in both AM and PM peak hours.

With about 130 PCU and 300 PCU added to the network in the AM and PM peak hours respectively in the ‘with construction’ scenario, the operational performance at the intersections is forecast to worsen.

In the ‘with construction’ scenario, the new eastern access road to the Rozelle civil and tunnel site (C5) would be accommodated as the northern approach to City West Link/The Crescent intersection. Construction vehicles would only be permitted to turn right out of this access road onto City West Link westbound; however safe operation would require a new traffic signal phase. It is forecast that this phase will only be required to run once every three cycles. During the AM peak hour, City West Link/The Crescent intersection level of service is forecast to deteriorate from LoS D to LoS E with an increase in average delay of about 15 seconds. It is noted that the forecast increase in traffic due to construction is only about one per cent. During the PM peak hour, the level of service is forecast to remain at LoS C.

A new temporary signalised intersection is also proposed on City West Link about 400 metres west of The Crescent, accommodating a second (western) site access to the Rozelle civil and tunnel site (C5). Construction vehicles would similarly only be permitted to turn right out of this access road, with a traffic signal phase required to safely accommodate this movement. This intersection is forecast to operate at LoS A in both peaks.

There is no adverse impact expected on The Crescent/James Craig Road intersection, with LoS B forecast in both ‘without construction’ and ‘with construction’ scenarios in both peaks. The intersection performance results for the road network under the 2021 ‘without construction’ and ‘with construction’ forecast volumes for the Option B scenario at Haberfield are summarised in **Table 7-27** and **Table 7-28** for the AM peak and PM peak respectively.

Table 7-27 Option B – 2021 AM peak hour intersection operational performance summary^

Cluster	Intersection	Without construction Volume (PCU)	Without construction LoS	With construction Volume (PCU)	With construction LoS
1	Parramatta Road | Harris Road	2,550	B	2,640	B
	Parramatta Road | Croydon Road | Arlington Street	3,280	B	3,360	B
	Parramatta Road | Great North Road	3,810	C	3,900	C
	Parramatta Road | Frederick Street | Wattle Street	4,880	D	4,970	D
	Parramatta Road | Bland Street	2,870	F	2,930	F
	Wattle Street | Ramsay Street	3,260	C	3,300	C
	Dobroyd Parade | Waratah Street	3,470	B	3,650	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,530	F	5,720	F
2	City West Link | James Street	5,530	F	5,720	F
	City West Link | Norton Street	5,290	C	5,440	C
	Darley Road | C4 site access	–	–	1,200	A
3	The Crescent | James Craig Road	6,730	B	6,760	B
	City West Link | The Crescent	6,800	D	6,880	E
	City West Link | C5 site access	–	–	4,770	A

^Traffic volume rounded to nearest 10

Table 7-28 Option B – 2021 PM peak hour intersection operational performance summary^

Cluster	Intersection	Without construction Volume (PCU)	Without construction LoS	With construction Volume (PCU)	With construction LoS
1	Parramatta Road | Harris Road	3,040	B	3,180	C
	Parramatta Road | Croydon Road | Arlington Street	3,610	D	3,750	E
	Parramatta Road | Great North Road	3,820	F	3,960	F
	Parramatta Road | Frederick Street | Wattle Street	4,950	E	5,090	E
	Parramatta Road | Bland Street	2,500	B	2,640	B
	Wattle Street | Ramsay Street	3,080	D	3,120	D
	Dobroyd Parade | Waratah Street	2,960	B	3,260	B
	Dobroyd Parade | Timbrell Drive | Mortley Avenue	5,450	F	5,750	F
2	City West Link | James Street	5,640	F	5,960	F
	City West Link | Norton Street	5,700	C	5,940	C
	Darley Road | C4 site access	–	–	1,210	A
3	The Crescent | James Craig Road	6,500	B	6,700	B
	City West Link | The Crescent	6,690	C	6,950	C
	City West Link | C5 site access	–	–	4,710	A

^Traffic volume rounded to nearest 10

7.5.3 Temporary closures and diversions during construction

In addition to the temporary road network modifications outlined in **Table 7-22**, additional modifications outlined in **Table 7-29** would be required as part of construction option B. Impacts from construction traffic and associated temporary network changes are considered above.

Road network modifications and traffic staging would be reviewed by the construction contractor during the development of the detailed design and detailed construction methodology, with the objective of minimising disruptions to the road network. At all locations where road closures are required, access to properties would be maintained throughout the construction period. Appropriate signage for road closures or detours would be installed.

Table 7-29 Indicative temporary road network modifications during construction – Option B

Location	Indicative road network modifications	Indicative duration	Road reinstatement
Parramatta Road West civil and tunnel site (C1b) and Parramatta Road East civil site (C3b)	• Works would be carried out on Alt Street and Bland Street to facilitate access via new driveways to the Parramatta Road West civil and tunnel site (C1b) and the Parramatta Road East civil site (C3b) • Temporary closures of one lane of Alt Street and Bland Street (either side of Parramatta Road) may be required for establishment of construction vehicle access provisions including installation of driveways and associated construction activities. Traffic management, that could include temporary diversions, would be implemented during temporary closures • Due to existing property driveways, there would be no loss of on-street parking on Alt Street or Bland Street	• Q4 2018 to Q1 2019 to complete road modification. • Q4 2018 to Q4 2022 including construction duration and reinstatement of roads	Once road modification works are complete, both lanes along Alt Street and/or Bland Street would be reopened in line with temporary design. When construction is complete, the road would be reinstated as per the existing arrangement

7.5.4 Traffic crashes

Construction traffic volumes are expected to be low when compared to existing traffic volumes on key arterial roads connecting to the construction ancillary facility locations. The greatest increase occurs on City West Link, west of City West Link/James Street intersection, where, as a worst case scenario, construction generates around 110 vehicles in the AM peak hour and around 190 vehicles in the PM peak hour. When compared to existing traffic volumes, total construction traffic would be the equivalent of around four per cent of peak hour traffic on City West Link at this location in the AM peak and six per cent of existing peak hour volumes in the PM peak.

As the volume of traffic generated by construction is expected to be low compared to existing traffic, the effects of this short-term increase on the existing road network is not expected to significantly impact road safety in the project area. There is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. Any foreseen impacts to road safety for all users during construction would be mitigated as much as possible through the provision of tailored traffic management plans and other measures detailed in **section 11.1**.

7.5.5 Public transport services

As for the Option A construction scenario at Haberfield, an increase in vehicles on the existing road network during the construction period using the Option B sites would likely result in increased delays at certain intersections along the Parramatta Road corridor and in surrounding areas. Heavy vehicle volumes would increase along major roads. The same impacts on public transport services in these areas would potentially be experienced. Any bus stop relocations would be agreed with Transport for

NSW and all affected bus operators, and would need to consider proposed pedestrian diversions during construction.

7.5.6 Walking and cycling

An increase in heavy vehicle volumes during the construction period in the project area and surrounding areas would potentially impact walking and cycling amenity. There no planned diversions to pedestrian footways and cycling paths during construction for the three Option B construction sites.

The Parramatta Road West civil and tunnel site (C1b) has a proposed heavy and light vehicle cross-over on Alt Street and the Parramatta Road East civil site (3b) has proposed light vehicle entries and exits on Alt Street and Bland Street. Bland Street is an existing local cycle route and, although this section of Alt Street is not a designated on-road cycle route, cycle logos are painted on Alt Street close to Parramatta Road.

Periodic, short-term closures of footpaths on both sides of Alt Street on the eastern and western sides of Parramatta Road may be required. These would be most likely to occur during site establishment, when access to these sites is being established. Where a footpath is temporarily closed, the corresponding footpath on the other side of the road would remain open.

While the volume of vehicles forecast to use these are low, minor impacts are anticipated during construction at these two sites as, while no diversions are required, there may be a safety impact. Traffic management measures would be implemented at the entry and exit driveways on Parramatta Road, Alt Street and Bland Street to manage potential interactions between construction traffic and pedestrians and cyclists.

7.6 Cumulative construction impacts

The construction of the proposed future Western Harbour Tunnel may overlap with this project (subject to approval). The Western Harbour Tunnel construction site would add about 66 PCU to the road network in the AM and PM peak hours, with construction vehicles travelling through Clusters 1, 2, 3 and 4.

Analysis indicates that the impact from additional Western Harbour Tunnel construction traffic on the clusters would be minimal, with most intersections operating at the same LoS as without Western Harbour Tunnel traffic. A few intersections within Cluster 1 are forecast to experience a slight worsening in level of service with the cumulative construction impact of the Western Harbour Tunnel construction site. The Parramatta Road/Wattle Street intersection level of service is forecast to worsen from LoS D to LoS E in the AM peak hour in both Option A and Option B. The Parramatta Road/Harris Road and the Parramatta Road/Croyden Road/Arlington Street intersections are forecast to worsen from LoS B to LoS C in the AM peak hour in Option B only. In the PM peak hour, the level of service at the Wattle Street/Ramsay Street intersection is forecast to worsen from LoS E to LoS F in Option A only.

The M4 East and New M5 are expected to be operational by 2019/20; hence their construction would not overlap in the 2021 assessment year. The construction of the M4-M5 Link mainline tunnels is indicatively programmed to start in late 2018, by which stage the M4 East and New M5 tunnel construction will either be complete or almost complete. Therefore, the overlap of tunnelling construction, the largest generator of heavy vehicle traffic, would not cause a substantial cumulative impact. The assessment has assumed that M4 East would be operational in 2021 and is used by construction vehicles accessing the construction sites for the project during the assessment year.

Elements of the construction program for the project may occur simultaneously with the construction of Sydney Gateway (subject to approval). However, no details of the construction of the Sydney Gateway project is yet available. The CTAMP would need to consider any overlap in heavy vehicle and other access routes, once this information becomes available.

Elements of the construction program may also occur simultaneously with the construction of Stage 2 of the Sydney Metro – Sydney Metro City and Southwest (Sydenham to Bankstown). The current indicative timeline for Sydney Metro City and Southwest indicates that several construction activities including tunnel fitout, station construction and fitout, and services facility construction and fitout will begin in 2021. However, no detail of the construction of the Sydney Metro City and Southwest is yet available. The CTAMP would need to consider any overlap in heavy vehicle and other access routes, once this information becomes available.

There may be some overlap between the construction of this project and the construction of components of the Green Square Town Centre project, as it is noted that the Green Square Town Centre project currently has a delivery timing of 5–8 years. Current construction timelines for the project indicate that many of the Green Square Town Centre development lots and streets are to be delivered prior to 2019. There are currently few components which have been identified as to be delivered after 2019, although several lots and streets are yet to have a construction period confirmed. Any quantifiable cumulative construction impacts which might result from this project would need to be considered in the CTAMP, if details become available.

At present, there are no other major projects whose construction would significantly increase traffic volumes and patterns along the key arterial roads within the project area during the construction period. Construction volumes associated with minor works are anticipated to have a negligible impact similar to that of daily or seasonal variations in traffic volumes and patterns. Notwithstanding, any scheduled construction activities would be taken into account during construction of the project.

Site management works would occur within the Rozelle Rail Yards at Rozelle before the commencement of construction of the M4-M5 Link. Site management works are planned to commence in 2017, with completion planned for 2018 and would be carried out in accordance with a separate planning approval issued in April 2017. There would be no cumulative impacts with the project.

8 Assessment of operational impacts without the project

8.1 Sydney metropolitan road network

This section details the traffic demand changes forecast by the WRTM and performance in a ‘without project’ scenario using forecast AM and PM peak hour traffic volumes for 2023 and 2033.

8.1.1 ‘Do minimum’ (2023)

The 2023 ‘do minimum’ case assumes NorthConnex, M4 Widening, M4 East, and New M5 are complete, but that the M4-M5 Link has not been built. It is called ‘do minimum’ rather than ‘do nothing’ as it assumes ongoing improvements would be made to the broader transport network including some new infrastructure and intersection improvements to improve capacity and cater for traffic growth.

Figure 8-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2023 ‘do minimum’ and the 2015 ‘base case’ scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 ‘do minimum’ scenario are shown in green and roads where volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change.

General traffic

Based on WRTM outputs, a reduction in daily traffic is forecast along Parramatta Road (west of the M4 East Parramatta Road ramps) as a result of the M4 East, and along the M5 East, as a result of the New M5. The forecast traffic on the M4 East and the New M5, which open between 2015 and 2023, are illustrated by the red bands on these links.

However, increased daily traffic is forecast along Parramatta Road (east of the M4 East Parramatta Road ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge and Anzac Bridge, as well as most other urban arterial roads in the study area, such as Victoria Road, City West Link, Hume Highway, Canterbury Road, Stoney Creek Road, Olympic Drive, Centennial Drive and Anzac Parade approaching the Sydney CBD. The increase in daily traffic is mainly due to the forecast increase in population and changes to employment distribution across Sydney. The amount of red on **Figure 8-1** represents this background increase in traffic.

Table 8-1 compares the 2023 ‘do minimum’ scenario with the 2015 ‘base case' scenario (which represents road conditions prior to the construction of M4 Widening, M4 East, KGRIU and New M5). An increase in VKT – 14.6 million daily vehicle kilometres, about 15 per cent more – and VHT – 706,000 daily vehicle hours, about 25 per cent more – is forecast on an average weekday on the Sydney road network compared to the 2015 base case scenario. The forecast indicates declining productivity of the road network.

Table 8-1 Comparison of daily VKT and VHT for metropolitan Sydney in 2023 ‘without project’ and 2015 ‘base case’ scenarios

Scenario	Year	Daily VKT (‘000 km)			Daily VHT (‘000 hours)		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2015	23,940	74,810	98,750	400	2,520	2,920
Do minimum (without project)	2023	26,880	86,520	113,400	470	3,160	3,630

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements largely follow the same pattern as the general traffic movements, with more pronounced reductions in daily heavy vehicle movements on Parramatta Road (west of the M4 East Parramatta Road ramps) and the M5 East, as a result of the presence of the M4 East and the New M5.

On-road public transport

The increases in traffic volumes and congestion on roads that are also key bus corridors would be expected to impact negatively on the reliability and the trip times of on-road public transport. These include Parramatta Road (east of the M4 East Parramatta Road ramps), which is a key bus corridor for services running between the Inner West and the Sydney CBD, Sydney Harbour Bridge, which allows buses north of the harbour to access the CBD, Anzac Bridge and Victoria Road, which links northwest bus services with the Sydney CBD, and Anzac Parade, which is a key corridor for bus services from the southeast to the Sydney CBD and beyond.

Source: WRTM v2.3, 2017

Figure 8-1 Difference in AWT between 2023 ‘do minimum’ and base year scenarios

8.1.2 'Do minimum' (2033)

This case assumes a future road network including NorthConnex, M4 Widening, M4 East, and New M5 and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth, but does not include the M4-M5 Link or other planned motorway projects, such as the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and F6 Extension.

Figure 8-2 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'do minimum' and the 2015 'base case' scenarios. As before, roads that are expected to carry less traffic in the future 2033 'do minimum' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red.

General traffic

Based on WRTM outputs, reductions in daily traffic are still forecast along Parramatta Road (west of the M4 East Parramatta Road ramps) and the M5 East, as a result of the M4 East and the New M5 projects. Increases in daily traffic movements in 2033 follow a similar pattern forecast for 2023 but with larger volumes. As in 2023, changes in population and employment distribution is the main cause of the forecast traffic increases along Parramatta Road (east of the M4 East Parramatta Road ramps), Southern Cross Drive, Sydney Harbour Tunnel, Sydney Harbour Bridge and Anzac Bridge, as well as most other urban arterial roads.

The amount of red shown on **Figure 8-2** is representative of the background increase in traffic due to the forecast growth in population and employment across the Sydney metropolitan area.

Table 8-2 compares the 2033 'do minimum' scenario with the 2015 'base case' scenario (which represents road conditions prior to the construction of M4 Widening, the M4 East and the New M5). An increase in VKT – 34.2 million daily vehicle kilometres, about 35 per cent more – and VHT – 2.3 million daily vehicle hours, about 80 per cent more – is forecast on an average weekday on the Sydney road network compared to the 2015 base case scenario. While the increase in VKT by 2033 is about double the increase by 2023, the increase in VHT by 2033 is more than 2.5 times the increase by 2023. This indicates that the network is becoming so congested that an increase in traffic on the network is causing an exponential increase in travel time.

Table 8-2 Comparison of daily VKT and VHT for metropolitan Sydney in 2033 'without project' and 2015 'base case' scenarios

Scenario	Year	Daily VKT ('000 km)			Daily VHT ('000 hours)		
		Motorway	Other	Total	Motorway	Other	Total
Base case	2015	23,940	74,810	98,750	400	2,520	2,920
Do minimum (without project)	2033	31,030	101,900	132,930	590	4,670	5,560

Source: WRTM v2.3, 2017

On-road freight

As in 2023, forecast changes in daily road-based freight or heavy vehicle movements largely follow the same pattern as the general traffic movements, with more pronounced reductions in daily heavy vehicle movements on Parramatta Road (west of the M4 East Parramatta Road ramps) and the M5 East, as a result of the M4 East and the New M5.

On-road public transport

It would be expected that, in line with the changes forecast for traffic volumes in 2033 compared with 2023, there would be a greater impact on trip times and reliability of bus services in 2033 due to larger increases in general traffic. Again, key bus corridors where service reliability would be impacted would include Parramatta Road (east of the M4 East Parramatta Road ramps), Sydney Harbour Bridge, Anzac Bridge and Victoria Road, and Anzac Parade.

Source: WRTM v2.3, 2017

Figure 8-2 Difference in AWT between 2033 ‘do minimum’ and base year scenarios

8.2 Operational performance – Wattle Street interchange

8.2.1 Changes to road network in 'do minimum' scenario

The Wattle Street interchange is at the eastern end of the M4 East project and, as such, associated M4 East road network infrastructure was included in the 'do minimum' or 'without project' scenario models, as summarised below:

- M4 East entry and exit ramps to accommodate surface road network access and egress at two locations:
  - Wattle Street (between the intersections of Ramsay Street and Waratah Street)
  - Parramatta Road (between the intersections of Bland Street and Dalhousie Street)
- To facilitate the entry and exit ramp infrastructure, a number of adjustments to the surface road network were included:
  - Wattle Street realigned and lanes reconfigured between Parramatta Road and Waratah Street intersections
  - Wattle Street/Ramsay Street intersection reconfigured, including the provision of:
    - A new northbound right turn bay from Wattle Street
    - A left turn bay provided from Wattle Street northbound to Ramsay Street westbound
    - Additional right turn lane from Dobroyd Parade southbound to Ramsay Street westbound
  - A third lane provided on Dobroyd Parade southbound approach to Waratah Street intersection
  - Dedicated right turn bay from the M4 East exit ramp to Waratah Street
  - Parramatta Road realigned and lanes reconfigured between Bland Street and Dalhousie Street, with Chandos Street, Rogers Avenue and Orpington Street approaches to Parramatta Road realigned accordingly as left-in left-out intersections
- A second right turn bay on Parramatta Road northbound approach to Great North Road in accordance with planned Pinch Point works by Roads and Maritime
- Parramatta Road kerbside lanes converted to bus lanes between the western end of the modelled network (west of Arlington Street) and east of Bland Street (where the lane drop (eastbound) and lane gain (westbound) occur. This is consistent with Condition B34 of the M4 East conditions of approval, which requires at least two lanes of Parramatta Road, from Burwood Road to Haberfield to be solely dedicated for the use of public transport. Left turning vehicles are allowed to enter kerbside lanes about 100 metres in advance of intersections to accommodate left turns.

8.2.2 Network performance

2023 'Do minimum' scenario

Table 8-3 and **Table 8-4** present a comparison of the performance of the modelled road network between the 2015 'base case' scenario and 2023 'do minimum' or 'without project' scenario for the AM and PM peak hours.

AM peak hour

The major road improvements included in the 'do minimum' scenario introduce more tunnelled motorway and remove traffic from parts of the surface road network. The subsequent improvement in vehicle travel times is offset by congestion originating to the east of City West Link/Timbrell Drive intersection. This downstream congestion for eastbound vehicles on City West Link blocks the exit of the Timbrell Drive intersection, and combined with the capacity restriction at the merge from two lanes to one lane east of the Waratah Street intersection, causes congestion issues at City West Link/Timbrell Drive intersection.

For eastbound City West Link vehicles, delays in the 2015 'base case' scenario, which are a result of downstream queuing from further east along City West Link, are spread over a large number of surface road intersections. A significant portion of this demand switches to the M4 East in the 'without project' scenario, resulting in reduced surface traffic volumes at key intersections along Parramatta Road and Wattle Street. This would result in an improvement in overall network performance, with an overall reduction in the number of stops and retention of average speed, despite the significant increase in demand entering the network.

Substantial delays are also observed at the M4 East Parramatta Road exit ramp, south of Bland Street. This results from the merge upstream of the Dalhousie Street intersection where there is existing congestion at Liverpool Road and also from the merge from three lanes to two lanes downstream of Sloane Street. Queuing is forecast to extend along the M4 East Parramatta Road exit ramp, reaching the M4 East Wattle Street exit ramp diverge.

Table 8-3 Wattle Street interchange network performance – AM peak hour (2015 'base case' vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	13,233	15,279	15%
Total vehicle kilometres travelled in network (km)	25,663	31,474	23%
Total time travelled approaching and in network (hr)	1,732	2,153	23%
Total vehicles arrived	13,191	14,483	10%
Total number of stops	244,016	242,127	-1%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.7	2.0	14%
Average time travelled in network (mins)	7.0	8.0	15%
Average number of stops	14.8	13.4	-9%
Average speed (km/h)	14.9	14.8	-1%
Unreleased vehicles			
Unreleased demand (veh)	41	796	-
% of total traffic demand	0%	5%	-

PM peak hour

In the PM peak hour, average speeds reduce in the 2023 'without project' scenario compared with the 2015 'base case' scenario. This is predominantly a result of forecast increased traffic demand to Frederick Street, which leads to a substantial increase in exit blocking at the Parramatta Road and Wattle Street intersection. This results in increased delays for other movements, particularly for Parramatta Road eastbound vehicles wanting to turn right to Frederick Street.

A substantial increase in traffic demand for Parramatta Road eastbound to 2023 is also forecast, which results in congestion on the M4 East Parramatta Road exit ramp. However, queuing on the exit ramp is not forecast to extend to the M4 East Wattle Street exit ramp diverge.

Table 8-4 Wattle Street interchange network performance – PM peak hour (2015 'base case' vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	13,559	15,209	12%
Total vehicle kilometres travelled in network (km)	27,377	29,075	6%
Total time travelled approaching and in network (hr)	1,504	2,176	44%
Total vehicles arrived	13,559	14,702	8%
Total number of stops	183,725	318,512	73%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.8	2%
Average time travelled in network (mins)	5.9	8.1	38%
Average number of stops	11.0	17.4	59%
Average speed (km/h)	18.3	13.5	-26%
Unreleased vehicles			
Unreleased demand (veh)	0	507	–
% of total traffic demand	0%	3%	–

2033 'Do minimum' scenario

Table 8-5 and **Table 8-6** present a comparison of the performance of the modelled road network between the 2023 and 2033 'do minimum' or 'without project' scenarios for the AM and PM peak hours produced using a microsimulation operational model.

AM peak hour

Road network traffic performance is forecast to deteriorate by 2033 compared to 2023 as a result of increased demand. Congestion from both the M4 East Wattle Street and Parramatta Road portals blocks past the M4 East exit ramp diverge, resulting in large delays to vehicles from the M4 accessing the surface road network in the peak hour. Average network conditions experienced by vehicles in the network are similar in 2033 to those in 2023; however, more vehicles are unreleased, ie cannot enter the network in the peak hour.

Table 8-5 Wattle Street interchange network performance – AM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	15,279	16,553	8%
Total vehicle kilometres travelled in network (km)	31,506	32,470	3%
Total time travelled approaching and in network (hr)	2,143	2,316	7%
Total vehicles arrived	14,497	15,505	7%
Total number of stops	236,008	272,807	13%

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.0	2.0	-1%
Average time travelled in network (mins)	8.0	8.3	3%
Average number of stops	13.1	14.5	8%
Average speed (km/h)	14.9	14.2	-4%
Unreleased vehicles			
Unreleased demand (veh)	782	1,048	-
% of total traffic demand	5%	6%	-

PM peak hour

The number of unreleased vehicles unable to enter the modelled network in the peak hour significantly increases in 2033 compared to 2023, as congestion worsens in response to the forecast increase in demand. As in 2023, forecast growth in traffic demand for Frederick Street is the main cause of increased congestion, with Parramatta Road eastbound right turners to Frederick Street impeded by exit blocking leading to queues along Parramatta Road.

In 2033, the Frederick Street exit blocking also impacts the Wattle Street southbound through movement with congestion ultimately blocking through City West Link/Timbrell Drive intersection and leading to unreleased vehicles on City West Link.

Congestion, as a result of increased forecast demand along Parramatta Road eastbound, is also seen to deteriorate, with M4 East Parramatta Road exit ramp queues often extending beyond the M4 East exit ramp diverge, with long queues along the M4 East.

Table 8-6 Wattle Street interchange network performance – PM peak hour (2023 ‘without project’ vs 2033 ‘without project’ scenario)

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	15,209	16,665	10%
Total vehicle kilometres travelled in network (km)	29,171	29,461	1%
Total time travelled approaching and in network (hr)	2,157	2,557	17%
Total vehicles arrived	14,726	15,451	5%
Total number of stops	320,111	387,426	22%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.8	-4%
Average time travelled in network (mins)	8.1	9.0	11%
Average number of stops	17.4	20.0	15%
Average speed (km/h)	13.6	11.7	-13%
Unreleased vehicles			

Network measure	2023 'without project'	2033 'without project'	Percentage change
Unreleased demand (veh)	483	1,214	-
% of total traffic demand	3%	7%	-

8.2.3 Intersection performance

Table 8-7 presents the modelled AM and PM peak hour LoS for key intersections at the Wattle Street interchange. The AM peak comparison suggest that in the 'without project' scenario, the intersection performance in the future years is forecast to be similar to the 2015 'base case' scenario; with the exception of the intersections of Parramatta Road/Wattle Street, at which performance is forecast to improve from LoS E to LoS C as a result of reduced demand on the surface road network, and City West Link/Timbrell Drive.

The performance of City West Link/Timbrell Drive intersection is seen to worsen over time, given the increased eastbound demand for City West Link that causes queuing along Wattle Street, with minor impacts noted at the upstream intersection of Waratah Street as a result.

In the PM peak hour, Sloane Street and Liverpool Road intersection performances are seen to worsen as a result of increased demand for Liverpool Road from Parramatta Road eastbound, causing congestion on all approaches, with queues in 2033 extending back along the M4 East Parramatta Road ramps. City West Link/Timbrell Drive intersection is unable to accommodate the forecast increased demand along City West Link and Timbrell Drive in the future years, performing at LoS F in both 2023 and 2033.

Table 8-7 Wattle Street interchange: key intersection performance (LoS) – 2023 and 2033 'without project' scenarios

Key intersections	2015 'base case'	2023 'without project'	2033 'without project'
AM peak hour			
Parramatta Road/Sloane Street	B	B	B
Parramatta Road/Liverpool Road	C	C	C
Parramatta Road/Dalhousie Street	B	B	C
Parramatta Road/Bland Street	B	B	C
Parramatta Road/Wattle Street	E	C	C
Parramatta Road/Great North Road	B	B	B
Parramatta Road/Arlington Street	B	C	C
Frederick Street/Church Street	B	B	B
Wattle Street/Ramsay Street	C	C	C
Dobroyd Parade/Waratah Street	A	A	B
City West Link/Timbrell Drive	C	D	F
PM peak hour			
Parramatta Road/Sloane Street	B	B	F
Parramatta Road/Liverpool Road	B	F	F
Parramatta Road/Dalhousie Street	B	B	B
Parramatta Road/Bland Street	B	B	B
Parramatta Road/Wattle Street	D	D	D

Key intersections	2015 'base case'	2023 'without project'	2033 'without project'
Parramatta Road/Great North Road	B	B	B
Parramatta Road/Arlington Street	B	C	C
Frederick Street/Church Street	B	B	B
Wattle Street/Ramsay Street	C	C	C
Dobroyd Parade/Waratah Street	A	B	B
City West Link/Timbrell Drive	D	F	F

8.2.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints, applied to reflect network congestion at intersections beyond the modelled network extents, were retained.

Average travel times were extracted from the model along the following routes:

- Parramatta Road – from Arlington Street to Liverpool Road (and in the opposite direction)
- Frederick Street to City West Link – from John Street to Timbrell Drive (and in the opposite direction)
- M4 East to City West Link – from start of M4 East exit ramp to Timbrell Drive
- M4 East to Parramatta Road (E) – from start of M4 East exit ramp to Liverpool Road.

Travel times, presented in **Figure 8-3** and **Figure 8-4**, are seen to generally increase between 2023 and 2033 'without project' scenarios as a result of increased demand and consequent congestion. The speed limit on the road network in the modelled area is 60 kilometres per hour.

During the AM peak, 2033 travel times generally remain consistent with 2023 conditions, which is predominantly due to much of the increased traffic being on links which are either:

- Relatively free flowing in both scenarios (therefore volume increases do not result in significant travel time differences)
- Are already over capacity in the 2023 scenario (therefore additional demand is simply supressed, with little impact on the travel times of vehicles within the network).

The consistent travel times in the AM peak hour align with the network performance, which forecast average speed in the network is relatively consistent between the two scenarios.

Travel times also remain generally similar in the PM peak, with minor increases in travel times across the network, in line with the forecast increased demand. It is however noted that much of the additional demand in the 2033 scenario is supressed/unreleased and so impacts on travel times for vehicles that are able to enter the network are reduced.

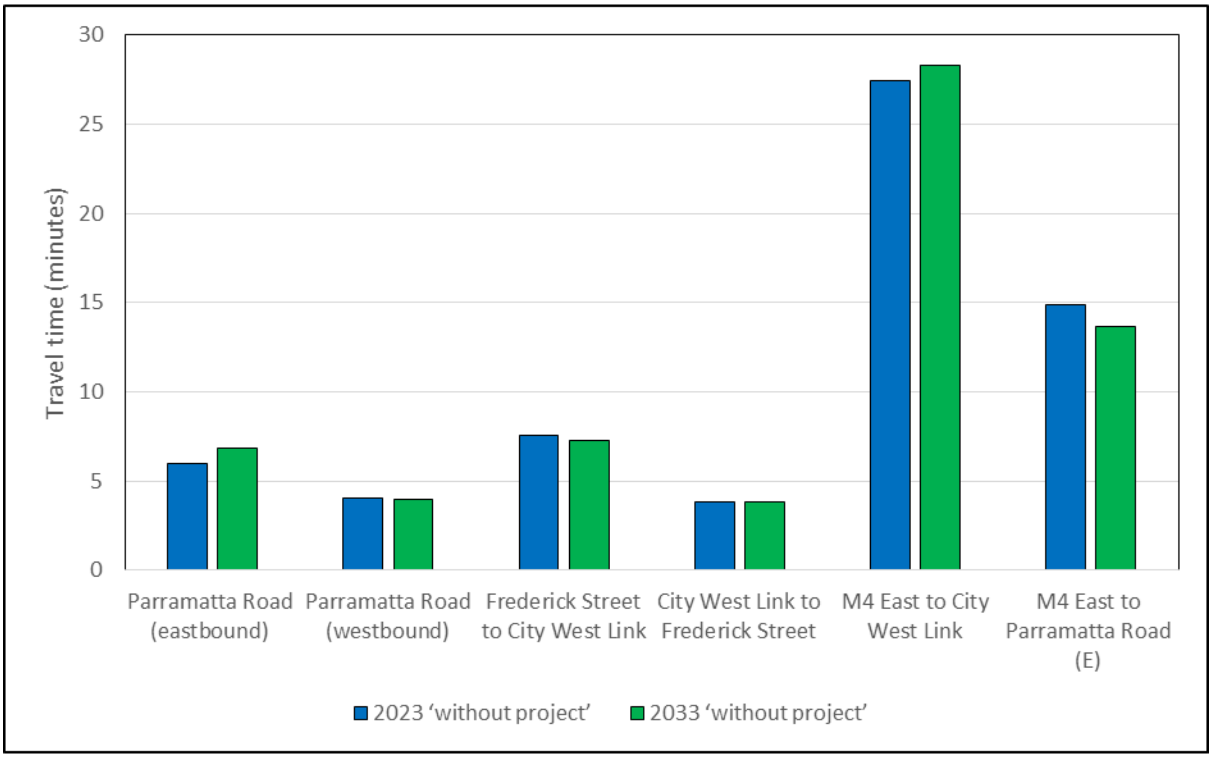


Figure 8-3 Wattle Street interchange: average travel time (mins) – AM peak hour 'without project' scenarios

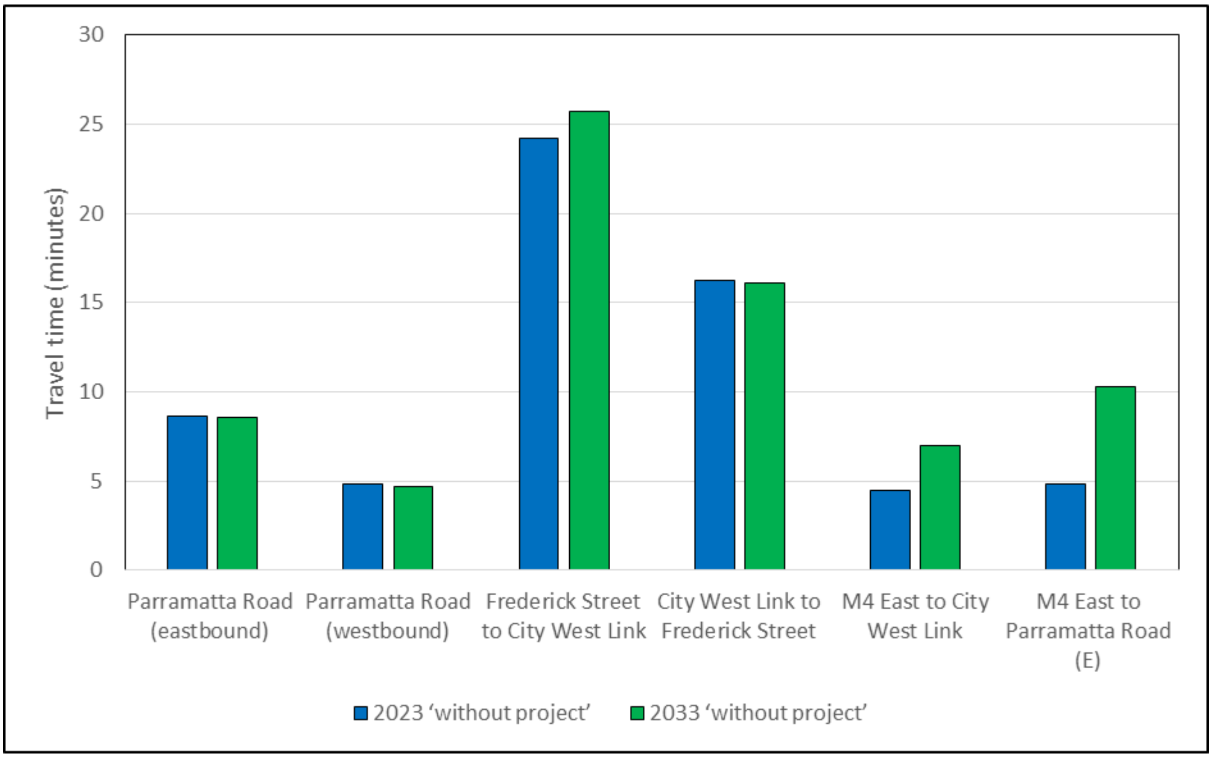


Figure 8-4 Wattle Street interchange: average travel time (mins) – PM peak hour 'without project' scenarios

8.2.5 Traffic crashes

The frequency of crashes on surface roads in the vicinity of the Wattle Street interchange would be expected to change relative to the forecast traffic volume changes. The potential future crashes were calculated using the historical crash rates from data recorded during the period from January 2012 to December 2016, and applied to the forecast traffic flows.

Traffic crash analysis comparing 2015 traffic conditions to 2033 'without project' conditions suggests that by 2033, an increase in traffic volumes would create a proportional increase in crash frequencies and costs along Parramatta Road in the vicinity of the Wattle Street interchange:

- Parramatta Road (Wattle Street to City Road)
  - Crashes would be expected to increase from an average of 108 to 130 per annum
  - The corresponding annual cost of crashes would rise from $11.6 million to $14.1 million per annum.

The above analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

8.2.6 Public transport services

As part of Condition B34 of the M4 East conditions of approval, at least two lanes of Parramatta Road from Burwood Road to Haberfield are to be solely dedicated for the use of public transport.

As the details of these planned bus lanes (eg kerbside or centre-running) are unknown, Parramatta Road kerbside lanes were converted to bus only lanes in the modelled network from the western model extent to east of Bland Street. Left turners were allowed to enter kerbside lanes 100 metres in advance of intersections to accommodate left turns. Future year bus frequencies were supplied by Transport for NSW and consist of an additional 40 buses per hour in each direction along Parramatta Road.

8.2.7 Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

8.3 Operational performance – Rozelle interchange

8.3.1 Changes to road network in 'do minimum' scenario

The road network within the Rozelle interchange operational model would not change from existing conditions in the 'do minimum' or 'without project' scenario.

8.3.2 Network performance

2023 'do minimum' scenario

Table 8-8 and **Table 8-9** present a comparison of the performance of the modelled road network between the 2015 'base case' scenario and 2023 'without project' scenario for the AM and PM peak hours.

AM peak hour

There is a forecast increase in demand of about 11 per cent, primarily due to changes in population and employment distribution. The 2023 forecast demands have a reduction in traffic to Bathurst Street and an increase to the Sussex Street exit ramp. As a result, there is a slight improvement in the Western Distributor eastbound operation. However, the forecast northbound demands on Victoria Road increase. As a result, due to insufficient capacity along Victoria Road further to the north, congestion on Victoria Road northbound is forecast to increase.

In terms of the overall network performance, the benefits of the slight improvement in flow on Western Distributor are more or less negated by the increased congestion on Victoria Road, which means that the overall network performance in 2023 ‘without project’ is slightly worse compared to the 2015 ‘base case’ scenario in terms of average travel times, number of stops and vehicle speeds.

Table 8-8 Rozelle interchange network performance – AM peak hour (2015 ’base case’ vs 2023 ‘without project’ scenario)

Network measure	2015 ‘base case’	2023 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	19,969	22,087	11%
Total vehicle kilometres travelled in network (km)	54,959	57,775	5%
Total time travelled approaching and in network (hr)	4,016	5,355	33%
Total vehicles arrived	20,298	21,621	7%
Total number of stops	267,250	302,654	13%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	2.7	0%
Average time travelled in network (mins)	9.6	10.1	5%
Average number of stops	11.5	12.3	7%
Average speed (km/h)	16.9	15.9	-6%
Unreleased vehicles			
Unreleased demand (veh)	357	1,278	–
% of total traffic demand	2%	6%	–

PM peak hour

Compared to the 2015 ‘base case’ scenario, the 2023 ‘with project’ scenario has a forecast 11 per cent increase in demand caused by changes in population and employment distribution. The increased demand causes a deterioration in network performance, with a lower average network speed and higher average number of stops per vehicle. A significant increase in the number of unreleased vehicles indicating increased congestion and deteriorating network performance is forecast.

The Victoria Road/The Crescent intersection continues to be the pinch point in the network for outbound (westbound) traffic, causing delays and queuing on Anzac Bridge and an increase in unreleased vehicles on Western Distributor (westbound).

Traffic over Sydney Harbour Bridge is forecast to increase. This would cause longer eastbound queuing on Western Distributor, which would extend further back onto Anzac Bridge, City West Link and Victoria Road.

Table 8-9 Rozelle interchange network performance – PM peak hour (2015 ‘base case’ vs 2023 ‘without project’ scenario)

Network measure	2015 ‘base case’	2023 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	22,148	24,694	11%
Total vehicle kilometres travelled in network (km)	61,980	61,136	-1%
Total time travelled approaching and in network (hr)	3,276	4,896	49%
Total vehicles arrived	20,714	21,854	6%
Total number of stops	133,380	146,986	10%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.0	2.8	-7%
Average time travelled in network (mins)	8.2	8.3	1%
Average number of stops	5.6	5.9	5%
Average speed (km/h)	21.9	20.3	-7%
Unreleased vehicles			
Unreleased demand (veh)	823	2,684	–
% of total traffic demand	4%	11%	–

2033 ‘Do minimum’ scenario

Table 8-10 and **Table 8-11** present a comparison of the performance of the modelled road network between the 2023 and 2033 ‘without project’ scenarios for the AM and PM peak hours.

AM peak hour

With a forecast 10 per cent increase in total demand from 2023 to 2033, the overall performance is forecast to deteriorate with longer average travel times, lower average speeds and higher average number of stops. The number of unreleased vehicles also increases, indicating growing congestion in the network.

Similar to the 2023 traffic pattern, the 2033 forecast demands show a reduction in demand to Bathurst Street and an increase in demand to Sussex Street. The Sussex Street exit ramp is not as constrained, and so this change in traffic patterns results in an improved northbound flow on the Western Distributor between Sussex Street and Sydney Harbour Bridge and a corresponding improvement in eastbound flow over Anzac Bridge.

Notwithstanding this improvement, the increase in overall demands and general network congestion result in a drop in the overall network performance.

Table 8-10 Rozelle interchange network performance – AM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,087	24,307	10%
Total vehicle kilometres travelled in network (km)	57,775	59,866	4%
Total time travelled approaching and in network (hr)	5,355	7,041	31%
Total vehicles arrived	21,621	22,682	5%
Total number of stops	302,654	314,527	4%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	2.6	-4%
Average time travelled in network (mins)	10.1	10.3	2%
Average number of stops	12.3	12.0	-2%
Average speed (km/h)	15.9	15.4	-3%
Unreleased vehicles			
Unreleased demand (veh)	1,278	2,233	–
% of total traffic demand	6%	9%	–

PM peak hour

In the PM peak hour, the forecast percentage increase in total demand is about seven per cent compared to 2023. However, there is a forecast reduction in eastbound traffic (about 200 vehicles per hour) to Sydney Harbour Bridge. As a result of this reduction, northbound queuing on Western Distributor and eastbound queuing on Anzac Bridge improves.

However, Victoria Road is forecast to be more congested, partly due to a significant increase in bus volumes, but also due to forecast increases in general traffic to both The Bays Precinct and to Johnston Street. These increases impact the Victoria Road/The Crescent intersection, which in turn has knock-on effects to westbound traffic over Anzac Bridge, particularly to the right-turn to Victoria Road. The westbound through movement is also impacted with long queues expected on the east approach to the intersection.

Table 8-11 Rozelle interchange network performance – PM peak hour (2023 'without project' vs 2033 'without project' scenario)

Network measure	2023 'without project'	2033 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	24,694	26,528	7%
Total vehicle kilometres travelled in network (km)	61,136	60,908	0%
Total time travelled approaching and in network (hr)	4,896	6,146	26%
Total vehicles arrived	21,854	22,679	4%
Total number of stops	146,986	151,862	3%

Network measure	2023 'without project'	2033 'without project'	Percentage change
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.7	-4%
Average time travelled in network (mins)	8.3	8.2	-1%
Average number of stops	5.9	5.9	0%
Average speed (km/h)	20.3	19.7	-3%
Unreleased vehicles			
Unreleased demand (veh)	2,684	3,591	–
% of total traffic demand	11%	14%	–

8.3.3 Intersection performance

Table 8-12 presents the modelled AM and PM peak hour LoS for key intersections at Rozelle. The intersection performance results demonstrate the following intersections are forecast to experience significant congestion during the AM and PM peak hours in the 'without project' case by 2033:

- Victoria Road/Lyons Road
- Victoria Road/Darling Street
- Victoria Road/Robert Street
- Victoria Road/The Crescent
- The Crescent/Johnston Street.

Table 8-12 Rozelle interchange: key intersection performance (LoS) – 2023 and 2033 'without project' scenarios

Key intersections	2015 'base case'	2023 'without project'	2033 'without project'
AM peak hour			
Victoria Road/Lyons Road	D	F	F
Victoria Road/Wellington Street	D	D	D
Victoria Road/Darling Street	F	F	F
Victoria Road/Robert Street	D	D	D
Victoria Road/The Crescent	B	B	C
The Crescent/James Craig Road	A	A	B
City West Link/The Crescent	B	B	B
The Crescent/Johnston Street	C	C	D
PM peak hour			
Victoria Road/Lyons Road	D	F	F
Victoria Road/Wellington Street	B	D	D
Victoria Road/Darling Street	F	F	F

Key intersections	2015 'base case'	2023 'without project'	2033 'without project'
Victoria Road/Robert Street	F	F	F
Victoria Road/The Crescent	F	F	E
The Crescent/James Craig Road	B	C	B
City West Link/The Crescent	D	F	D
The Crescent/Johnston Street	F	F	E

With higher 2033 traffic demands in the PM peak hour, the westbound traffic is constrained by the capacity of Anzac Bridge, which limits the flows that reach Victoria Road, The Crescent and City West Link. Therefore, improved levels of service at Victoria Road/The Crescent, City West Link/James Craig Road, City West Link/The Crescent and The Crescent/Johnston Street intersections are forecast in the 2033 PM peak hour.

8.3.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints, applied to reflect network congestion at intersections beyond the modelled network extents, were retained. In addition to network performance statistics, average travel times were extracted from the model along Victoria Road and City West Link onto Anzac Bridge and were compared for the modelled years under the 'without project' scenario. Travel times for two 'inbound' and 'outbound' routes were measured:

Inbound

- From the northern end of Iron Cove Bridge to the eastern edge of Anzac Bridge via Victoria Road
- From City West Link/Catherine Street intersection to the eastern edge of Anzac Bridge via City West Link.

Outbound

- From the eastern edge of Anzac Bridge to the northern end of Iron Cove Bridge via Victoria Road
- From the eastern edge of Anzac Bridge to City West Link/Catherine Street intersection via City West Link.

Figure 8-5 and **Figure 8-6** shows the travel times for these routes in the AM and PM peak hours. The speed limit on the road network in the modelled area is 60 kilometres per hour.

In the AM peak hour, due to the difference in trip distribution with fewer vehicles heading to Bathurst Street and more to Sussex Street, traffic flow on the Western Distributor is forecast to improve, resulting in less queuing back on Anzac Bridge. Therefore, slightly better travel times are forecast to be achieved in the eastbound direction. In the westbound direction, especially towards Iron Cove Bridge, travel times worsened due to increases in both the forecast demands and number of bus movements.

In the PM peak hour, differences in trip distribution at different times resulted in travel time changes along each route. In 2023, northbound bus volumes on Victoria Road increase, which worsens congestion and northbound travel times. However, by 2033, increased congestion on Anzac Bridge due to forecast growth in traffic to The Crescent results in fewer vehicles northbound on Victoria Road and correspondingly better journey times on this route.

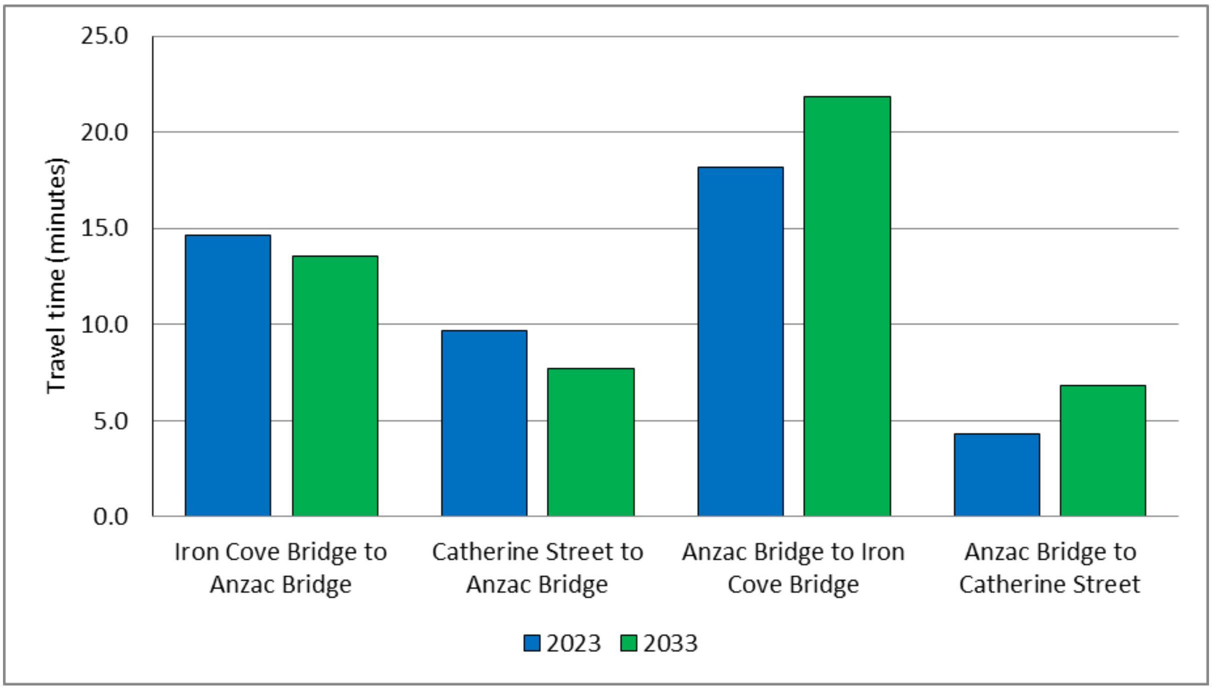


Figure 8-5 Rozelle interchange: average travel time (mins) – AM peak hour 'without project' scenarios

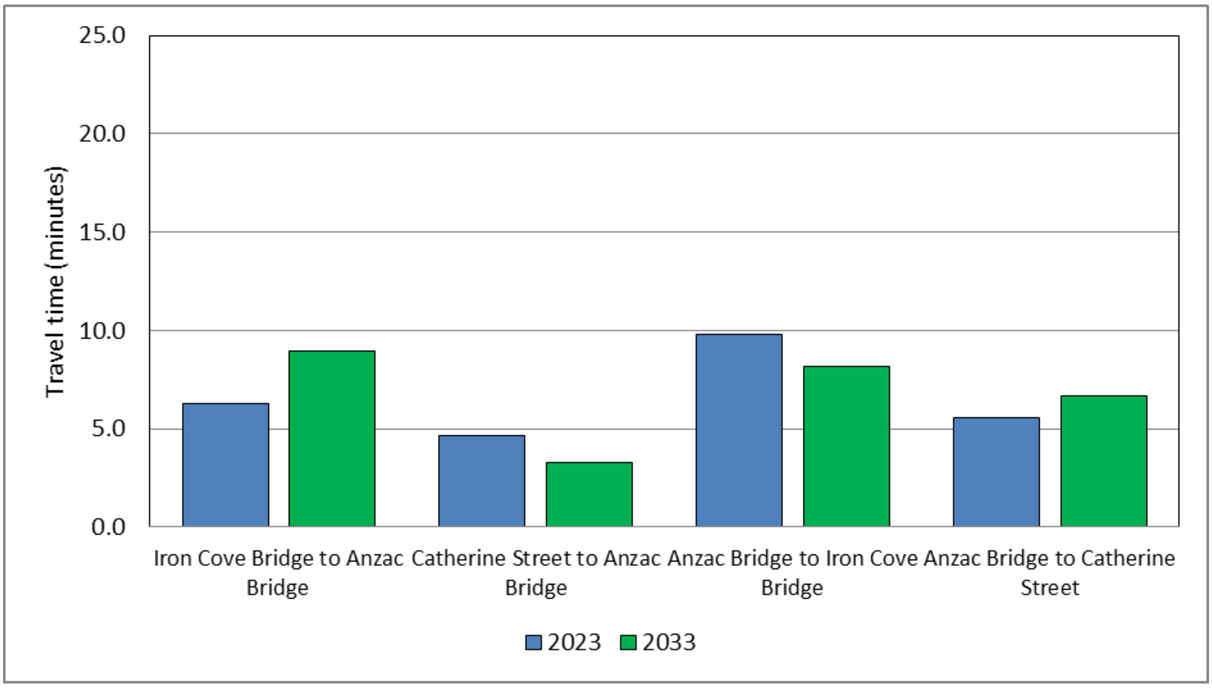


Figure 8-6 Rozelle interchange: average travel time (mins) – PM peak hour 'without project' scenarios

8.3.5 Traffic crashes

The frequency of crashes on the roads in the vicinity of the Rozelle interchange would be expected to increase in proportion to forecast traffic volume growth in the future. The potential for crashes – indicated by the crash rates per vehicle kilometre travelled in **section 6.4.4** – would remain.

By 2033, the growth in traffic volumes would create a proportional rise in crash frequencies and costs along the following road sections:

- Anzac Bridge (Victoria Road to Miller Street)
  - Crashes would be expected to increase from an average of 22 to 27 per annum
  - The corresponding annual cost of crashes would rise from $5.5 million to $6.8 million per annum
- City West Link (James Street to Victoria Road)
  - Crashes would be expected to increase from an average of 34 to 39 per annum
  - The corresponding annual cost of crashes would rise from $8.4 million to $9.7 million per annum
- Victoria Road (Darling Street to The Crescent)
  - Crashes would be expected to increase from an average of 19 to 24 per annum
  - The corresponding annual cost of crashes would rise from $5.4 million to $6.8 million per annum
- Lilyfield Road (Victoria Road to Canal Road)
  - Crashes would be expected to increase from an average of eight to 22 per annum
  - The corresponding annual cost of crashes would rise from $2.3 million to $6.3 million per annum
- The Crescent (City West Link to Wigram Road)
  - Crashes would be expected to increase from an average of 12 to 13 per annum
  - The corresponding annual cost of crashes would rise from $2.9 million to $3.0 million per annum
- Johnston Street (The Crescent to Parramatta Road)
  - Crashes would be expected to increase from an average of 12 to 16 per annum
  - The corresponding annual cost of crashes would rise from $3.3 million to $4.3 million per annum.

The above analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

8.3.6 Public transport services

Increased bus frequencies are planned along Victoria Road. Bus movement and frequency forecasts have been provided by Transport for NSW, which indicate more than two buses per minute in the peak direction along most of Victoria Road and more than three buses per minute on the southern section of Victoria Road. They would continue to run in kerbside bus lanes as currently demarcated.

8.3.7 Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in the **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

8.4 Operational performance – St Peters interchange

8.4.1 Changes to road network in 'do minimum' scenario

The St Peters interchange is at the eastern end of the New M5 project and, as such, associated New M5 road network infrastructure was included in the 'do minimum' or 'without project' scenario models. Since the New M5 EIS assessment, the following changes to the road network have been planned and have also been included in the 'do minimum' or 'without project' scenario:

- In accordance with planned Pinch Point works by Roads and Maritime at the Princes Highway/Railway Road intersection – Railway Road approach changed to a left lane marked for left turning traffic only, which joins Princes Highway at a give-way slip lane, and a right lane marked for right turning traffic only at the signals. The two lane section develops about 70 metres before the stop line. The Princes Highway northbound approach has three through lanes with the left-hand lane shared with left turning traffic. The Princes Highway southbound approach consists of two through lanes and a single right turn lane
- The Airport North Precinct project was included in the model – this project consists of improvements to Robey Street, Qantas Drive and O'Riordan Street, as follows:
  - Provision of a third lane in both directions on O'Riordan Street between Robey Street and Bourke Road
  - At the O'Riordan Street/King Street intersection, provision of new southbound dedicated right turn lane, about 75 metres long
  - At the O'Riordan Street/Robey Street intersection, the Robey Street eastbound approach is signalised to provide a crossing for pedestrians, the O'Riordan Street southbound approach has four through lanes and a signalised slip lane for left turning traffic
  - At the Qantas Drive/Robey Street intersection, the eastbound left turn is converted from free flowing to signalised with the provision of pedestrian crossing
  - At the O'Riordan Street/Bourke Road intersection, the northbound left turn into Bourke Road is converted from a single lane to two lanes
- Gardeners Road/Kent Road intersection – layout changed from T-junction to four-legged intersection. The northern leg is to provide access to local businesses and is accessible from Gardeners Road west and from Kent Street with only left turn exit permitted. The west approach has three through lanes and a single right turn lane about 90 metres long. The east approach is similar to the previous design, with three through lanes, but the left turn bay is converted to a signalised slip lane with a pedestrian crossing. The southbound exit is a single lane with slip lane joining it as an added lane, which then flares to three lanes
- Campbell Road/Bourke Road intersection – layout changed to match new design of four-legged intersection at this location to provide a signalised access at the access easement, which currently exists for the Goodman's site.

While investigations into the King Street Gateway project are underway, no confirmed road layout changes are available, and so this project has not been included in the operational modelling around the St Peters interchange. The King Street Gateway project is not impeded by the M4-M5 Link project.

Not all of the forecast demand to and from the Sydney Airport precinct could be accommodated in the peak hour without the Sydney Gateway project. This change in forecast demand is reported in the network performance tables.

8.4.2 Network performance

2023 'Do minimum' scenario

Table 8-13 and Table 8-14 present a comparison of the performance of the modelled road network between the 2015 'base case' scenario and 2023 'without project' scenario for the AM and PM peak hours.

AM peak hour

The comparison shows an overall decrease in performance, which is reflected in increased total time travelled in the network and increased number of stops. There is a 18 per cent increase in total traffic demand which results in more vehicles arriving at their destination, but this also affects all average measures per vehicle, which are considerably worse in the 2023 'without project' scenario. Average speed in the network drops by 34 per cent and there are noticeably more unreleased vehicles (eight per cent of total peak hour demand).

Table 8-13 St Peters interchange network performance – AM peak hour (2015 'base case' vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,080	26,060	18%
Total vehicle kilometres travelled in network (km)	62,220	77,500	25%
Total time travelled approaching and in network (hr)	2,350	5,150	119%
Total vehicles arrived	21,840	23,710	9%
Total number of stops	105,830	201,290	90%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	2.8	7%
Average time travelled in network (mins)	5.8	9.5	63%
Average number of stops	4.8	8.5	75%
Average speed (km/h)	26.8	17.6	-34%
Unreleased vehicles			
Unreleased demand (veh)	90	2,120	–
% of total traffic demand	0%	8%	–
Demand reduction to/from Sydney Airport precinct (veh)	–	640	–

PM peak hour

The comparison shows that, despite 18 per cent more demand in the 2023 'without project' scenario, the modelled network performs similarly to the 2015 'base case' scenario in the PM peak. The number of vehicles arriving at their destination increased by the same proportion as the total demand and average speed in the network is comparable with the 2015 'base case'. The increase in average speed in the 'without project' scenario is due to the ramps leading to and from the New M5. These ramps not only allow vehicles to travel faster, which increase the overall average speed in the network, but also remove a proportion of traffic from the surface network freeing up some capacity for the remaining surface traffic. The result is that despite higher overall demands, the overall network performance is similar to the 2015 'base case' network performance.

Table 8-14 St Peters interchange network performance – PM peak hour (2015 'base case' vs 2023 'without project' scenario)

Network measure	2015 'base case'	2023 'without project'	Percentage change
All vehicles			
Total traffic demand (veh)	21,390	25,210	18%
Total vehicle kilometres travelled in network (km)	59,650	78,920	32%
Total time travelled approaching and in network (hr)	2,370	2,850	20%
Total vehicles arrived	21,160	24,960	18%
Total number of stops	101,670	127,390	25%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	2.9	10%
Average time travelled in network (mins)	5.9	6.1	2%
Average number of stops	4.8	5.1	6%
Average speed (km/h)	26.1	28.2	8%
Unreleased vehicles			
Unreleased demand (veh)	250	220	–
% of total traffic demand	1%	1%	–
Demand reduction to/from Sydney Airport precinct (veh)	–	230	–

2033 'Do minimum' scenario

Table 8-15 and **Table 8-16** present a comparison of the performance of the modelled road network between the 2023 and 2033 'without project' scenarios for the AM and PM peak hours.

AM peak hour

The AM peak hour network performance indicates a further increase in demand in the 2033 'without project' scenario and the overall network performance declines without the project. With 12 per cent higher demand than the 2023 'without project' scenario, the number of vehicles arriving at their destination drops by 13 per cent and total time travelled in the network more than doubles. All average vehicle performance metrics decrease, with average speed in the network dropping to eight kilometres per hour and the number of unreleased vehicles increasing to 24 per cent of the total demand. This indicates that by 2033 the network struggles to cope with the forecast traffic demand.

Table 8-15 St Peters interchange network performance – AM peak hour (2023 ‘without project’ vs 2033 ‘without project’ scenario)

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	26,060	29,160	12%
Total vehicle kilometres travelled in network (km)	77,500	72,830	-6%
Total time travelled approaching and in network (hr)	5,150	12,360	140%
Total vehicles arrived	23,710	20,720	-13%
Total number of stops	201,290	274,310	36%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.6	-8%
Average time travelled in network (mins)	9.5	17.0	80%
Average number of stops	8.5	13.2	56%
Average speed (km/h)	17.6	9.0	-49%
Unreleased vehicles			
Unreleased demand (veh)	2,120	6,950	–
% of total traffic demand	8%	24%	–
Demand reduction to/from Sydney Airport precinct (veh)	640	690	–

PM peak hour

The PM peak hour network performance results show that, similar to the AM peak hour, the network suffers from increased congestion by 2033 without the project. All performance indicators deteriorate and the average speed of around 18 kilometres per hour indicates a road network with decreased performance and a greater number of vehicles failing to enter the modelled network.

Table 8-16 St Peters interchange network performance – PM peak hour (2023 ‘without project’ vs 2033 ‘without project’ scenario)

Network measure	2023 ‘without project’	2033 ‘without project’	Percentage change
All vehicles			
Total traffic demand (veh)	25,210	27,610	10%
Total vehicle kilometres travelled in network (km)	78,920	84,570	7%
Total time travelled approaching and in network (hr)	2,850	4,970	74%
Total vehicles arrived	24,960	26,350	6%
Total number of stops	127,390	195,250	53%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	2.8	-3%
Average time travelled in network (mins)	6.1	9.2	51%

Average number of stops	5.1	7.4	45%
Average speed (km/h)	28.2	18.0	-36%
Unreleased vehicles			
Unreleased demand (veh)	220	1,150	–
% of total traffic demand	1%	4%	–
Demand reduction to/from Sydney Airport precinct (veh)	230	320	–

8.4.3 Intersection performance

Table 8-17 presents the modelled AM and PM peak hour LoS for key intersections at St Peters. The level of service for each intersection is forecast to consistently worsen when compared with the 2015 ‘base case’ scenario. By 2033, the network is forecast to not be able to accommodate the forecast traffic demand, especially in the AM peak hour.

Table 8-17 St Peters interchange: key intersection performance (LoS) – 2023 and 2033 ‘without project’ scenarios

Key intersections	2015 ‘base case’	2023 ‘without project’	2033 ‘without project’
AM peak hour			
Princes Highway/Sydney Park Road	C	C	F
Princes Highway/May Street	D	C	F
Princes Highway/Canal Road	D	F	F
Princes Highway/Railway Road	F	F	F
Sydney Park Rd/Mitchell Road	C	B	F
Euston Road/Sydney Park Road	A	C	F
Unwins Bridge Road/Campbell Street	C	D	F
Campbell Road/Euston Road	A	C	F
Campbell Road/Bourke Road	-	B	B
Princes Highway/Campbell Street	C	F	F
Ricketty Street/Kent Road	C	E	F
Gardeners Road/Kent Road	A	C	F
Gardeners Road/Bourke Road	C	F	F
Gardeners Rd/O'Riordan Street	D	F	F
PM peak hour			
Princes Highway/Sydney Park Road	D	B	C
Princes Highway/May Street	F	C	B
Princes Highway/Canal Road	D	D	F
Princes Highway/Railway Road	D	D	F
Sydney Park Rd/Mitchell Road	D	C	D
Euston Road/Sydney Park Road	B	D	D
Unwins Bridge Road/Campbell Street	D	E	F

Key intersections	2015 'base case'	2023 'without project'	2033 'without project'
Campbell Road/Euston Road	A	E	E
Campbell Road/Bourke Road	-	B	B
Princes Highway/Campbell Street	D	F	F
Ricketty Street/Kent Road	C	C	F
Gardeners Road/Kent Road	A	B	D
Gardeners Road/Bourke Road	D	D	F
Gardeners Rd/O'Riordan Street	E	F	F

8.4.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints, applied to reflect network congestion at intersections beyond the modelled network extents, were retained.

In addition to network performance statistics, travel times for selected routes within the modelled area were extracted and compared for the 2023 and 2033 'without project' scenarios. Travel times were measured for the following routes:

- Princes Highway, near Bellevue Street, to Euston Road, north of Maddox Street (and in the opposite direction)
- WestConnex South (New M5 northbound exit ramp) to Euston Road, north of Maddox Street (and in the opposite direction)
- King Street, north of Sydney Park Road, to Domestic Airport Terminals (and in the opposite direction)
- Railway Road, near Unwins Bridge Road, to Gardeners Road, east of Botany Road (and in the opposite direction).

Figure 8-7 and **Figure 8-8** show a comparison of travel times recorded on these routes in the 2023 and 2033 'without project' conditions. In both peak hours, each route has consistently longer travel times in 2033, with the highest increase on the route between King Street and the Domestic Terminals.

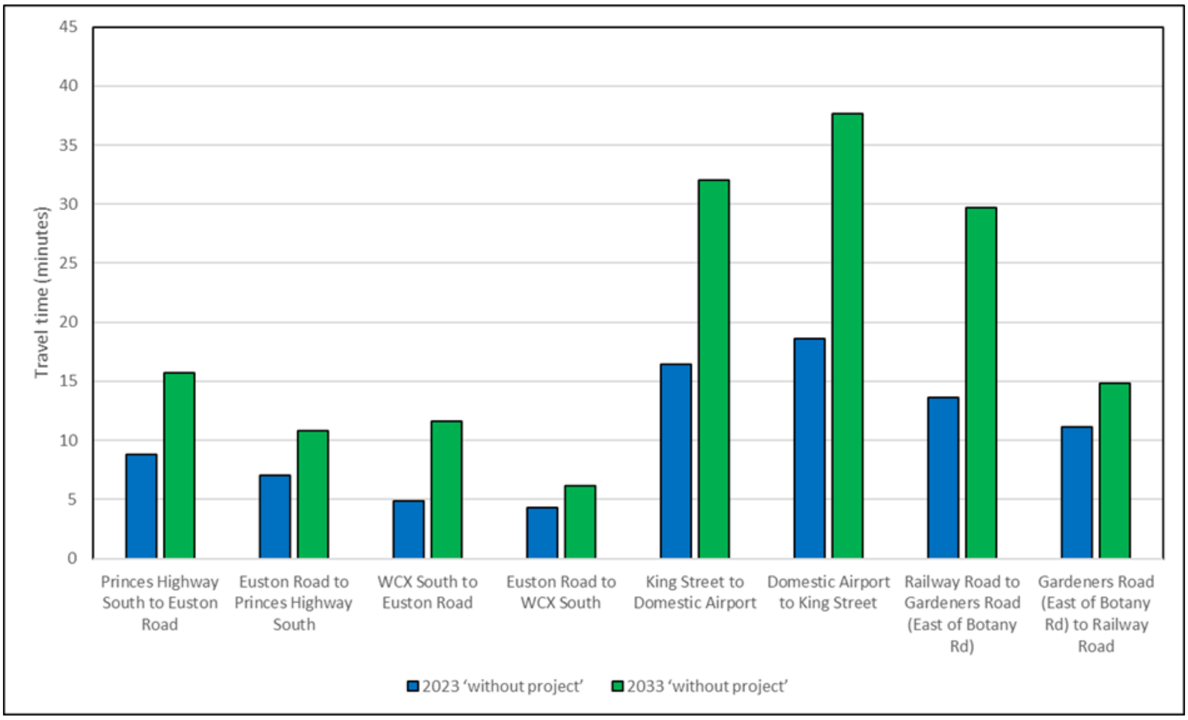


Figure 8-7 St Peters interchange: average travel time (mins) – AM peak hour 'without project' scenarios

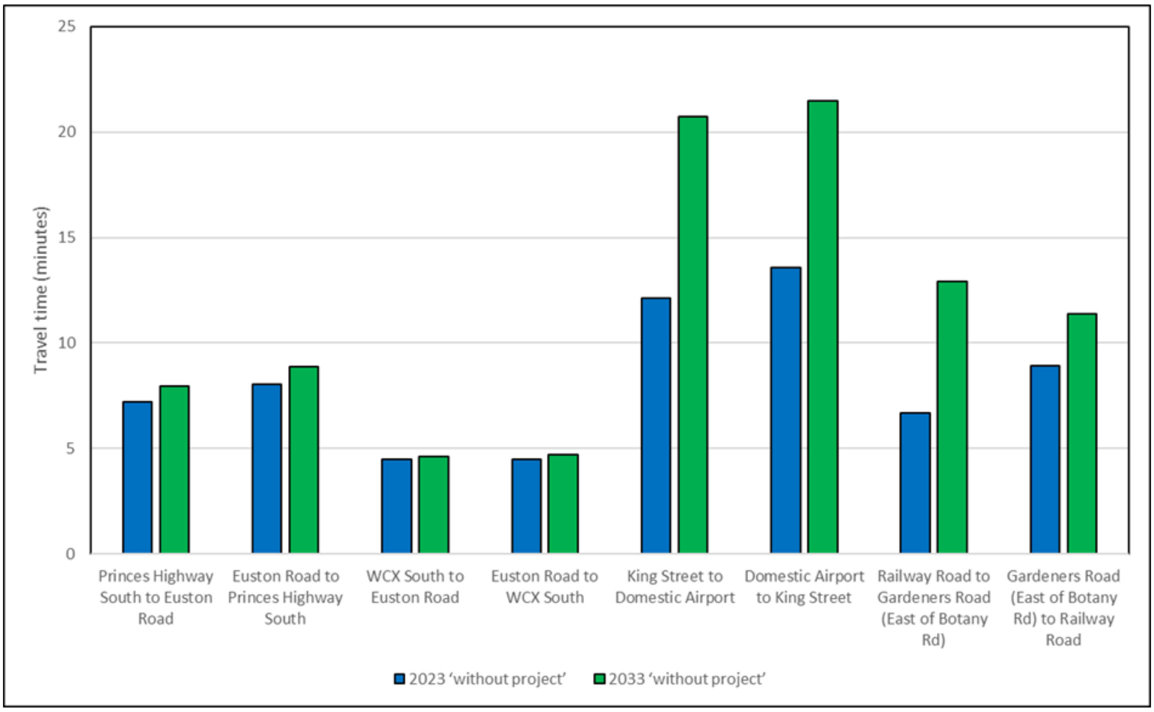


Figure 8-8 St Peters interchange: average travel time (mins) – PM peak hour 'without project' scenarios

8.4.5 Traffic crashes

The frequency of crashes on surface roads in the St Peters area would be expected to change relative to the forecast traffic volume changes, as well as the intersection upgrades planned as part of the New M5 project. This is described in detail in the Traffic and Transport Technical working paper of the New M5 EIS (AECOM 2015).

Traffic crash analysis comparing existing traffic conditions to 2033 ‘without project’ conditions suggests that by 2033, the growth in traffic volumes would create a proportional change in crash frequencies and costs along the following road sections in the vicinity of the St Peters area:

- Princes Highway (Enmore Road to Gannon Street)
  - Crashes would be expected to increase from an average of 81 to 95 per annum
  - The corresponding cost of crashes would rise from $8.4 million to $9.8 million per annum
- Canal Road/ Ricketty Street/ Gardeners Road (Princes Highway to Botany Road)
  - Crashes would be expected to decrease from an average of 50 to 39 per annum, due to a reduction in forecast traffic using these roads
  - The corresponding cost of crashes would decrease from $4.4 million to $3.5 million per annum
- Euston Road (Sydney Park Road to Campbell Road)
  - Crashes would be expected to increase from an average of four to 35 per annum
  - The corresponding cost of crashes would rise from $0.4 million to $2.7 million per annum
- Bourke Road (Wyndham Street to Gardeners Road)
  - Crashes would be expected to increase from an average of 14 to 32 per annum
  - The corresponding cost of crashes would rise from $1.1 million to $2.4 million per annum.

The frequency of crashes on the combined M5 East and New M5 motorways would also be expected to increase in proportion to forecast traffic growth on these roads in the future. The potential for crashes on the M5 East Motorway has been assumed to remain at the crash rates per vehicle kilometre travelled as calculated from data recorded during the period from January 2009 to December 2013. The potential for crashes in the New M5 tunnel has been undertaken using the crash rates on the existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels).

Traffic crash analysis of the M5 Motorway corridor, comparing existing traffic conditions, to 2033 ‘without project’ conditions, suggests that in 2033, there would be a small decrease in the total number and cost of crashes on the M5 Motorway corridor despite a large increase in traffic volumes:

- Crashes would be expected to decrease slightly, from an average of 96 per annum on the M5 East, to a total of 94 per annum across the M5 East and the New M5
- The corresponding annual cost of crashes would fall from $5.9 million on the M5 East to a total of $5.7 million per annum on the M5 East and the New M5.

The above analysis has been undertaken assuming the future frequency, type, and severity of crashes would be consistent with historic trends. On this basis the forecast growth in traffic would be expected to result in both the total number and cost of crashes increasing.

8.4.6 Public transport services

Sydney’s Bus Future (Transport for NSW, 2013) was developed to complement the *Transport Master Plan* by redesigning the city’s bus network to meet current and future customer needs through identifying short and longer term priorities for bus services across Sydney. Transport for NSW has identified the following planned suburban routes, which have target average speeds, including dwell times, of 18 to 25 kilometres per hour[14], that would travel through the St Peters interchange area:

- Chatswood to Airport via Sydney CBD and Botany Road (new route replacing the M20)
- Lane Cove to Eastgardens via Sydney CBD, Surry Hills and Botany Rd (new route)

[14] Transport for NSW, *Sydney’s Bus Future*, 2013

- Hurstville to Sydney CBD via Earlwood and Newtown (current route 423)
- Bondi Junction to Miranda via Airport and Eastgardens (new route)
- Bondi Junction to Burwood via Airport and Eastgardens (current route 400)
- Bondi Junction to Burwood via Sydenham (current route 418).

Sydney's Rail Future: Modernising Sydney's Trains (Transport for NSW 2012) was developed to complement the *Transport Master Plan* with a particular focus on improving Sydney's rail system. In particular, *Sydney's Rail Future* highlighted the need to improve the East Hills, Airport and Inner West railway line, which runs generally parallel to the project, and also highlights the introduction of a Rapid Transit line, as an extension of the North West Rail Link. Now called Sydney Metro, this rapid transit line would primarily serve north-western Sydney and the Lower North Shore through the Sydney CBD to Bankstown via Sydenham. Sydney Metro Northwest is programmed to open in 2019, while Sydney Metro City and South West (the extension through the Sydney CBD to Bankstown) is programmed to open from 2024. Sydney Metro would not serve the two closest stations to the study area – St Peters and Mascot stations. The closest metro station would be Sydenham Station.

8.4.7 Active transport facilities

Details of planned walking and cycling facilities in the absence of the project can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

9 Future year traffic volumes and patterns with the project

9.1 Introduction

Chapter 4 provides details of the modelling approach used to derive future year traffic demand for road and intersection locations within the project area. As previously discussed, the WRTM underpins all future year traffic forecasts, as it has been specifically developed to assess infrastructure improvements associated with the WestConnex component projects individually and in combination.

Specifically, the objective of the WRTM demand modelling was to forecast use of the project and traffic on the metropolitan road network of Sydney, estimating traffic volumes for different periods of the day based on expected land use changes, as well as proposed road network improvements for six key scenarios. For the purpose of assessing the impacts of the project on surrounding roads, with an exclusive focus on the study area rather the wider Sydney road network, the adopted three stage approach: forecasting, rebasing and operational traffic modelling, provides a more accurate representation of how future year traffic growth would affect observed traffic demands than direct output from the WRTM.

However, a wider assessment can also be undertaken using only traffic forecasting data as this provides evidence of high level patterns across parallel strategic corridors within and external to the study area for peak and daily time periods. Consequently, traffic volumes were directly sourced from the WRTM for key roads in the study area, with the results documented in subsequent sections, based on the following modelling characteristics and scenarios:

- Time periods:
  - AWT
  - One hour AM peak
  - One hour PM peak
- Modelled scenarios:
  - Operation ‘do minimum’ or ‘without project’ (2023): with M4 Widening and KGRIU operational and assumes that NorthConnex, M4 East, and New M5 are complete, but that the M4-M5 Link has not been built. It is called ‘do minimum’ rather than ‘do nothing’ as it assumes ongoing improvements would be made to the broader road and public transport network over time including some new infrastructure and intersection enhancements to improve capacity and cater for traffic growth
  - Operation ‘with project’ (2023): with the 2023 ‘do minimum’ projects completed and the M4-M5 Link complete and open to traffic
  - Operation ‘cumulative’ (2023): with 2023 ‘do minimum’ projects and M4-M5 Link completed, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel projects operational.
  - Operation ‘do minimum’ or ‘without project’ (2033): with the same 2023 ‘do minimum‘ projects complete and some upgrades to the broader road and public transport network over time to improve capacity and cater for traffic growth but does not include the M4-M5 Link
  - Operation ‘with project’ (2033): with the 2033 ‘do minimum’ projects completed and the M4-M5 Link complete and open to traffic
  - Operation ‘cumulative’ (2033): with the 2033 ‘do minimum’ projects and M4-M5 Link completed, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link, and the F6 Extension projects complete and operational.

9.2 Screenline/parallel routes analysis

The purpose of the screenline analysis is to examine how traffic may shift between alternative parallel routes or corridors through the study area. The analysis would also indicate if any toll avoidance behaviour is forecast.

Due to the geographic scale of the project, four screenlines were selected and their locations are indicated on **Figure 9-1**. They were placed to collectively analyse directional and two-way traffic volume outputs from the different modelling scenarios for each common future year.

- The east–west screenline captures changes in east–west traffic movement and includes a location on the M4-M5 Link mainline between the Wattle Street and Rozelle interchanges, as well as on four parallel corridors (City West Link, Darley Road, Marion Street and Parramatta Road). This screenline also includes a location on Lyons Road, which would reflect any changes in traffic using Lyons Road to travel to and from Victoria Road
- The upper north–south screenline captures changes in vehicle travel patterns on north–south links north of Parramatta Road, including Norton Street, Balmain Road, Catherine Street, Johnston Street, Booth Street (north of Pyrmont Bridge Road) and Ross Street (north of Bridge Road). These roads are close to the Rozelle interchange and would display changes in traffic on surface roads as a result of the new road connections at the Rozelle interchange
- The lower north–south screenline includes a location on the M4-M5 Link mainline between the Rozelle interchange and the St Peters interchange, as well as locations on 10 north–south regional connector roads (Stanmore Road, Addison Road, Sydenham Road, Marrickville Road, King Street, Wyndham Street, Botany Road, Elizabeth Street, South Dowling Street and the Southern Cross Drive)
- The cross-harbour screenline looks at changes in cross-harbour traffic flow on the Sydney Harbour Bridge, Sydney Harbour Tunnel and the Gladesville Bridge. It also includes a location on the proposed future Western Harbour Tunnel and Beaches Link in the 2023 and 2033 'cumulative' scenarios.

The results of the screenline assessment are provided in a series of analysis tables. These tables provide details of eastbound, westbound and two-way traffic volumes on each road, the screenline share (per cent) of each road and the total directional and two-way traffic volumes across the full screenline. Consequently, each table provides sufficient information to provide an understanding of:

- Future year AWT volumes and patterns in the project area for each modelled scenario
- The level of travel demand that would transfer to the project, and the resultant impacts on surface road traffic
- The volume of traffic that would shift to alternative routes.

It is noted that the screenline analysis presented is based on volumes taken directly from the WRTM for high level comparison, and have not been rebased as described in **section 4.2**. These forecast traffic volumes include both fixed and induced traffic demand.

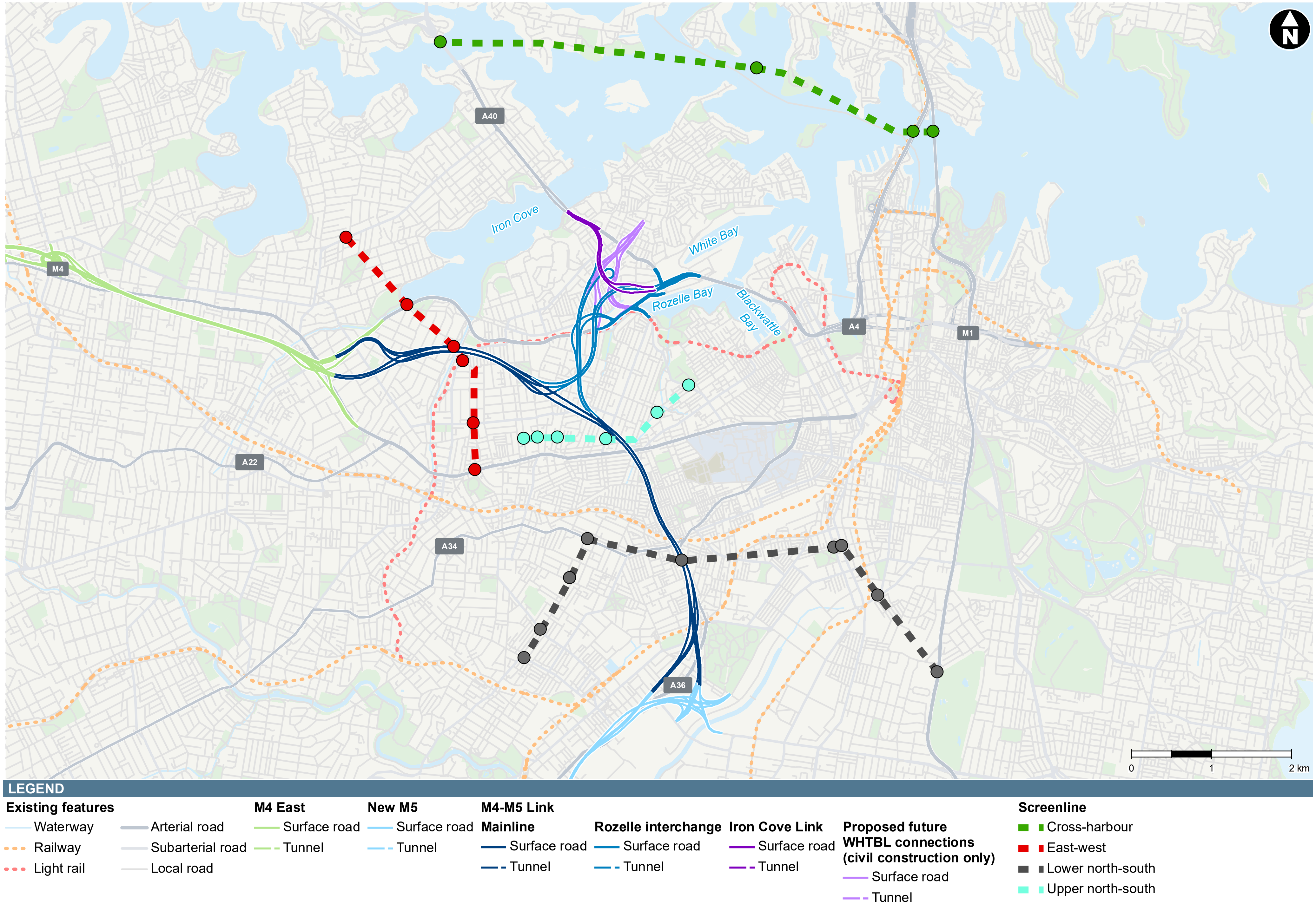


Figure 9-1 Screenline locations

9.3 East–west screenline

9.3.1 Average weekday traffic (AWT) analysis

Table 9-1 presents a comparison of the forecast AWT volumes from WRTM at the east–west screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing 2023 'without project' and 'with project' scenarios are:

- Two-way AWT crossing the east–west screenline is forecast to increase by 28 per cent in the 'with project' scenario. This increase can partially be attributed to rerouting of vehicles that choose to use the M4-M5 Link to access the airport and Port Botany instead of using alternative routes not captured in the screenline, such as the M5 in combination with the M7, A3 or A6, or routes encompassing connector roads between the M4 and the M5. This increase occurs on the M4-M5 Link, with 38 per cent of two-way AWT crossing the screenline forecast to use the M4-M5 Link in 2023
- As a consequence of traffic using the M4-M5 Link, two-way AWT on surface roads is forecast to decrease by just over 20 per cent in the 'with project' scenario
- The largest decreases in two-way AWT occur on Parramatta Road, Marion Street and City West Link, which run parallel to the M4-M5 Link between the Wattle Street and Rozelle interchanges. Two-way AWT is forecast to decrease on Parramatta Road by 25 per cent (more than 15,000 vehicles), on Marion Street by 40 per cent (more than 2,000 vehicles) and on City West Link by 23 per cent (more than 14,000 vehicles)
- Without the project, vehicles travelling from north of the harbour, via the Gladesville Bridge, to the south, have the option of travelling via Lyons Road, or via Victoria Road and Iron Cove Bridge. With the project, the Iron Cove Link and the M4-M5 Link provide alternative routes to Lyons Road, contributing to a forecast 14 per cent fall in two-way AWT on Lyons Road
- There is a small forecast increase in daily southbound vehicles on Darley Road of four per cent (less than 500 vehicles). This is likely resultant from traffic moving between the surface road network and the M4-M5 Link and Iron Cove Link, via the interchange at Rozelle. This change is considered to be minimal and within daily traffic limits of traffic volume changes on the road network. Two-way AWT forecasts are the same with or without the project.

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are the same as for the 2023 comparisons:

- Two-way AWT crossing the east–west screenline is forecast to increase by just over 30 per cent in the 'with project' scenario. This increase can be attributed to traffic shifting to the M4-M5 Link
- There is a significant shift in traffic away from surface roads, and onto the M4-M5 Link mainline between the Wattle Street and Rozelle interchanges, with almost 40 per cent of two-way AWT crossing the screenline forecast to use the M4-M5 Link in 2033
- There is also a small forecast increase in southbound vehicles on Darley Road, but is considered to be within daily limits of traffic volume changes on the road network. Two-way AWT forecasts are similar with or without the project.

Table 9-2 presents a comparison of the forecast AWT volumes from the WRTM at the east–west screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 'cumulative' to the 'without project' scenarios for 2023 and 2033 are that the patterns of change are similar to those observed in the comparison of 'with project' to 'without project':

- Rerouting of traffic to the M4-M5 Link, away from roads not captured in the screenline, contributes to an increase in two-way AWT crossing the screenline of 36 per cent in 2023, and 41 per cent in 2033

- Two-way AWT on surface roads crossing the screenline is forecast to decrease by 22 per cent in both 2023 and 2033, as vehicles use the M4-M5 Link instead
- In both 2023 and 2033, traffic moving between the surface road network and the new links via the Wattle Street and Rozelle interchanges, contributes to an increase in forecast daily southbound traffic for Darley Road of about five per cent or less, which is within the typical daily traffic limits of traffic volume changes on the road network.

Table 9-1 East–west screenline: WRTM comparison for with and without project scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'with project'		Change	2033 'without project'		2033 'with project'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Eastbound	Lyons Rd	17,400	19%	14,800	13%	-15%	20,800	21%	16,800	13%	-19%
	City West Link	33,500	38%	25,500	22%	-24%	34,300	35%	28,100	22%	-18%
	M4-M5 Link	–	–	43,700	38%	–	–	–	49,600	39%	–
	Darley Rd	8,800	10%	8,500	7%	-3%	9,000	9%	8,700	7%	-3%
	Marion St	3,500	4%	1,600	1%	-54%	4,300	4%	2,000	2%	-53%
	Parramatta Rd	26,100	29%	20,400	18%	-22%	29,100	30%	22,300	17%	-23%
	Total	**89,300**		**114,500**		**28%**	**97,500**		**127,500**		**31%**
Westbound	Lyons Rd	18,600	20%	16,300	13%	-12%	20,300	20%	17,300	13%	-15%
	City West Link	30,300	32%	23,800	20%	-21%	31,700	31%	25,500	19%	-20%
	M4-M5 Link	–	–	45,100	37%	–	–	–	49,800	38%	–
	Darley Rd	9,200	10%	9,600	8%	4%	10,200	10%	10,700	8%	5%
	Marion St	2,800	3%	2,100	2%	-25%	3,400	3%	2,600	2%	-24%
	Parramatta Rd	34,400	36%	24,600	20%	-28%	37,000	36%	26,200	20%	-29%
	Total	**95,300**		**121,500**		**27%**	**102,600**		**132,100**		**29%**
Two-way	Lyons Rd	36,000	20%	31,100	13%	-14%	41,100	21%	34,100	13%	-17%
	City West Link	63,800	35%	49,300	21%	-23%	66,000	33%	53,600	21%	-19%
	M4-M5 Link	–	–	88,800	38%	–	–	–	99,400	38%	–
	Darley Rd	18,000	10%	18,100	8%	1%	19,200	10%	19,400	7%	1%
	Marion St	6,300	3%	3,700	2%	-41%	7,700	4%	4,600	2%	-40%
	Parramatta Rd	60,500	33%	45,000	19%	-26%	66,100	33%	48,500	19%	-27%
	Total	**184,600**		**236,000**		**28%**	**200,100**		**259,600**		**30%**

Source: WRTM v2.3, 2017

Table 9-2 East–west screenline: WRTM comparison for without project and cumulative scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'cumulative'		Change	2033 'without project'		2033 'cumulative'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Eastbound	Lyons Rd	17,400	19%	14,500	12%	-17%	20,800	21%	16,000	12%	-23%
	City West Link	33,500	38%	23,900	20%	-29%	34,300	35%	26,400	19%	-23%
	M4-M5 Link	–	–	52,400	43%	–	–	–	63,800	46%	–
	Darley Rd	8,800	10%	8,400	7%	-5%	9,000	9%	8,600	6%	-4%
	Marion St	3,500	4%	1,500	1%	-57%	4,300	4%	1,900	1%	-56%
	Parramatta Rd	26,100	29%	20,200	17%	-23%	29,100	30%	22,200	16%	-24%
	Total	**89,300**		**120,900**		**35%**	**97,500**		**138,900**		**42%**
Westbound	Lyons Rd	18,600	20%	15,100	12%	-19%	20,300	20%	16,200	11%	-20%
	City West Link	30,300	32%	24,100	18%	-20%	31,700	31%	25,800	18%	-19%
	M4-M5 Link	–	–	54,800	42%	–	–	–	62,300	43%	–
	Darley Rd	9,200	10%	9,600	7%	4%	10,200	10%	10,700	7%	5%
	Marion St	2,800	3%	2,100	2%	-25%	3,400	3%	2,600	2%	-24%
	Parramatta Rd	34,400	36%	24,900	19%	-28%	37,000	36%	26,300	18%	-29%
	Total	**95,300**		**130,600**		**37%**	**102,600**		**143,900**		**40%**
Two-way	Lyons Rd	36,000	20%	29,600	12%	-18%	41,100	21%	32,200	11%	-22%
	City West Link	63,800	35%	48,000	19%	-25%	66,000	33%	52,200	18%	-21%
	M4-M5 Link	–	–	107,200	43%	–	–	–	126,100	45%	–
	Darley Rd	18,000	10%	18,000	7%	0%	19,200	10%	19,300	7%	1%
	Marion St	6,300	3%	3,600	1%	-43%	7,700	4%	4,500	2%	-42%
	Parramatta Rd	60,500	33%	45,100	18%	-25%	66,100	33%	48,500	17%	-27%
	Total	**184,600**		**251,500**		**36%**	**200,100**		**282,800**		**41%**

Source: WRTM v2.3, 2017

9.3.2 Peak hour analysis

Figure 9-2 and **Figure 9-3** illustrate the changes in the two-way peak hour volumes at the east–west screenline. The forecasts indicate that the impact of the project on peak hour traffic volumes are similar to the impacts forecast for AWT volumes, with traffic shifting off surface roads crossing the screenline, and onto the M4-M5 Link. However, traffic volume decreases on City West Link and Parramatta Road are much smaller in the peak hours compared to the total daily decrease. This is likely because traffic volumes on the M4-M5 Link in the peak hour mean that a smaller proportion of vehicles using Parramatta Road and City West Link can shift to use the M4-M5 Link, resulting in a greater number of vehicles remaining on these roads during peak hours, compared to off-peak times.

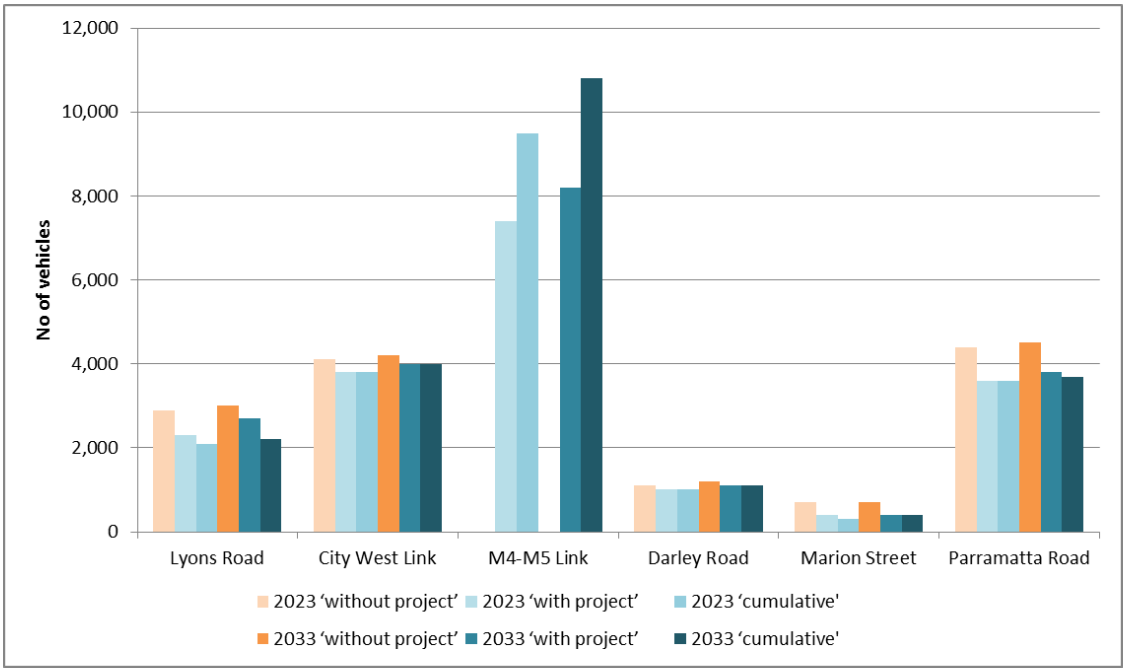


Figure 9-2 East–west screenline: comparison of two-way AM peak one hour volumes

Source: WRTM v2.3, 2017

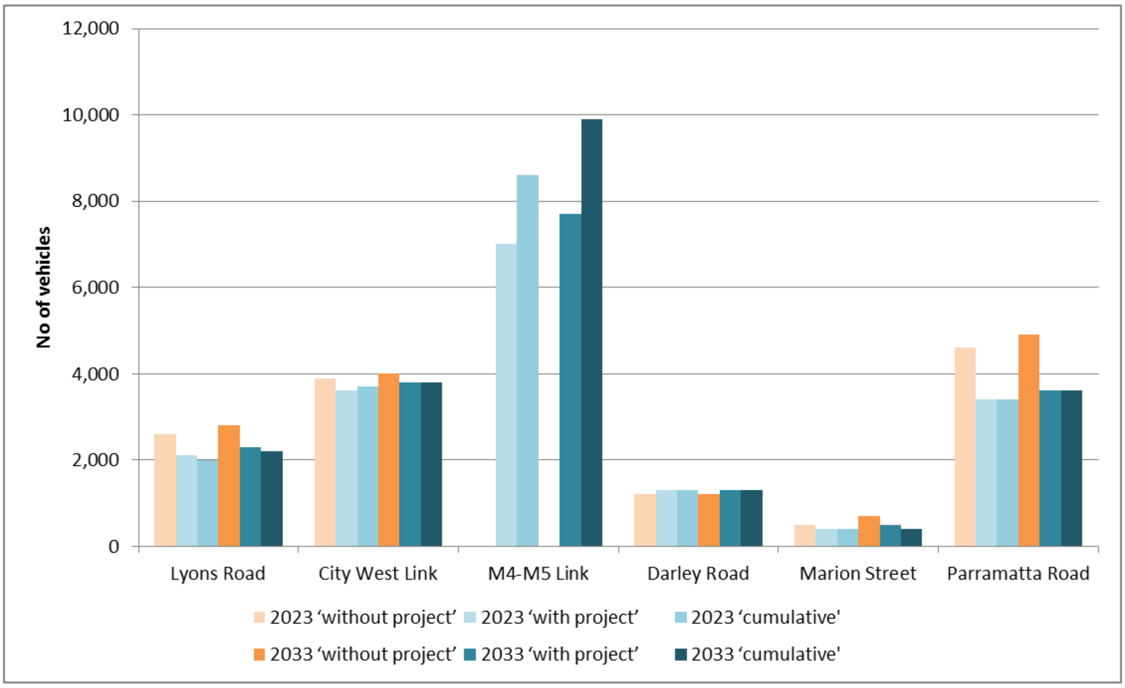


Figure 9-3 East–west screenline: comparison of two-way PM peak one hour volumes

Source: WRTM v2.3, 2017

9.4 Upper north–south screenline

9.4.1 Average weekday traffic (AWT) analysis

Table 9-3 presents a comparison of the forecast AWT volumes from the WRTM at the upper north–south screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing the 2023 'without project' and 'with project' scenarios are:

- A reduction in AWT on Parramatta Road results in reductions on some north–south roads connecting to Parramatta Road, including on Norton Street, where southbound AWT volumes decrease by about 25 per cent, and on Balmain Road, where northbound AWT volumes decrease by about 20 per cent
- The shift in vehicles onto the M4-M5 Link also results in an increase in traffic on some roads including Johnston Street and Ross Street as traffic moves between the surface road network and the M4-M5 Link.

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are similar to those observed in the 2023 comparisons with:

- As forecast AWT on Parramatta Road decreases, reductions are also forecast for north–south connectors to Parramatta Road, in particular for southbound AWT on Norton Street and northbound AWT on Balmain Road
- Again, an increase in AWT is forecast for Johnston Street and Ross Street, as traffic moves between the surface road network and new road links at the Rozelle interchange.

Table 9-4 presents a comparison of the forecast AWT volumes from the WRTM at the upper north–south screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 'cumulative' to the 'without project' scenarios for 2023 and 2033 are that the patterns of change are similar to those observed in the comparison of 'with project' to 'without project':

- There are forecast traffic flow reductions on some north–south roads connecting to Parramatta Road, as AWT on Parramatta Road decreases, with large forecast declines in southbound AWT on Norton Street, of 25 per cent in 2023 and 28 per cent in 2033, and in northbound AWT on Balmain Road of 17 per cent in 2023 and 19 per cent in 2033
- The movement of traffic, between the surface road network and new road links at the Rozelle interchange contribute to an increase in traffic on some roads including Johnston Street, where AWT is forecast to increase by 15 per cent in 2023 and by 12 per cent in 2033, and for Ross Street where traffic is forecast to increase by 16 per cent in 2023 and by 20 per cent in 2033. As a percentage of traffic crossing the screenline, this represents an increase of about three per cent or less.

Table 9-3 Upper north–south screenline: WRTM comparison for with and without project scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'with project'		Change	2033 'without project'		2033 'with project'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Norton Street	3,500	11%	3,600	12%	3%	4,100	11%	4,400	12%	7%
	Balmain Road	6,900	21%	5,600	18%	-19%	7,300	20%	5,900	16%	-19%
	Catherine Street	3,100	10%	3,000	10%	-3%	3,400	9%	3,400	9%	0%
	Johnston Street	7,800	24%	8,700	28%	12%	9,700	26%	10,100	28%	4%
	Booth Street	4,200	13%	3,600	12%	-14%	4,800	13%	4,200	12%	-13%
	Ross Street	7,000	22%	6,700	21%	-4%	8,000	21%	7,900	22%	-1%
	Total	**32,500**		**31,200**		**-4%**	**37,300**		**35,900**		**-4%**
Southbound	Norton Street	5,900	22%	4,500	17%	-24%	7,200	24%	5,200	17%	-28%
	Balmain Road[1]	–	–	–	–	–	–	–	–	–	–
	Catherine Street	6,100	23%	6,100	23%	0%	6,100	21%	6,600	22%	8%
	Johnston Street	5,300	20%	6,200	23%	17%	6,300	21%	7,100	23%	13%
	Booth Street	3,500	13%	3,600	14%	3%	3,700	13%	4,200	14%	14%
	Ross Street	5,500	21%	6,200	23%	13%	6,300	21%	7,500	25%	19%
	Total	**26,300**		**26,600**		**1%**	**29,600**		**30,600**		**3%**
Two-way	Norton Street	9,400	16%	8,100	14%	-14%	11,300	17%	9,600	14%	-15%
	Balmain Road	6,900	12%	5,600	10%	-19%	7,300	11%	5,900	9%	-19%
	Catherine Street	9,200	16%	9,100	16%	-1%	9,500	14%	10,000	15%	5%
	Johnston Street	13,100	22%	14,900	26%	14%	16,000	24%	17,200	26%	8%
	Booth Street	7,700	13%	7,200	12%	-6%	8,500	13%	8,400	13%	-1%
	Ross Street	12,500	21%	12,900	22%	3%	14,300	21%	15,400	23%	8%
	Total	**58,800**		**57,800**		**-2%**	**66,900**		**66,500**		**-1%**

Source: WRTM v2.3, 2017
Note: Balmain Road is northbound only between Parramatta Road and Leichhardt Street

Table 9-4 Upper north–south screenline: WRTM comparison for without project and cumulative scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'cumulative'		Change	2033 'without project'		2033 'cumulative'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Norton Street	3,500	11%	3,900	12%	11%	4,100	11%	4,500	12%	10%
	Balmain Road	6,900	21%	5,700	17%	-17%	7,300	20%	5,900	16%	-19%
	Catherine Street	3,100	10%	3,000	9%	-3%	3,400	9%	3,500	9%	3%
	Johnston Street	7,800	24%	8,800	27%	13%	9,700	26%	10,700	28%	10%
	Booth Street	4,200	13%	3,600	11%	-14%	4,800	13%	4,100	11%	-15%
	Ross Street	7,000	22%	7,900	24%	13%	8,000	21%	9,200	24%	15%
	Total	**32,500**		**32,900**		**1%**	**37,300**		**37,900**		**2%**
Southbound	Norton Street	5,900	22%	4,400	16%	-25%	7,200	24%	5,200	17%	-28%
	Balmain Road[1]	–	–	–	–	–	–	–	–	–	–
	Catherine Street	6,100	23%	6,100	23%	0%	6,100	21%	6,700	21%	10%
	Johnston Street	5,300	20%	6,300	23%	19%	6,300	21%	7,200	23%	14%
	Booth Street	3,500	13%	3,600	13%	3%	3,700	13%	4,200	13%	14%
	Ross Street	5,500	21%	6,600	24%	20%	6,300	21%	7,900	25%	25%
	Total	**26,300**		**27,000**		**3%**	**29,600**		**31,200**		**5%**
Two-way	Norton Street	9,400	16%	8,300	14%	-12%	11,300	17%	9,700	14%	-14%
	Balmain Road	6,900	12%	5,700	10%	-17%	7,300	11%	5,900	9%	-19%
	Catherine Street	9,200	16%	9,100	15%	-1%	9,500	14%	10,200	15%	7%
	Johnston Street	13,100	22%	15,100	25%	15%	16,000	24%	17,900	26%	12%
	Booth Street	7,700	13%	7,200	12%	-6%	8,500	13%	8,300	12%	-2%
	Ross Street	12,500	21%	14,500	24%	16%	14,300	21%	17,100	25%	20%
	Total	**58,800**		**59,900**		**2%**	**66,900**		**69,100**		**3%**

Source: WRTM v2.3, 2017
Note: Balmain Road is northbound only between Parramatta Road and Leichhardt Street

9.4.2 Peak hour analysis

Figure 9-4 and **Figure 9-5** illustrate the changes in the peak hour volumes at the upper north–south screenline. Similar to the AWT forecasts, the AM peak and PM peak hour forecasts show changes in traffic volumes on north–south links, with increases on some roads and decreases on others as vehicles shift from Parramatta Road to use the M4-M5 Link.

It was observed in **section 9.3.2**, that it is likely that traffic volumes on the M4-M5 Link in the peak hour mean that a smaller proportion of vehicles using Parramatta Road and City West Link would shift to using the M4-M5 Link, resulting in a greater number of vehicles remaining on these roads during peak hours compared to off-peak times. The impact of more vehicles remaining on Parramatta Road as a result can also be seen in the upper north–south screenline, where there is less of a decrease in traffic volumes on roads linking to Parramatta Road. This contributes to an increase in two-way AWT crossing the screenline, of up to six per cent in the AM peak, and up to nine per cent in the PM peak.

As was the case for the AWT forecasts, both the AM and PM peak forecasts show increases in traffic on Ross Street as vehicles access the M4-M5 Link, the Iron Cove Link in the 'with project' scenarios, and, in the 'cumulative' scenario, the proposed future Western Harbour Tunnel and Beaches Link.

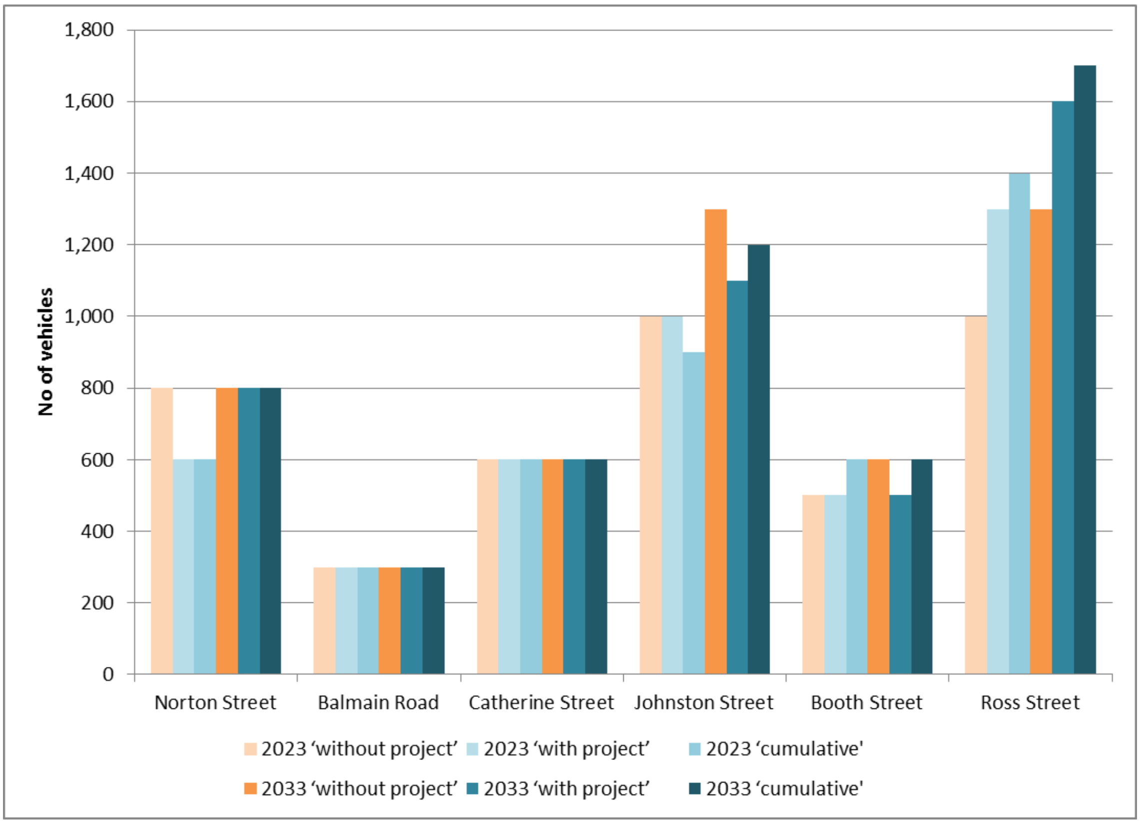


Figure 9-4 Upper north–south screenline: comparison of two-way AM peak one hour volumes

Source: WRTM v2.3, 2017

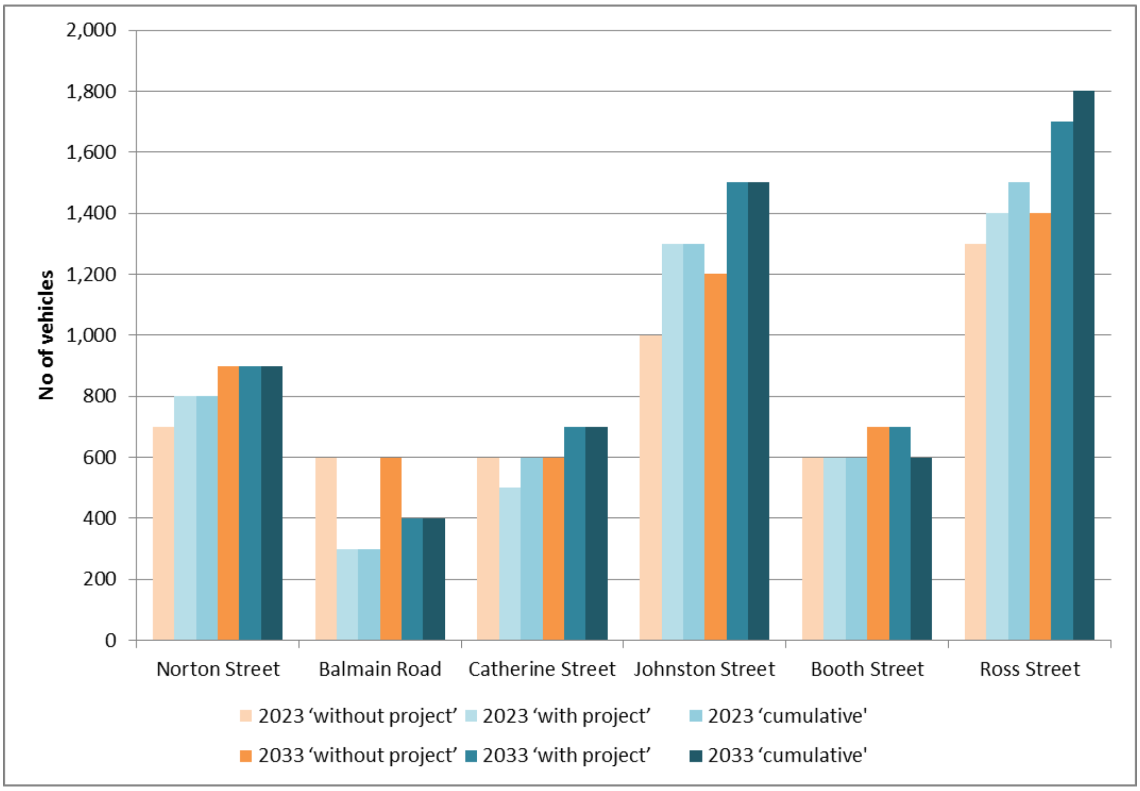


Figure 9-5 Upper north–south screenline: comparison of two-way PM peak one hour volumes

Source: WRTM v2.3, 2017

9.5 Lower north–south screenline

9.5.1 Average weekday traffic (AWT) analysis

Table 9-5 presents a comparison of the forecast AWT volumes from the WRTM at the lower north–south screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing the 2023 'without project' and 'with project' scenarios are:

- There is a 10 per cent increase in two-way AWT forecast to cross the screenline in the 'with project' scenario. However, this increase is entirely on the M4-M5 Link. Two-way traffic on the M4-M5 Link is forecast to be 16 per cent of total two-way AWT crossing the screenline, with AWT crossing the screenline on existing surface roads forecast to decrease by seven per cent
- The greatest forecast reductions in traffic volume occur on Stanmore Road and Southern Cross Drive. Total two-way AWT is forecast to fall by just under 6,000 vehicles daily or 16 per cent on Stanmore Road, and by about 5,500 vehicles daily, or three per cent, on Southern Cross Drive
- There are also significant forecast reductions on King Street, where two-way AWT traffic decreases by just under 4,000 vehicles daily (a drop of 19 per cent), and on Sydenham Road where two-way AWT traffic decreases by about 3,000 vehicles daily (a drop of 10 per cent).

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are the same as for the 2023 comparisons:

- A 12 per cent increase in AWT crossing the screenline is forecast with the project, and is predominantly due to traffic using the M4-M5 Link, with two-way traffic on the M4-M5 Link forecast to be 17 per cent of total two-way AWT crossing the screenline, while AWT crossing the screenline on existing surface roads is forecast to decrease by seven per cent

- Again, the greatest forecast reductions in daily traffic volume occur on Southern Cross Drive and Stanmore Road, with significant reductions also forecast for King Street and Sydenham Road.

Table 9-6 presents a comparison of the forecast AWT volumes from the WRTM at the lower north–south screenline location under the 2023 and 2033 ‘without project’ and ‘cumulative’ scenarios. Key observations comparing the ‘cumulative’ to ‘without project’ scenarios for 2023 and 2033 are that the patterns of change are similar to those observed in the comparison of ‘with project’ to ‘without project’:

- In both 2023 and 2033 ‘cumulative’ scenarios, two-way AWT crossing the screenline is forecast to increase, predominantly due to traffic using the M4-M5 Link. Traffic on the M4-M5 Link is forecast to be 24 per cent in 2023, and 27 per cent in 2033, of total two-way AWT crossing the screenline. At the same time there is an overall decrease forecast in traffic on the surface roads included in the screenline
- The greatest forecast reduction in traffic volume in both 2023 and 2033 occurs on Southern Cross Drive. Two-way AWT on Southern Cross Drive is forecast to fall by about 14 per cent in 2023, and about 16 per cent in 2033. This is due to vehicles travelling from areas north of the harbour to areas around the airport, or to the M5, with the proposed future Western Harbour Tunnel and Beaches Link, M4-M5 Link and the proposed future Sydney Gateway providing a new parallel route
- As in the ‘with project’ scenario, there are significant forecast reductions on Stanmore Road and Sydenham Road. While in the ‘cumulative‘ scenario, there is also a significant forecast reduction in northbound AWT on Botany Road of about 3,000 vehicles daily or nine per cent, due to the presence of Sydney Gateway providing an alternative, higher-order route from Sydney Airport and Port Botany precinct to the St Peters interchange
- There are slight forecast increases in southbound AWT on Wyndham Street, Botany Road, Elizabeth Street and King Street in the ‘cumulative’ scenario. However, in terms of total southbound AWT crossing the screenline, the forecast increase of traffic on these roads, in both 2023 and 2033, represents an increase of about two per cent.

Table 9-5 Lower north–south screenline: WRTM comparison for with and without project scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'with project'		Change	2033 'without project'		2033 'with project'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Stanmore Road	16,700	10%	13,800	7%	-17%	17,900	10%	14,900	7%	-17%
	Addison Road	4,200	2%	3,700	2%	-12%	4,500	2%	4,000	2%	-11%
	Sydenham Road	15,000	9%	13,500	7%	-10%	15,400	8%	14,200	7%	-8%
	Marrickville Road	7,600	5%	7,000	4%	-8%	8,400	5%	7,700	4%	-8%
	M4-M5 Link	–	–	32,900	17%	–	–	–	37,200	18%	–
	King Street	10,500	6%	8,600	5%	-18%	12,000	7%	9,600	5%	-20%
	Wyndham Street	16,500	10%	15,900	8%	-4%	17,900	10%	17,400	8%	-3%
	Botany Road	12,200	7%	11,700	6%	-4%	13,700	8%	13,400	6%	-2%
	Elizabeth Street	9,300	6%	9,000	5%	-3%	10,300	6%	9,900	5%	-4%
	Southern Cross Drive	76,700	45%	73,300	39%	-4%	81,800	45%	78,400	38%	-4%
	Total	**168,700**		**189,400**		**12%**	**181,900**		**206,700**		**14%**
Southbound	Stanmore Road	19,600	11%	16,600	8%	-15%	20,400	10%	17,800	8%	-13%
	Addison Road	3,600	2%	2,400	1%	-33%	4,200	2%	2,900	1%	-31%
	Sydenham Road	15,600	9%	14,100	7%	-10%	16,100	8%	14,800	7%	-8%
	Marrickville Road	8,800	5%	7,900	4%	-10%	9,700	5%	8,600	4%	-11%
	M4-M5 Link	-	-	28,500	14%	-	-	-	32,800	15%	-
	King Street	10,400	6%	8,400	4%	-19%	12,100	6%	9,900	5%	-18%
	Wyndham Street	7,300	4%	6,500	3%	-11%	7,700	4%	7,200	3%	-6%
	Botany Road	19,900	11%	19,500	10%	-2%	21,500	11%	21,400	10%	0%
	Elizabeth Street	12,200	7%	11,600	6%	-5%	13,700	7%	13,100	6%	-4%
	Southern Cross Drive	85,800	47%	83,700	42%	-2%	90,100	46%	87,200	40%	-3%
	Total	**183,200**		**199,200**		**9%**	**195,500**		**215,700**		**10%**
Two-way	Stanmore Road	36,300	10%	30,400	8%	-16%	38,300	10%	32,700	8%	-15%
	Addison Road	7,800	2%	6,100	2%	-22%	8,700	2%	6,900	2%	-21%
	Sydenham Road	30,600	9%	27,600	7%	-10%	31,500	8%	29,000	7%	-8%
	Marrickville Road	16,400	5%	14,900	4%	-9%	18,100	5%	16,300	4%	-10%
	M4-M5 Link	–	–	61,400	16%	–	–	–	70,000	17%	–
	King Street	20,900	6%	17,000	4%	-19%	24,100	6%	19,500	5%	-19%
	Wyndham Street	23,800	7%	22,400	6%	-6%	25,600	7%	24,600	6%	-4%
	Botany Road	32,100	9%	31,200	8%	-3%	35,200	9%	34,800	8%	-1%
	Elizabeth Street	21,500	6%	20,600	5%	-4%	24,000	6%	23,000	5%	-4%
	Southern Cross Drive	162,500	46%	157,000	40%	-3%	171,900	46%	165,600	39%	-4%
	Total	**351,900**		**388,600**		**10%**	**377,400**		**422,400**		**12%**

Source: WRTM v2.3, 2017

Table 9-6 Lower north–south screenline: WRTM comparison for without project and cumulative scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'cumulative'		Change	2033 'without project'		2033 'cumulative'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Stanmore Road	16,700	10%	13,900	7%	-17%	17,900	10%	15,000	7%	-16%
	Addison Road	4,200	2%	3,800	2%	-10%	4,500	2%	4,100	2%	-9%
	Sydenham Road	15,000	9%	13,900	7%	-7%	15,400	8%	14,500	7%	-6%
	Marrickville Road	7,600	5%	7,500	4%	-1%	8,400	5%	8,500	4%	1%
	M4-M5 Link	–	–	47,200	24%	–	–	–	58,000	26%	–
	King Street	10,500	6%	9,100	5%	-13%	12,000	7%	11,200	5%	-7%
	Wyndham Street	16,500	10%	15,400	8%	-7%	17,900	10%	17,400	8%	-3%
	Botany Road	12,200	7%	9,000	5%	-26%	13,700	8%	10,500	5%	-23%
	Elizabeth Street	9,300	6%	8,900	4%	-4%	10,300	6%	9,800	4%	-5%
	Southern Cross Drive	76,700	45%	69,700	35%	-9%	81,800	45%	71,900	33%	-12%
	Total	**168,700**		**198,400**		**18%**	**181,900**		**220,900**		**21%**
Southbound	Stanmore Road	19,600	11%	16,700	8%	-15%	20,400	10%	17,800	8%	-13%
	Addison Road	3,600	2%	2,500	1%	-31%	4,200	2%	3,000	1%	-29%
	Sydenham Road	15,600	9%	14,500	7%	-7%	16,100	8%	15,000	7%	-7%
	Marrickville Road	8,800	5%	8,300	4%	-6%	9,700	5%	9,000	4%	-7%
	M4-M5 Link	–	–	48,800	24%	–	–	–	61,300	27%	-
	King Street	10,400	6%	10,600	5%	2%	12,100	6%	12,800	6%	6%
	Wyndham Street	7,300	4%	8,300	4%	14%	7,700	4%	8,900	4%	16%
	Botany Road	19,900	11%	20,300	10%	2%	21,500	11%	21,400	9%	0%
	Elizabeth Street	12,200	7%	13,000	6%	7%	13,700	7%	14,600	6%	7%
	Southern Cross Drive	85,800	47%	60,400	30%	-30%	90,100	46%	62,200	28%	-31%
	Total	**183,200**		**203,400**		**11%**	**195,500**		**226,000**		**16%**
Two-way	Stanmore Road	36,300	10%	30,600	8%	-16%	38,300	10%	32,800	7%	-14%
	Addison Road	7,800	2%	6,300	2%	-19%	8,700	2%	7,100	2%	-18%
	Sydenham Road	30,600	9%	28,400	7%	-7%	31,500	8%	29,500	7%	-6%
	Marrickville Road	16,400	5%	15,800	4%	-4%	18,100	5%	17,500	4%	-3%
	M4-M5 Link	–	–	96,000	24%	–	–	–	119,300	27%	–
	King Street	20,900	6%	19,700	5%	-6%	24,100	6%	24,000	5%	–
	Wyndham Street	23,800	7%	23,700	6%	0%	25,600	7%	26,300	6%	3%
	Botany Road	32,100	9%	29,300	7%	-9%	35,200	9%	31,900	7%	-9%
	Elizabeth Street	21,500	6%	21,900	5%	2%	24,000	6%	24,400	5%	2%
	Southern Cross Drive	162,500	46%	130,100	32%	-20%	171,900	46%	134,100	30%	-22%
	Total	**351,900**		**401,800**		**14%**	**377,400**		**446,900**		**18%**

Source: WRTM v2.3, 2017

9.5.2 Peak hour analysis

Figure 9-6 and **Figure 9-7** illustrate the changes in the peak hour volumes at the lower north–south screenline. The peak hour forecasts indicate traffic volume changes are similar to those in the daily forecasts, with traffic shifting from surface roads crossing the screenline and onto the M4-M5 Link. However, road network capacity constraints limit the shifts in traffic in the peak hours, and hence reductions in traffic on surface roads crossing the screenline are not as high in the peak hours compared to across the day.

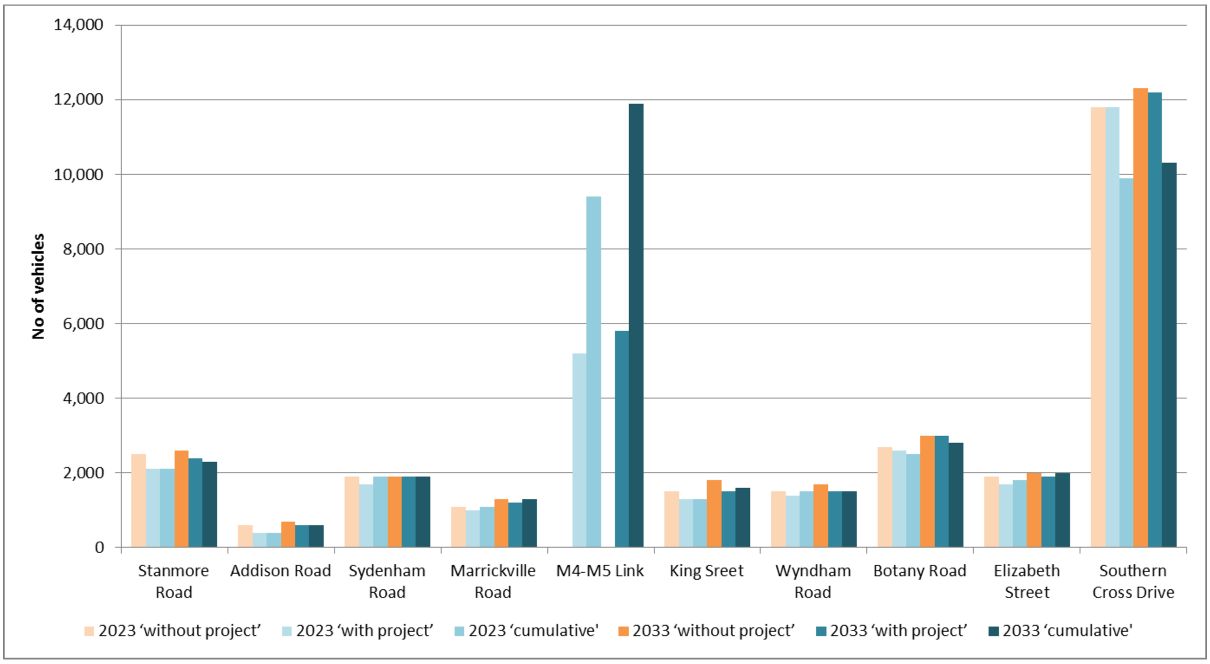


Figure 9-6 Lower north–south screenline: comparison of two-way AM peak one hour volumes

Source: WRTM v2.3, 2017

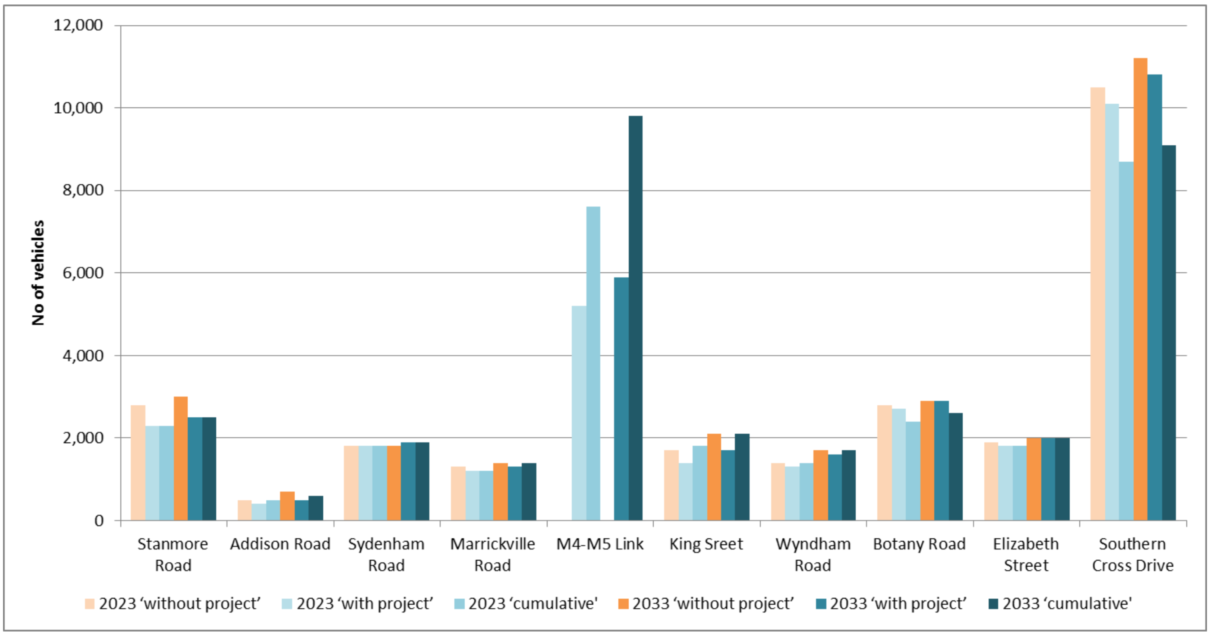


Figure 9-7 Lower north–south screenline: comparison of two-way PM peak one hour volumes

Source: WRTM v2.3, 2017

9.6 Cross-harbour screenline

9.6.1 Average weekday traffic (AWT) analysis

Table 9-7 presents a comparison of the forecast AWT volumes from the WRTM at the cross-harbour screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing the 2023 'without project' and 'with project' scenarios are:

- With no new alternative harbour crossing as part of the 'with project' scenario, there are minimal forecast changes to total daily traffic crossing the harbour on the Gladesville Bridge, the Sydney Harbour Bridge and the Sydney Harbour Tunnel in the 'with project' scenario
- On the Gladesville Bridge, two-way AWT is forecast to increase by six per cent in the 'with project' scenario. This reflects the increase in traffic along Victoria Road, as vehicles are attracted to use the Iron Cove Link and the M4-M5 Link via the Rozelle interchange.

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are the same as for the 2023 comparisons:

- Again, there are minimal forecast changes in two-way AWT crossing the screenline in the 'with project' scenario and two-way AWT on the Gladesville Bridge is forecast to increase by seven per cent in the 'with project' scenario due to vehicles being attracted to use the Iron Cove Link and the M4-M5 Link via the Rozelle interchange.

Table 9-8 presents a comparison of the forecast AWT volumes from the WRTM at the cross-harbour screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 2023 'without project' and 'cumulative' scenarios are:

- In the 'cumulative' scenario, forecast two-way AWT crossing the screenline increases by three per cent, due in part to traffic induced by the proposed future Western Harbour Tunnel connection (a component of the proposed future Western Harbour Tunnel and Beaches Link project). The proposed future Western Harbour Tunnel component, without a surface connection at Rozelle, is forecast to carry nine per cent of two-way AWT crossing the screenline
- In the 'cumulative' scenario, there is a forecast shift in traffic from the Sydney Harbour Bridge and the Sydney Harbour Tunnel onto the proposed future Western Harbour Tunnel, with two-way AWT forecast to decrease by six per cent on the Sydney Harbour Bridge and by 23 per cent in the Sydney Harbour Tunnel
- On the Gladesville Bridge, two-way AWT is forecast to increase by 13 per cent in the 'cumulative' scenario, reflecting the increase in traffic forecast to access the M4-M5 Link including the Iron Cove Link.

Key observations comparing the 2033 'without project' and 'cumulative' scenarios are that the patterns of change of traffic demand are the same as for the 2023 comparisons:

- In the 2033 'cumulative' scenario, forecast two-way AWT crossing the screenline increases by seven per cent, due in part to traffic induced by the proposed future Western Harbour Tunnel and Beaches Link connection; with the proposed future Western Harbour Tunnel and Beaches Link, without a surface connection at Rozelle, forecast to carry 12 per cent of two-way AWT crossing the screenline
- The forecast changes in two-way AWT on the Sydney Harbour Bridge, Sydney Harbour Tunnel and on Gladesville Bridge are similar to that forecast in 2023.

Table 9-7 Cross-harbour screenline: WRTM comparison for with and without project scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'with project'		Change	2033 'without project'		2033 'with project'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Gladesville Bridge	41,700	21%	43,800	21%	5%	44,800	21%	46,500	22%	4%
	Western Harbour Tunnel	–	–	–	–	–	–	–	–	–	–
	Syd Harbour Bridge	106,400	52%	108,300	53%	2%	111,800	52%	114,300	53%	2%
	Syd Harbour Tunnel	54,800	27%	52,400	26%	-4%	56,500	27%	55,100	26%	-2%
	Total	**202,900**		**204,500**		**1%**	**213,100**		**215,900**		**1%**
Southbound	Gladesville Bridge	48,200	24%	51,600	26%	7%	49,000	23%	52,000	25%	6%
	Western Harbour Tunnel	–	–	–	–	–	–	–	–	–	–
	Syd Harbour Bridge	87,800	44%	87,100	43%	-1%	94,600	45%	93,800	44%	-1%
	Syd Harbour Tunnel	64,000	32%	63,100	31%	-1%	66,100	32%	65,300	31%	-1%
	Total	**200,000**		**201,800**		**1%**	**209,700**		**211,100**		**1%**
Two-way	Gladesville Bridge	89,900	22%	95,400	23%	6%	93,800	22%	98,500	23%	5%
	Western Harbour Tunnel	–	–	–	–	–	–	–	–	–	–
	Syd Harbour Bridge	194,200	48%	195,400	48%	1%	206,400	49%	208,100	49%	1%
	Syd Harbour Tunnel	118,800	29%	115,500	28%	-3%	122,600	29%	120,400	28%	-2%
	Total	**402,900**		**406,300**		**1%**	**422,800**		**427,000**		**1%**

Source: WRTM v2.3, 2017

Table 9-8 Cross-harbour screenline: WRTM comparison for without project and cumulative scenarios – AWT volumes

Direction	Location	2023 'without project'		2023 'cumulative'		Change	2033 'without project'		2033 'cumulative'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Northbound	Gladesville Bridge	41,700	21%	49,900	24%	20%	44,800	21%	50,400	22%	13%
	Western Harbour Tunnel	–	–	16,900	8%	–	–	–	25,600	11%	–
	Syd Harbour Bridge	106,400	52%	95,800	46%	-10%	111,800	52%	106,100	47%	-5%
	Syd Harbour Tunnel	54,800	27%	45,400	22%	-17%	56,500	27%	45,000	20%	-20%
	Total	**202,900**		**208,000**		**3%**	**213,100**		**227,100**		**7%**
Southbound	Gladesville Bridge	48,200	24%	51,900	25%	8%	49,000	23%	52,800	23%	8%
	Western Harbour Tunnel	–	–	22,400	11%	–	–	–	29,500	13%	–
	Syd Harbour Bridge	87,800	44%	86,600	42%	-1%	94,600	45%	92,200	41%	-3%
	Syd Harbour Tunnel	64,000	32%	46,400	22%	-28%	66,100	32%	50,500	22%	-24%
	Total	**200,000**		**207,300**		**4%**	**209,700**		**225,000**		**7%**
Two-way	Gladesville Bridge	89,900	22%	101,800	25%	13%	93,800	22%	103,200	23%	10%
	Western Harbour Tunnel	–	–	39,300	9%	–	–	–	55,100	12%	–
	Syd Harbour Bridge	194,200	48%	182,400	44%	-6%	206,400	49%	198,300	44%	-4%
	Syd Harbour Tunnel	118,800	29%	91,800	22%	-23%	122,600	29%	95,500	21%	-22%
	Total	**402,900**		**415,300**		**3%**	**422,800**		**452,100**		**7%**

Source: WRTM v2.3, 2017

9.6.2 Peak hour analysis

Figure 9-8 and **Figure 9-9** illustrate the changes in the peak hour volumes at the cross-harbour screenline. The forecasts indicate project impacts on peak hour traffic volumes similar to those forecast for AWT, with only minor changes in traffic volume crossing the harbour on the Gladesville Bridge, the Sydney Harbour Bridge and the Sydney Harbour Tunnel in the 'with project' scenario.

As with the AWT forecasts, there are significant falls in peak hour traffic forecast on existing cross-harbour links with the introduction of the proposed future Western Harbour Tunnel and Beaches Link, without a surface connection at Rozelle, in the 'cumulative' scenario. In the 'cumulative' scenario, there is a small forecast increase in traffic on the Sydney Harbour Bridge in the PM peak hour. This increase, together with a greater decrease in traffic in the Sydney Harbour Tunnel and a smaller shift in traffic to the proposed future Western Harbour Tunnel and Beaches Link, indicates a slight preference for the Sydney Harbour Bridge in the PM peak hour compared to the AM peak hour.

The forecast increases in traffic on the Gladesville Bridge in the 'with project' scenario are much less in the peak hours compared to the daily (AWT) forecast increases, and would typically be considered to fall within daily traffic volume variation on the road network. This reflects the fact that peak hour spare capacity on this road is limited with any increase mainly occurring in off-peak periods. In the 'cumulative' scenario, there is a small forecast reduction in the peak hour volumes on Gladesville Bridge in the AM peak hour, reflecting some traffic shifting to the proposed future Western Harbour Tunnel and Beaches Link or other routes.

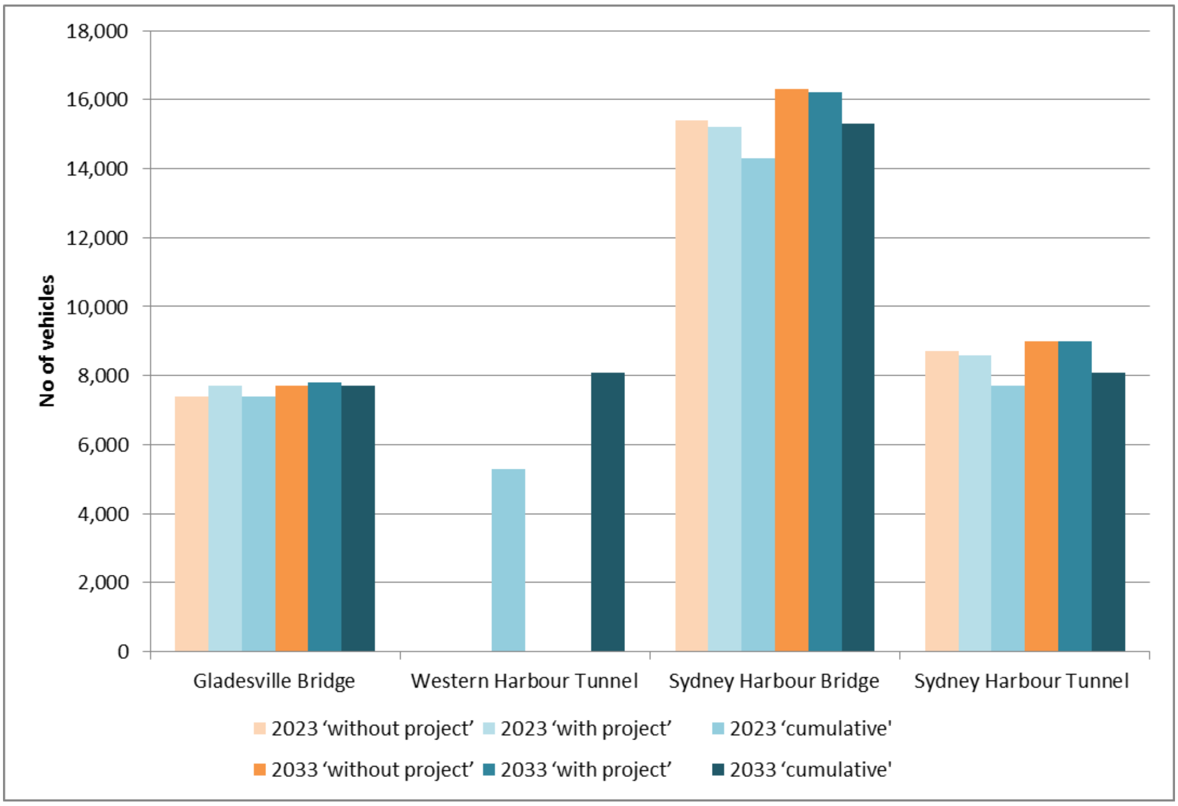


Figure 9-8 Cross-harbour screenline: comparison of two-way AM peak one hour volumes

Source: WRTM v2.3, 2017

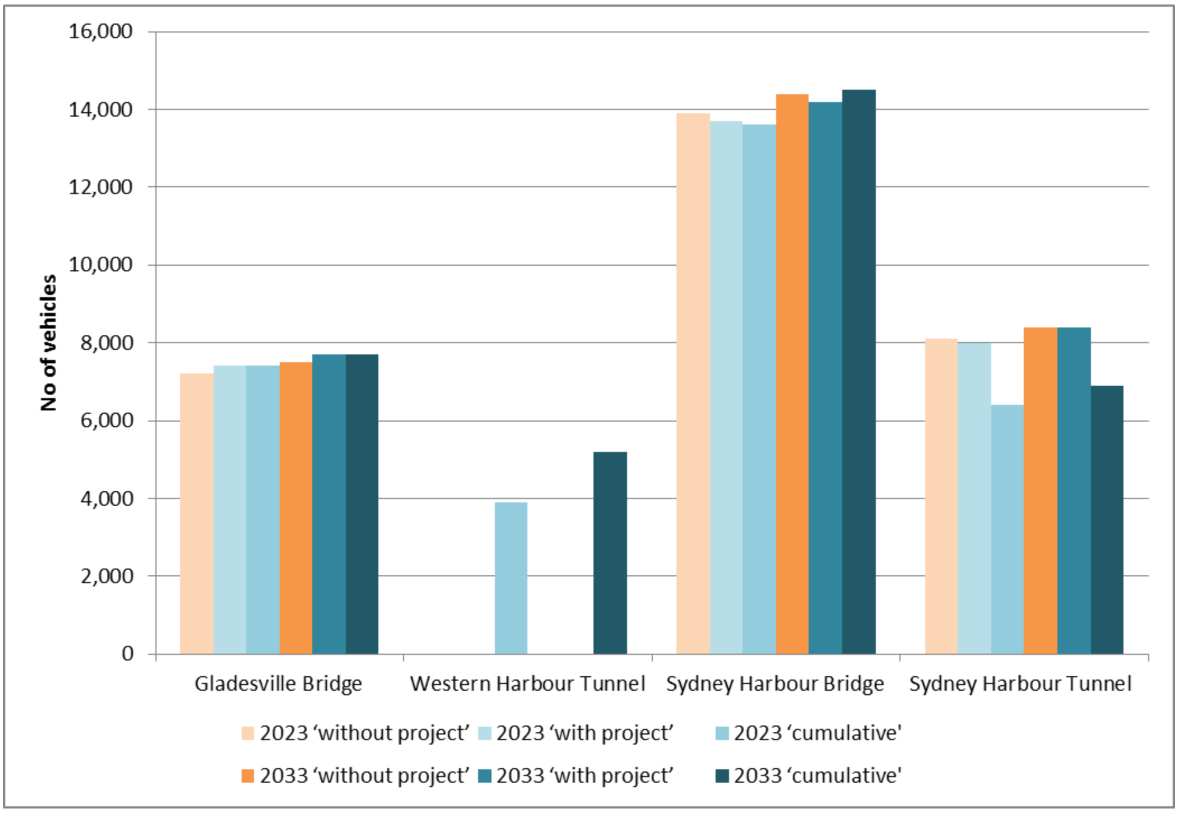


Figure 9-9 Cross-harbour screenline: comparison of two-way PM peak one hour volumes

Source: WRTM v2.3, 2017

9.7 Heavy vehicle analysis

Section 9.3 to **section 9.6** presented the results of screenline analysis for all vehicles – lights and heavies. A separate analysis of only heavy vehicles was carried out for the east–west, upper north–south and lower north–south screenlines to confirm if there were any different traffic pattern shifts forecast for heavy vehicles. The detailed analysis can be found in **Annexure D**, with a summary provided here.

A decrease in the daily volume of heavy vehicles on surface roads is generally forecast across all screenlines, as heavy vehicles shift onto the M4-M5 Link. This shift from surface roads onto the M4-M5 Link can be clearly seen in the east–west screenline, where daily heavy vehicle volumes on Parramatta Road and City West Link are forecast to drop by 40 tp 50 per cent, and in the lower north–south screenline, where daily heavy vehicles volumes on roads in the Inner West, such as Stanmore Road, Sydenham Road, Marrickville Road and King Street, are forecast to drop by 20 to 50 per cent.

The upper north–south screenline captures roads connecting City West Link and Parramatta Road. While there is an overall decrease in daily heavy vehicle volumes crossing this screenline, there are forecast increases on Johnston Street and Ross Street as vehicles move between the surface road network and the M4-M5 Link. However, in the peak hours, these increases are generally less than 80 heavy vehicle movements per hour, and in some cases are directional, with an increase in one peak hour forecast changing to a decrease in the other peak hour.

9.8 Toll avoidance

Preference surveys to understand the value people in Sydney place on travel time savings associated with major infrastructure improvements were undertaken as part of the development of the WRTM. The WRTM includes tolling and general cost parameters that reflect the findings from these surveys. The WRTM considers that different motorists place different values on paying tolls to make time savings, including heavy vehicle motorists.

The M4-M5 Link is a new piece of tolled infrastructure and so would not generate toll avoidance in the same way as, for example, the M4 Widening project that reinstated the toll back onto the existing M4 Motorway or the New M5 project that introduced a toll on the existing M5 East Motorway. Generally, the traffic using the new M4-M5 Link in the future would have been travelling on other roads. However, more traffic would use the project if it was untolled, so a form of toll avoidance would occur.

The screenline analysis presented in **Chapter 9** found no major shifts in daily forecast traffic onto alternative, parallel routes as a result of the project. Once the M4-M5 Link is operational, it is expected that there would be a period where drivers trial using their existing, toll-free routes or the new, tolled M4-M5 Link, before deciding on a regular route. Congestion in peak periods on existing, toll-free surface roads would provide an incentive to use the new, tolled road.

The proposed M4-M5 Link Road Network Performance Review Plan will require an Operational Traffic Performance Review at 12 months and at five years after the M4-M5 Link is open to traffic. This review would examine potential management measures following the collection of updated data that will facilitate an understanding of actual project outcomes. Roads and Maritime will, as part of the ongoing consultation with Councils, develop post-opening mitigation measures, if required.

10 Assessment of operational impacts with the project

This section details the forecast traffic performance during the 'with project' scenarios. The detailed assessments have been undertaken using forecast traffic volumes produced from the WRTM for the following scenarios:

- 'With project' (2023): NorthConnex, M4 Widening, M4 East, New M5 and the M4-M5 Link are complete and open to traffic
- 'With project' (2033): The same road network as 2023 is complete and open to traffic. This is required by the SEARs and assumes no proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link or F6 Extension.

10.1 Sydney metropolitan road network

10.1.1 'With project' (2023)

Figure 10-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2023 'with project' and the 'without project' scenario. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'with project' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

General traffic

The project provides a key link in the Sydney motorway network, connecting the M4 Motorway to the M5 Motorway, as well as to the Western Distributor, Cross City Tunnel and the M1 Motorway. With the inclusion of the project, a large volume of traffic is forecast to shift to the M4-M5 Link, including the Iron Cove Link, with significant reductions in daily traffic volumes forecast on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link and Victoria Road (south of Iron Cove Bridge). Increases in daily traffic are also forecast on the M4 East and Anzac Bridge/Western Distributor, as traffic accesses the M4-M5 Link. This can be clearly seen by the thick red lines on the motorway network and the corresponding reduction in traffic on the surface network as illustrated by the green lines.

Changes in operational performance on these surface roads are dealt with in **sections 10.3** and **10.4**.

As a consequence of traffic using the project, reductions in traffic are forecast for the existing M5 East Motorway, Southern Cross Drive and King Georges Road, north of the existing M5 East Motorway. Traffic reductions are also forecast on roads through the Inner West, such as Stanmore Road and Sydenham Road, which link Parramatta Road to the St Peters and Mascot areas, as traffic shifts to the M4-M5 Link instead.

Increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport are forecast, with traffic reductions projected for sections of Princes Highway and Canal Road. Changes in operational performance on these surface roads close to the St Peters interchange are described in **section 10.5**.

With the inclusion of the M4-M5 Link, the WRTM is forecasting reductions in peak period travel times between the M4 corridor and the Sydney Airport/Port Botany precinct in 2023, with traffic shifting from the A3 (King Georges Road) corridor to the M4-M5 Link. For example:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 25 minute saving comparing the 2023 'with project' scenario to a scenario without WestConnex
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by about five minutes. This saving is part of a 15 minute saving comparing the 2023 'with project' scenario to a scenario without WestConnex

- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 15 minute saving comparing the 2023 ‘with project’ scenario to a scenario without WestConnex.

Some improvement in travel times between the Victoria Road corridor and the Sydney Airport/Port Botany precinct are also forecast in the ‘with project’ scenario.

In 2023, with the inclusion of the project, road network productivity is forecast to improve as indicated by a drop in the daily VKT and VHT on the arterial (non-motorway) network, with an increase in kilometres and hours travelled along the motorway routes. Overall, the road network would accommodate more or longer trips in a shorter time. As shown in **Table 10-1**, the increase in daily VKT and drop in VHT is mainly due to traffic using the new motorway, with reductions in daily VKT and VHT forecast on non-motorway roads.

Table 10-1 Comparison of daily 2023 VKT and VHT for metropolitan Sydney in ‘without project’ and ‘with project’ scenarios

Scenario	Daily VKT (‘000 km)			Daily VHT (‘000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum (without project)	26,880	86,520	113,400	470	3,160	3,630
With project	27,730	86,050	113,780	480	3,120	3,600

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements generally follow the same pattern as the general traffic movements, with significant reductions in daily heavy vehicle traffic volumes focused on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link, Victoria Road (south of Iron Cove Bridge), King Georges Road and the existing M5 East Motorway. There are also reductions along Stanmore Road and Sydenham Road in the Inner West.

Increases in daily heavy vehicle traffic are forecast on surface roads between the St Peters interchange and Sydney Airport. Reductions in daily heavy vehicle volumes are forecast on sections of Princes Highway and Canal Road. Changes in operational performance on these surface roads close to the St Peters interchange are described in **section 10.5**.

On-road public transport

Changes in traffic volumes on roads that are also key bus corridors would be expected to impact on the reliability and the journey times of on-road public transport. Reduced traffic volumes on key bus corridors would improve public transport journey times and reliability.

While bus journey times would benefit from forecast reduced traffic on Victoria Road (south of Iron Cove Bridge), this would be offset by the forecast increased traffic and congestion on Anzac Bridge/Western Distributor.

A large forecast decrease in traffic on Parramatta Road, east of the M4 East Parramatta Road ramps, would improve reliability and trip times of bus services on Parramatta Road.

Changes by Local Government Area (LGA) on non-motorway links

Table 10-2 presents the percentage changes in daily VKT, VHT and average speed in 2023 with the project on non-motorway links in the LGAs closest to the project. The average speed would vary by time of day and by road type. The forecast percentage changes indicate that, apart from Bayside, all other LGAs either benefit from reduced traffic on surface roads or there is no forecast change. This is also illustrated by the routes shown in green on **Figure 10.1**. The increase in VKT and VHT in

Bayside LGA is due to forecast increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport, in the absence of Sydney Gateway.

Table 10-2 Percentage change in daily travel distance, time and average speed on non-motorway links by LGA in 2023

Local Government Area	Daily VKT	Daily VHT	Daily average speed
Bayside	1%	3%	-2%
Burwood	-2%	-2%	0%
Canada Bay	0%	0%	0%
Canterbury-Bankstown	-1%	-3%	2%
Inner West	-12%	-20%	10%
Strathfield	-2%	-4%	2%
Sydney	-2%	-2%	0%

Source: WRTM v2.3, 2017

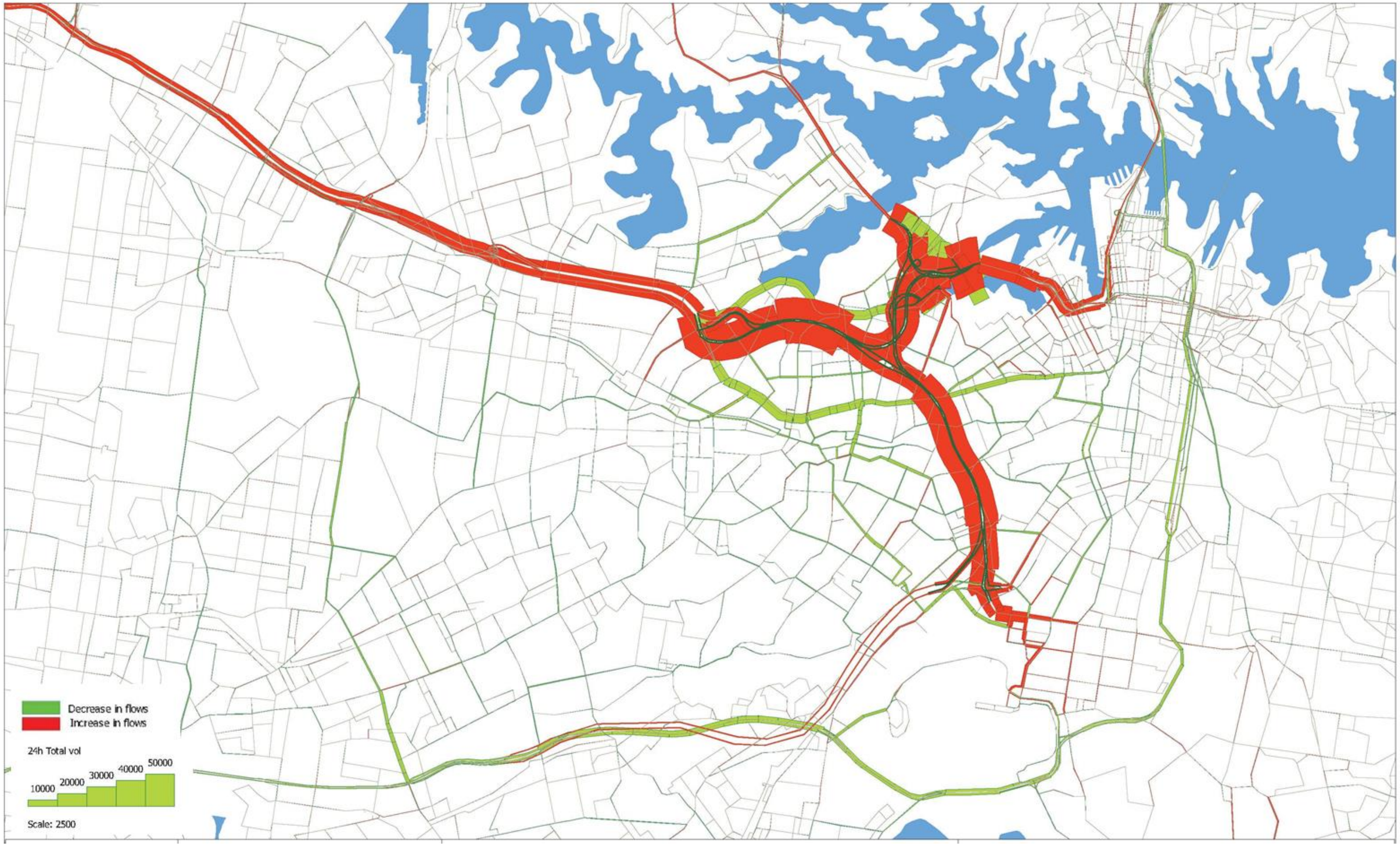


Figure 10-1 Difference in AWT between 2023 'with project' and 'without project' scenarios

Source: WRTM v2.3, 2017

10.1.2 'With project' (2033)

Figure 10-2 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'with project' and the 'without project' scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2033 'with project' scenario are shown in green and roads where volumes are forecast to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

General traffic

The pattern of change highlighted in the 2023 comparison is generally the same as in the 2033 comparison. On some roads, the forecast increases in daily traffic volumes are less pronounced due to the growth in background traffic by 2033.

With the inclusion of the M4-M5 Link, the WRTM is forecasting reductions in peak period travel times between the M4 corridor and the Sydney Airport/Port Botany precinct in 2033, with traffic shifting from the A3 (King Georges Road) corridor to the M4-M5 Link. For example:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 30 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by about five minutes. This saving is part of a 20 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex
- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by about 10 minutes. This saving is part of a 20 minute saving comparing the 2033 'with project' scenario to a scenario without WestConnex.

Road network productivity is forecast to improve in 2033, with the inclusion of the project. There is a drop in the daily VKT and VHT on the arterial (non-motorway) network with an increase in kilometres and hours travelled along the motorway routes, as seen in **Table 10-3**. The addition of the M4-M5 Link provides a significant overall benefit to the network where more or longer trips could be made on the road network in a shorter time.

Table 10-3 Comparison of daily 2033 VKT and VHT for metropolitan Sydney in 'without project' and 'with project' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
Do minimum (without project)	31,030	101,900	132,930	590	4,670	5,560
With project	32,010	101,410	133,430	600	4,610	5,220

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements generally follow the same pattern as the 2023 comparison. Significant reductions in daily heavy vehicle traffic are focused on Parramatta Road (east of the M4 East Parramatta Road ramps), City West Link, Victoria Road (south of Iron Cove Bridge), King Georges Road and the existing M5 East Motorway.

On-road public transport

The anticipated impacts of the project upon on-road public transport in 2023 and 2033 are similar. Reduced traffic is forecast on Victoria Road (south of Iron Cove Bridge) in 2033, however this is offset by the forecast increase on Anzac Bridge/Western Distributor.

A large forecast decrease in traffic on Parramatta Road, east of the M4 East Parramatta Road ramps, would improve reliability and trip times of bus services on Parramatta Road.

Changes by Local Government Area (LGA) on non-motorway links

Table 10-4 presents the percentage changes in daily VKT, VHT and average speed in 2033 with the project on non-motorway links in the LGAs that are closest to the project. The average speed would vary by time of day and by road type. The changes are similar to the 2023 comparison. Apart from Bayside, all other LGAs benefit from reduced traffic on surface roads or there is no forecast change. Again, the increase in VKT and VHT in Bayside LGA is due to forecast increases in daily traffic on surface roads between the St Peters interchange and Sydney Airport, in the absence of Sydney Gateway.

Table 10-4 Percentage change in daily travel distance, time and average speed by LGA in 2033

Local Government Area	Daily VKT	Daily VHT	Daily average speed
Bayside	1%	4%	-3%
Burwood	-2%	-3%	1%
Canada Bay	-1%	-1%	0%
Canterbury-Bankstown	-1%	-4%	3%
Inner West	-11%	-21%	14%
Strathfield	-1%	-4%	3%
Sydney	-2%	-2%	0%

Source: WRTM v2.3, 2017

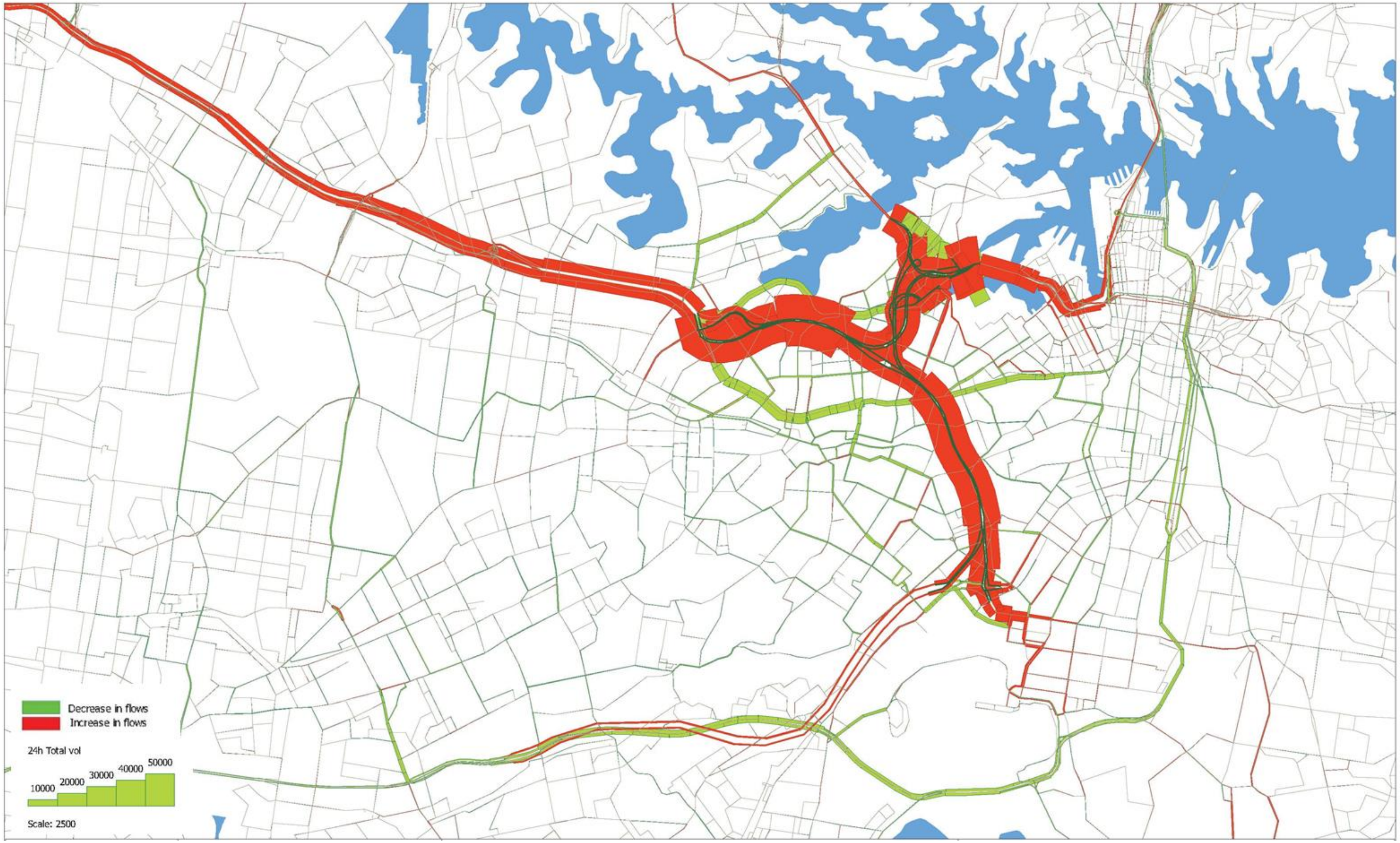


Figure 10-2 Difference in AWT between 2033 ‘with project’ and ‘without project’ scenarios

Source: WRTM v2.3, 2017

10.2 Operational performance – M4-M5 Link Motorway

10.2.1 Mid-block level of service

Mid-block levels of service on the M4-M5 Link motorway under 2023 'with project' and 2033 'with project' scenarios in peak hours are provided in **Table 10-5** and **Table 10-6** using results determined from microsimulation models. The motorway was divided into five sections as follows:

- Interface with the M4 East, west of the Wattle Street interchange
- Wattle Street interchange to Rozelle interchange
- Rozelle interchange bypass
- Rozelle interchange to St Peters interchange
- Interface with the New M5, south of the St Peters interchange.

The results indicate that the new motorway is forecast to operate at a good level of service in both 2023 and 2033 'with project' scenarios.

Table 10-5 M4-M5 Link motorway LoS – 2023 'with project' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak						
1	Interface with M4 East	3	3,470	80	14.5	C
2	Wattle Street interchange to Rozelle interchange	4	4,340	80	13.6	C
3	Rozelle interchange bypass	2	1,970	80	12.3	C
4	Rozelle interchange to St Peters interchange	4	2,950	80	9.2	B
5	Interface with New M5	2	340	80	2.1	A
Southbound – PM peak						
1	Interface with M4 East	3	2,610	80	10.9	B
2	Wattle Street interchange to Rozelle interchange	4	3,190	80	10.0	B
3	Rozelle interchange bypass	2	1,750	80	10.9	B
4	Rozelle interchange to St Peters interchange	4	2,550	80	8.0	B
5	Interface with New M5	2	750	80	4.7	A
Northbound – AM peak						
1	Interface with New M5	2	1,180	80	7.4	B
2	St Peters interchange to Rozelle interchange	4	3,230	80	10.1	B
3	Rozelle interchange bypass	2	2,460	80	15.4	C
4	Rozelle interchange to Wattle Street interchange	4	4,060	80	12.7	C
5	Interface with M4 East	3	3,560	77	14.8	C
Northbound – PM peak						
1	Interface with New M5	2	410	80	2.6	A
2	St Peters interchange to Rozelle interchange	4	3,490	80	10.9	B
3	Rozelle interchange bypass	2	2,380	80	14.8	C
4	Rozelle interchange to Wattle Street interchange	4	4,810	80	15.0	C
5	Interface with M4 East	3	4,100	77	17.1	D

Note: The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

Table 10-6 M4-M5 Link motorway LoS – 2033 'with project' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak						
1	Interface with M4 East	3	3,760	80	15.7	C
2	Wattle Street interchange to Rozelle interchange	4	4,750	80	14.8	C
3	Rozelle interchange bypass	2	1,940	80	12.2	C
4	Rozelle interchange to St Peters interchange	4	3,060	80	9.6	B
5	Interface with New M5	2	450	80	2.8	A
Southbound – PM peak						
1	Interface with M4 East	3	3,150	80	13.1	C
2	Wattle Street interchange to Rozelle interchange	4	3,840	80	12.0	C
3	Rozelle interchange bypass	2	2,250	80	14.0	C
4	Rozelle interchange to St Peters interchange	4	3,290	80	10.3	B
5	Interface with New M5	2	1,110	80	6.9	A
Northbound – AM peak						
1	Interface with New M5	2	1,740	80	10.9	B
2	St Peters interchange to Rozelle interchange	4	3,920	80	12.3	C
3	Rozelle interchange bypass	2	3,010	80	18.8	D
4	Rozelle interchange to Wattle Street interchange	4	4,700	75	15.7	C
5	Interface with M4 East	3	4,150	80	17.3	D
Northbound – PM peak						
1	Interface with New M5	2	560	80	3.5	A
2	St Peters interchange to Rozelle interchange	4	3,950	80	12.3	C
3	Rozelle interchange bypass	2	2,730	80	17.1	D
4	Rozelle interchange to Wattle Street interchange	4	5,200	79	16.5	D
5	Interface with M4 East	3	4,450	80	18.5	D

Note: The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

10.2.2 Traffic crashes

Table 10-7 presents the crash analysis for the M4-M5 Link. The analysis has been undertaken based on crash rates on the existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels).

These crashes would be balanced against the reduction in crashes forecast by the reduction in traffic volumes on the surface roads. With crash rates on motorways much lower than on surface arterial roads, a general reduction in accidents would be expected.

Table 10-7 M4-M5 Link: crash analysis for 2023 and 2033 'with project' scenarios

Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'					
Wattle Street interchange	Rozelle interchange	1.25	87,470	23	$264,300
Rozelle interchange bypass		1.36	39,620	11	$130,300
Rozelle interchange	St Peters interchange	2.24	60,500	29	$327,600
2033 'with project'					
Wattle Street interchange	Rozelle interchange	1.25	97,910	26	$295,900
Rozelle interchange bypass		1.36	45,370	13	$149,200
Rozelle interchange	St Peters interchange	2.24	68,910	33	$373,200

10.3 Operational performance – Wattle Street interchange

10.3.1 Changes to road network in 'with project' scenario

Road network changes additional to those discussed in **section 8.2.1** are relatively minor. Under the 'with project' scenario, the movement between the M4 East and M4-M5 Link is available as well as M4-M5 Link entry and exit ramp movements to Wattle Street between Parramatta Road and Ramsay Street. Activation of the latter ramps (the stubs are being built as part of M4 East) leads to line marking changes and lane designation changes on Wattle Street close to the Parramatta Road intersection with an additional right turn lane added to the Wattle Street southbound approach to Parramatta Road.

10.3.2 Network performance

2023 'with project' scenario

Table 10-8 and **Table 10-9** present a comparison of the performance of the road network between the 2023 'without project' and 'with project' scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

The 'with project' scenario introduces more tunnelled motorway links, and while the forecast traffic demand significantly increases after the opening of the M4-M5 Link, the new links contribute to a substantial increase in the average vehicle speed. Network conditions change compared to the 'without project' scenario as demand to the M4 exit ramps is much lower when the mainline 'through' movement is available to the M4-M5 Link. The number of vehicles on the surface network is reduced as a result of traffic shifting to the M4-M5 Link – in particular 'through' traffic demand along Parramatta Road (eastbound and westbound) – with subsequent benefits to the surface road network.

Forecast demand to City West Link and Parramatta Road eastbound from the M4 East is lower than the 'without project' scenario. However, congestion is forecast along Wattle Street northbound, with queues extending through the Ramsay Street intersection, as a result of increases in surface network traffic demand to City West Link between the two scenarios. Queuing is not forecast to prevent entry to or exit from the project.

Table 10-8 Wattle Street interchange network performance – AM peak hour (2023 'without project' scenario vs 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	15,279	21,410	40%
Total vehicle kilometres travelled in network (km)	31,474	34,696	10%
Total time travelled approaching and in network (hr)	2,153	1,667	-22%
Total vehicles arrived	14,483	21,113	46%
Total number of stops	242,127	166,849	-31%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.0	1.6	-20%
Average time travelled in network (mins)	8.0	4.5	-44%
Average number of stops	13.4	7.1	-48%
Average speed (km/h)	14.8	21.0	42%
Unreleased vehicles			
Unreleased demand (veh)	796	297	–
% of total traffic demand	5%	1%	–

PM peak hour

The 'with project' scenario introduces more tunnelled motorway links, and so a substantial increase in traffic is accommodated within the network, and overall average speeds increase due to the new M4-M5 Link reducing congestion on the surface road network.

The introduction of the project Wattle Street exit ramp requires a change in layout at the Wattle Street approach to the Parramatta Road/Wattle Street intersection, which reduces the number of surface through lanes from two to one, with the second through lane used by the M4-M5 Link exit ramp. Westbound queues extending along Wattle Street/Dobroyd Parade are therefore forecast to increase in the 'with project' scenario, despite a slight reduction in surface demand from City West Link. This results in forecast queuing back and unreleased demand at the westbound City West Link network entry. The westbound queuing is also forecast to cause side road queuing at the Ramsay Street intersection with Wattle Street, resulting in unreleased demand on the Ramsay Street westbound approach. The westbound queuing is also forecast to inhibit access into the M4 East Wattle Street entry ramp.

Increased demand to Frederick Street is forecast to cause queuing back along Frederick Street and inhibit the Parramatta Road eastbound right turn movement into Frederick Street, which in turn is forecast to cause delay to the Parramatta Road left turn movement into Wattle Street and into the project Wattle Street entry ramp.

Forecast demand along Parramatta Road is reduced following the M4-M5 Link opening, with fewer vehicles resulting in improved performance of the 'with project' scenario along this corridor when compared to 'without project' conditions.

Table 10-9 Wattle Street interchange network performance – PM peak hour (2023 'without project' scenario vs 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	15,209	20,825	37%
Total vehicle kilometres travelled in network (km)	29,075	33,968	17%
Total time travelled approaching and in network (hr)	2,176	1,907	-13%
Total vehicles arrived	14,702	20,049	36%
Total number of stops	318,512	201,602	-37%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.6	-12%
Average time travelled in network (mins)	8.1	5.3	-34%
Average number of stops	17.4	8.7	-50%
Average speed (km/h)	13.5	18.0	34%
Unreleased vehicles			
Unreleased demand (veh)	507	776	–
% of total traffic demand	3%	4%	–

2033 'with project' scenario

Table 10-10 and **Table 10-11** present a comparison of the performance of the road network between the 2033 'without project' and 'with project' scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

As per the 2023 scenario, forecast traffic demand to City West Link and Parramatta Road eastbound from the M4 East is lower than the 'without project' scenario, with much shorter queues on the M4 East exit ramp and on Wattle Street, due to the availability of the M4-M5 Link. This in turn accounts for the large increase in average speed within the network. There are fewer unreleased vehicles in the 'with project' scenario, which is in line with the reduced demand for City West Link and subsequent reduced impact on vehicles originating from Frederick Street. Overall, the network performs better in the 'with project' scenario.

Queuing is still observed to extend from the eastern end of the modelled road network; with queuing blocking through the Liverpool Road intersection. However, this is not forecast to extend beyond the Dalhousie Street intersection or to the M4 East Parramatta Road exit ramp. Queuing is not forecast to prevent entry to or exit from the project.

Table 10-10 Wattle Street interchange network performance – AM peak hour (2033 'without project' scenario vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	16,553	23,609	43%
Total vehicle kilometres travelled in network (km)	32,470	37,632	16%
Total time travelled approaching and in network (hr)	2,316	1,821	-21%
Total vehicles arrived	15,505	23,114	49%
Total number of stops	272,807	213,460	-22%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.0	1.6	-20%
Average time travelled in network (mins)	8.3	4.5	-46%
Average number of stops	14.5	8.3	-43%
Average speed (km/h)	14.2	20.9	47%
Unreleased vehicles			
Unreleased demand (veh)	1,048	495	-
% of total traffic demand	6%	2%	-

PM peak hour

Compared to the 2033 'without project' scenario, the 2033 'with project' scenario results show an increase in average speed as a result of significantly reduced delay on the M4 East Parramatta Road exit ramp. This exit ramp was heavily congested in the 2033 'without project' scenario, with queuing back that extends to the M4 East. The reduction in delay to this movement is greater than the increase in delay on the Wattle Street approach to Parramatta Road (caused by increased demand to Frederick Street), and therefore average speeds increase.

The 2033 'with project' scenario is forecast to experience different traffic patterns compared to the 'without project' scenario with the surface road network forecast to experience more congestion. The number of through lanes for surface traffic for the Wattle Street to Frederick Street movement reduces and significant queuing is observed on the Wattle Street approach to Parramatta Road. This is forecast to result in unreleased demand at City West Link and Ramsay Street approaches and inhibit access into the M4 East Wattle Street entry ramp.

In addition, increased demand to Frederick Street is forecast to cause queuing back along Frederick Street and inhibit the Parramatta Road eastbound right turn movement into Frederick Street, which in turn is forecast to cause delay to the Parramatta Road left turn movement into Wattle Street and into the project Wattle Street entry ramp.

Eastbound queuing is forecast from the City West Link/Timbrell Drive intersection back to the Parramatta Road/Wattle Street intersection, which is then forecast to inhibit access into the project Wattle Street entry ramp for the through movement from Frederick Street and the left turn movement from Parramatta Road.

While both 'without project' and 'with project' scenarios have capacity constraints by 2033, the 'with project' scenario is better able to accommodate future year traffic demand than the 'without project' scenario.

Table 10-11 Wattle Street interchange network performance – PM peak hour (2033 'without project' scenario vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	16,665	22,866	37%
Total vehicle kilometres travelled in network (km)	29,461	36,878	25%
Total time travelled approaching and in network (hr)	2,557	2,316	-9%
Total vehicles arrived	15,451	21,917	42%
Total number of stops	387,426	265,136	-32%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.8	1.6	-8%
Average time travelled in network (mins)	9.0	6.0	-33%
Average number of stops	20.0	10.5	-47%
Average speed (km/h)	11.7	16.1	38%
Unreleased vehicles			
Unreleased demand (veh)	1,214	949	–
% of total traffic demand	7%	4%	–

10.3.3 Intersection performance

Table 10-12 presents the modelled AM and PM peak hour LoS for key intersections at the Wattle Street interchange.

During the 2023 and 2033 AM peak hour, the performance at the Parramatta Road/Wattle Street intersection is forecast to worsen in the 'with project' scenario, despite vehicle volumes using the surface road network reducing. The reduction in through lanes for surface traffic from Wattle Street to Frederick Street causes queuing on the southbound approach and increases the overall intersection delay. Elsewhere, intersection performance is forecast to be similar to the 'without project' scenario.

During the 2033 AM peak, the City West Link/Timbrell Drive intersection is forecast to improve in 'with project' scenario, as a result of reduced demand for City West Link from the M4 East Wattle Street exit ramp, as this demand remains on the motorway.

During the 2023 PM peak hour, the performance of the Parramatta Road/Liverpool Road intersection is forecast to improve in the 'with project' scenario, as a result of reduced demand for the intersection as traffic shifts to the M4-M5 Link. Elsewhere, performance remains relatively consistent with the 'without project' scenario.

Table 10-12 Wattle Street interchange: key intersection performance (LoS) – 2023 and 2033 'with project' scenarios

Key intersections	2015 Base	2023 'without project'	2023 'with project'	2033 'without project'	2033 'with project'
AM peak hour					
Parramatta Road/Sloane Street	B	B	B	B	C
Parramatta Road/Liverpool Road	C	C	C	C	C
Parramatta Road/Dalhousie Street	B	B	B	C	B
Parramatta Road/Bland Street	B	B	B	C	B
Parramatta Road/Wattle Street	E	C	E	C	E
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	C	D
Frederick Street/Church Street	B	B	C	B	C
Wattle Street/Ramsay Street	C	C	C	C	C
Dobroyd Parade/Waratah Street	A	A	A	B	B
City West Link/Timbrell Drive	C	D	D	F	D
PM peak hour					
Parramatta Road/Sloane Street	B	B	B	F	C
Parramatta Road/Liverpool Road	B	F	C	F	E
Parramatta Road/Dalhousie Street	B	B	B	B	B
Parramatta Road/Bland Street	B	B	B	B	B
Parramatta Road/Wattle Street	D	D	D	D	D
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	C	D
Frederick Street/Church Street	B	B	B	B	B
Wattle Street/Ramsay Street	C	C	C	C	C
Dobroyd Parade/Waratah Street	A	B	A	B	A
City West Link/Timbrell Drive	D	F	E	F	F

10.3.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints were retained to reflect network congestion at intersections beyond the modelled network extents.

Figure 10-3 demonstrates that in the AM peak hour, Parramatta Road eastbound travel times reduce slightly as a result of forecast reductions in the surface road network traffic. Westbound travel times remain fairly constant given the lesser congestion in that direction. While total demand for City West Link reduces or remains at a similar level with the project, the forecast increase in surface traffic demand to City West Link and northbound demand from Frederick Street causes congestion northbound/eastbound along Wattle Street and City West Link, resulting in increased travel times on the Frederick Street to City West Link movement. Large reductions in travel time are forecast between the M4 East and Parramatta Road (E), as fewer vehicles make this movement, with traffic shifting to the M4-M5 Link.

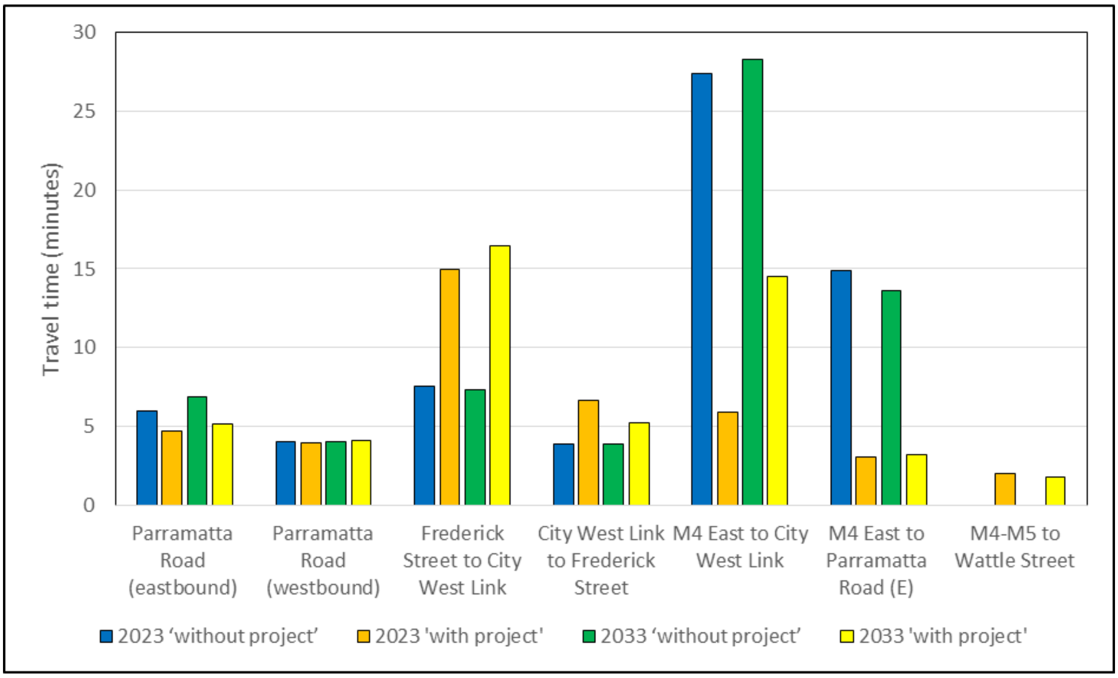


Figure 10-3 Wattle Street interchange: average travel time (mins) – AM peak hour 'with project' scenarios

Figure 10-4 presents the travel times in the PM peak hour 'with project' scenarios, which demonstrates that the project has a positive impact along Parramatta Road eastbound, as a result of the forecast reduction in traffic demand. Travel time benefits are also seen in travelling from Frederick Street to City West Link; however this is attributed more to traffic signal phasing changes, where this approach receives more green time in the 'with project' scenario.

Travel time benefits are seen in the M4 East exit ramp movements to both City West Link and Parramatta Road, as a result of a forecast reduction in traffic as traffic shifts onto the M4-M5 Link.

Travel time increases are seen along City West Link on the southbound approach to Parramatta Road, mainly as a result of the reduction in through lanes for surface traffic to Frederick Street.

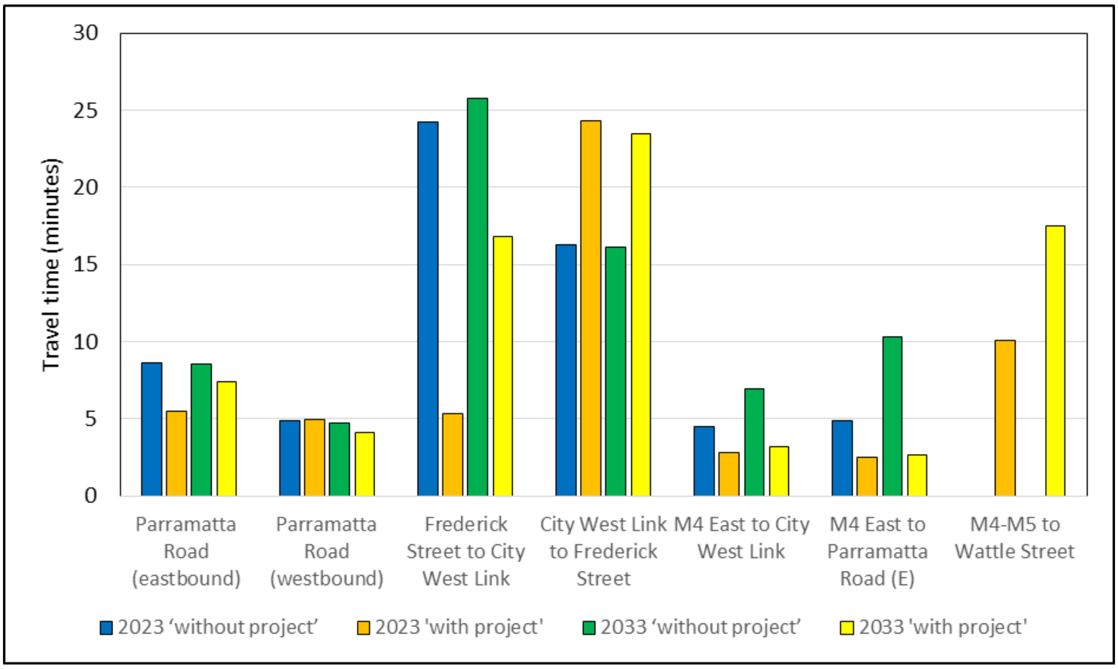


Figure 10-4 Wattle Street interchange: average travel time (mins) – PM peak hour 'with project' scenarios

10.3.5 Traffic crashes

Table 10-13 presents the crashes forecast under the 2023 'with project' scenario compared to the 'without project' scenario.

Daily traffic on the Parramatta Road is forecast to decrease in the 2023 'with project' scenario compared to the 'without project' scenario, resulting in a decrease in the total number and cost of crashes. Average annual crashes are forecast to decrease from 120 to 96, with the average annual cost of crashes falling from $12.9 million to $10.4 million.

Table 10-13 Parramatta Road between Wattle Street and City Road: crash comparison between 2023 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Parramatta Road	Wattle Street	City Road	6.6	68,200	120	$12,905,600
2023 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	54,760	96	$10,363,200

Table 10-14 compares the crashes forecast under the 2033 scenarios. Similarly, in 2033, forecasts indicate than a decrease in daily traffic in the 2033 'with project' scenario compared to the 'without project' scenario on Parramatta Road between Wattle Street and City Road, results in a decrease in the total number and cost of crashes. Average annual crashes decrease from 130 to 104 and the average annual cost of crashes decreases from $14.1 million to $11.2 million.

Table 10-14 Parramatta Road between Wattle Street and City Road: crash comparison between 2033 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'without project'						
Parramatta Road	Wattle Street	City Road	6.6	74,340	130	$14,068,700
2033 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	59,100	104	$11,184,200

10.3.6 Public transport services

Bus lane infrastructure and service frequencies remain the same in the 'with project' and 'without project' scenarios. **Figure 10-5** and **Figure 10-6** show the comparison in travel times for buses between the 'without project' and 'with project' scenarios for the AM and PM peak hours. Only routes along Parramatta Road are presented as other bus routes in the area have minimal frequencies during the peak hours.

The project demonstrates improvements in Parramatta Road bus travel times during the AM peak hour, particularly the eastbound movement. This is primarily due to the reduction in general traffic demand. The westbound direction is less congested in the modelled scenarios, and so bus travel times remain relatively unchanged from the 'without project' scenario.

In the PM peak hour, bus travel times are seen to reduce in the ‘with project’ scenario when compared to the ‘without project’ scenario, especially for eastbound buses. Reductions in travel times are also seen for westbound buses due to forecast reduction in general traffic demand along Parramatta Road.

The forecast reduction in general traffic demand along Parramatta Road would provide the opportunity to investigate improving public transport operations, such as extending the planned kerbside bus lanes (part of the M4 East project) east of the M4 East entry and exit ramps on Parramatta Road.

10.3.7 Active transport facilities

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

10.3.8 Impact on local property access and on-street parking

There is no planned impact on local property access or on-street residential or business parking in the Wattle Street interchange area as part of the project.

The southern end of Northcote Street is to remain closed during construction as per the existing arrangement for construction of the M4 East project. Once construction of the M4-M5 Link is completed, this would be permanently reopened.

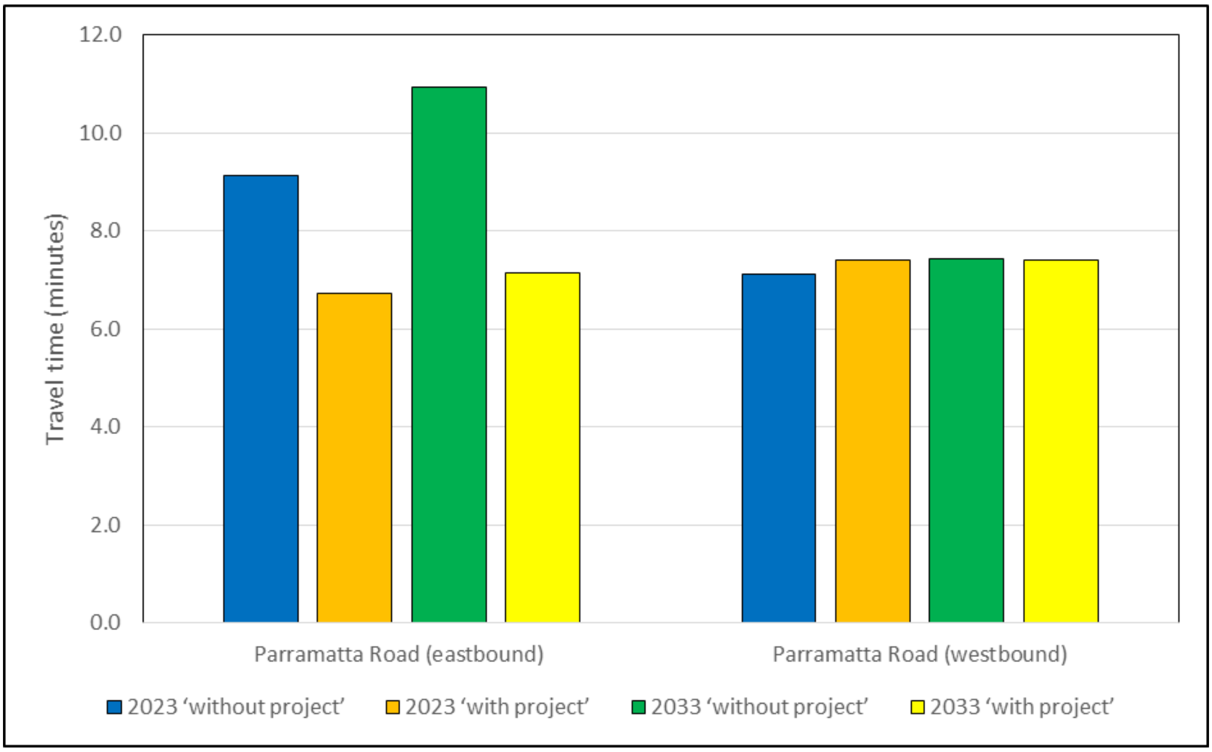


Figure 10-5 Wattle Street interchange: AM peak hour average travel time for buses – 'with project' comparison

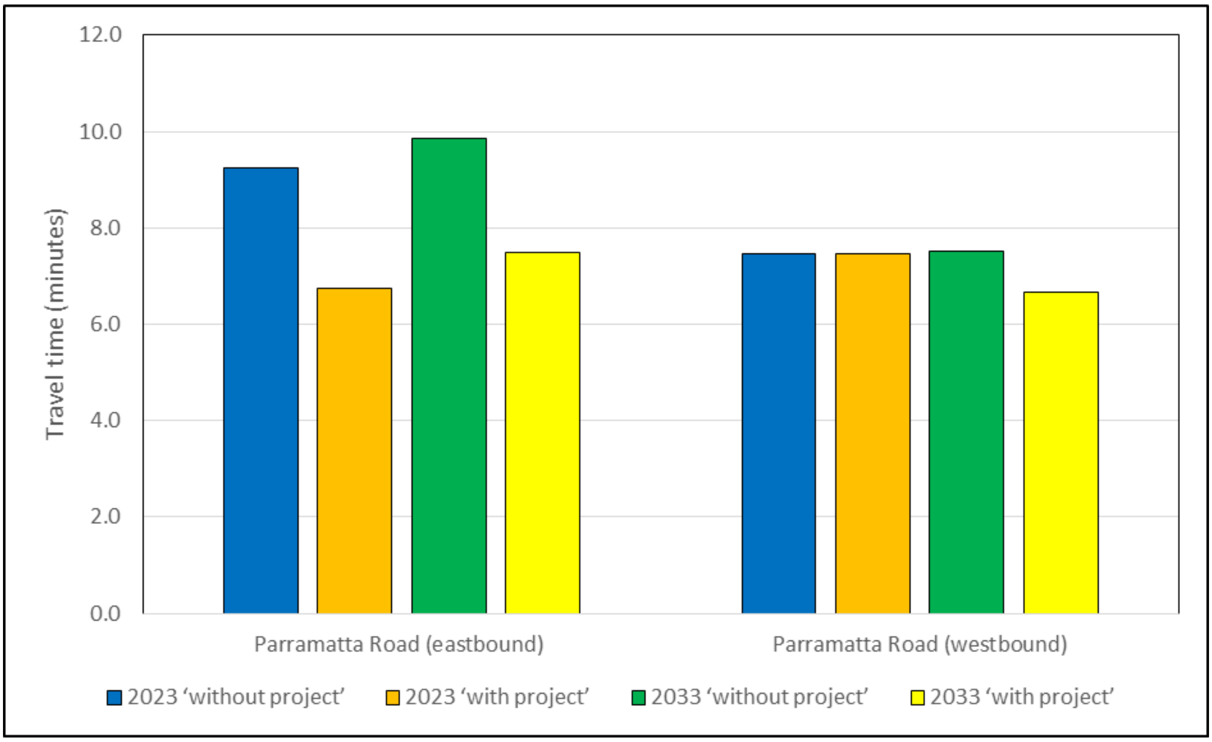


Figure 10-6 Wattle Street interchange: PM peak hour average travel time for buses – 'with project' comparison

10.4 Operational performance – Rozelle interchange

10.4.1 Changes to road network in 'with project' scenario

Figure 10-7 shows the 'with project' model network. In addition to the Rozelle surface works described in **section 2.2**, the 'with project' road network includes the following links added to the 'do minimum' or 'without project' scenario networks:

- Iron Cove Link, which provides a tunnel link between Victoria Road just south of Iron Cove Bridge and Anzac Bridge via a tunnel under Rozelle
- A new tunnel link between the M4 in the west and Anzac Bridge in the east. This link merges with the Iron Cove Link before connecting with Anzac Bridge
- A new tunnel link between the M5 and City West Link at a new intersection, west of the City West Link/The Crescent intersection
- A new tunnel link between the M5 and Victoria Road, just south of Iron Cove Bridge. This link joins the Iron Cove Link to/from Anzac Bridge.

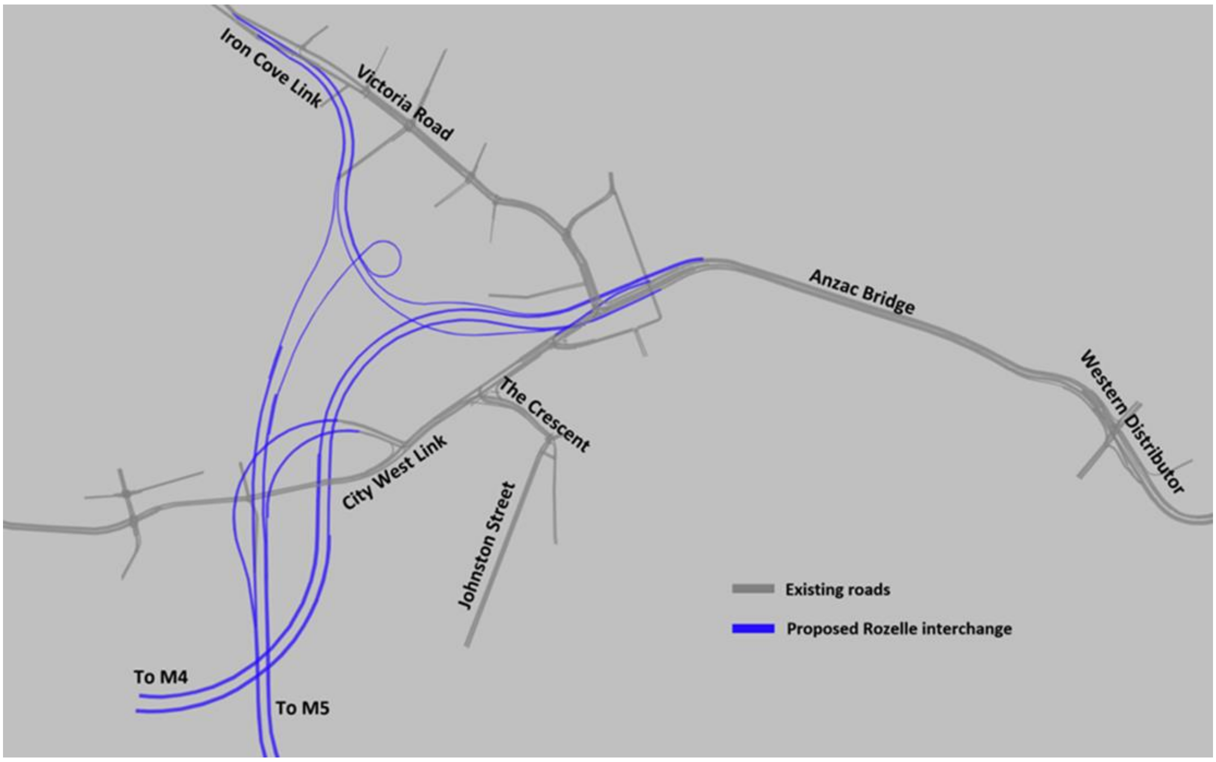


Figure 10-7 Rozelle interchange: 'with project' road network

10.4.2 Network performance

2023 'with project' scenario

Table 10-15 and **Table 10-16** present a comparison of the performance of the road network (as shown in **Figure 10-7**), between the 2023 'without project' and 'with project' scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

The 2023 'with project' scenario is forecast to have a 15 per cent increase in traffic demand compared to the 'without project' scenario. However, improved network performance metrics are forecast with decreased travel times, fewer stops and increased average speeds, with 10 per cent more vehicles arriving at their destination. This improvement is primarily due to the 'with project' network changes and a shift in traffic to the new motorway links, which provide higher speeds and less congestion compared to the surface network.

However, the AM peak citybound movements remain affected by the queues back from the Bathurst Street/Cross City Tunnel exit ramp. In addition, the downstream exit blocking from Sydney Harbour Bridge on the Western Distributor (similar to the 2015 base congestion issues) also contributes to decreased performance and increased eastbound congestion on the Western Distributor. As a result, in spite of the improvement in network performance metrics, the number of unreleased vehicles almost doubles when compared with the 2023 'without project' network. The congestion on the Western Distributor and Anzac Bridge is forecast to cause some queuing in the Iron Cove Link, and to a lesser extent on the M4 exit ramp. This is not forecast to extend back to the M4-M5 Link mainline. Mitigation measures to minimise these queues is discussed in **section 11.2.2**.

With the forecast traffic demand, the merge of two lanes from City West Link and two lanes from Victoria Road into two lanes on the eastbound approach to Anzac Bridge is forecast to cause significant queuing on City West Link.

Table 10-15 Rozelle interchange network performance – AM peak hour (2023 'without project' vs 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	22,087	25,327	15%
Total vehicle kilometres travelled in network (km)	57,775	73,188	27%
Total time travelled approaching and in network (hr)	5,355	6,308	18%
Total vehicles arrived	21,621	23,799	10%
Total number of stops	302,654	274,030	-9%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	3.1	15%
Average time travelled in network (mins)	10.1	9.8	-2%
Average number of stops	12.3	10.1	-18%
Average speed (km/h)	15.9	18,8	18%
Unreleased vehicles			
Unreleased demand (veh)	1,278	2,309	-
% of total traffic demand	6%	9%	-

PM peak hour

In the PM peak hour, the overall network performance of the 'with project' scenario shows a significant improvement compared to the 2023 'without project' network, in spite of a forecast 14 per cent increase in demand. This improvement is partially attributed to the changed road network and a shift in traffic to the free flowing motorway links. This is particularly true for the peak traffic direction, namely the outbound or westbound direction leaving the city. Once these vehicles reach the ramp entries to the M4 and to Iron Cove Link, they are forecast to operate in free flow conditions.

However, in the eastbound direction, the forecast demands increase significantly compared to the 'without project' scenario. As a result, the downstream capacity constraint at Sydney Harbour Bridge causing eastbound flow breakdown on Western Distributor and Anzac Bridge. This is expected to cause significant delays across Anzac Bridge with queuing extending back onto Victoria Road and City West Link. This eastbound congestion partially offsets the improvements in the westbound direction; however, the overall network performance is expected to improve in the 'with project' scenario.

Table 10-16 Rozelle interchange network performance – PM peak hour (2023 'without project' vs 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	24,694	28,109	14%
Total vehicle kilometres travelled in network (km)	61,136	80,108	31%
Total time travelled approaching and in network (hr)	4,896	5,091	4%
Total vehicles arrived	21,854	24,261	11%
Total number of stops	146,986	179,138	22%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	3.3	18%
Average time travelled in network (mins)	8.3	7.9	-4%
Average number of stops	5.9	6.4	8%
Average speed (km/h)	20.3	25.1	23%
Unreleased vehicles			
Unreleased demand (veh)	2,684	2,655	–
% of total traffic demand	11%	9%	–

2033 'with project' scenario

Table 10-17 and **Table 10-18** present a comparison of the performance of the road network between the 2033 'without project' and 'with project' scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

Similar to the 2023 'with project' scenario, the 2033 'with project' network is expected to provide significant improvements to overall road network performance when compared to the 'without project' scenario, with shorter average travel times, fewer number of stops and higher average speed, even with the forecast 15 per cent increase in demand. As before, this can be attributed to the introduction of the project, and the significant demand shifting to motorway links with higher speeds and less congestion.

In the 'with project' scenario, the Western Distributor is forecast to be more congested compared to the 'without project' scenario due to the increase in forecast traffic demand. The citybound movements are likely to be affected by the queues from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from the Sydney Harbour Bridge, which cause flow breakdown on Anzac Bridge. This congestion on the Western Distributor and Anzac Bridge is forecast to cause queuing in the Iron Cove Link, and to a lesser extent on the M4 exit ramp. This is not forecast to extend back to the M4-M5 Link mainline. Mitigation measures to minimise these queues is discussed in **section 11.2.2**.

While the eastbound direction is more congested, with a resultant increase in unreleased vehicles, westbound traffic movement is forecast to improve significantly, primarily due to the additional westbound capacity provided by the M4 and the Iron Cove Link.

As in 2023, with the forecast traffic demand, the merge of two lanes from City West Link and two lanes from Victoria Road into two lanes on the eastbound approach to Anzac Bridge causes queuing along City West Link.

Table 10-17 Rozelle interchange network performance – AM peak hour (2033 'without project' vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	24,307	28,023	15%
Total vehicle kilometres travelled in network (km)	59,866	77,690	30%
Total time travelled approaching and in network (hr)	7,041	7,221	3%
Total vehicles arrived	22,682	25,794	14%
Total number of stops	314,527	272,544	-13%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	3.0	14%
Average time travelled in network (mins)	10.3	9.3	-9%
Average number of stops	12.0	9.2	-23%
Average speed (km/h)	15.4	19.4	26%
Unreleased vehicles			
Unreleased demand (veh)	2,233	2,719	–
% of total traffic demand	9%	10%	–

PM peak hour

As in the 2023 models, there is a significant improvement in the road network performance in the PM peak hour, due to the increased capacity provided by the direct link from Anzac Bridge to the M4 and Iron Cove Link. The overall network performance is forecast to improve compared to the 'without project' scenario, with average speed increasing and the number of vehicles arriving at their destination zones increasing by about 20 per cent.

Notwithstanding these improvements, eastbound traffic is forecast to still be affected by the queuing effects from the Sydney Harbour Bridge.

Table 10-18 Rozelle interchange network performance – PM peak hour (2033 'without project' vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	26,528	30,259	14%
Total vehicle kilometres travelled in network (km)	60,908	86,924	43%
Total time travelled approaching and in network (hr)	6,146	5,286	-14%
Total vehicles arrived	22,679	27,082	19%
Total number of stops	151,862	92,817	-39%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	3.2	20%
Average time travelled in network (mins)	8.2	6.1	-25%
Average number of stops	5.9	3.1	-47%
Average speed (km/h)	19.7	31.3	59%
Unreleased vehicles			
Unreleased demand (veh)	3,591	2,974	–
% of total traffic demand	14%	10%	–

10.4.3 Intersection performance

Table 10-19 presents the modelled AM and PM peak hour LoS for key intersections at Rozelle. In the 2023 AM peak hour, the forecast intersection performances are similar in the 'without project' and 'with project' scenarios. However, in the 2033 AM peak hour, due to forecast demand from Victoria Road to The Crescent, delays are forecast at the Victoria Road/The Crescent intersection in the 'with project' scenario. The southbound queuing at this intersection is forecast to also result in a poor level of service at the Victoria Road/Robert Street intersection.

In the PM peak hour 'with project' scenario, the intersections along Victoria Road and City West Link are forecast to operate at an improved level of service compared with the 'without project' scenario, due to the direct link from Anzac Bridge to the M4 and Iron Cove Link.

The Victoria Road/Lyons Road intersection in both peak hours, the Victoria Road/Darling Street and Victoria Road/Robert Street intersections in the AM peak hour and The Crescent/Johnston Street intersection in the PM peak hour remain at or over capacity due to the forecast demands. Upgrades are proposed as part of the project at The Crescent/Johnston Street intersection, but any further upgrades at this intersection to improve performance are constrained by the existing light rail bridge.

Table 10-19 Rozelle interchange: key intersection performance (LoS) – 2023 and 2033 'with project' scenarios

Key intersections	2015 Base	2023 'without project'	2023 'with project'	2033 'without project'	2033 'with project'
AM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	D	D	C	D	D
Victoria Road/Darling Street	F	F	F	F	F
Victoria Road/Robert Street	D	D	C	D	F
Victoria Road/The Crescent	B	B	C	C	D
The Crescent/James Craig Road	A	A	B	B	B
City West Link/The Crescent	B	B	C	B	D
The Crescent/Johnston Street	C	C	C	D	C
The Crescent/M5 ramps	–	–	B	–	B
PM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	B	D	B	D	C
Victoria Road/Darling Street	F	F	D	F	D
Victoria Road/Robert Street	F	F	C	F	C
Victoria Road/The Crescent	F	F	C	E	C
The Crescent/James Craig Road	B	C	A	B	A
City West Link/The Crescent	D	F	B	D	C
The Crescent/Johnston Street	F	F	F	E	F
The Crescent/M5 ramps	–	–	B	–	B

10.4.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints were retained to reflect network congestion at intersections beyond the modelled network extents. Average travel times were extracted along both Victoria Road and City West Link onto Anzac Bridge, between the same extents as described in **section 8.3.4**, and are presented in **Figure 10-8** and **Figure 10-9**.

During the AM peak hour, the model shows increased travel times in the peak direction (inbound to the city) on Victoria Road and City West Link due primarily to flow breakdown on the Western Distributor, which causes queuing back onto City West Link, Iron Cove Link and Victoria Road. Mitigation for this is discussed in **section 11.2.2**. The Iron Cove Link would introduce a new link, which provides a faster travel time from Iron Cove Bridge to Anzac Bridge than via Victoria Road. Significant improvement is reported in the westbound direction due to the direct link provided by the project from Anzac Bridge to the M4 and Iron Cove Link.

During the PM peak hour, the model results show a significant improvement in the peak direction travel times (westbound out of the city) compared to the 'without project' scenario. The average travel time from Anzac Bridge to Iron Cove Bridge is forecast to reduce by about six minutes in the project case, from about 10 minutes via Victoria Road to about four minutes via Iron Cove Link. However, the eastbound journey time is forecast to increase due to increased demand and capacity constraints at Sydney Harbour Bridge, resulted in queuing back along Western Distributor and Anzac Bridge.

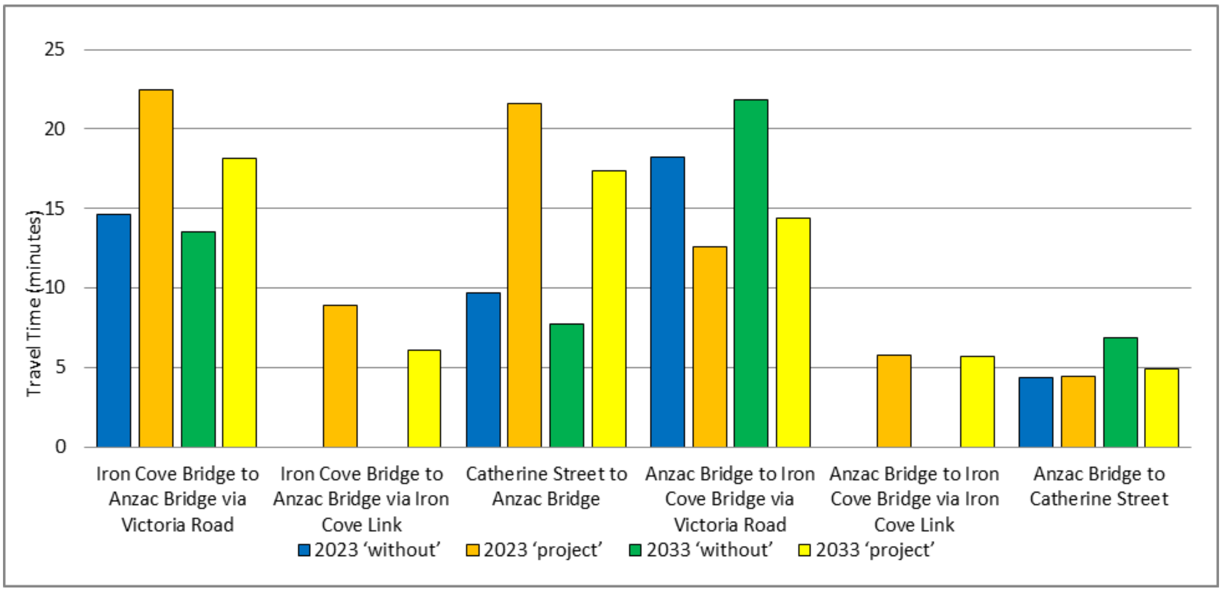


Figure 10-8 Rozelle interchange: average travel time (mins) – AM peak hour 'with project' scenarios

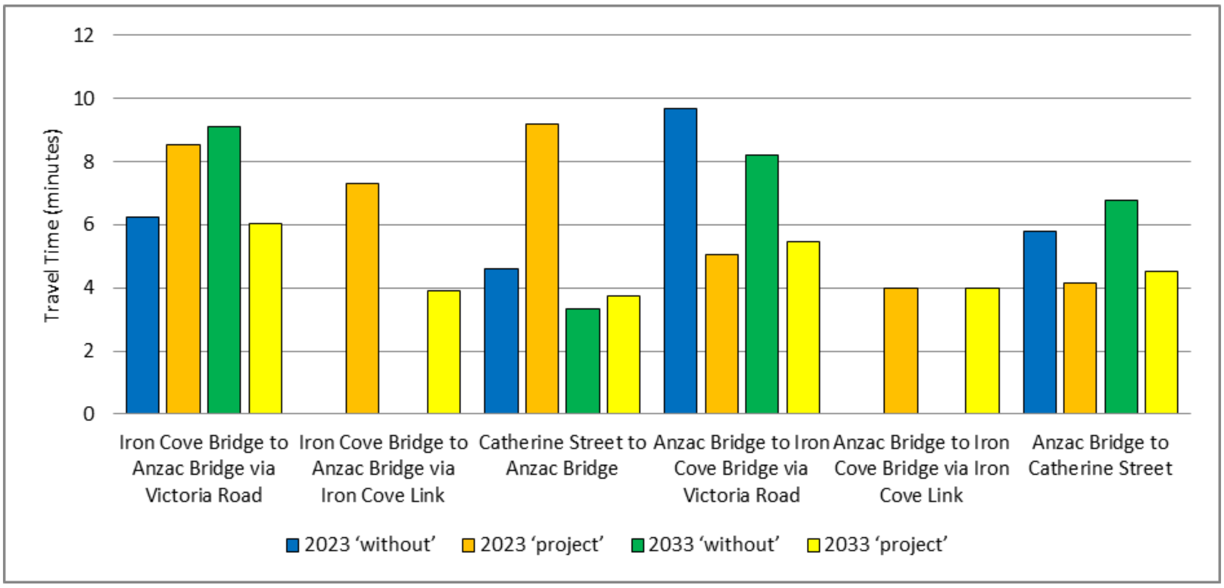


Figure 10-9 Rozelle interchange: average travel time (mins) – PM peak hour 'with project' scenarios

10.4.5 Traffic crashes

Table 10-20 presents the crashes forecast under the 2023 'with project' scenario compared to the 'without project' scenario.

Daily traffic on Anzac Bridge is forecast to increase in the 2023 'with project' scenario compared to the 'without project' scenario, resulting in an increase in total number and cost of crashes. However, forecast decreases in daily traffic on other roads in the vicinity, especially City West Link and Victoria Road, result in a decrease in the total number and cost of crashes at these locations compared to the 'with project' scenario of about four per cent.

Table 10-20 Rozelle and surrounds: crash comparison between 2023 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	157,170	25	$6,428,100
City West Link	James Street	Victoria Road	2.13	89,390	35	$8,616,900
Victoria Road	Darling Street	The Crescent	0.85	100,520	23	$6,451,300
Lilyfield Road	Victoria Road	Canal Road	2.48	9,202	18	$4,957,700
The Crescent	City West Link	Wigram Road	1.32	26,960	12	$2,804,800
Johnston Street	The Crescent	Parramatta Road	1.80	18,311	14	$3,826,100
2023 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	193,310	31	$7,906,200
City West Link	James Street	Victoria Road	2.13	69,810	27	$6,729,500
Victoria Road	Darling Street	The Crescent	0.85	61,640	14	$3,956,000
Lilyfield Road	Victoria Road	Canal Road	2.48	9,644	18	$5,196,000
The Crescent	City West Link	Wigram Road	1.32	32,600	14	$3,391,500
Johnston Street	The Crescent	Parramatta Road	1.80	20,621	16	$4,308,800

Table 10-21 compares the crashes forecast under the 2033 scenarios. Similar to 2023, forecast decreases in daily traffic in the 2033 'with project' scenario compared to the 'without project' scenario on roads such as City West Link and Victoria Road result in a decrease in the total number and cost of crashes at these locations, but daily traffic on Anzac Bridge, The Crescent and Johnston Street is forecast to increase, resulting in an increase in total number and cost of crashes.

Compared to the 2033 'without project' scenario, there is a small change in the forecast number and cost of annual crashes at these locations (with less than one per cent increase).

Table 10-21 Rozelle and surrounds: crash comparison between 2033 'with project' and 'without project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'without project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	167,260	27	$6,840,800
City West Link	James Street	Victoria Road	2.13	100,440	39	$9,682,100
Victoria Road	Darling Street	The Crescent	0.85	106,730	24	$6,849,900
Lilyfield Road	Victoria Road	Canal Road	2.48	11,743	22	$6,326,700
The Crescent	City West Link	Wigram Road	1.32	29,230	13	$3,040,900
Johnston Street	The Crescent	Parramatta Road	1.80	20,545	16	$4,293,000
2033 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	210,110	34	$8,593,300
City West Link	James Street	Victoria Road	2.13	88,450	35	$8,526,300
Victoria Road	Darling Street	The Crescent	0.85	72,340	16	$4,642,700
Lilyfield Road	Victoria Road	Canal Road	2.48	10,855	21	$5,848,100
The Crescent	City West Link	Wigram Road	1.32	40,650	18	$4,229,000
Johnston Street	The Crescent	Parramatta Road	1.80	24,716	19	$5,164,400

10.4.6 Public transport services

Figure 10-10 and **Figure 10-11** show the comparison in travel times for buses between the 'without project' and 'with project' scenarios for the AM and PM peak hours. The main bus route on Victoria Road, Anzac Bridge and the bus lanes to and from Druitt Street is presented.

The results show longer citybound bus journey times in the AM peak, due to the congested traffic conditions on Western Distributor and Anzac Bridge combined with the increased demands to Bathurst Street and Sydney Harbour Bridge, compared to the 'without project' case. Mitigation for this is discussed in **section 11.2.2**.

In the outbound direction, the Iron Cove Link significantly improves the congestion over Anzac Bridge. As a result, bus journey times reduce in the 'with project' scenario.

The forecast reduction in general traffic demand on Victoria Road between Iron Cove Link and Anzac Bridge would provide the opportunity to investigate improving public transport operations, such as extending the existing bus lanes on Victoria Road.

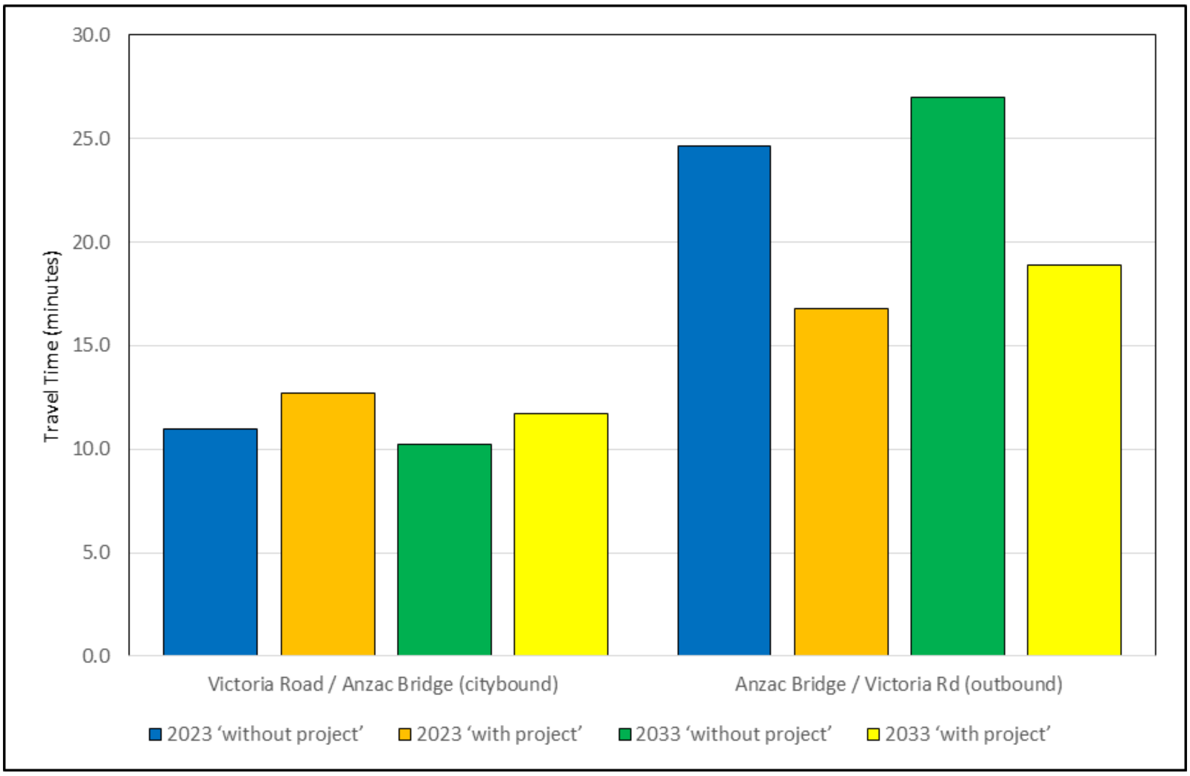


Figure 10-10 Rozelle interchange: average travel time for buses – AM peak hour 'with project' comparison

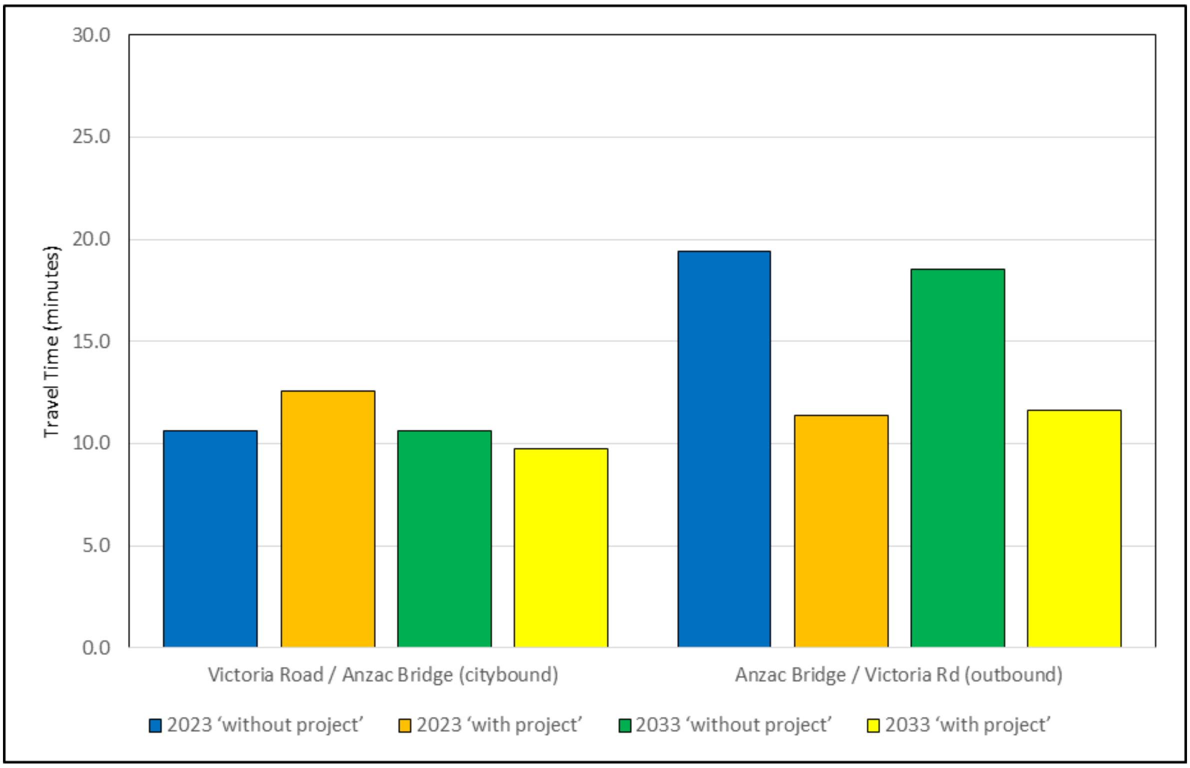


Figure 10-11 Rozelle interchange: average travel time for buses – PM peak hour 'with project' comparison

10.4.7 Active transport facilities

The project would deliver new pedestrian and cycle infrastructure in Lilyfield and Rozelle. This infrastructure has been designed to maintain and enhance pedestrian and cyclist accessibility and connectivity, providing new and upgraded east–west connections linking Lilyfield and Rozelle with the Anzac Bridge, the future Bays Precinct and Balmain, and north–south connections linking Lilyfield and Rozelle with Annandale and Glebe.

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

10.4.8 Impact on local property access and on-street parking

As part of the Iron Cove Link surface works, modifications to the intersections between Victoria Road and Clubb Street, Toelle Street, Callan Street and Byrnes Street would occur to allow the introduction of the Iron Cove Link portal.

Toelle Street and Callan Street would be reopened in the same traffic operational arrangement as existing. Clubb Street would be converted into a permanent cul-de-sac. Residents accessing Clubb Street could use Toelle Street or Callan Street via Manning Street to access from Victoria Road. The Byrnes Street cul-de-sac would be retained but would be moved a short distance to the southwest.

As a result of these road layout changes, there are permanent impacts on residential and business on-street parking provision. This is described in **Table 10-22**. Most of these parking spaces are adjacent to properties being acquired and so the impact of their loss is reduced. The final numbers would be confirmed during detailed design.

Table 10-22 Indicative permanent impact on on-street parking spaces

Road section	Indicative impact
Byrnes Street, at the northeast end	Loss of around five spaces
Clubb Street, at the northeast end	Loss of around nine spaces
Toelle Street, at the northeast end	Loss of around seven spaces
Callan Street, at the northeast end	Loss of around two spaces

10.5 Operational performance – St Peters interchange

10.5.1 Changes to road network in ‘with project’ scenario

In the ‘with project’ scenario, ramps providing connectivity to the M4-M5 Link are introduced to the modelled road network. Not all of the forecast demand to and from the Sydney Airport precinct could be accommodated in the peak hour without the Sydney Gateway project. This reduction in forecast demand is reported in the network performance tables.

Even with this demand reduction, the surface road network in the model is unable to accommodate the forecast peak hour demands without the additional road capacity provided by Sydney Gateway. Sydney Gateway introduces a bypass to Mascot town centre and, in its absence, it would be necessary to introduce a number of upgrades at the following intersections to accommodate the forecast traffic:

- Gardeners Road/Kent Road
- Gardeners Road/O’Riordan Street
- Kent Road/Coward Street
- Bourke Road/Coward Street
- Kent Road/Ricketty Street.

These upgrades would not be required once Sydney Gateway was in place, but have been included in the ‘with project’ scenario to enable network performance statistics to be generated.

Should Sydney Gateway be delayed for a significant length of time, it is expected that both the New M5 Road Network Performance Review Plan (conditioned as part of the New M5 approval) and the proposed M4-M5 Link Road Network Performance Review would confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections. These reviews would examine potential management measures at the above intersections, and other locations as identified in the Road Network Performance Review, following the collection of data that would facilitate a clearer understanding of actual project impacts.

10.5.2 Network performance

2023 ‘with project’ scenario

Table 10-23 and **Table 10-24** present a comparison of the performance of the road network between the 2023 ‘without project’ and ‘with project’ scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

In the AM peak hour, the 2023 ‘with project’ scenario network performance is similar to the ‘without project’ scenario performance. Demand was reduced by about 700 trips, with those trips not being served by this network in the peak hour. Even with this reduction, total demand was nine per cent higher than the ‘without project’ scenario.

In the ‘with project’ scenario, the average vehicle performance metrics are slightly improved compared to the ‘without project’ scenario but there is a slight increase in the number of unreleased vehicles. On average, the ‘with project’ scenario shows that trips are forecast to take less time, with vehicles travelling slightly more quickly and with less congestion than the ‘without project’ scenario. Queuing in the network is not forecast to prevent entry to or exit from the project.

Table 10-23 St Peters interchange network performance – AM peak hour (2023 ‘without project’ vs ‘with project’ scenario)

Network measure	2023 ‘without project’	2023 ‘with project’	Percentage change
All vehicles			
Total traffic demand (veh)	26,060	28,470	9%
Total vehicle kilometres travelled in network (km)	77,500	89,120	15%
Total time travelled approaching and in network (hr)	5,150	5,350	4%
Total vehicles arrived	23,710	26,190	10%
Total number of stops	201,290	205,570	2%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.9	6%
Average time travelled in network (mins)	9.5	8.9	-6%
Average number of stops	8.5	7.9	-8%
Average speed (km/h)	17.6	19.9	13%
Unreleased vehicles			
Unreleased demand (veh)	2,120	2,470	–
% of total traffic demand	8%	9%	–
Demand reduction to/from Sydney Airport precinct (veh)	640	720	–

PM peak hour

In the PM peak hour, the network performance results show that with an 11 per cent increase in total demand, the number of kilometres travelled in the network is higher than in 2023 'without project' scenario and total time travelled in the network is almost twice as much. Even with the reduced Sydney Airport demand (about 350 trips), the network performance measures suggest that the 2023 'with project' case is more congested, which is reflected in longer average trip time and average speed in the network dropping by about 28 per cent.

Queuing in the network is not forecast to prevent entry to or exit from the project. However, congestion in the Mascot area limits vehicles able to travel through the network in the peak hour to enter the motorway.

Table 10-24 St Peters interchange network performance – PM peak hour (2023 'without project' vs 'with project' scenario)

Network measure	2023 'without project'	2023 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	25,210	27,920	11%
Total vehicle kilometres travelled in network (km)	78,920	90,610	15%
Total time travelled approaching and in network (hr)	2,850	4,710	65%
Total vehicles arrived	24,960	26,600	7%
Total number of stops	127,390	186,400	46%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	2.9	3%
Average time travelled in network (mins)	6.1	8.6	42%
Average number of stops	5.1	7.0	37%
Average speed (km/h)	28.2	20.4	-28%
Unreleased vehicles			
Unreleased demand (veh)	220	1,030	–
% of total traffic demand	1%	4%	–
Demand reduction to/from Sydney Airport precinct (veh)	230	360	–

2033 'with project' scenario

Table 10-25 and **Table 10-26** present a comparison of the performance of the road network between the 2033 'without project' and 'with project' scenarios for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

The 2033 AM peak hour network performance results show that the 'with project' scenario is forecast to provide improved network operation when compared with the 'without project' scenario. The 'with project' scenario introduces more tunnelled motorway links, and while there is a 10 per cent increase in forecast traffic demand after the opening of the project, the new links contribute to a substantial increase in the average vehicle speed. A higher number of vehicles reach their destination and spend less total time in the network. Average speed in the network almost doubles and the number of unreleased vehicles within peak hour is lower. Demand was reduced by about 800 trips to and from Sydney Airport, with those trips not being served by the network in the peak hour.

Despite better overall network performance, forecast queuing from the Euston Road/Campbell Road and Gardeners Road/Kent Road intersections eventually exceeds the capacity of the southbound exit ramp and reaches the mainline.

Table 10-25 St Peters interchange network performance – AM peak hour (2033 'without project' vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	29,160	31,990	10%
Total vehicle kilometres travelled in network (km)	72,830	92,690	27%
Total time travelled approaching and in network (hr)	12,360	7,890	-36%
Total vehicles arrived	20,720	27,130	31%
Total number of stops	274,310	250,290	-9%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.6	2.8	11%
Average time travelled in network (mins)	17.0	10.9	-36%
Average number of stops	13.2	9.2	-30%
Average speed (km/h)	9.0	15.7	73%
Unreleased vehicles			
Unreleased demand (veh)	6,950	4,310	–
% of total traffic demand	24%	13%	–
Demand reduction to/from Sydney Airport precinct (veh)	690	830	–

PM peak hour

In the 2033 PM peak hour, the network performance results show that the 'with project' scenario is more congested than the 'without project' scenario. Demand was reduced by about 400 trips to and from Sydney Airport, with those trips not being served by the network in the peak hour. However, the total demand still increases by 12 per cent and all indicators show that the network is performing inefficiently.

Queuing in the network is not forecast to prevent entry to or exit from the project. However, congestion in the Mascot area limits vehicles able to travel through the network in the peak hour to enter the motorway.

Table 10-26 St Peters interchange network performance – PM peak hour (2033 'without project' vs 'with project' scenario)

Network measure	2033 'without project'	2033 'with project'	Percentage change
All vehicles			
Total traffic demand (veh)	27,610	30,990	12%
Total vehicle kilometres travelled in network (km)	84,570	84,000	-1%
Total time travelled approaching and in network (hr)	4,970	9,700	95%
Total vehicles arrived	26,350	24,120	-8%
Total number of stops	195,250	248,790	27%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	2.7	-1%
Average time travelled in network (mins)	9.2	14.5	58%
Average number of stops	7.4	10.3	39%
Average speed (km/h)	18.0	11.2	-38%
Unreleased vehicles			
Unreleased demand (veh)	1,150	6,340	–
% of total traffic demand	4%	20%	–
Demand reduction to/from Sydney Airport precinct (veh)	320	420	–

Even with a reduction in forecast demand to and from the Sydney Airport precinct, a number of intersection upgrades would be required in the absence of Sydney Gateway to accommodate the forecast growth in traffic demand in the 'with project' scenarios. These upgrades would enable the network to perform at a similar network performance to the 'without project' scenario in the AM peak, but at a reduced network performance in the PM peak hour. This illustrates that the Sydney Gateway project is required to accommodate the forecast traffic demands at the St Peters interchange and surrounds. This is presented in the 'cumulative' scenario network performance results in **section 12.6.2**, which includes Sydney Gateway as part of the road network.

10.5.3 Intersection performance

Table 10-27 presents the modelled AM and PM peak hour LoS for key intersections at St Peters in the 2023 and 2033 'with project' scenarios compared to the 'without project' scenarios.

Table 10-27 St Peters interchange: key intersection performance (LoS) – 2023 and 2033 'with project' scenarios

Key intersections	2015 Base	2023 'without project'	2023 'with project'	2033 'without project'	2033 'with project'
AM peak hour					
Princes Highway/Sydney Park Road	C	C	C	F	C
Princes Highway/May Street	D	C	C	F	D
Princes Highway/Canal Road	D	F	F	F	F
Princes Highway/Railway Road	F	F	F	F	F
Sydney Park Rd/Mitchell Road	C	B	C	F	C
Euston Road/Sydney Park Road	A	C	C	F	D
Unwins Bridge Road/Campbell Street	C	D	D	F	F
Campbell Road/Euston Road	A	C	C	F	D
Campbell Road/Bourke Road	-	B	D	B	F
Princes Highway/Campbell Street	C	F	F	F	F
Ricketty Street/Kent Road*	C	E	D	F	F
Gardeners Road/Kent Road*	A	C	D	F	F
Gardeners Road/Bourke Road	C	F	E	F	F
Gardeners Rd/O'Riordan Street*	D	F	F	F	F
PM peak hour					
Princes Highway/Sydney Park Road	D	B	B	C	C
Princes Highway/May Street	F	C	C	B	B
Princes Highway/Canal Road	D	D	C	F	E
Princes Highway/Railway Road	D	D	F	F	F
Sydney Park Rd/Mitchell Road	D	C	C	D	D
Euston Road/Sydney Park Road	B	D	D	D	D
Unwins Bridge Road/Campbell Street	D	E	E	F	F
Campbell Road/Euston Road	A	E	D	E	F
Campbell Road/Bourke Road	-	B	C	B	F
Princes Highway/Campbell Street	D	F	E	F	E
Ricketty Street/Kent Road*	C	C	D	F	F
Gardeners Road/Kent Road*	A	B	D	D	F
Gardeners Road/Bourke Road	D	D	F	F	F
Gardeners Rd/O'Riordan Street*	E	F	F	F	F

*These intersections have upgrades in the 'with project' scenarios

The modelling results show that in the AM peak hour, under the 2023 'with project' scenario, the intersections generally record similar LoS compared with the 'without project' scenario, except for the Campbell Road/Bourke Road and Gardeners Road/Bourke Road intersections, while by 2033, all of the intersections perform similar or better in the 'with project' scenario, with the exception of the Campbell Road/Bourke Road intersection.

In the 2023 PM peak hour, the intersections generally forecast similar LoS compared with the 'without project' scenario, except for the Campbell Road/Euston Road, Princes Highway/Campbell Street and Gardeners Road/Bourke Road intersections. In the 2033 PM peak hour, most intersections are forecast to operate poorly, which corresponds to the poor network performance reported in **Table 10-26**.

The surface network in the 'without project' and 'with project' scenarios is not the same. The additions in the 'with project' scenario are the M4-M5 Link entry and exit ramps at St Peters interchange and the surface road intersection upgrades required to accommodate the additional forecast traffic demand, in the absence of Sydney Gateway. Mitigation for this is discussed in **section 11.2.2**.

10.5.4 Travel times

Figure 10-12 and **Figure 10-13** show a comparison of travel times recorded on travel time routes in 2023 and 2033 under 'without project' and 'with project' conditions in the AM and PM peak hours.

In the AM peak hour, 2023 travel times for all sections are similar between scenarios, with more considerable differences in 2033. In the 2033 'without project' scenario, the AM peak hour network is very congested and all travel time sections generate long delays. Travel times show considerable improvement in the 2033 'with project' scenario.

In the PM peak hour, routes that do not run through Mascot, such as Princes Highway to Euston Road, have comparable travel times between scenarios. However, the Railway Road to Gardeners Road and King Street to Domestic Airport routes are affected by Mascot congestion and travel times forecast in the 'with project' scenarios are consistently longer than the ones forecast in 'without project' scenarios. Mitigation for this is discussed in **section 11.2.2**.

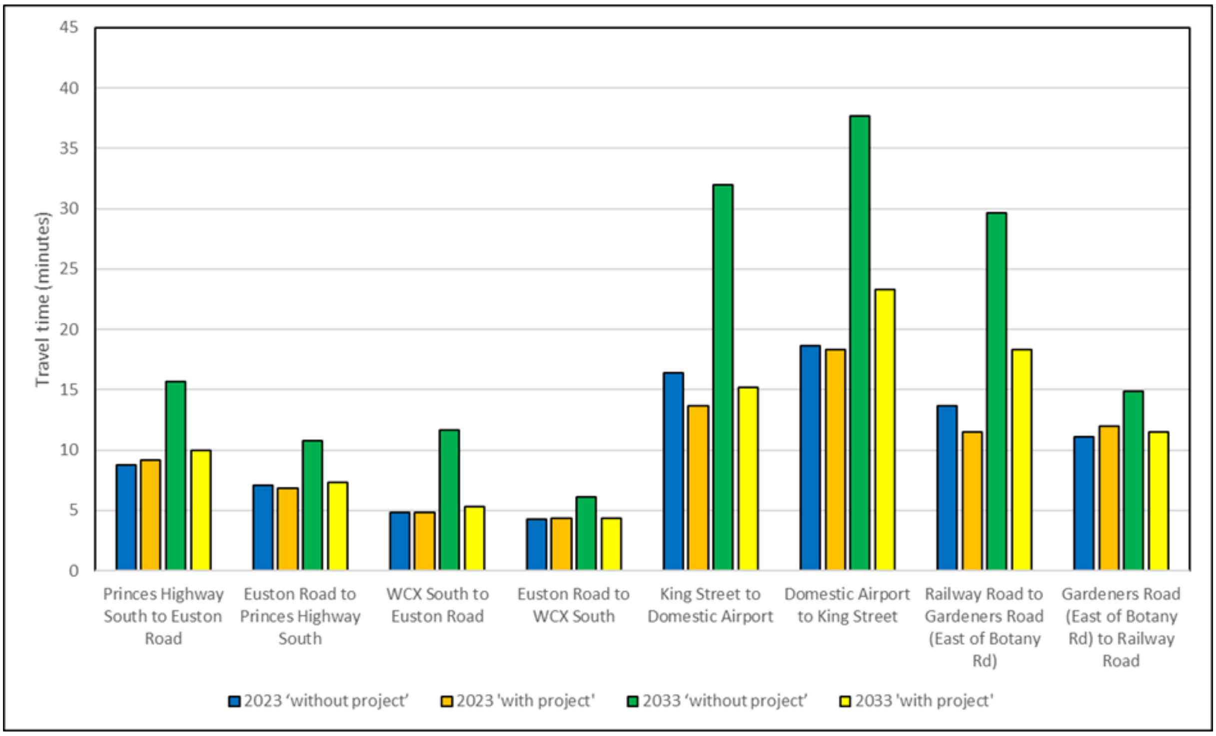


Figure 10-12 St Peters interchange: average travel time (mins) – AM peak hour 'with project' scenarios

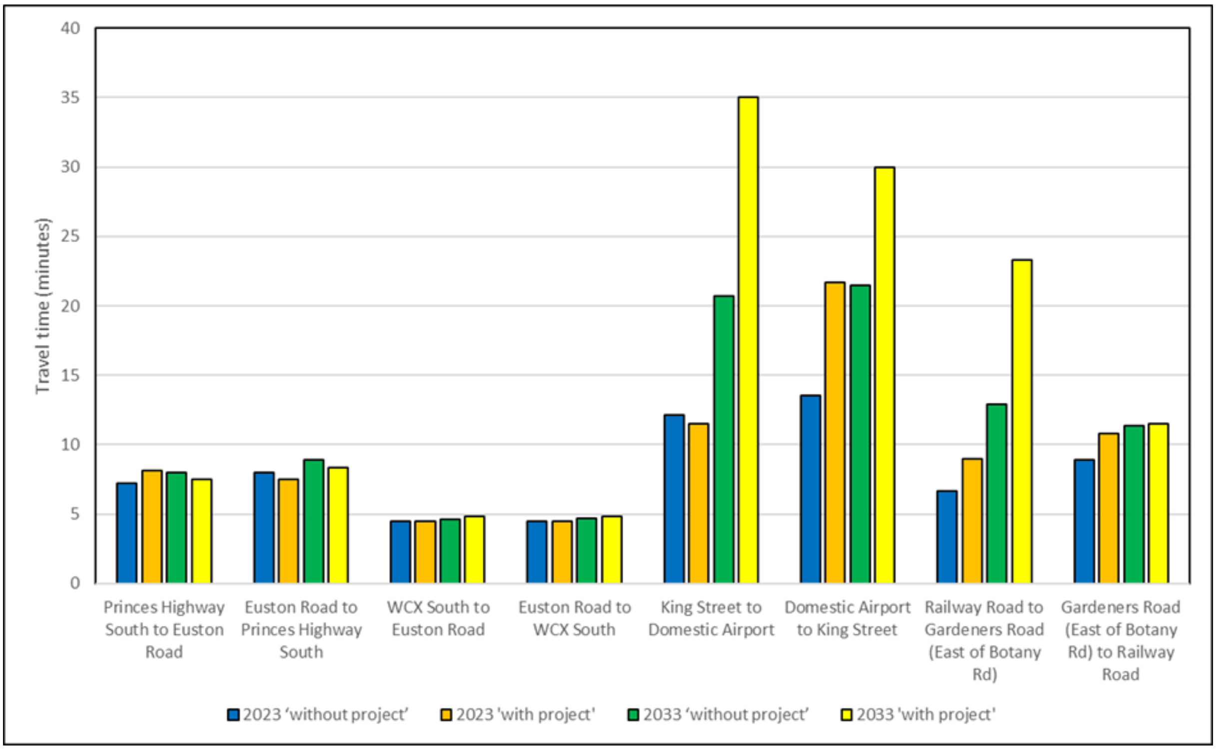


Figure 10-13 St Peters interchange: average travel time (mins) – PM peak hour 'with project' scenarios

10.5.5 Traffic crashes

It was assumed that the frequency of crashes on surface roads in the vicinity of the St Peters area, on the M5 East and the New M5 forecast under the 'with project' scenarios would change relative to forecast traffic changes and historical crash rates for these roads. Traffic crash analysis on surface roads in the vicinity of the St Peters area have also taken into account crash reductions resultant from intersection upgrades planned as part of the New M5 project. This approach is the same as that which was outlined for the 'without project' crash analysis undertaken in **section 6.6.3**.

Table 10-28 presents the crashes forecast under the 2023 'with project' scenario compared to the 'without project' scenario. The forecast change in daily traffic on the surface roads in the vicinity of the St Peters area varies. There are increases of less than 10 per cent forecast for Princes Highway and Euston Road, a decrease of just over 10 per cent forecast for Bourke Road, and a more significant decrease of about 25 per cent forecast for Canal Road/ Ricketty Street/ Gardeners Road.

Table 10-28 shows that there is an overall decrease in the number of cost of annual crashes on surface roads in the vicinity of the St Peters area with the project.

Table 10-28 St Peters and surrounds: crash comparison between 2023 'without project' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
Princes Highway	Enmore Road	Gannon Street	3.8	54,630	87	$9,013,400
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	28,150	34	$3,075,200
Euston Road	Sydney Park Road	Campbell Road	0.9	42,490	31	$2,447,600
Bourke Road	Wyndham Street	Gardeners Road	2.1	28,340	31	$2,326,600
2023 'with project'						
Princes Highway	Enmore Road	Gannon Street	3.8	57,230	91	$9,442,400
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	21,820	27	$2,383,700
Euston Road	Sydney Park Road	Campbell Road	0.9	45,330	34	$2,611,200
Bourke Road	Wyndham Street	Gardeners Road	2.1	25,250	27	$2,072,900

Table 10-29 compares the crashes forecast under the 2033 scenarios. In the 2033 'with project' scenario, the forecast increase in traffic on Euston Road would cause an increase in the total number and cost of crashes on Euston Road, south of Sydney Park Road. A forecast increase in traffic on Princes Highway between Enmore Road and Gannon Street also causes an increase in the number and cost of crashes at this location. However, the significant decrease in daily traffic forecast on the Canal Road/ Ricketty Street/ Gardeners Road, and Bourke Road between Wyndham Street and Gardeners Road, in combination with the intersection upgrades, would result in a reduction in the total number and cost of crashes on these roads.

Table 10-29 shows that there is a benefit in the reduction in number and cost of crashes at these locations of about four per cent compared to the 'without project' scenario.

Table 10-29 St Peters and surrounds: crash comparison between 2033 'without project' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'without project'						
Princes Highway	Enmore Road	Gannon Street	3.8	59,220	95	$9,770,700
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	32,230	39	$3,520,900
Euston Road	Sydney Park Road	Campbell Road	0.9	47,120	35	$2,714,300
Bourke Road	Wyndham Street	Gardeners Road	2.1	29,460	32	$2,418,600
2033 'with project'						
Princes Highway	Enmore Road	Gannon Street	3.8	61,780	99	$10,193,100
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	24,000	29	$2,621,900
Euston Road	Sydney Park Road	Campbell Road	0.9	49,540	37	$2,853,700
Bourke Road	Wyndham Street	Gardeners Road	2.1	26,450	29	$2,171,500

Table 10-30 presents the changes in crashes forecast under the 'with project' scenarios compared to the 'without project' scenarios on the M5 East Motorway and the New M5.

The analysis has been undertaken assuming the future frequency, type, and severity of crashes on the M5 East Motorway would be consistent with historic trends. This is a conservative estimate, as the crash rates are likely to improve with a reduction in congestion. The crash rates on the existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels) were used for the New M5.

On this basis, the shift in traffic from the M5 East Motorway to the New M5 would be expected to result in a reduction in both the total number and cost of crashes. In 2023, this results in a road safety benefit with a 10 per cent reduction in crash numbers and a reduction in crash costs from $4.9 million to $4.4 million. In 2033, the project would result in a road safety benefit with a 10 per cent reduction in crash numbers and a reduction in crash costs from $5.7 million to $5.2 million.

Table 10-30 M5 East Motorway: crash comparison between 'without project' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'without project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	58,080	71	$4,363,300
New M5	Western portal	St Peters portal	8.8	24,450	9	$520,100
Total					80	$4,883,400
2023 'with project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	49,850	61	$3,745,000
New M5	Western portal	St Peters portal	8.8	29,450	11	$626,500
Total					72	$4,371,500
2033 'without project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	67,930	83	$5,103,300
New M5	Western portal	St Peters portal	8.8	29,340	11	$624,200
Total					94	$5,727,500
2033 'with project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	58,720	72	$4,411,400
New M5	Western portal	St Peters portal	8.8	35,820	13	$762,000
Total					85	$5,173,400

10.5.6 Public transport services

Figure 10-14 shows the comparison in average bus travel time across the St Peters modelled road network between the 'without project' and 'with project' scenarios for the AM and PM peak hours. As there are not one or two dominant bus corridors in the modelled network, an average of all bus travel times has been reported.

In the AM peak hour, the average bus travel time is similar across the scenarios, with a small increase in the 2023 'with project' scenario compared to the 2023 'without project' scenario, and similar times in the 2033 comparison. In the PM peak hour, there is an increase in the average bus travel time in the 2023 'with project' compared to the 2023 'without project' scenario, and again in the 2033 comparison. This reflects the general network comparison and operation in the 2033 PM peak.

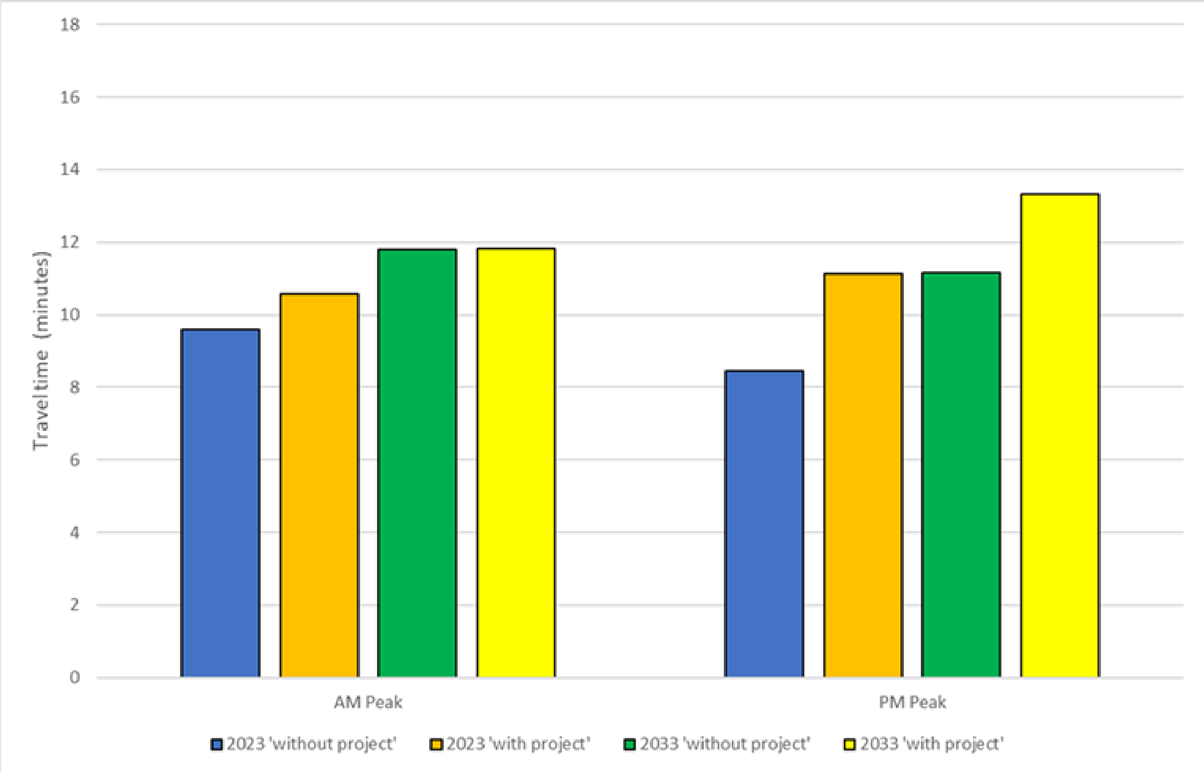


Figure 10-14 St Peters interchange: average travel time for buses – 'with project' comparison

10.5.7 Active transport facilities

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

10.5.8 Impact on local property access and on-street parking

There is no planned impact to local property access or on-street residential or business parking in the St Peters interchange area as part of the project.

10.6 Operations under staged opening

The mainline tunnels are planned for completion in 2022, while the Rozelle interchange is planned for completion in 2023. Therefore, there would be a period of around 12 months during which the mainline tunnels would be operational, without the Rozelle interchange and the Iron Cove Link. This would allow the benefits to the Sydney metropolitan road network of linking the M4 East and the New M5 component projects to be realised as soon as possible.

Under the staged opening, the mainline tunnels would operate at a lane capacity of two lanes in each direction with forecast two-way AWT of about 49,500 vehicles per day. Operational modelling indicates that forecast peak hour volumes would be within the capacity of the two lanes and LoS D or better is forecast.

In a ‘mainline only’ scenario, the Wattle Street and St Peters interchanges are the only entry and exit points for M4-M5 Link traffic. A comparison was made of the forecast traffic volumes at the Wattle Street interchange area and the St Peters interchange area in this ‘mainline only’ scenario with the other scenarios tested in this EIS. This comparison found that the forecast two-way traffic in a ‘mainline only’ scenario for the AM peak, PM peak and daily time periods was less than forecast traffic in at least one of the other scenarios tested in the EIS.

As an example, **Table 10-31** compares the AM peak, PM peak and daily two-way traffic volumes in a 2023 ‘mainline only’ scenario to the corresponding traffic volumes in the 2023 and 2033 ‘with project’ scenario around the Wattle Street and St Peters interchanges. As shown, all of the road links have more traffic in one of the other two scenarios. Therefore, it is not considered necessary to model the temporary ‘mainline only’ scenario as the impact of higher forecast traffic volumes was tested in other scenarios in this EIS.

Table 10-31 Comparison of two-way traffic under a 2023 ‘mainline only’ scenario

Key criteria locations	2023 ‘mainline only’			2023 ‘with project’ (mainline, Rozelle interchange and Iron Cove Link)			2033 ‘with project’ (mainline, Rozelle interchange and Iron Cove Link)		
	AM	PM	AWT	AM	PM	AWT	AM	PM	AWT
Wattle Street interchange and surrounds									
Wattle Street M4-M5 Link entry and exit ramps	920	950	9,500	1,560	1,360	19,000	1,770	1,540	21,000
Parramatta Road (west of Wattle St)	2,860	3,330	44,500	3,180	3,520	47,500	3,380	3,820	52,000
St Peters interchange and surrounds									
St Peters M4-M5 Link entry and exit ramps	5,450	5,800	66,500	5,290	5,640	70,000	5,700	6,230	76,500
Euston Road (south of Sydney Park Rd)	4,140	3,530	56,000	3,940	3,410	54,500	4,470	3,740	59,500
Gardeners Road (east of Bourke St)	4,270	3,950	46,000	4,280	3,950	47,000	4,340	4,150	48,500
Campbell Street (west of Princes Highway)	1,530	1,550	24,500	1,550	1,530	24,500	1,570	1,580	25,000

11 Management of impacts with the project

11.1 Management of construction impacts

11.1.1 Construction Traffic and Access Management Plan

A CTAMP will be prepared as part of the Construction Environmental Management Plan. The CTAMP will include the guidelines, general requirements and principles of traffic management to be implemented during construction. It will be prepared in accordance with Austroads *Guide to Road Design* (with appropriate Roads and Maritime supplements), the RTA *Traffic Control at Work Sites* manual and AS1742.3: *Manual of uniform traffic control devices – Part 3:Traffic control for works on roads*, and any other relevant standard, guide or manual. It will seek to minimise delays and disruptions, and identify and respond to any changes in road safety as a result of highway construction works.

The overarching strategy of the CTAMP will be to:

- Ensure all stakeholders are considered during all stages of the project
- Provide safe routes for pedestrians and cyclists during construction
- Design the permanent works and develop construction methodologies so that interaction with existing road users is minimised thereby creating a safer work and road user environment
- Plan and stage works to minimise the need for road occupancy, where possible
- Develop project staging plans in consultation with relevant traffic and transport stakeholders
- Minimise the number of changes to the road users' travel paths and, where changes are required, implement a high standard of traffic controls which effectively warn, inform and guide. This would minimise confusion by providing clear and concise traffic management schemes
- Comprehensively communicate changes to roads or paths to emergency services, public transport operators, other road user groups and any other affected stakeholders
- Identify measures to manage the movements of construction-related traffic to minimise traffic and access disruptions in the public road network
- Propose a car parking strategy for construction staff at the various worksites, in consultation with local councils and stakeholders associated with any facilities adjacent to the project site. This would include the promotion of public transport and carpooling to reduce worksite-related vehicle movements. The strategy would be developed to limit impacts on the surrounding communities and would include the parking management measures that would be implemented on adjacent local streets. The strategy would also be developed in consultation with the M4 East and New M5 contractors to identify opportunities to use existing parking arrangements associated with those projects during their respective construction periods and once those periods are completed.

Staging the construction works on key parts of the network – such as City West Link, Victoria Road, The Crescent, Anzac Bridge – would be critical to enable these key roads to continue to function with as minimal impact as possible.

11.1.2 Other mitigation strategies during construction

It is expected that the construction contractor would take all reasonable measures to ensure that road user delays are kept to an absolute minimum and that safe access is maintained for all road users.

In addition to development of a CTAMP, the following mitigation strategies would be implemented to manage and control traffic during construction, in consultation with the CBD Coordination Office, if appropriate:

- Identify potential road user delays during the planning and consultation phases
- During detailed design and construction planning for the project, develop construction staging and temporary works that minimises conflicts with the existing road network and maximises spatial separation between work areas and travel lanes

- Investigate potential offsite areas that could be used for construction workforce parking, including government owned land and other potential areas near to the construction ancillary facilities, and secure them for use during construction where required and possible.
- Isolate work areas from general traffic
- Develop alternative work methods to minimise delays and road user impacts, for example utilising more efficient plant and equipment, and applying different design solutions
- Provide temporary closed-circuit television (CCTV) and Variable Message Signs at the outset of construction to link with the existing Transport Management Centre (TMC) network to facilitate monitoring and management of impacts and traffic safety
- During construction, work with the TMC to observe traffic flows and incidents from CCTV footage and modify sites and activities where possible to address any identified issues
- Provide a mechanism for the community to report incidents and delays, for example a project phone number. This could be advertised along the construction site’s interface with the road network
- Schedule construction-related transport movements to avoid peak traffic periods and adversely affecting congestion, where possible
- Develop and adopt robust community and stakeholder communication protocols regarding altered traffic conditions
- Minimise impacts on the pedestrian paths and cycle lanes, and provide timely alternatives during construction where practical and safe to do so
- Identify impacts on bus stops and provide alternative locations and access in consultation with Transport for NSW and the relevant bus service provider
- Manage local road closures and maintain adequate property access. This would be undertaken in consultation with Roads and Maritime, local councils and property owners likely to be impacted
- Identify haulage routes and communicate, along with site access requirements and restrictions, to all relevant drivers
- Identify potential truck marshalling areas and use where possible, to minimise potential queuing and traffic and access disruptions in the local area
- Monitor heavy vehicle movements to and from sites to ensure compliance with road traffic noise criteria at night
- Prepare a road dilapidation report, in consultation with relevant councils and road owners, identifying existing conditions of local roads and mechanisms to repair damage to the road network caused by heavy vehicle movements associated with the project.

11.2 Management of operational impacts

11.2.1 Network changes included in project design

Changes to the surface road network are proposed within the M4-M5 Link project design to complement and/or mitigate the impacts of the project. These include:

- Minor physical integration works with the surface road network at the Wattle Street interchange, including road pavement and line marking
- Minor physical integration works with the surface road network at the St Peters interchange, including road pavement and line marking
- The Rozelle interchange surface works, including:
  - Widening and realignment of City West Link, The Crescent and Victoria Road at Lilyfield and Rozelle
  - Realigning The Crescent at Annandale, including a new bridge for The Crescent to pass over Whites Creek and modifications to the intersections with City West Link and Johnston Street

- Reconstructing the intersection of The Crescent and Victoria Road at Rozelle, including construction of a new bridge at Victoria Road, while maintaining the eastbound through movement to Anzac Bridge under the intersection
  - New active transport network infrastructure connecting the Rozelle Rail Yards with the wider pedestrian and cyclist network, including two north–south pedestrian and cyclist bridges over City West Link and an east–west underpass below Victoria Road
- The Iron Cove Link surface works, including:
  - Realignment of the westbound (southern) carriageway of Victoria Road between Springside Street and the eastern abutment of Iron Cove Bridge
  - Permanent closure of Clubb Street south of Victoria Road at the start of construction
  - Minor modifications to other intersections along the southern side of Victoria Road including Toelle Street, Callan Street and Springside Street. These streets would generally remain open during construction and would provide the same turning movements as the existing arrangement once works are complete
  - Minor changes to the right hand turn movement from Victoria Road into Terry Street
  - Upgrades and modifications to the shared pedestrian and cycle paths along the westbound (southern) carriageway of Victoria Road.

11.2.2 Operational traffic review

The traffic assessment has identified intersections where the operational performance would significantly change under the future traffic demands as modelled. This assessment has been based on forecast traffic demands derived from the WRTM and, consequently, the outcome may be affected by the limitations of the modelling process as described in **section 4.2**.

By 2033, peak demand conditions with or without the project are likely to start earlier and finish later than today to accommodate greater forecast traffic demand arising from increased population and changes to land use. Due to forecast congestion, some of this traffic is predicted to not be able to start or finish their journey within the peak period. Some drivers will therefore choose to make their journey either earlier or later in the peak period to avoid delay. This behaviour called 'peak spreading' is consistent with what has occurred in Sydney and in other international cities.

As with the M4 East and New M5 projects, Roads and Maritime would undertake a review of network performance, in consultation with Transport for NSW and relevant councils, to confirm the operational traffic impacts of the M4-M5 Link on surrounding arterial roads and major intersections at both 12 months and at five years after the commencement of operation of the M4-M5 Link. The assessment would be based on updated traffic surveys at the time and the methodology used would be comparable with that used in this assessment.

Wattle Street interchange and surrounds

The analysis has identified key constraints impacting the performance of the network on Frederick Street (southbound), Parramatta Road (eastbound) and City West Link (northbound) in the 'without project' scenario. The capacity constraints on Parramatta Road and City West Link are generally reduced by the M4-M5 Link project, particularly in 2023. It is expected that the M4 East Road Network Performance Review Plan would examine potential management measures at these locations following the collection of updated data that would facilitate an understanding of actual project outcomes.

Notwithstanding the above, Roads and Maritime proposes the following opportunity to manage operational impacts:

- The identified exit blocking from Frederick Street through the Parramatta Road/Wattle Street intersection in the 'with project' scenario arises from forecast increase in southbound demand, combined with capacity restrictions at downstream intersections and limited storage space on Frederick Street. Management measures to be investigated by Roads and Maritime, in consultation with relevant local councils, could include:
  - Queuing and capacity monitoring and management on the Frederick Street/Milton Street

corridor

– Managing lane use and utilisation to improve the operation of the corridor.

Rozelle interchange and surrounds

The analysis has shown that the Anzac Bridge/Western Distributor is currently at or close to capacity and cannot accommodate more demand, especially in the eastbound AM peak hour, due to existing operational and geometric features of the road network. In all future scenarios, the forecast demand would exceed capacity and therefore management is required.

With the M4-M5 Link operational, there is an increase in the forecast eastbound AM peak hour demand, as the M4 exit ramp and the Iron Cove Link to Anzac Bridge/Western Distributor provide bypasses of City West Link and Victoria Road respectively. Once the proposed future Western Harbour Tunnel is operational, this forecast demand increase diminishes, but would still exceed the capacity of Anzac Bridge/Western Distributor.

Roads and Maritime is developing a strategy to ensure appropriate network integration in the areas surrounding the Rozelle interchange, including:

- Capacity improvement measures – a number of areas have been identified for investigation to improve capacity including the intersection of the Western Distributor and Pyrmont Bridge Road at Pyrmont, the merge and weave arrangements on the Western Distributor in close proximity to Darling Harbour, modifications through the use of moveable medians on the approaches to the Harbour Bridge and a review of kerbside use of the road network at the interfaces with the Western Distributor to remove key bottlenecks and allow additional capacity where appropriate
- Project staging options – effective staging of the opening of major projects would also keep forecast demands closer to capacity and key adjustments to current staging and program timelines for major projects with the surrounding network may be required. Investigations are underway by Roads and Maritime to determine the effect and viability of altering key project timelines to achieve the best road network performance.. This may include timing projects to reduce ‘spikes’ in the forecast demand that would exceed capacity operation and ensure effective control of traffic. As many of these projects are still in development, the requirements for staging are yet to be determined
- Demand management measures – demand management measures are being considered to effectively manage peak demand on critical links. These include the use of Smart Motorways (including ramp metering, variable speed limits and lane use management) and arterial management through the re-optimisation of the Sydney coordinated adaptive traffic system (SCATS)[15] to manage the altered traffic patterns that will occur with the introduction of the M4-M5 Link project.

Specific measures will be identified as investigations progress and their implementation will depend on their complexity and appropriate timing to minimise impact on the community. Roads and Maritime will carry out these investigations in consultation with SMC, councils and NSW DP&E to develop a program of works.

The Crescent, Johnston Street and Ross Street are forecast to experience increased levels of demand with the introduction of the project, with people travelling to and from the southern fringe of the Sydney CBD through the Annandale area. A strategy is being developed by Roads and Maritime to ensure the impacts of the project are minimised. The strategy will involve investigating and identifying capacity improvement and mitigation measures along The Crescent, Ross Street and Johnston Street. These measures will be implemented in a staged approach to accommodate forecast demand firstly for the M4-M5 Link and thereafter for the proposed future Western Harbour Tunnel. Implementation of these measures will depend on the complexity of the measure and will be implemented at an appropriate stage to minimise impact on the community.

[15] The Sydney coordinated adaptive traffic system (SCATS) is a traffic management system used to synchronise traffic signals to optimise traffic flow.

St Peters interchange and surrounds

The analysis has indicated a deteriorated network performance in the St Peters and Mascot area with the project. However, once Sydney Gateway is in place, a considerable amount of traffic would be removed from the St Peters and Mascot area and the network performance improved to a level generally better than in the ‘without project’ scenarios. Sydney Gateway is expected to be open at a similar time to the M4-M5 Link. Specific interim mitigation measures for the ‘with project’ scenario are therefore not proposed.

Should the Sydney Gateway project be delayed for a significant length of time, it is expected that both the New M5 Road Network Performance Review Plan (conditioned as part of the New M5 approval) and the proposed M4-M5 Link Road Network Performance Review would confirm the operational traffic impacts of the projects on surrounding arterial roads and major intersections. These reviews are scheduled at 12 months and five years after the commencement of operation of the New M5 and the M4-M5 Link respectively. Key intersections in the St Peters and Mascot areas are already identified for investigation as part of the New M5 conditions of approval and the following should be included in the M4-M5 Link Road Network Performance Review Plan:

- Gardeners Road/Kent Road
- Gardeners Road/O’Riordan Street
- Kent Road/Coward Street
- Bourke Road/Coward Street
- Kent Road/Ricketty Street.

These reviews would examine potential management measures at these locations, and other locations as identified in the Road Network Performance Review, following the collection of data that would facilitate a clearer understanding of actual project impacts.

11.2.3 Other management techniques and mitigation measures

Management of road network assets is a key function of Roads and Maritime, which uses network and corridor planning strategies to best manage and enhance these assets to maximise community benefits. Network and corridor planning is a process aimed at enhancing the capacity to manage the road network performance to meet community expectations. Integrated network and corridor planning processes are critical to working towards the vision of ‘a safe, sustainable and efficient road transport system’.

The process involves a few key elements including:

- Setting network and corridor objectives in line with NSW and Australian Government strategies and community expectations
- Analysing anticipated performance against appropriate safety, traffic and asset measures
- Identifying strategic priorities to achieve appropriate safety, traffic and asset performance over the longer term within the context of limited funding.

As a key part of network management, network and/or corridor optimisation is a key tool in the management of project impacts. Together with the ongoing delivery of the Pinch Point Program through the Easing Sydney’s Congestion office, which targets peak hour traffic hotspots, and other infrastructure measures previously discussed, network optimisation facilitates the management of impacts identified to ensure travel time savings are maintained to the greatest possible extent by minimising intersection and mid-block delays.

In addition to an optimisation strategy and potential infrastructure provision, the maintenance of the existing traffic control system is a key ingredient in providing Roads and Maritime with the tools to appropriately manage congestion on the network. A review of existing SCATS infrastructure at key intersections in the study area, including detectors, will be undertaken and upgrades implemented where appropriate.

12 Assessment of cumulative impacts

12.1 Cumulative projects

This section details the forecast traffic performance of the study area during the 'cumulative' scenarios. The detailed assessments have been undertaken using forecast traffic volumes produced using the WRTM for the following scenarios:

- **Operation 'cumulative' (2023)**: With the 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway and the proposed future Western Harbour Tunnel (a component of the proposed future Western Harbour Tunnel and Beaches Link project) operational
- **Operation 'cumulative' (2033)**: With the 'do minimum' projects completed, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel and Beaches Link and F6 Extension projects operational.

Three other major Roads and Maritime projects are currently in planning and have been included in the cumulative assessments:

- Proposed future Sydney Gateway – comprises a new road link between the St Peters interchange (which is being delivered as part of the New M5 project) and Sydney Airport, with connections towards Port Botany. The proposed future Sydney Gateway project would assist in addressing the high volumes of heavy vehicle traffic generated by the Sydney Airport and Port Botany precincts.
- Proposed future Western Harbour Tunnel and Beaches Link – the proposed future Western Harbour Tunnel and Beaches Link would provide a further tunnel crossing of Sydney Harbour to the west of Sydney Harbour Bridge which, together with WestConnex, would act as a western bypass of the Sydney CBD. It would connect to the M4-M5 Link at the Rozelle interchange, cross underneath Sydney Harbour between the Birchgrove and Waverton areas, and connect with the Warringah Freeway at North Sydney. The Beaches Link component comprises a tunnel that would connect to the Warringah Freeway, cross underneath Middle Harbour and connect with the Burnt Bridge Creek Deviation at Balgowlah. It would also involve the duplication of the Wakehurst Parkway between Seaforth and Frenchs Forest
- F6 Extension (previously referred to as South Link) – a proposed motorway link between the New M5 at Arncliffe and the existing M1 Princes Highway at Loftus, generally along the alignment known as the F6 corridor.

These projects are subject to separate environmental assessment and approval.

Sydney Metro Northwest (Rouse Hill to Chatswood) and Sydney Metro City and Southwest (Chatswood to Bankstown) are included in all future strategic modelling scenarios. Sydney Metro West was recently announced by NSW Government, is at the early stage of development and has not been included in the future strategic modelling scenarios.

12.2 Sydney metropolitan road network

12.2.1 'Cumulative' (2023)

Figure 12-1 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2023 'cumulative' and the 'with project' scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'cumulative' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

General traffic

In the 2023 'cumulative' scenario, the project enables the development of the future Sydney motorway network, connecting the proposed future Western Harbour Tunnel to the M5 Motorway corridor, creating a western bypass of the Sydney CBD. With the inclusion of the proposed future Sydney Gateway and Western Harbour Tunnel, increases in traffic on the M4-M5 Link are forecast, particularly between the Rozelle and St Peters interchanges due to the extended motorway network. A decrease in daily traffic is forecast on the M4 exit ramp to Anzac Bridge, Anzac Bridge/Western Distributor and the Sydney Harbour Bridge due to the inclusion of the proposed future Western Harbour Tunnel. Changes in peak period operational performance on these roads are dealt with in **section 12.5**.

Decreased traffic is forecast on the Sydney Harbour Bridge, Sydney Harbour Tunnel, Southern Cross Drive and the existing M5 East due to the introduction of the proposed future Sydney Gateway and Western Harbour Tunnel.

With the inclusion of Sydney Gateway, decreases in daily traffic on surface roads between the St Peters interchange and Sydney Airport, and the Princes Highway, are forecast. Changes in peak period operational performance on these surface roads close to the St Peters interchange are dealt with in **section 12.6**.

As presented in **Chapter 9**, while a shift in daily traffic onto parallel routes as a result of the project is not forecast, increased use of The Crescent and Johnston Street is forecast. Changes in peak period operational performance on these roads are dealt with in **section** .

With the inclusion of the proposed future Western Harbour Tunnel and Sydney Gateway projects, further reductions in peak period travel times compared to the 'with project' scenario are forecast between the M4 corridor and the Sydney Airport/Port Botany precinct in 2023. For example:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by a further 10 minutes. This saving is part of a 35 minute saving comparing the 2023 'cumulative' scenario to a scenario without the M4 East and New M5
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by a further five minutes. This saving is part of a 20 minute saving comparing the 2023 'cumulative' scenario to a scenario without the M4 East and New M5
- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by a further five minutes. This saving is part of a 20 minute saving comparing the 2023 'cumulative' scenario to a scenario without the M4 East and New M5.

Road network productivity improves in 2023, with the inclusion of the proposed future Western Harbour Tunnel and Sydney Gateway. There is a drop in the daily VKT and VHT on the arterial network with an increase in kilometres travelled along the motorway routes, as shown in **Table 12-1**. Overall, a greater distance could be travelled on the road network in a shorter time.

Table 12-1 Comparison of daily 2023 VKT and VHT for metropolitan Sydney in the 'with project' and 'cumulative' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
With project	27,730	86,050	113,780	480	3,120	3,600
Cumulative	27,980	85,970	113,950	470	3,110	3,570

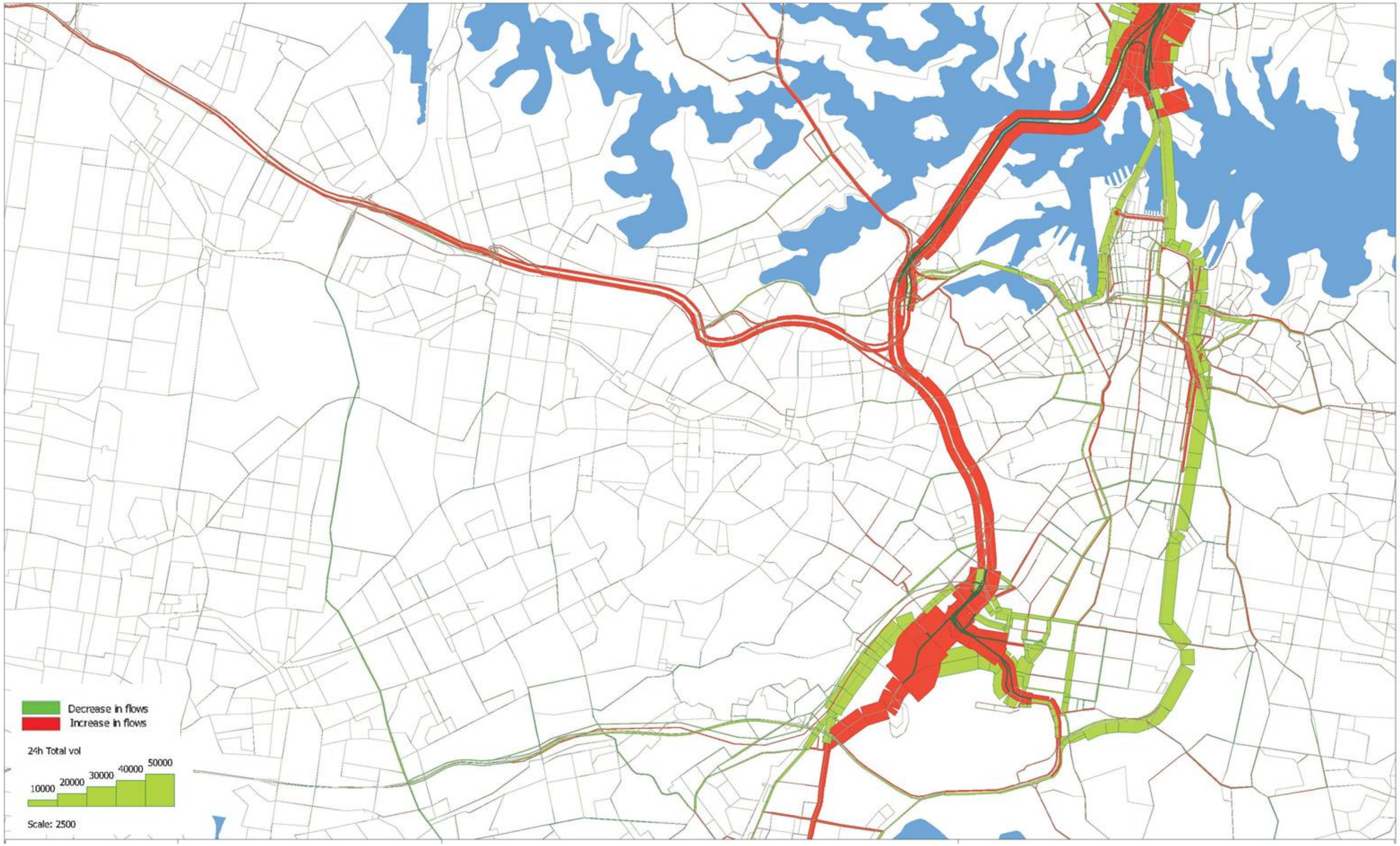
Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements generally follow the same pattern as the general traffic movements. There are significant reductions in daily heavy vehicle traffic focused on the M4 East exit ramp to Anzac Bridge, Anzac Bridge/Western Distributor and the Sydney Harbour Bridge (especially northbound), and on Southern Cross Drive and Sydney Harbour Tunnel (especially southbound). Decreases in heavy vehicle traffic on surface roads between the St Peters interchange and Sydney Airport are also forecast due to Sydney Gateway.

On-road public transport

Reductions in forecast traffic volume as a result of the inclusion of the proposed future Sydney Gateway and Western Harbour Tunnel would be expected to improve the reliability and trip times for public transport bus services on those roads. Assuming the mitigation strategy discussed in **section 11.2.2**, the decrease in daily traffic forecast for Anzac Bridge/Western Distributor could improve reliability and trip times for bus services travelling between the northwest and the Sydney CBD via Victoria Road. Forecast decreases in traffic for the Sydney Harbour Bridge could improve trip times and reliability for bus services travelling between the north and the Sydney CBD on the Warringah Freeway and Pacific Highway.



Source: WRTM v2.3, 2017

Figure 12-1 Difference in AWT between 2023 'cumulative' and 'with project' scenarios

12.2.2 'Cumulative' (2033)

Figure 12-2 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'cumulative' and the 'with project' scenarios. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2033 'cumulative' scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change. These forecast traffic volumes include both fixed and induced traffic demand.

General traffic

In a 2033 'cumulative' scenario, the project enables the further development of the future Sydney motorway network, connecting the proposed future Beaches Link (a component of the proposed future Western Harbour Tunnel and Beaches Link) and F6 Extension, creating a major north–south motorway link. The pattern of change highlighted in 2023 is generally the same for 2033, with the scale of increases or decreases mainly due to the growth in forecast traffic. However, with the inclusion of the F6 Extension, decreases in daily traffic on the Princes Highway (especially south of the M5 East) are forecast due to traffic switching to use the motorway links.

With the inclusion of the proposed future Western Harbour Tunnel and Beaches Link, Sydney Gateway and F6 Extension projects, reductions in peak period travel times are forecast between the M4 corridor and the Sydney Airport/Port Botany precinct, in the 2033 'cumulative' scenario. For example:

- Between Parramatta and Sydney Airport, average peak period travel times are forecast to reduce by a further five minutes. This saving is part of a 40 minute saving comparing the 2033 'cumulative' scenario to a scenario without previous WestConnex stages (M4 East and New M5)
- Between Burwood and Sydney Airport, average peak period travel times are forecast to reduce by a further 10 minutes. This saving is part of a 30 minute saving comparing the 2033 'cumulative' scenario to a scenario without the M4 East and New M5
- Between Silverwater and Port Botany, average peak period travel times are forecast to reduce by a further 10 minutes. This saving is part of a 30 minute saving comparing the 2033 'cumulative' scenario to a scenario without the M4 East and New M5.

Road network productivity improves in 2033, with the inclusion of the proposed future Western Harbour Tunnel and Beaches Link, Sydney Gateway and F6 Extension projects. There is a drop in the daily VKT and VHT on the arterial network with an increase in kilometres travelled along the motorway routes, as shown in **Table 12-2**. Overall, a greater distance could be travelled on the road network in a shorter time.

Table 12-2 Comparison of daily 2033 VKT and VHT for metropolitan Sydney in 'with project' and 'cumulative' scenarios

Scenario	Daily VKT ('000 km)			Daily VHT ('000 hours)		
	Motorway	Other	Total	Motorway	Other	Total
With project	32,010	101,410	133,430	600	4,610	5,220
Cumulative	33,780	100,650	134,420	600	4,500	5,100

Source: WRTM v2.3, 2017

On-road freight

Forecast changes in daily road-based freight or heavy vehicle movements generally follow the same pattern as 2023, with a larger decrease on General Holmes Drive (south of the M5 East) forecast due to the inclusion of the F6 Extension.

On-road public transport

The impacts for on-road public transport in 2033 are similar to those anticipated in 2023 in the 'cumulative' scenarios. Assuming the mitigation strategy discussed in **section 11.2.2**, reductions in traffic on Anzac Bridge/Western Distributor would be expected to improve the reliability and trip times of bus services that travel between the northwest and the Sydney CBD via Victoria Road. Reductions in forecast traffic volumes on the Sydney Harbour Bridge would be expected to improve the reliability and trip times of buses travelling between the north and the Sydney CBD via the Pacific Highway and Warringah Freeway.

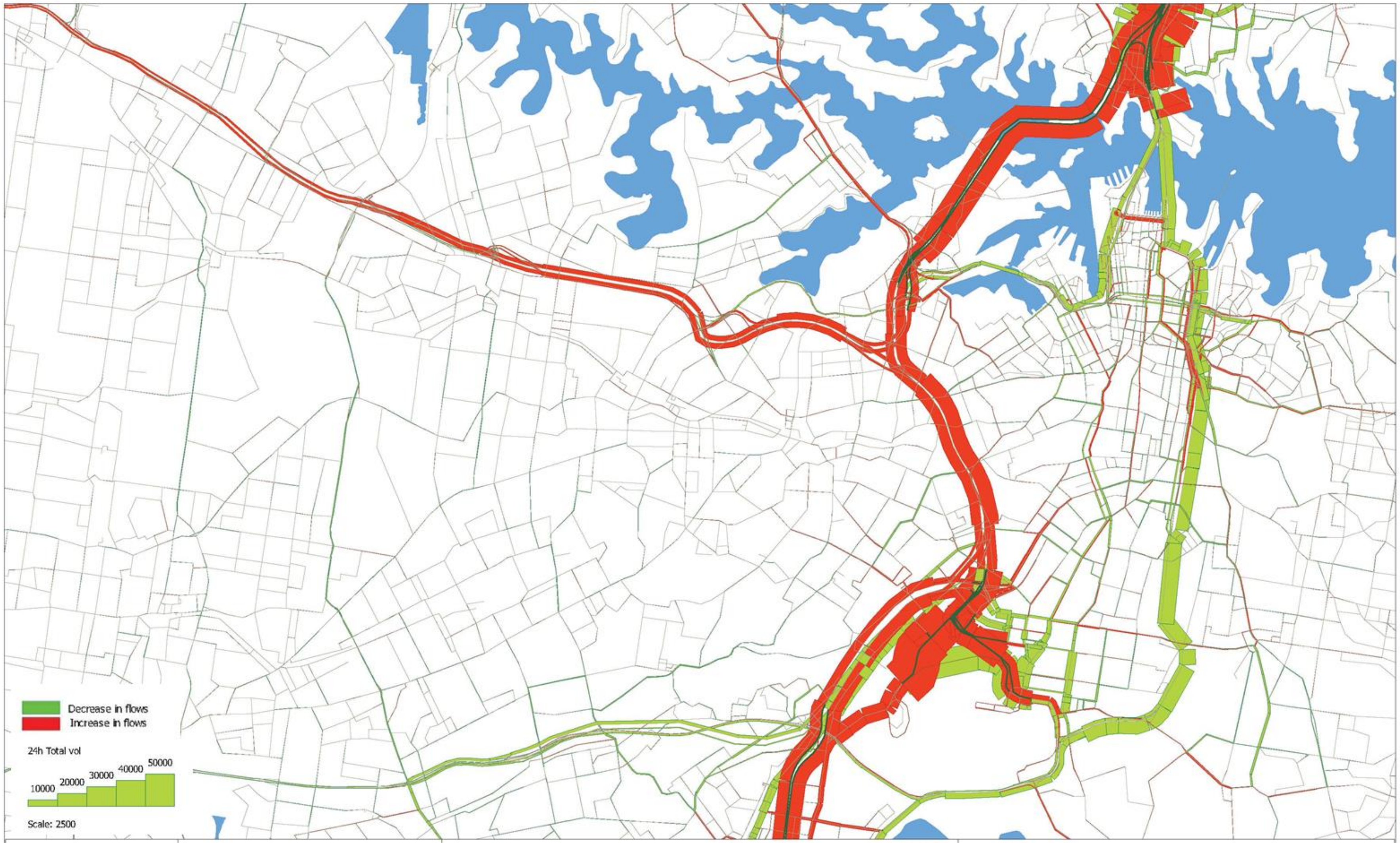


Figure 12-2 Difference in AWT between 2033 'cumulative' and 'with project' scenarios

Source: WRTM v2.3, 2017

12.3 Operational performance – M4-M5 Link motorway

12.3.1 Mid-block level of service

Analysis of mid-block levels of service on the M4-M5 Link motorway under the 2023 'cumulative' and 2033 'cumulative' scenarios in peak hours are provided in **Table 12-3** and **Table 12-4**. As noted in **section 10.2.1**, for the purposes of this analysis the motorway was divided into five sections.

Compared to the 2023 'with project' scenario, the 2023 'cumulative' scenario analysis of microsimulation modelling indicates that traffic flows on the motorway are forecast to generally be denser with a corresponding reduction in level of service in the peak hours. However, the motorway is forecast to still generally operate at an acceptable level of service.

Table 12-3 M4-M5 Link motorway LoS – 2023 'cumulative' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak hour						
1	Interface with M4 East	3	4,920	76	21.7	D
2	Wattle Street interchange to Rozelle interchange	4	6,110	70	21.9	D
3	Rozelle interchange bypass	2	2,580	80	16.1	D
4	Rozelle interchange to St Peters interchange	4	5,660	80	17.7	D
5	Interface with New M5	2	380	80	2.4	A
Southbound – PM peak hour						
1	Interface with M4 East	3	3,020	80	12.6	C
2	Wattle Street interchange to Rozelle interchange	4	3,660	80	11.4	C
3	Rozelle interchange bypass	2	2,100	80	13.1	C
4	Rozelle interchange to St Peters interchange	4	4,190	80	13.1	C
5	Interface with New M5	2	990	80	6.2	A
Northbound – AM peak hour						
1	Interface with New M5	2	1,190	80	7.4	B
2	St Peters interchange to Rozelle interchange	4	5,050	80	15.8	C
3	Rozelle interchange bypass	2	2,680	80	16.7	D
4	Rozelle interchange to Wattle Street interchange	4	4,850	80	15.2	C
5	Interface with M4 East	3	4,310	80	17.9	D
Northbound – PM peak hour						
1	Interface with New M5	2	330	80	2.1	A
2	St Peters interchange to Rozelle interchange	4	4,620	80	14.5	C
3	Rozelle interchange bypass	2	2,550	80	16.0	C
4	Rozelle interchange to Wattle Street interchange	4	6,350	80	19.8	D
5	Interface with M4 East	3	5,600	80	23.3	E

Note: The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

The 2033 'cumulative' scenario analysis indicates traffic flows on the motorway are forecast to be denser compared to the 2033 'with project' scenario, with a corresponding reduction in level of service in the peak hours. This is due to the additional motorway links in the 'cumulative' scenario (proposed future Western Harbour Tunnel and Beaches Link, Sydney Gateway, and F6 Extension projects), resulting in more traffic in the M4-M5 Link. Sections of the motorway are forecast to operate at LoS E in the peak hours, particularly around the merge and diverge locations, eg where the Wattle Street interchange ramps and the mainline connect. Even with this increased density, average motorway speeds are still forecast to be 60 kilometres per hour or above in the peak hours.

Table 12-4 M4-M5 Link motorway LoS – 2033 'cumulative' scenario

Section	Location and direction	No. of lanes	Modelled flow (PCU)	Speed (km/h)	Density (PCU/km/ln)	LOS
Southbound – AM peak hour						
1	Interface with M4 East	3	5,310	71	25.0	E
2	Wattle Street interchange to Rozelle interchange	4	6,830	63	27.0	E
3	Rozelle interchange bypass	2	2,400	80	15.0	C
4	Rozelle interchange to St Peters interchange	4	6,520	77	21.1	D
5	Interface with New M5	2	880	80	5.5	A
Southbound – PM peak hour						
1	Interface with M4 East	3	4,160	78	17.7	D
2	Wattle Street interchange to Rozelle interchange	4	5,030	76	16.5	D
3	Rozelle interchange bypass	2	3,050	79	19.2	D
4	Rozelle interchange to St Peters interchange	4	6,030	75	20.0	D
5	Interface with New M5	2	2,340	80	14.7	C
Northbound – AM peak hour						
1	Interface with New M5	2	2,600	75	17.2	D
2	St Peters interchange to Rozelle interchange	4	7,080	69	25.5	E
3	Rozelle interchange bypass	2	3,320	78	21.4	D
4	Rozelle interchange to Wattle Street interchange	4	5,930	70	21.1	D
5	Interface with M4 East	3	5,360	80	22.3	E
Northbound – PM peak hour						
1	Interface with New M5	2	780	80	4.9	A
2	St Peters interchange to Rozelle interchange	4	5,530	77	18.0	D
3	Rozelle interchange bypass	2	2,780	80	17.4	D
4	Rozelle interchange to Wattle Street interchange	4	6,720	75	22.3	E
5	Interface with M4 East	3	5,920	80	24.7	E

Note: The reported speed has been capped at the posted 80 kilometres per hour. The microsimulation models allow vehicle speeds slightly higher than the posted speed, which models reality, especially in uncongested, free flow conditions.

Provision has been made for Smart (or Managed) Motorway infrastructure in the M4-M5 Link design. A Smart Motorway uses technology to monitor, provide intelligence and control the motorway to ease congestion and keep traffic flowing more effectively. Technology, including lane use management signs, vehicle detection equipment, CCTV cameras and entry ramp signals, allows road operators to manage, in real-time, traffic entering, exiting and traversing the motorway. A comprehensive network-wide strategy could have significant benefits in maintaining acceptable operating conditions on the motorway in the future.

12.3.2 Traffic crashes

Table 12-5 presents the comparison between the crash forecast under the 2023 'cumulative' scenario compared to the 'with project' scenario. The increase in forecast traffic in the cumulative scenario is reflected in an increase in forecast crashes, especially on the section between the Rozelle and St Peters interchanges.

Once again, these crashes would be balanced against the reduction in crashes forecast by the reduction in traffic volumes on the surface roads. With crash rates on motorways much lower than on surface arterial roads, a general reduction in accidents would be expected.

Table 12-5 M4-M5 Link: crash comparison between 2023 'with project' and 'cumulative' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	87,470	23	$264,300
M4-M5 Link	Rozelle interchange bypass		1.36	39,620	11	$130,300
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	60,500	29	$327,600
2023 'cumulative'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	105,600	28	$319,100
M4-M5 Link	Rozelle interchange bypass		1.36	47,690	14	$156,800
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	94,510	45	$511,800

Table 12-6 presents the comparison between the 2033 'cumulative' scenario compared to the 'with project' scenario. The comparison is similar to the 2023 comparison. The increase in forecast traffic in the cumulative scenario, especially on the section between the Rozelle and St Peters interchanges, is reflected in an increase in forecast crashes.

Table 12-6 M4-M5 Link: crash comparison between 2033 'with project' and 'cumulative' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'with project'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	97,910	26	$295,900
M4-M5 Link	Rozelle interchange bypass		1.36	45,370	13	$149,200
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	68,910	33	$373,200
2033 'cumulative'						
M4-M5 Link	Wattle Street interchange	Rozelle interchange	1.25	124,190	33	$375,300
M4-M5 Link	Rozelle interchange bypass		1.36	56,870	16	$187,000
M4-M5 Link	Rozelle interchange	St Peters interchange	2.24	117,530	56	$636,400

12.4 Operational performance – Wattle Street interchange

12.4.1 Changes to road network in ‘cumulative’ scenarios

There are no road network differences between ‘with project’ and ‘cumulative’ scenarios at the Wattle Street interchange.

12.4.2 Network performance

2023 ‘cumulative’ scenario

Table 12-7 and **Table 12-8** present a comparison of the performance of the road network between the 2023 ‘with project’ and ‘cumulative’ scenarios for the AM and PM peak hours using microsimulation modelling.

AM peak hour

The 2023 AM peak hour ‘cumulative’ network conditions are similar to the ‘with project’ network, with the main cause of congestion being excess demand for City West Link which is forecast to occasionally block back beyond the Ramsay Street intersection. This impacts Ramsay Street, Waratah Street and Timbrell Drive, which are forecast to all experience queuing. Queuing at the eastbound M4 East Parramatta Road ramps merge is minimal, however the models forecast extensive queuing at Liverpool Road. There is an increase in average speed due to the higher proportion of vehicles using the M4-M5 Link in the ‘cumulative’ scenario.

Table 12-7 Wattle Street interchange network performance – AM peak hour (2023 ‘with project’ scenario vs ‘cumulative’ scenario)

Network measure	2023 ‘with project’	2023 ‘cumulative’	Percentage change
All vehicles			
Total traffic demand (veh)	21,410	23,457	10%
Total vehicle kilometres travelled in network (km)	34,696	37,629	8%
Total time travelled approaching and in network (hr)	1,667	1,579	-5%
Total vehicles arrived	21,113	23,193	10%
Total number of stops	166,849	149,784	-10%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.6	1.6	0%
Average time travelled in network (mins)	4.5	3.9	-13%
Average number of stops	7.1	5.9	-17%
Average speed (km/h)	21.0	24.1	15%
Unreleased vehicles			
Unreleased demand (veh)	297	264	–
% of total traffic demand	1%	1%	–

PM peak hour

The 2023 ‘cumulative’ conditions are similar to those for the 2023 ‘with project’ scenario, with the main cause of congestion remaining the forecast demand to Frederick Street. This traffic cannot be accommodated because of downstream congestion blocking back from southwest of the modelled network extents. As with the ‘with project’ scenario, significant queues are forecast on Parramatta Road eastbound approach to Wattle Street and on Wattle Street itself. The forecast increase in total demand in the ‘cumulative’ scenario results in an increase in average speed, as much of this additional demand is along the M4-M5 Link, which is free flowing at relatively high speeds.

Table 12-8 Wattle Street interchange network performance – PM peak hour (2023 ‘with project’ scenario vs ‘cumulative’ scenario)

Network measure	2023 ‘with project’	2023 ‘cumulative’	Percentage change
All vehicles			
Total traffic demand (veh)	20,825	22,365	7%
Total vehicle kilometres travelled in network (km)	33,968	35,981	6%
Total time travelled approaching and in network (hr)	1,907	1,801	-5%
Total vehicles arrived	20,049	21,879	9%
Total number of stops	201,602	174,221	-14%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.6	1.6	-1%
Average time travelled in network (mins)	5.3	4.7	-11%
Average number of stops	8.7	7.1	-19%
Average speed (km/h)	18.0	20.1	12%
Unreleased vehicles			
Unreleased demand (veh)	776	486	–
% of total traffic demand	4%	2%	–

2033 ‘cumulative’ scenario

Table 12-9 and **Table 12-10** present a comparison of the performance of the road network between the 2033 ‘with project’ and ‘cumulative’ scenarios for the AM and PM peak hours, using microsimulation modelling.

AM peak hour

The 2033 ‘cumulative’ scenario forecasts a minor increase in overall average speed due to an increase in forecast demand for the M4-M5 Link mainline when compared to the ‘with project’; similar to the 2023 comparisons. The same issues as in the ‘with project’ scenario remain, with there still being significant Wattle Street/Dobroyd Parade congestion impacting side road approaches. One notable difference is that forecast demand from the M4 to City West Link reduces in the ‘cumulative’ scenario and therefore blocking from the Wattle Street merge does not extend as far back along Wattle Street to Parramatta Road, as it does in the 2033 ‘with project’ scenario.

In the ‘cumulative’ scenario, the modelling forecasts a significant increase in demand to and from the surface road network from M4-M5 Link ramps, and reduced demand to and from the M4 East ramps.

Table 12-9 Wattle Street interchange network performance – AM peak hour (2033 'with project' scenario vs 'cumulative' scenario)

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	23,609	26,182	11%
Total vehicle kilometres travelled in network (km)	37,632	40,385	7%
Total time travelled approaching and in network (hr)	1,821	1,873	3%
Total vehicles arrived	23,114	25,752	11%
Total number of stops	213,460	205,145	-4%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.6	1.5	-2%
Average time travelled in network (mins)	4.5	4.2	-6%
Average number of stops	8.3	7.3	-12%
Average speed (km/h)	20.9	21.8	4%
Unreleased vehicles			
Unreleased demand (veh)	495	430	–
% of total traffic demand	2%	2%	–

PM peak hour

The 2033 'cumulative' conditions are similar to the 2033 'with project' conditions, with the forecast demand for Frederick Street remaining the main cause of congestion. As in the 'with project' scenario, with the capacity constraints at the Wattle Street intersection and the increase in westbound demand, queuing on the Parramatta Road westbound approach to Wattle Street extends through the Bland Street intersection.

Minor road approaches within the network are seen to have large queues as a result of congestion on Parramatta Road and Wattle Street. This occurs at Bland Street, Great North Road, Croydon Road, Liverpool Road and Sloane Street.

Table 12-10 Wattle Street interchange network performance – PM peak hour (2033 'with project' scenario vs 'cumulative' scenario)

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	22,866	25,106	10%
Total vehicle kilometres travelled in network (km)	36,878	38,897	5%
Total time travelled approaching and in network (hr)	2,316	2,356	2%
Total vehicles arrived	21,917	24,301	11%
Total number of stops	265,136	280,891	6%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	1.6	1.6	-3%
Average time travelled in network (mins)	6.0	5.7	-6%
Average number of stops	10.5	10.3	-2%
Average speed (km/h)	16.1	16.7	3%
Unreleased vehicles			
Unreleased demand (veh)	949	805	–
% of total traffic demand	4%	3%	–

12.4.3 Intersection performance

Table 12-11 presents the modelled AM and PM peak hour LoS for key intersections at the Wattle Street interchange.

Performance across the majority of the network is consistent between 'with project' and 'cumulative' scenarios, with intersections performing at the same or better levels of service. Performance improvements are noted in the 2033 PM peak hour 'cumulative' scenario when compared to the 'with project' scenario, as a result of reduced demand to and from Parramatta Road to the east.

Table 12-11 Wattle Street interchange: key intersection performance (LoS) – 2023 and 2033 'cumulative' scenarios

Key intersections	2015 'base case'	2023 'with project'	2023 'cumulative'	2033 'with project'	2033 'cumulative'
AM peak hour					
Parramatta Road/Sloane Street	B	B	B	C	C
Parramatta Road/Liverpool Road	C	C	C	C	C
Parramatta Road/Dalhousie Street	B	B	B	B	B
Parramatta Road/Bland Street	B	B	B	B	B
Parramatta Road/Wattle Street	E	E	D	E	E
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	D	D
Frederick Street/Church Street	B	C	C	C	D
Wattle Street/Ramsay Street	C	C	C	C	C

Key intersections	2015 'base case'	2023 'with project'	2023 'cumulative'	2033 'with project'	2033 'cumulative'
Dobroyd Parade/Waratah Street	A	A	B	B	B
City West Link/Timbrell Drive	C	D	C	D	C
PM peak hour					
Parramatta Road/Sloane Street	B	B	B	C	B
Parramatta Road/Liverpool Road	B	C	B	E	C
Parramatta Road/Dalhousie Street	B	B	B	B	B
Parramatta Road/Bland Street	B	B	B	B	B
Parramatta Road/Wattle Street	D	D	D	D	D
Parramatta Road/Great North Road	B	B	B	B	B
Parramatta Road/Arlington Street	B	C	C	D	D
Frederick Street/Church Street	B	B	B	B	B
Wattle Street/Ramsay Street	C	C	C	C	C
Dobroyd Parade/Waratah Street	A	A	A	A	A
City West Link/Timbrell Drive	D	E	D	F	F

12.4.4 Travel times

For the purpose of assessing travel times through the network, exit blocking constraints were retained to reflect network congestion at intersections beyond the modelled network extents.

Figure 12-3 and **Figure 12-4** highlight the difference in network travel times between 'with project' and 'cumulative' scenarios in the AM and PM peak hours, derived from microsimulation modelling.

In the AM peak hour, delay to vehicles destined for City West Link is reduced in the 'cumulative' scenario as a result of reduced forecast demand, particularly from the M4 East Wattle Street exit ramp. Elsewhere, travel times remain relatively consistent between 'with project' and 'cumulative' scenarios.

Travel times in the PM peak also remain similar to the 'with project' scenario outputs, highlighting the relatively minor difference in traffic flow patterns within the network between the two scenarios. The impact of Frederick Street blocking back is again prevalent, with significant travel times on City West Link to Frederick Street and M4-M5 Link to Wattle Street sections.

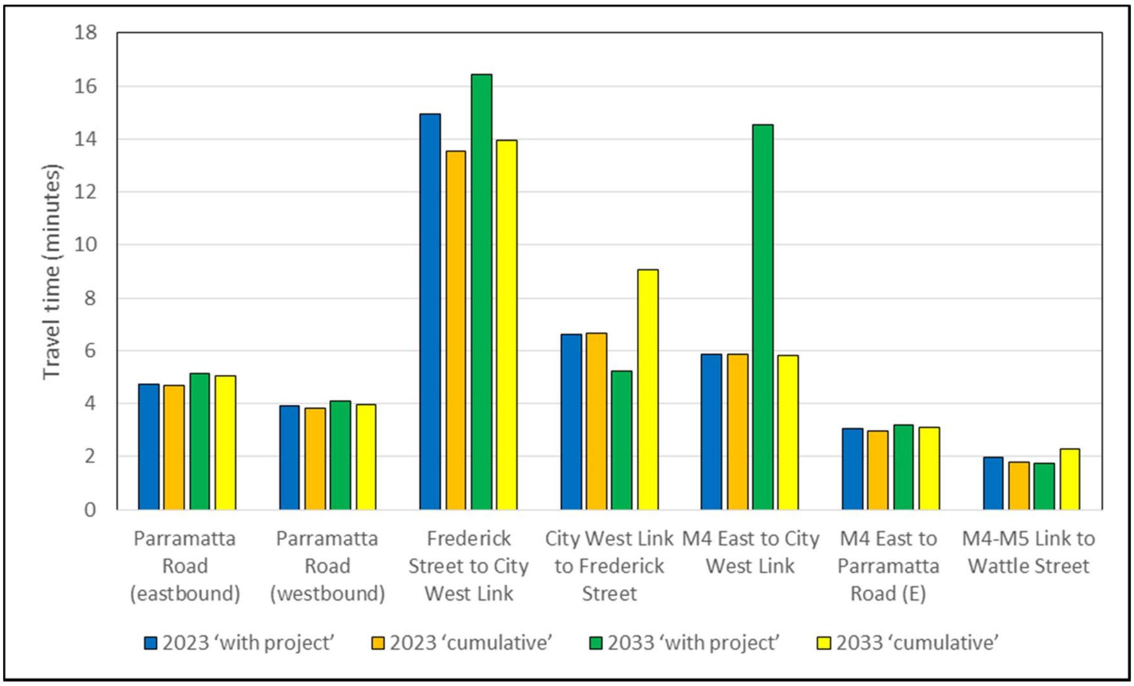


Figure 12-3 Wattle Street interchange: average travel time (mins) – AM peak hour 'cumulative' scenarios

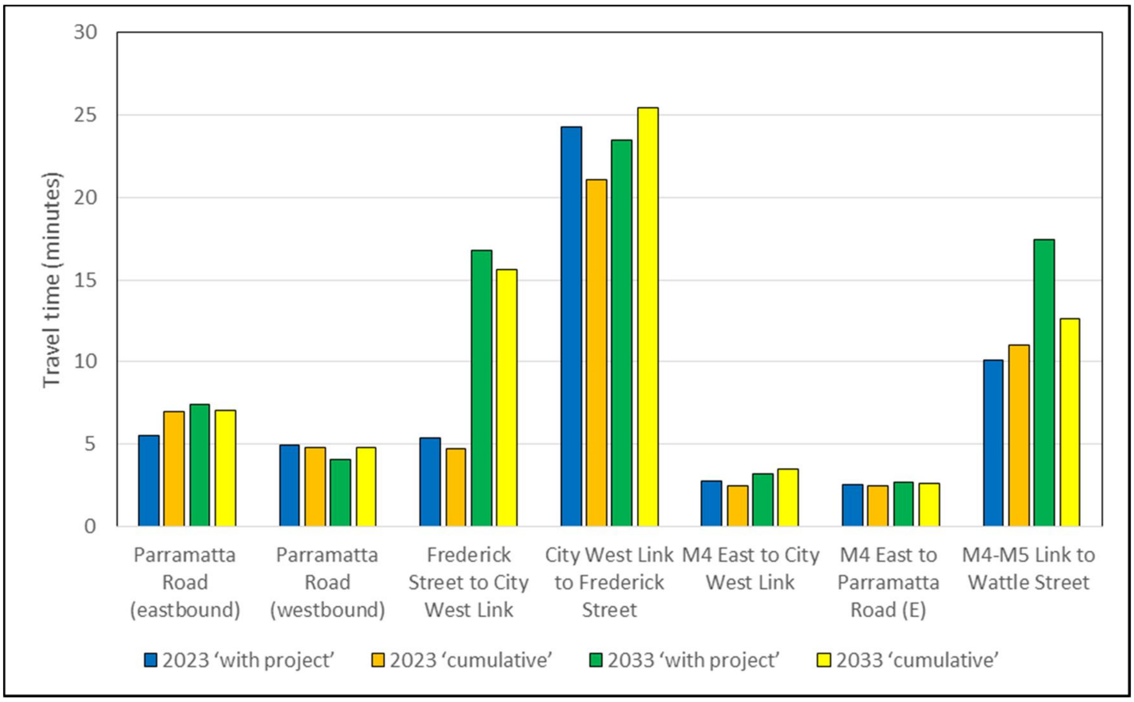


Figure 12-4 Wattle Street interchange: average travel time (mins) – PM peak hour 'cumulative' scenarios

12.4.5 Traffic crashes

Table 12-12 presents the crashes forecast under the 2023 'cumulative' scenario compared to the 'with project' scenario. Daily traffic on Parramatta Road is forecast to increase slightly in the 2023 'cumulative' scenario compared to the 'with project' scenario, resulting in no change to the total number of crashes, and a minimal increase in the cost of crashes of less than one per cent.

Table 12-12 Wattle Street interchange and surrounds: crash comparison between 2023 'cumulative' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	54,760	96	$10,363,200
2023 'cumulative'						
Parramatta Road	Wattle Street	City Road	6.6	54,950	96	$10,398,400

Table 12-13 compares the crashes forecast under the 2033 scenarios. Similar to the 2023 comparison, daily traffic on Parramatta Road is forecast to increase slightly, resulting in no change to the total number of crashes, and a minimal increase in cost of crashes of less than one per cent.

Table 12-13 Wattle Street interchange and surrounds: crash comparison between 2033 'cumulative' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'with project'						
Parramatta Road	Wattle Street	City Road	6.6	59,100	104	$11,184,200
2033 'cumulative'						
Parramatta Road	Wattle Street	City Road	6.6	59,150	104	$11,194,300

12.4.6 Public transport services

There is no change to public transport provision in the ‘cumulative’ scenario compared to the ‘with project’ scenario. **Figure 12-5** and **Figure 12-6** show a comparison in bus journey times between ‘with project’ and ‘cumulative’ scenarios in the AM and PM peak hours.

The results indicate that the travel times are similar between the two scenarios.

12.4.7 Active transport facilities

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

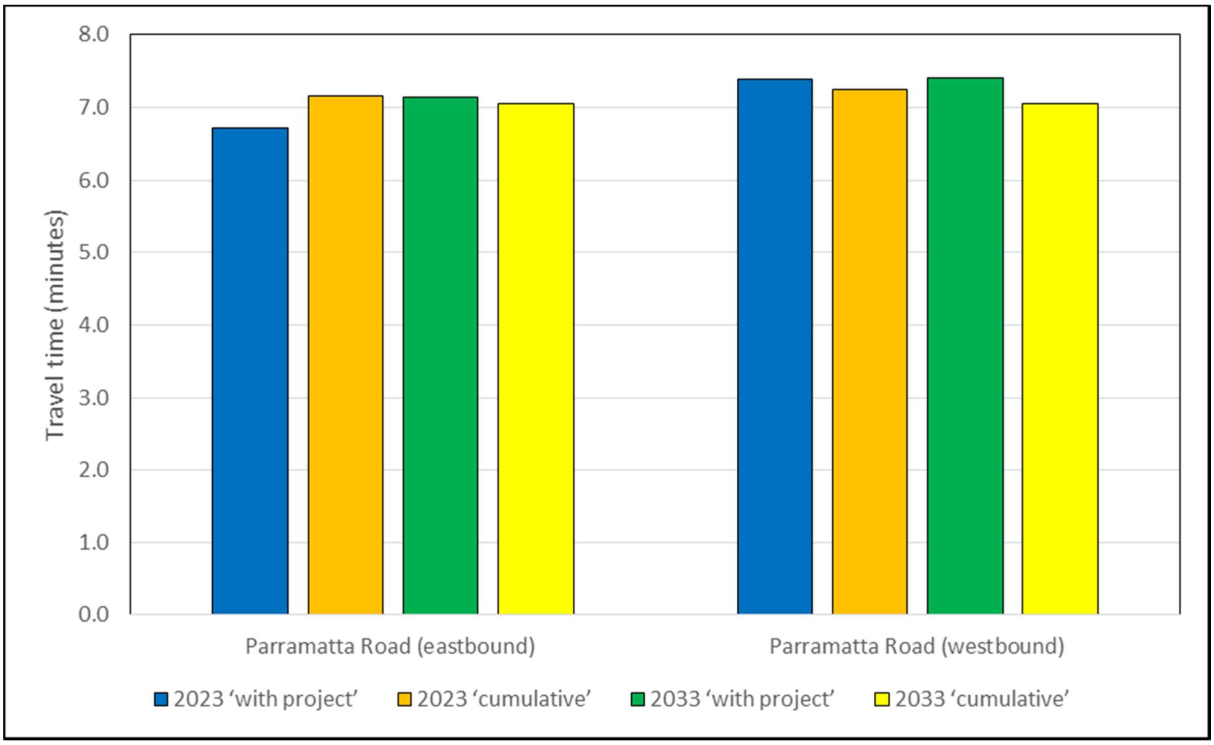


Figure 12-5 Wattle Street interchange: AM peak hour average bus travel time – 'cumulative' comparison

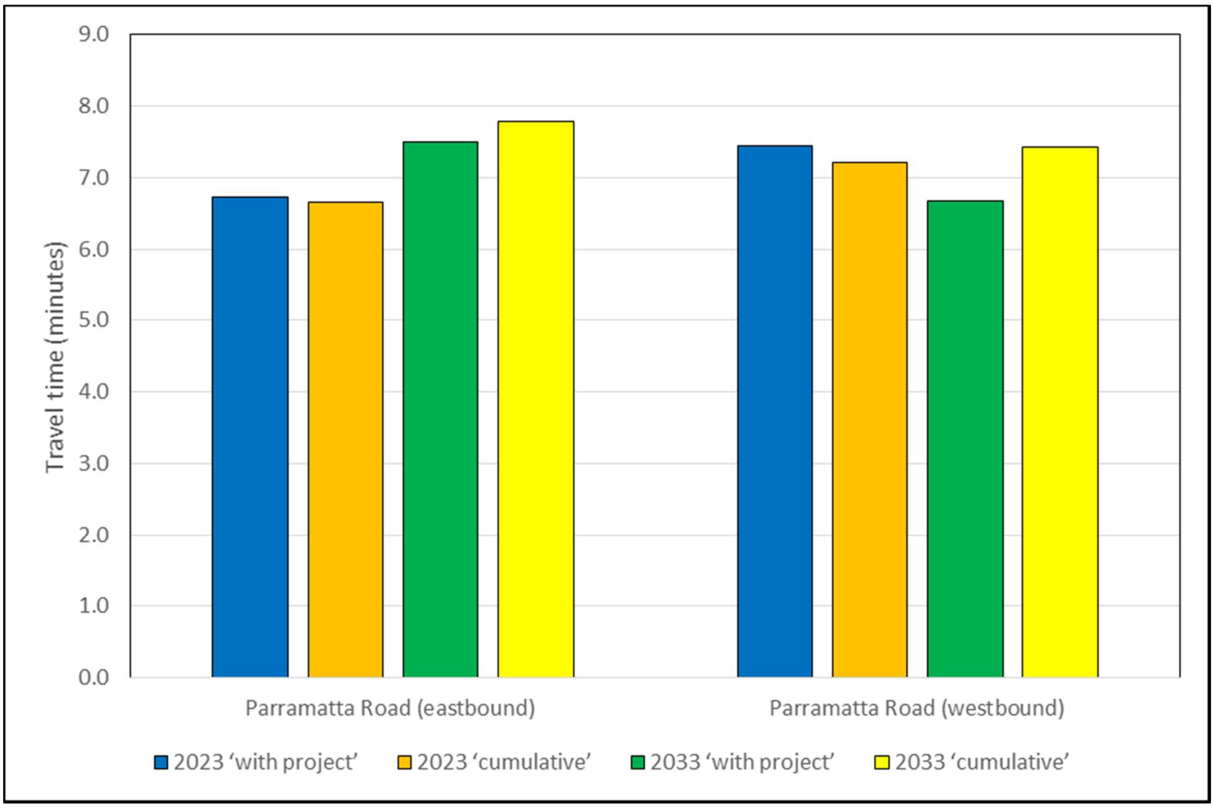


Figure 12-6 Wattle Street interchange: PM peak hour average bus travel time – 'cumulative' comparison

12.5 Operational performance – Rozelle interchange

12.5.1 Changes to road network in 'cumulative' scenario

Figure 12-7 shows the 'cumulative' road network. The 'cumulative' models include the proposed future Western Harbour Tunnel in the 2023 'cumulative' scenario, and the addition of the Beaches Link component in the 2033 'cumulative' scenario. The proposed future Western Harbour Tunnel and Beaches Link would connect to:

- The M5 to the south providing a north–south through route
- The M4 to the west providing an east–west through route.

This operational assessment does not assume there are surface connections between the proposed future Western Harbour Tunnel and Beaches Link and City West Link.

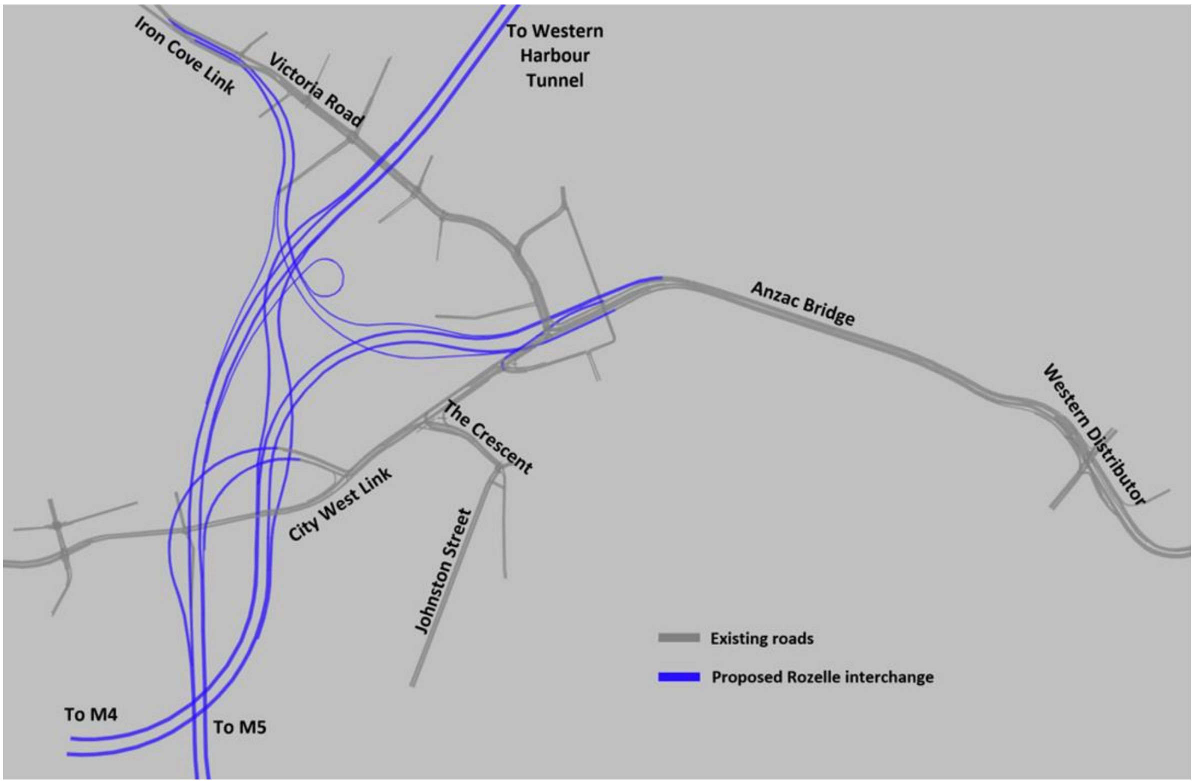


Figure 12-7 Rozelle interchange: 'cumulative' road network for operational traffic modelling

12.5.2 Network performance

2023 'cumulative' scenario

Table 12-14 and **Table 12-15** present a comparison of the performance of the road network as shown in **Figure 12-7**, between the 2023 'with project' and 'cumulative' scenarios for the AM and PM peak hours, using microsimulation modelling. The 'cumulative scenario introduces more tunnelled motorway links in the modelled area, and while the forecast traffic demand significantly increases after the opening of the proposed future Western Harbour Tunnel, the new links result in a substantial increase in the average vehicle speed in the network.

AM peak hour

In the AM peak hour, a 17 per cent increase in demand is forecast for the 'cumulative' scenario compared to the 'with project' scenario. In spite of this increase, compared with the 'with project' scenario, the 'cumulative' network is forecast to provide benefits to the Western Distributor and Anzac Bridge operation. This is primarily because of traffic shifting from the Sydney Harbour Bridge to the proposed future Western Harbour Tunnel. The results in **Table 12-14** show a significant improvement in overall network performance with higher average speed, fewer stops and fewer unreleased vehicles. However, without mitigation, queuing from the Bathurst Street exit ramp is forecast to remain an issue and is likely to extend up the exit ramp and impact eastbound flow on the Western Distributor and Anzac Bridge.

Table 12-14 Rozelle interchange network performance – AM peak hour (2023 'with project' vs 'cumulative' scenario)

Network measure	2023 'with project'	2023 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	25,327	29,689	17%
Total vehicle kilometres travelled in network (km)	73,188	91,329	25%
Total time travelled approaching and in network (hr)	6,308	4,139	-34%
Total vehicles arrived	23,799	29,253	23%
Total number of stops	274,030	127,991	-53%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.1	3.1	2%
Average time travelled in network (mins)	9.8	5.9	-40%
Average number of stops	10.1	4.0	-60%
Average speed (km/h)	18.8	31.7	69%
Unreleased vehicles			
Unreleased demand (veh)	2,309	703	–
% of total traffic demand	9%	2%	–

PM peak hour

In the PM peak, the forecast demand for the 'cumulative' scenario increases by about 10 per cent more than the 'with project' scenario. In spite of this increase, the modelled network is forecast to perform better in the 'cumulative' case compared to the 'with project' case. This is due to less traffic forecast to use the Western Distributor to head west across Anzac Bridge as traffic shifts to use the proposed future Western Harbour Tunnel.

Table 12-15 Rozelle interchange network performance – PM peak hour (2023 'with project' vs 'cumulative' scenario)

Network measure	2023 'with project'	2023 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	28,109	30,805	10%
Total vehicle kilometres travelled in network (km)	80,108	96,899	21%
Total time travelled approaching and in network (hr)	5,091	3,480	-32%
Total vehicles arrived	24,261	29,496	22%
Total number of stops	179,138	68,692	-62%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.3	3.3	-1%
Average time travelled in network (mins)	7.9	5.1	-36%
Average number of stops	6.4	2.1	-66%
Average speed (km/h)	25.1	39.0	56%
Unreleased vehicles			
Unreleased demand (veh)	2,655	1,351	–
% of total traffic demand	9%	4%	–

2033 'cumulative' scenario

Table 12-16 and **Table 12-17** present a comparison of the performance of the road network between the 2033 'with project' and 'cumulative' scenarios for the AM and PM peak hours, using microsimulation modelling.

AM peak hour

As in the 2023 'cumulative' scenario, the 2033 'cumulative' scenario provides some benefit to the Western Distributor and Anzac Bridge compared to the 'with project case', due to the shift in traffic to the proposed future Western Harbour Tunnel instead of Anzac Bridge and Sydney Harbour Bridge. This reassignment results in better flow for northbound traffic on Western Distributor towards Sydney Harbour Bridge in the AM peak. The result is that the network performance indicators all show significant improvements, despite a 24 per cent increase in forecast demand. However, the queue from the Bathurst Street exit ramp still has the potential to queue back to the Western Distributor and negatively impact eastbound traffic on Anzac Bridge.

Table 12-16 Rozelle interchange network performance – AM peak hour (2033 'with project' vs 'cumulative' scenario)

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	28,023	34,863	24%
Total vehicle kilometres travelled in network (km)	77,690	103,220	33%
Total time travelled approaching and in network (hr)	7,221	5,654	-22%
Total vehicles arrived	25,794	33,314	29%
Total number of stops	272,544	151,561	-44%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.0	3.1	3%
Average time travelled in network (mins)	9.3	6.0	-36%
Average number of stops	9.2	4.2	-55%
Average speed (km/h)	19.4	31.2	61%
Unreleased vehicles			
Unreleased demand (veh)	2,719	1,911	–
% of total traffic demand	10%	5%	–

PM peak hour

As in 2023, the 2033 'cumulative' network is forecast to perform better compared to the 'with project' case, despite a 15 per cent increase in forecast demand. Again, this is due to lower forecast volumes on the Western Distributor heading west across Anzac Bridge. As a result, the network performance is slightly better than the 'with project' network.

Table 12-17 Rozelle interchange network performance – PM peak hour (2033 'with project' vs 'cumulative' scenario)

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	30,259	34,705	15%
Total vehicle kilometres travelled in network (km)	86,924	102,632	18%
Total time travelled approaching and in network (hr)	5,286	4,820	-9%
Total vehicles arrived	27,082	32,230	19%
Total number of stops	92,817	81,682	-12%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.2	3.2	-1%
Average time travelled in network (mins)	6.1	5.2	-16%
Average number of stops	3.1	2.3	-25%
Average speed (km/h)	31.3	37.1	18%
Unreleased vehicles			

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
Unreleased demand (veh)	2,974	2,537	–
% of total traffic demand	10%	7%	–

12.5.3 Intersection performance

Table 12-18 presents the modelled AM and PM peak hour LoS for key intersections at Rozelle in the 2023 and 2033 'cumulative' scenarios compared to the 'with project' scenarios.

The forecast intersection performances in the 'cumulative' scenario are similar to the 'with project' scenario at most intersections in both peak hours. Improved performance is forecast at the Victoria Road/The Crescent intersection, as a result of traffic forecast to reassign to the proposed future Western Harbour Tunnel and Beaches Link project.

However, as in the 'with project' scenario, the Victoria Road/Lyons Road intersection in both peak hours, the Victoria Road/Darling Street and Victoria Road/Robert Street intersections in the AM peak hour and The Crescent/Johnston Street intersection in both peak hours remain at or over capacity due to the forecast demands.

Table 12-18 Rozelle interchange: key intersection performance (LoS) – 2023 and 2033 'cumulative' scenarios

Key intersections	2015 'base case'	2023 'with project'	2023 'cumulative'	2033 'with project'	2033 'cumulative'
AM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	D	C	C	D	C
Victoria Road/Darling Street	F	F	F	F	F
Victoria Road/Robert Street	D	C	C	F	E
Victoria Road/The Crescent	B	C	C	D	D
The Crescent/James Craig Road	A	B	A	B	B
City West Link/The Crescent	B	C	C	D	C
The Crescent/Johnston Street	C	C	C	C	F
The Crescent/M5 ramps	–	B	B	B	B
PM peak hour					
Victoria Road/Lyons Road	D	F	F	F	F
Victoria Road/Wellington Street	B	B	B	C	C
Victoria Road/Darling Street	F	D	D	D	D
Victoria Road/Robert Street	F	C	C	C	C
Victoria Road/The Crescent	F	C	C	C	C
The Crescent/James Craig Road	B	A	A	A	A
City West Link/The Crescent	D	B	C	C	C
The Crescent/Johnston Street	F	F	F	F	F
The Crescent/M5 ramps	–	B	B	B	C

12.5.4 Travel times

Figure 12-8 and **Figure 12-9** show the travel time on Victoria Road/Iron Cove Link and City West Link, including Anzac Bridge in the AM and PM peak hours derived from microsimulation modelling.

In the AM peak hour, travel times in the peak eastbound direction are forecast to significantly reduce in the 'cumulative' scenario in both 2023 and 2033. In the westbound direction, increases in travel times to Iron Cove Bridge via Victoria Road are forecast due to the combination of forecast increase in demand to Victoria Road and the congestion on Victoria Road to the north (through Drummoyne) causing traffic to queue back on Victoria Road.

In the PM peak hour, the westbound travel time is forecast to remain similar between the 'project' and 'cumulative' scenarios.

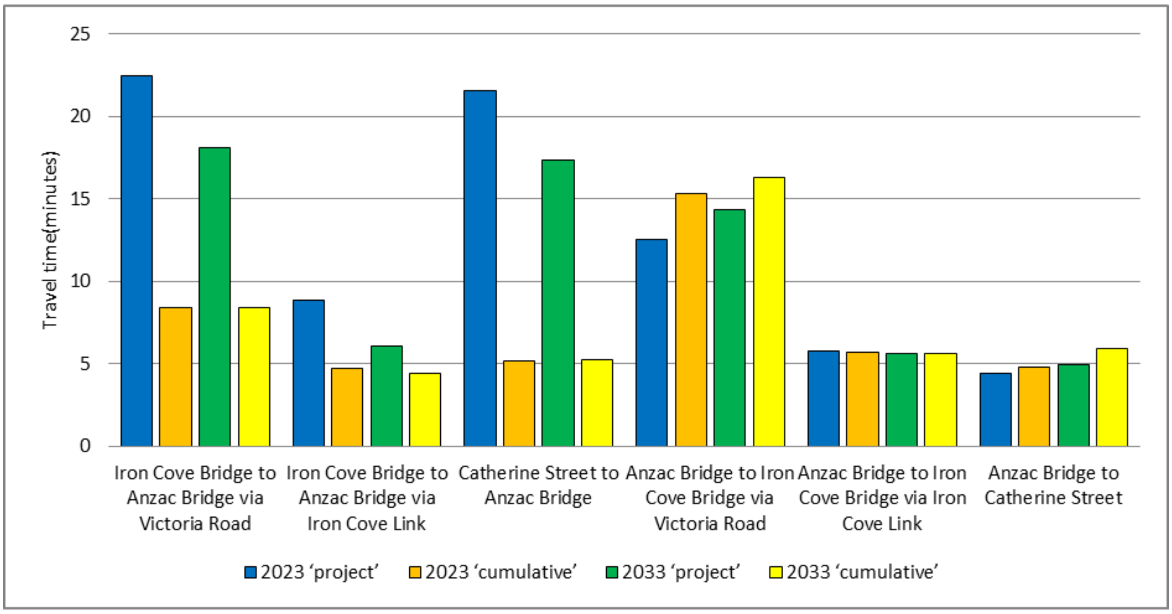


Figure 12-8 Rozelle interchange: average travel time (mins) – AM peak hour 'cumulative' scenarios

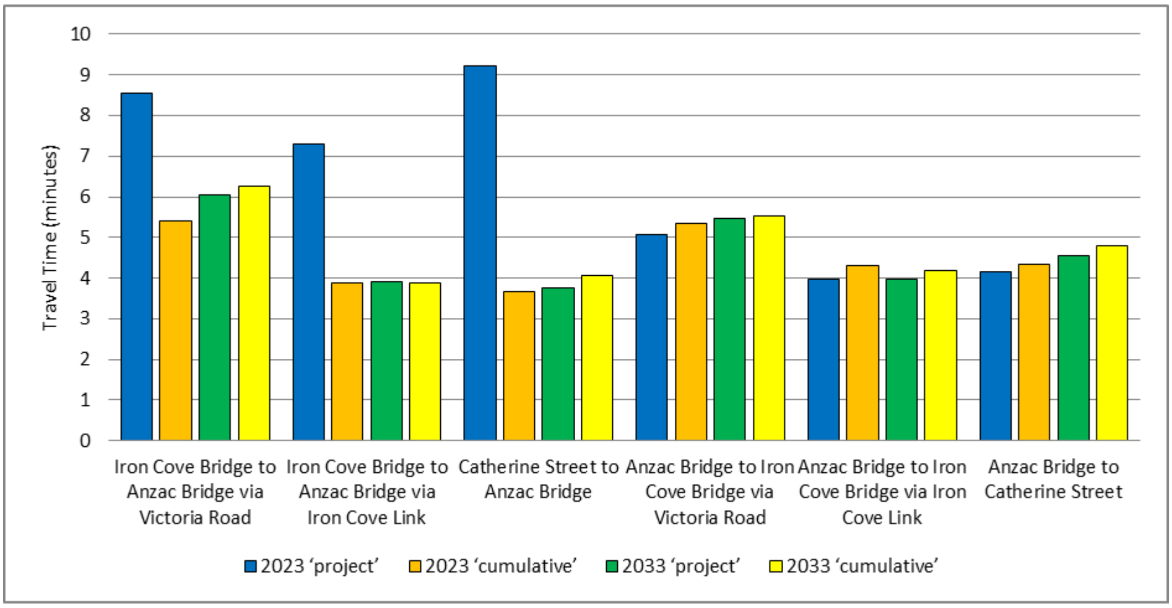


Figure 12-9 Rozelle interchange: average travel time (mins) – PM peak hour 'cumulative' scenarios

12.5.5 Traffic crashes

Table 12-19 presents the crashes forecast under the 2023 'cumulative' scenario compared to the 'with project' scenario.

Daily traffic on Anzac Bridge is forecast to decrease in the 2023 'cumulative' scenario compared to the 'with project' scenario, resulting in a decrease in total number and cost of crashes. However, forecast increases in daily traffic on other roads in the vicinity, especially The Crescent and Johnston Street, result in an increase in the total number and cost of crashes at these locations compared to the 'with project' scenario of about six per cent.

Table 12-19 Rozelle and surrounds: crash comparison between 2023 'cumulative' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	193,310	31	$7,906,200
City West Link	James Street	Victoria Road	2.13	69,810	27	$6,729,500
Victoria Road	Darling Street	The Crescent	0.85	61,640	14	$3,956,000
Lilyfield Road	Victoria Road	Canal Road	2.48	9,644	18	$5,196,000
The Crescent	City West Link	Wigram Road	1.32	32,600	14	$3,391,500
Johnston Street	The Crescent	Parramatta Road	1.80	20,621	16	$4,308,800
2023 'cumulative'						
Anzac Bridge	Miller Street	Victoria Road	0.99	181,440	29	$7,420,700
City West Link	James Street	Victoria Road	2.13	74,030	29	$7,136,300
Victoria Road	Darling Street	The Crescent	0.85	61,080	14	$3,920,100
Lilyfield Road	Victoria Road	Canal Road	2.48	8,361	16	$4,504,400
The Crescent	City West Link	Wigram Road	1.32	44,000	19	$4,577,500
Johnston Street	The Crescent	Parramatta Road	1.80	26,369	21	$5,509,900

Table 12-20 compares the crashes forecast under the 2033 scenarios. Similar to the 2023 comparison, daily traffic on Anzac Bridge is forecast to decrease, resulting in a decrease in total number and cost of crashes, while forecast increases in daily traffic on other roads in the vicinity, especially The Crescent and Johnston Street, result in an increase in the total number and cost of crashes at these locations. Compared to the 2033 'with project' scenario, there is an overall increase of about three per cent.

Table 12-20 Rozelle and surrounds: crash comparison between 2033 'cumulative' and 'with project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'with project'						
Anzac Bridge	Miller Street	Victoria Road	0.99	210,110	34	$8,593,300
City West Link	James Street	Victoria Road	2.13	88,450	35	$8,526,300
Victoria Road	Darling Street	The Crescent	0.85	72,340	16	$4,642,700
Lilyfield Road	Victoria Road	Canal Road	2.48	10,855	21	$5,848,100
The Crescent	City West Link	Wigram Road	1.32	40,650	18	$4,229,000
Johnston Street	The Crescent	Parramatta Road	1.80	24,716	19	$5,164,400
2033 'cumulative'						
Anzac Bridge	Miller Street	Victoria Road	0.99	192,540	31	$7,874,700
City West Link	James Street	Victoria Road	2.13	90,360	36	$8,710,500
Victoria Road	Darling Street	The Crescent	0.85	71,090	16	$4,562,500
Lilyfield Road	Victoria Road	Canal Road	2.48	9,821	19	$5,291,100
The Crescent	City West Link	Wigram Road	1.32	50,970	23	$5,302,600
Johnston Street	The Crescent	Parramatta Road	1.80	29,871	23	$6,241,600

12.5.6 Public transport services

Figure 12-10 and **Figure 12-11** show the comparison in travel times for buses between the 'cumulative' and 'with project' scenarios for the AM and PM peak hours. The main bus route on Victoria Road, Anzac Bridge and the bus lanes to and from Druitt Street is presented.

With the reduction in demand over Anzac Bridge, citybound bus journey times are forecast to improve in AM and PM peak hours. However, with the combination of the increase in demand to Victoria Road and the congestion on Victoria Road to the north causing traffic to queue back along Victoria Road, outbound bus journey times are forecast to increase during the AM peak hour. During the PM peak hour, the outbound bus journey times remain similar to the 'with project' scenario.

12.5.7 Active transport facilities

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

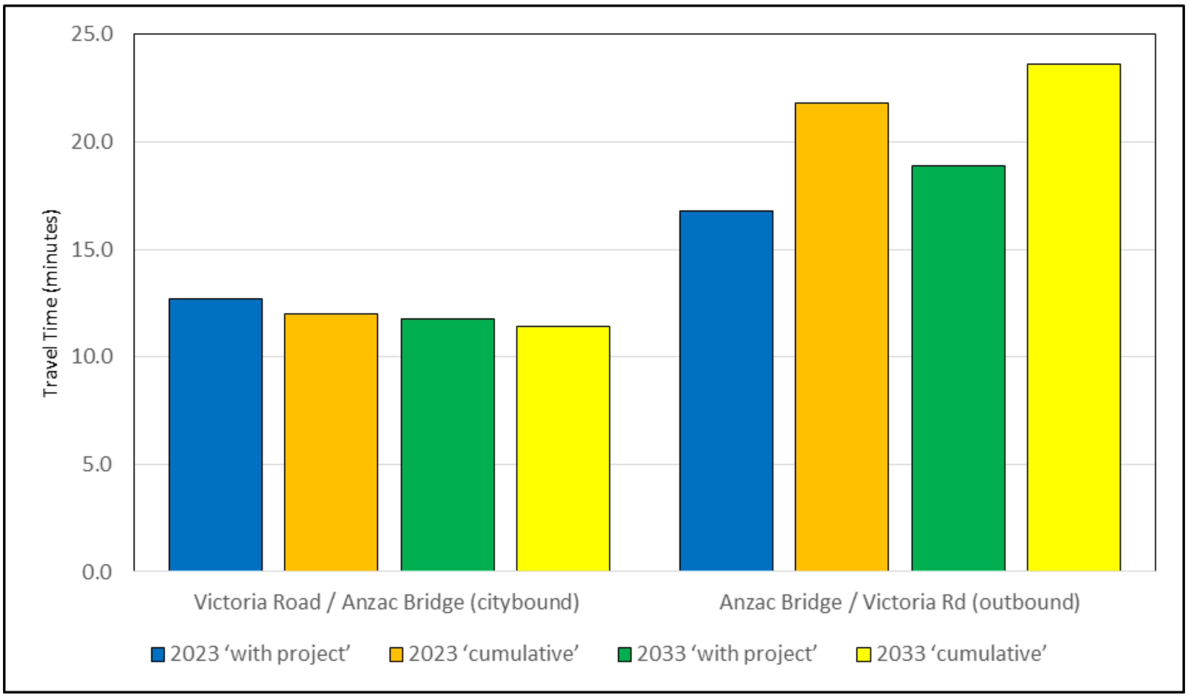


Figure 12-10 Rozelle interchange: average travel time for buses – AM peak hour 'cumulative' comparison

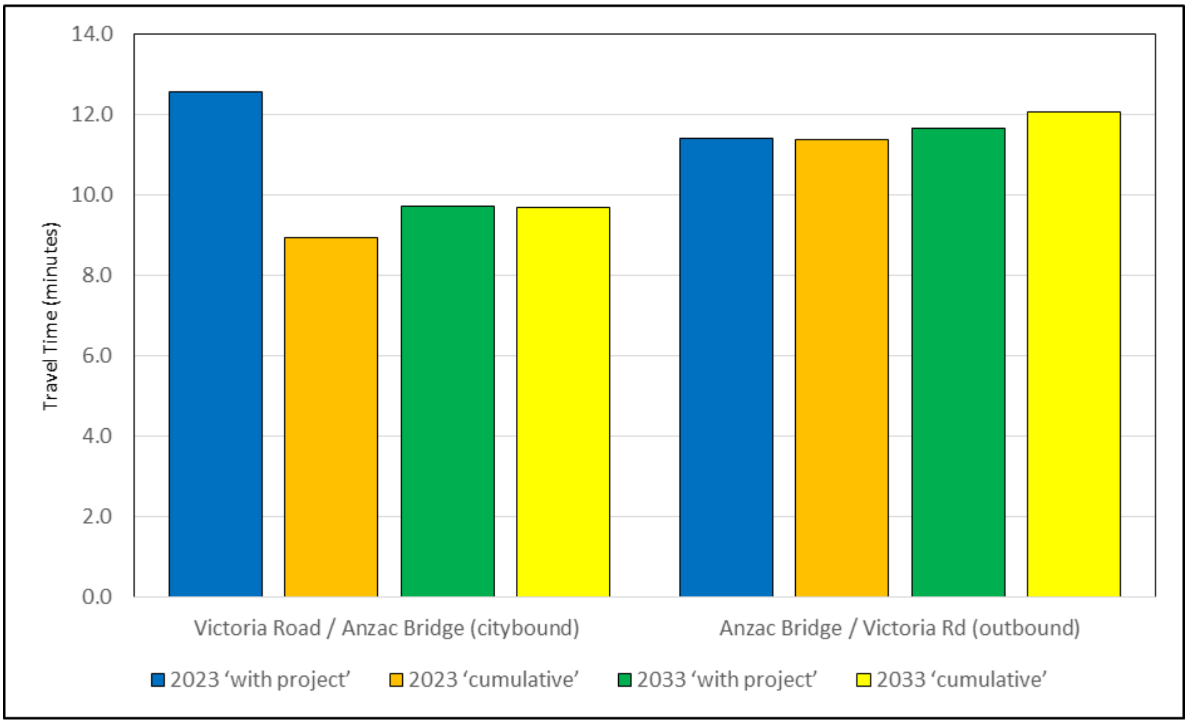


Figure 12-11 Rozelle interchange: average travel time for buses – PM peak hour 'cumulative' comparison

12.5.8 Cumulative scenario with proposed future Western Harbour Tunnel and Beaches Link surface ramps at City West Link

While the construction impact of the proposed future Western Harbour Tunnel and Beaches Link entry and exit ramps connecting to City West Link is included in this EIS, the operational traffic impact of these ramps has not been included in this traffic assessment.

A preliminary assessment with these ramps operational has been carried out and indicates that there is likely to be some reduction in traffic on the Western Distributor and Sydney Harbour Bridge, as more traffic would be able to access the proposed future Western Harbour Tunnel and Beaches Link. However, there is likely to be increased traffic on City West Link, The Crescent and Johnston Street. The impacts of these surface ramps would be assessed in detail as part of future environmental assessment for the proposed future Western Harbour Tunnel and Beaches Link to be carried out by others.

12.6 Operational performance – St Peters interchange

12.6.1 Changes to road network in ‘cumulative’ scenario

In the 2023 and 2033 ‘cumulative’ scenarios, Sydney Gateway is included in the St Peters interchange modelled road network. This provides a new link from the St Peters interchange to the Sydney Airport/Port Botany precinct. Sydney Gateway also connects to a realigned Airport Drive and Coward Street extension. The realigned Airport Drive connects to Princes Highway via existing Bellevue Street.

As part of the Sydney Gateway project, in the vicinity of the Sydney Airport Domestic Airport, a new flyover bypasses Airport Drive intersections with Robey Street and O’Riordan Street. This new flyover means Airport Drive/Robey Street and Airport Drive/O’Riordan Street intersection layout adjustments, as follows:

- Airport Drive/Robey Street intersection: westbound through movement removed as a result of the flyover and a free flow left turn from Domestic Airport
- Airport Drive/O’Riordan Street intersection: due to reduced demand for right turn, lane configuration on O’Riordan Street southbound changed to provide three through lanes for Domestic Airport access, one bus lane and one right turn lane.

While investigations into the King Street Gateway project are underway, no confirmed road layout changes are available, and so this project has not been included in the operational modelling around the St Peters interchange.

The full forecast demand to and from the Sydney Airport precinct is used in the models of the ‘cumulative’ scenarios.

12.6.2 Network performance

2023 ‘cumulative’ scenario

Table 12-21 and **Table 12-22** present a comparison of the performance of the road network, between the 2023 ‘with project’ and ‘cumulative’ scenarios for the AM and PM peak hours, using microsimulation modelling. The network performance improvement is mainly attributable to improved connectivity between the airport area and St Peters interchange, with vehicles not having to travel through the Mascot area, thereby bypassing a number of signalised intersections with limited capacity.

AM peak hour

The AM peak hour network performance results show overall improvement compared to the ‘with project’ scenario. Despite the total demand being eight per cent higher, total travel time is shorter and more vehicles are able to reach their destination. In addition, vehicles experience fewer stops on average and average speed in the network is forecast to significantly increase. The ‘cumulative’ scenario network is better able to cope with increased demand, which is reflected in fewer unreleased vehicles, without the need to cap demand.

Table 12-21 St Peters interchange network performance – AM peak hour (2023 'with project' vs 'cumulative' scenario)

Network measure	2023 'with project'	2023 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	28,470	30,710	8%
Total vehicle kilometres travelled in network (km)	89,120	108,010	21%
Total time travelled approaching and in network (hr)	5,350	4,110	-23%
Total vehicles arrived	26,190	29,490	13%
Total number of stops	205,570	147,220	-28%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	3.3	12%
Average time travelled in network (mins)	8.9	6.8	-24%
Average number of stops	7.9	5.0	-36%
Average speed (km/h)	19.9	29.1	46%
Unreleased vehicles			
Unreleased demand (veh)	2,470	1,390	–
% of total traffic demand	9%	5%	–
Demand reduction to/from Sydney Airport precinct (veh)	720	–	–

PM peak hour

The PM peak hour network performance results show a similar trend to the AM peak hour. Total demand increases, but total travel time drops, with more vehicles reaching their destination.

All measures per vehicle indicate improved network operation with average speed in the network increasing by almost 30 per cent. In addition, the number of unreleased vehicles is comparable to the 'with project' scenario without the need to cap demand.

Table 12-22 St Peters interchange network performance – PM peak hour (2023 'with project' vs 'cumulative' scenario)

Network measure	2023 'with project'	2023 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	27,920	29,180	5%
Total vehicle kilometres travelled in network (km)	90,610	100,810	11%
Total time travelled approaching and in network (hr)	4,710	4,140	-12%
Total vehicles arrived	26,600	28,030	5%
Total number of stops	186,400	160,720	-14%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.9	3.2	8%
Average time travelled in network (mins)	8.6	7.3	-15%

Network measure	2023 'with project'	2023 'cumulative'	Percentage change
Average number of stops	7.0	5.7	-18%
Average speed (km/h)	20.4	26.0	27%
Unreleased vehicles			
Unreleased demand (veh)	1,030	1,040	–
% of total traffic demand	4%	4%	–
Demand reduction to/from Sydney Airport precinct (veh)	360	–	–

2033 'cumulative' scenario

Table 12-23 and **Table 12-24** present a comparison of the performance of the road network between the 2033 'with project' and 'cumulative' scenarios for the AM and PM peak hours, using microsimulation modelling.

AM peak hour

The 2033 AM peak network performance results show overall improvement, although not as significant as in 2023. Even though the total forecast demand is higher than the 'with project' forecast demand, more vehicles are forecast to reach their destination. Average measures per vehicle show improvement and there are fewer unreleased vehicles.

Table 12-23 St Peters interchange network performance – AM peak hour (2033 'with project' vs 'cumulative' scenario)

Network measure	2033 'with project'	2033 'cumulative'	Percentage change
All vehicles			
Total traffic demand (veh)	31,990	36,820	15%
Total vehicle kilometres travelled in network (km)	92,690	131,490	42%
Total time travelled approaching and in network (hr)	7,890	7,470	-5%
Total vehicles arrived	27,130	32,980	22%
Total number of stops	250,290	253,840	1%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.8	3.3	17%
Average time travelled in network (mins)	10.9	10.0	-9%
Average number of stops	9.2	7.7	-17%
Average speed (km/h)	15.7	20.1	28%
Unreleased vehicles			
Unreleased demand (veh)	4,310	2,760	–
% of total traffic demand	13%	7%	–
Demand reduction to/from Sydney Airport precinct (veh)	830	–	–

PM peak hour

The 2033 PM peak network performance results show significantly better network operation in ‘cumulative’ scenario. Even with total forecast demand higher by 14 per cent, total travel time is shorter and the number of vehicles arriving at their destination increases. In the ‘with project’ scenario, the network performs poorly, with an average speed of about 11 kilometres per hour. In the ‘cumulative’ scenario, with higher demand, the average speed in the network is forecast to improve significantly. In addition, the number of unreleased vehicles is substantially reduced without the need to cap demand.

Table 12-24 St Peters interchange network performance – PM peak hour (2033 ‘with project’ vs ‘cumulative’ scenario)

Network measure	2033 ‘with project’	2033 ‘cumulative’	Percentage change
All vehicles			
Total traffic demand (veh)	30,990	35,240	14%
Total vehicle kilometres travelled in network (km)	84,000	123,080	47%
Total time travelled approaching and in network (hr)	9,700	6,130	-37%
Total vehicles arrived	24,120	32,550	35%
Total number of stops	248,790	204,030	-18%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	2.7	3.3	20%
Average time travelled in network (mins)	14.5	8.7	-40%
Average number of stops	10.3	6.3	-39%
Average speed (km/h)	11.2	22.6	101%
Unreleased vehicles			
Unreleased demand (veh)	6,340	2,370	–
% of total traffic demand	20%	7%	–
Demand reduction to/from Sydney Airport precinct (veh)	420	–	–

Overall, the network around St Peters in the ‘cumulative’ scenario performs better in both forecast years and both peak hours, with the most improvement occurring in the 2033 PM ‘cumulative’ scenario. Despite higher total demand, each ‘cumulative’ scenario records higher average speed in the network and has more vehicles arriving at their destination than the corresponding ‘with project’ case.

The Sydney Gateway connection to and from the St Peters interchange takes a considerable amount of traffic from the Mascot area, contributing to the better operation of the network and accommodation of the full forecast traffic demand.

12.6.3 Intersection performance

Table 12-25 presents the modelled AM and PM peak hour LoS for key intersections at St Peters in the 2023 and 2033 ‘cumulative’ scenarios compared to the ‘with project’ scenarios. The results show that in both forecast years and peak hours, many intersections operate at similar or better LoS in the ‘cumulative’ scenario’ compared to the ‘with project’ scenario, mainly as a result of the proposed future Sydney Gateway.

Table 12-25 St Peters interchange: key intersection performance (LoS) – 2023 and 2033 'cumulative' scenarios

Key intersections	2015 'base case'	2023 'with project'	2023 'cumulative'	2033 'with project'	2033 'cumulative'
AM peak hour					
Princes Highway/Sydney Park Road	C	C	C	C	C
Princes Highway/May Street	D	C	C	D	C
Princes Highway/Canal Road	D	F	E	F	F
Princes Highway/Railway Road	F	F	F	F	F
Sydney Park Rd/Mitchell Road	C	C	B	C	D
Euston Road/Sydney Park Road	A	C	C	D	E
Unwins Bridge Road/Campbell Street	C	D	D	F	E
Campbell Road/Euston Road	A	C	D	D	E
Campbell Road/Bourke Road	–	D	C	F	E
Princes Highway/Campbell Street	C	F	F	F	F
Ricketty Street/Kent Road*	C	D	D	F	F
Gardeners Road/Kent Road*	A	D	C	F	F
Gardeners Road/Bourke Road	C	E	C	F	F
Gardeners Rd/O'Riordan Street*	D	F	F	F	F
PM peak hour					
Princes Highway/Sydney Park Road	D	B	C	C	F
Princes Highway/May Street	F	C	B	B	C
Princes Highway/Canal Road	D	C	F	E	D
Princes Highway/Railway Road	D	F	F	F	F
Sydney Park Rd/Mitchell Road	D	C	C	D	C
Euston Road/Sydney Park Road	B	D	C	D	D
Unwins Bridge Road/Campbell Street	D	E	D	F	F
Campbell Road/Euston Road	A	D	D	F	F
Campbell Road/Bourke Road	–	C	D	F	D
Princes Highway/Campbell Street	D	E	E	E	F
Ricketty Street/Kent Road*	C	D	B	F	C
Gardeners Road/Kent Road*	A	D	B	F	C
Gardeners Road/Bourke Road	D	F	D	F	F
Gardeners Rd/O'Riordan Street*	E	F	F	F	F

*These intersections have upgrades in the 'with project' scenarios

12.6.4 Travel times

Figure 12-12 and **Figure 12-13** show a comparison of travel times on routes in 2023 and 2033 under 'with project' and 'cumulative' scenarios in the AM and PM peak hours, derived from microsimulation modelling.

In the 2023 AM peak hour, travel times for routes that do not run through Mascot are very comparable between scenarios. However, the Domestic Airport to King Street and Railway Road to Gardeners Road routes are forecast to have reductions in travel times in the ‘cumulative’ scenario. The 2033 AM peak hour travel times show a similar trend, with the exception of Gardeners Road to Railway Road route.

The PM peak hour travel times generally follow the same trend as the AM peak hour. In both forecast years, travel times on routes not running through Mascot are comparable. The Domestic Airport to King Street (and reverse) and Railway Road to Gardeners Road routes are forecast to benefit from Sydney Gateway and are forecast to have large reductions in travel times in the ‘cumulative’ scenario.

The ‘cumulative’ scenario takes a considerable amount of traffic from the Mascot area, which generally cases results in travel time reduction for corresponding travel time routes.

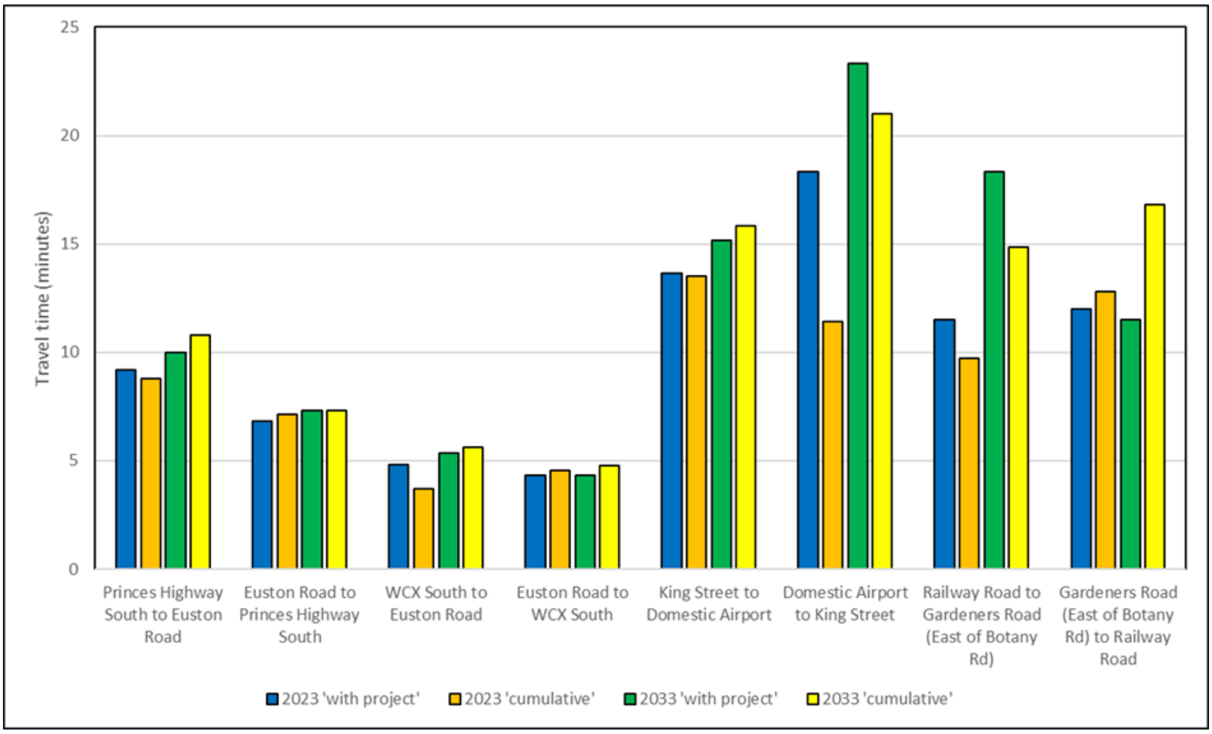


Figure 12-12 St Peters interchange: average travel time (mins) – AM peak hour ‘cumulative’ scenarios

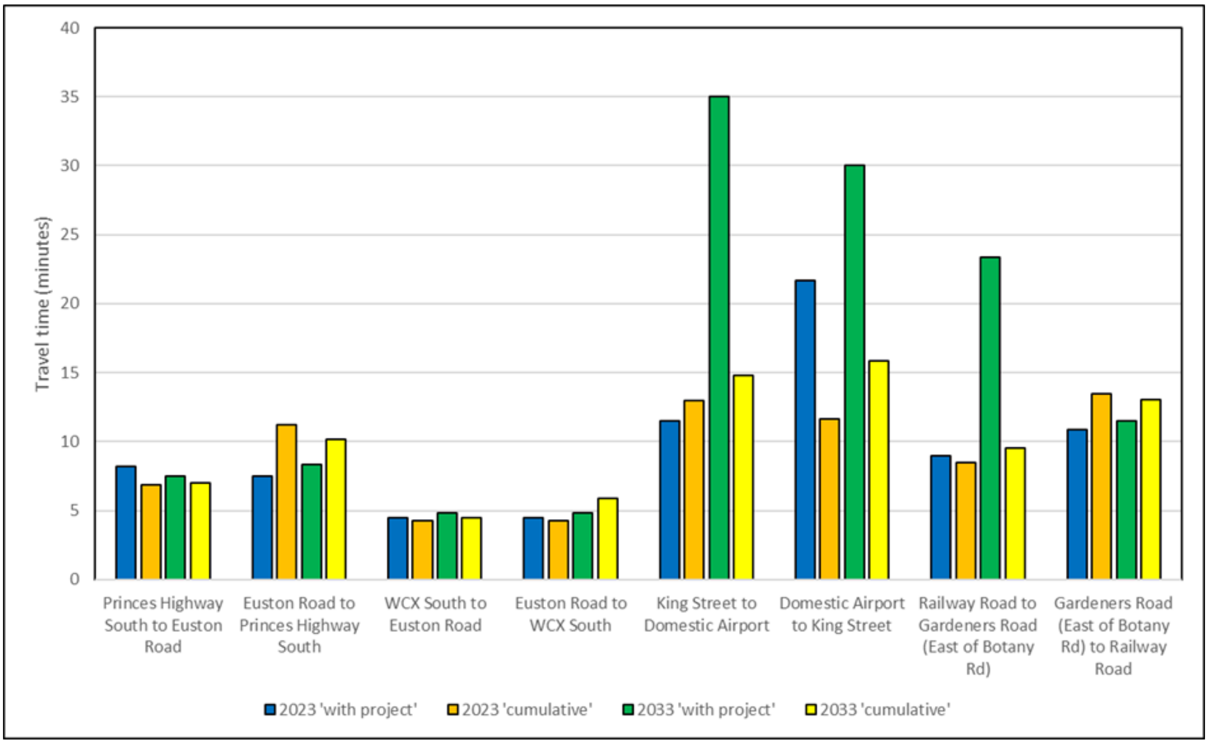


Figure 12-13 St Peters interchange: average travel time (mins) – PM peak hour ‘cumulative’ scenarios

12.6.5 Traffic crashes

As before, it was assumed that the frequency of crashes on surface roads in the vicinity of the St Peters area and on the M5 East and the New M5 motorways would change relative to forecast traffic changes and historical crash rates for these roads. This approach is the same as outlined for the ‘without project’ crash analysis undertaken in **section 6.6.3**.

Table 12-26 presents the crashes forecast under the 2023 ‘cumulative’ scenario compared to the ‘with project’ scenario. The forecast change in daily traffic on the surface roads in the vicinity of the St Peters area varies. There are increases of around five per cent forecast for Euston Road and Bourke Road. A significant decrease of almost 60 per cent is forecast for Prince Highway between Enmore Road and Gannon Street, and for Canal Road/ Ricketty Street/ Gardeners Road.

Table 12-26 shows that there is an overall decrease in the number of cost of annual crashes on surface roads in the vicinity of the St Peters area in the ‘cumulative’ scenario.

Table 12-26 St Peters and surrounds: crash comparison between 2023 ‘with project’ and ‘cumulative’ scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 ‘with project’						
Princes Highway	Enmore Road	Gannon Street	3.8	57,230	91	$9,442,400
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	21,820	27	$2,383,700
Euston Road	Sydney Park Road	Campbell Road	0.9	45,330	34	$2,611,200
Bourke Road	Wyndham Street	Gardeners	2.1	25,250	27	$2,072,900

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
		Road				
2023 'cumulative'						
Princes Highway	Enmore Road	Gannon Street	3.8	23,540	38	$3,883,900
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	9,900	12	$1,081,500
Euston Road	Sydney Park Road	Campbell Road	0.9	47,660	35	$2,745,400
Bourke Road	Wyndham Street	Gardeners Road	2.1	26,810	29	$2,201,000

Table 12-27 compares the crashes forecast under the 2033 'with project' and 'cumulative' scenarios. In the 2033 'cumulative' scenario, the forecast increase in traffic on Euston Road would cause an increase in the total number and cost of crashes on Euston Road, south of Sydney Park Road. However, the significant decrease in daily traffic forecast on Princes Highway, between Gannon Street and Enmore Road, and on Canal Road/ Ricketty Street/ Gardeners Road, would result in a reduction in the total number and cost of crashes on these roads.

Table 12-27 shows that there is a significant reduction in the number and cost of crashes at these locations of about 37 per cent compared to the 'with project' scenario.

Table 12-27 St Peters and surrounds: crash comparison between 2033 'with project' and 'cumulative' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2033 'with project'						
Princes Highway	Enmore Road	Gannon Street	3.8	61,780	99	$10,193,100
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	24,000	29	$2,621,900
Euston Road	Sydney Park Road	Campbell Road	0.9	49,540	37	$2,853,700
Bourke Road	Wyndham Street	Gardeners Road	2.1	26,450	29	$2,171,500
2033 'cumulative'						
Princes Highway	Enmore Road	Gannon Street	3.8	23,510	38	$3,878,900
Canal Road/ Ricketty Street/ Gardeners Road	Princes Highway	Botany Road	2.4	11,330	14	$1,237,700
Euston Road	Sydney Park Road	Campbell Road	0.9	54,230	40	$3,123,900
Bourke Road	Wyndham Street	Gardeners Road	2.1	27,200	29	$2,233,000

Table 12-28 presents the changes in crashes forecast under the 'with project' scenario compared to the 'cumulative' scenario on the M5 East Motorway and the New M5.

The analysis has been undertaken assuming the future frequency, type, and severity of crashes on the M5 East Motorway would be consistent with historic trends. This is a conservative estimate, as the crash rates are likely to improve with a reduction in congestion. The crash rates on the existing Sydney motorway tunnels (Lane Cove, Eastern Distributor, Cross City and Sydney Harbour tunnels) were used for the New M5.

In the 2023 'cumulative' scenario, the forecast traffic on the M5 corridor is similar to the 'with project' scenario, and there are no changes forecast regarding the number of crashes on the M5 corridor.

In the 2033 'cumulative' scenario, while there is a forecast shift in traffic to use the F6 Extension, overall, the volume of vehicles on the M5 corridor is similar when compared to the 2033 'with project' scenario. As a result, there is no change in traffic accidents forecast for the M5 corridor in the 'cumulative' scenario.

Table 12-28 M5 East and New M5 Motorways: crash comparison between 'with project' and 'cumulative project' scenarios

Road	Section from	Section to	Section length (km)	ADT (veh)	Average annual crashes	Average annual cost
2023 'with project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	49,850	61	$3,745,000
New M5	Western portal	St Peters portal	8.8	29,450	11	$626,500
Total					72	$4,371,500
2023 'cumulative'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	49,540	61	$3,721,700
New M5	Western portal	St Peters portal	8.8	29,600	11	$629,700
Total					72	$4,351,400
2033 'with project'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	58,720	72	$4,411,400
New M5	Western portal	St Peters portal	8.8	35,820	13	$762,000
Total					85	$5,173,400
2033 'cumulative'						
M5 East Motorway	King Georges Road	General Holmes Drive	9.5	55,820	69	$4,193,500
New M5	Western portal	F6 Extension	5.8	28,320	7	$393,700
New M5	F6 Extension	St Peters portal	3	77,260	10	$549,300
Total					85	$5,136,500

12.6.6 Public transport services

Figure 12-14 shows the comparison in average bus travel time across the St Peters modelled road network between the 'cumulative' and 'with project' scenarios for the AM and PM peak hours.

In the AM peak hour, the average bus travel time is similar across the scenarios. In the PM peak hour, the average bus travel times increase slightly in 2023 and 2033 in the 'cumulative' scenarios.

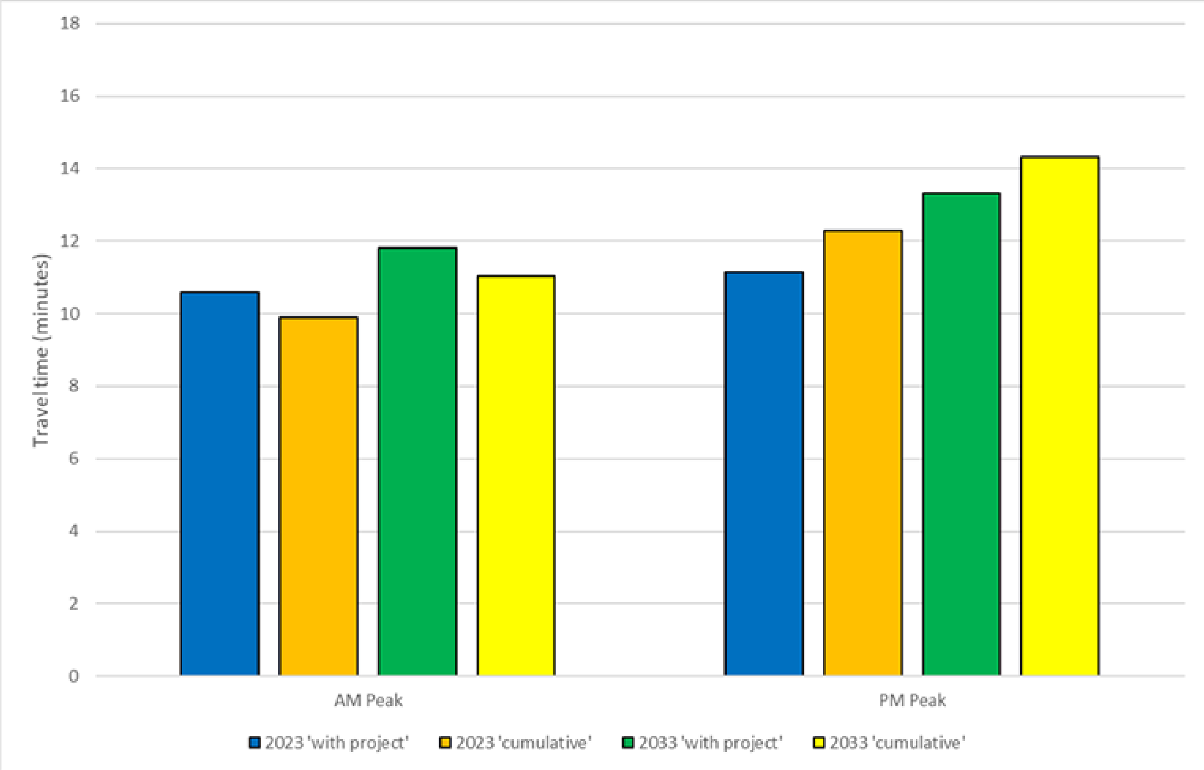


Figure 12-14 St Peters interchange: average travel time for buses – 'cumulative' comparison

12.6.7 Active transport facilities

Details of planned walking and cycling facilities can be found in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

12.7 Cumulative scenario mitigation

While specific mitigation measures for the cumulative scenarios assessed in this report are beyond the scope of this EIS, the issues identified would be examined as part of the design development for the proposed future Western Harbour Tunnel and Beaches Link and Sydney Gateway projects and as part of Roads and Maritime network mitigation strategies.

Ongoing consultation with the design teams for these projects is occurring with the objective of minimising cumulative traffic impacts.

13 Conclusion

Strategic and operational traffic modelling has assessed the M4-M5 Link project, on its own and as part of the broader planned motorway network development. Key outcomes of the traffic operational modelling include:

- Sections of the Sydney surface road network are currently approaching or exceeding capacity in the peak periods. The predicted peak period traffic volumes on the surface road network show significant growth by 2033 with or without the M4-M5 Link. This forecast growth in traffic demand is consistent with the forecast growth in population in the Sydney Metropolitan Area. It is expected that, given the predicted growth in traffic volumes, future peak periods would become longer in both the AM and PM peaks, spreading congestion over longer periods of the day
- By 2033, the surface road network adjacent to the M4-M5 Link is forecast to be at or close to capacity in peak periods without the project. The completion of the M4-M5 Link, as well as the Sydney Gateway, is forecast to reduce vehicle distance travelled on non-motorway roads, such as in the Inner West. In the 'with project' scenarios, overall network productivity is improved, with longer or more trips able to take place in less time
- Reduced travel times are forecast on key corridors, such as between the M4 Motorway corridor and the Sydney Airport/Port Botany precinct, and reduced traffic is forecast on sections of major arterial roads including City West Link, Parramatta Road, Victoria Road, King Street, Princes Highway, Southern Cross Drive and Sydenham Road
- Reduced heavy vehicle volumes on non-motorway links is also forecast, as heavy vehicles are forecast to shift onto the M4-M5 Link. Daily heavy vehicle volumes on Parramatta Road and City West Link are forecast to drop by 40 to 50 per cent, and roads in the Inner West, such as Stanmore Road, Sydenham Road, Marrickville Road and King Street, are forecast to drop by 20 to 50 per cent. Almost 2,000 heavy vehicles are forecast to be removed from Parramatta Road, east of the M4 East Parramatta Road ramps, each weekday
- The provision of new connectivity at the Wattle Street, Rozelle and St Peters interchanges is forecast to increase congestion in parts of Mascot, along Frederick Street at Haberfield, Victoria Road north of Iron Cove Bridge, Johnston Street at Annandale and on the Western Distributor. A number of these areas are forecast to improve when the proposed future Sydney Gateway and Western Harbour Tunnel and Beaches Link projects are completed
- An implementation strategy to manage existing capacity constraints and to ensure appropriate network integration of the project is being developed. This strategy is likely to include active traffic management measures both on the motorway and arterial networks.

The key strategic traffic objectives of the project are to:

- Provide an efficient motorway link between the M4 and M5 motorways and improve traffic flow on the motorway network
- Enable long term motorway network development, including facilitating new cross-harbour capacity and connections to Sydney's south
- Improve accessibility and reliability of commercial vehicle movement in the M4 and M5 corridors to economic centres, including to Sydney Airport and Port Botany economic zone
- Improve traffic conditions and ease future congestion on the inner western and south-western network, including Parramatta Road, supporting urban regeneration and growth
- Improve overall network productivity.

Based on the assessments undertaken, the project would contribute to the overall WestConnex program of works by fulfilling these objectives.

References

- *Guide to Traffic Management – Part 3 Traffic Studies and Analysis* (Austroads 2013)
- *Traffic Modelling Guidelines* (Roads and Maritime 2013)
- *Guide to Traffic Generating Developments Version 2.2* (RTA 2002).
- *A Plan for Growing Sydney* (NSW Government 2015)
- *NSW Long Term Transport Master Plan* (Transport for NSW 2012)
- *NSW Freight and Ports Strategy* (Transport for NSW 2013)
- *State Infrastructure Strategy Update 2014* (Infrastructure NSW 2014)
- *Sydney Airport Master Plan 2033* (Sydney Airport Corporation Limited 2013)
- *Sydney City Centre Access Strategy* (Transport for NSW 2013)
- *Parramatta Road Corridor Urban Transformation Strategy* (UrbanGrowth NSW 2016)
- *Transformation Plan: The Bays Precinct, Sydney* (UrbanGrowth NSW 2015)
- *Principles and Procedures for Economic Appraisal of Transport Investment and Initiatives* (Transport for NSW 2013)
- *Metropolitan Road Freight Hierarchy on the State Road Network Practice Note* (Department of Transport 2011)

Annexures

Annexure A Response to Agency comments

Annexure Table 1 How agency comments have been addressed in this report

Agency letters	
Inner West Council	
Comment	**Section where addressed in EIS**
· Traffic impact assessment for the project should not be restricted to major roads – it should also address possible impacts on the adjacent road network.	· A traffic impact assessment was undertaken on the road network adjacent to the project and is presented through screenline analysis in **Chapter 9** and operational modelling in **Chapter 10**.
· Implications that freer flow on Victoria Road may have on: - Adjacent shopping areas including Rozelle and Drummoyne - Pedestrian safety - Induced demand for private car travel - The psychological and physical barrier presented by Victoria Road - Possible increases in the severity of accidents on Victoria Road, resulting from potentially higher speeds.	· While there may be a reduction in future forecast traffic on Victoria Road, south of the Iron Cove Link portals, the number of traffic signals on Victoria Road means that traffic would not be free flow. Accident and safety implications are presented in **Chapter 10**. Induced demand is included in the WRTM traffic forecasts, while other implications are assessed in **Appendix P** (Technical working paper: Social and economic) of the EIS.
· As hazardous vehicles would not be permitted in the tunnel, they are likely to use Victoria Road, consequently being exposed to higher vehicle speeds (resulting from freer flow). The possibility of these higher speeds leading to increased accident severity should be addressed (particularly in relation to hazardous goods vehicles).	· Hazardous vehicles would be on the surface roads if there was no M4-M5 Link tunnel. While there may be a reduction in future forecast traffic on Victoria Road, south of the Iron Cove Link portals, the number of traffic signals on Victoria Road means that traffic would not be free flow. The transport of dangerous goods is regulated by the *Dangerous Goods (Road and Rail Transport) Act 2008* (NSW), *Dangerous Goods (Road and Rail Transport) Regulation 2014* (NSW) and the *Australian Code for the Transport of Dangerous Goods by Road and Rail* supported by relevant Australian Standards.
· Implications of surface road traffic on the adjacent active transport network, particularly in relation to increased conflict with motorised vehicles.	· Active transport is dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

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· Opportunities for improved public and active transport provision on Victoria Road, timed to coincide with the opening of the Iron Cove Link.	· The Victoria Road Bus Improvement Project was taken into account in the project design and active transport opportunities are dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.
· Opportunities for place making and public domain improvements on Victoria Road, timed to coincide with opening of the Iron Cove Link.	· Urban design opportunities are dealt with in **Appendix L** (Technical working paper: Urban Design) of the EIS.
· Opportunities to rescind unused road widening reservations along Victoria Road.	· This outside the scope of this project and would be considered by Roads and Maritime as part of their network planning.
· Consideration of induced traffic including: - Quantum of induced traffic; - Number for trips converted from public transport; - CO_2 and other GHG emissions created by the induced traffic and the environmental implication thereof.	· Induced demand is included in the WRTM traffic forecasts and equates to about 0.3 per cent additional daily trips in 2033. Implications of CO_2 and GHG emissions are dealt with in **Appendix W** (Detailed greenhouse gas calculations).
· Implications on The Bays Precinct including the likely private car travel demand to be created by ease of access to WestConnex (in contrast to a less car dependent type of development that could be encouraged if no motorway direct access were provided to The Bays Precinct).	· The Bays Precinct traffic demand is included in the STM and WRTM forecasts. The type of development at The Bays Precinct would be shaped by the development and parking controls established for the precinct.
· Included in the above assessment should be consideration of the environmental/sustainability consequences (the difference in the environmental impact of a car dependent Bays Precinct in comparison to a sustainable transport oriented Bays Precinct).	· Assumptions on land use development at The Bays Precinct are included in the STM and WRTM forecasts and are not different between future scenarios.
· Impact on local access and internal circulation that may result from street closures associated with the project.	· The scope of operational modelling includes areas of the network that would be directly impacted by street closures.
· Pedestrian safety issues associated with freer flow/higher speeds on Victoria Road including: - The implications that freer flow on Victoria Road may have on pedestrian access across it, particularly in relation to Sydney Buses' proposed reduction in the number of bus stops and the potential for this to encourage pedestrians to attempt to cross Victoria Road mid-block; - The need to introduce a 40 kilometre per hour School Zone on Victoria Road near Rozelle Public School.	· While there may be a reduction in future forecast traffic on Victoria Road, south of the Iron Cove Link portals, the number of traffic signals on Victoria Road means that traffic would not be free flow. The Victoria Road Bus Improvement Project was taken into account in the project design and active transport opportunities are dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

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· Potential impact for easier access to Anzac Bridge (and freer flow on Victoria Road) to result in greater demand for private car travel to Sydney CBD.	· The WRTM traffic forecasts include any induced demand, such as to the Sydney CBD, due to the project, and therefore this is included in the assessment. While there may be a reduction in future forecast traffic on Victoria Road, south of the Iron Cove Link portals, the number of traffic signals on Victoria Road means that traffic will not be free flow.
· Detailed analysis of all intersections adjacent to the portals should include weekend, as well as weekday peak, operation.	· A comparison of weekday and weekend traffic volumes in the study area was undertaken that revealed the peak weekday hourly volumes are similar or higher than the peak weekend hourly volumes. Therefore, the weekday scenario is the worst traffic situation and is appropriate to be tested as such. This is also standard assessment methodology and consistent with all previous WestConnex assessments.
· Modelling should include heavy and hazardous goods vehicle forecasts for the surrounding surface road network. This should be examined for all phases of the project (including construction, early stages of operation and longer term operation – eg Western Harbour Crossing completed).	· Heavy vehicles are included in the WRTM and the construction traffic forecasts. Within WRTM, trucks are all vehicles of Austroads class 3 and higher. While trucks carrying hazardous materials would not be able use the tunnels, most of these restrictions apply to a subset of articulated vehicles and are not relevant to rigid vehicles, which are the majority of the truck class.
· Management of access to Iron Cove foreshore and The Bay Run, both during construction and once completed.	· This is dealt with in **Chapter 7** and in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.
· Consideration of the impact of the Iron Cove Link on a possible future light rail line to the White Bay Power Station/Cruise Passenger Terminal portion of The Bays Precinct.	· There are no publicly available plans indicating light rail to service White Bay or The Bays Precinct, so this has not been assessed. The use of Glebe Island Bridge is not precluded by the project.
· Consideration of the impact of the Iron Cove Link on the (combined Council and RMS) proposal to create and enhanced local environment and separated cycleway along Lilyfield Road (between the Bay Run and Anzac Bridge).	· This is dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.
· Consideration of the impact of the Iron Cove Link on the possible reinstatement of Glebe Island Bridge as an active transport link.	· This is dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS.

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Ashfield Council (received prior to the amalgamation of Ashfield Council into the Inner West Council)	
Comment	**Section where addressed in EIS**
· Traffic impacts on local streets during and after construction works: Detailed plans and traffic modelling must be provided showing how local, state and regional roads and streets in the Ashfield LGA would be affected during construction works, post and/or completion of Stage 3 works and how increased and changed traffic impacts would be managed.	· A traffic impact analysis has been undertaken to assess the impact of the project on the affected local road network. The construction impacts are included in **Chapter 7** and the operational impacts are presented in **Chapter 10**, with mitigation strategies provided in **Chapter 11**.
· The traffic modelling must be undertaken at a sufficient scale and level of detail (eg Nano Modelling) to describe the local impacts of the proposal compared with the current base situation. In addition, the modelling should be sufficiently fine grained to demonstrate the interactions between vehicles, pedestrians and cyclists at a local level on the hierarchy of the streets and roads outlined above. The modelling must also analyse the impact arising from any proposed road closures (whether temporary or permanent) along the corridor and particularly around tunnel portals. The boundary for this area and degree of traffic modelling must be sufficiently broad and go well beyond the immediate Parramatta Road/City West Link Road corridor. It is considered that as a minimum all state, regional and collector roads and local streets north of Parramatta Road within the Ashfield LGA be included in the traffic modelling. Works which are required in the future to be constructed to ameliorate the impacts of new additional regional traffic travelling through the Ashfield LGA would create a cost burden for Council. Therefore, the EIS must provide indicative examples and extent of the type of treatments required, make an estimate of their construction costs, and identify how the State Government intends to implement those works.	· Modelling has been undertaken using microsimulation modelling. This methodology is consistent with the approach used for similar projects. The modelling is sufficiently refined to address the interaction of road users at a micro-level. A detailed breakdown of the assessment methodology is provided in **Chapter 4**. The scope of the modelling was developed taking into consideration the secretaries requirements, agency letters and forecast project impacts. The resulting scope of assessment can be seen in **Chapter 4** and **Annexure B**. The results of the traffic impact assessment are reported in **Chapter 10**, with mitigation strategies provided in **Chapter 11**.
· Public transport impacts during and after construction works: The modelling must identify impacts on public transport operations both during construction and post construction of the Stage 3 works. Should any changes be proposed to existing public transport routes or new public transport routes/links be created the modelling must identify such changes and impacts arising from the changes.	· Future public transport performance and impacts during construction were assessed in this traffic impact assessment. The construction impacts are included in **Chapter 7** and the performance impacts on public transport are discussed in **Chapter 10**.
· Cumulative impacts during and after construction works: It remains unclear as to the timing of the commencement of construction of the Stage 3 M4-M5 Link works. While a notional 'opening year' of 2023 is noted in the SSI application, the EIS needs to consider cumulative impacts arising from all three sections of WestConnex being under construction concurrently. If this is not the intention then the EIS needs to examine all options for potential disposal of spoil arising from the M4-M5 Link – road, tunnel, water, etc or a combination of all options.	· The cumulative impacts from construction of all three sections of WestConnex were reviewed and discussed in **Chapter 7**.

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· It would be highly desirable from a local environmental and amenity perspective for spoil haulage routes for Stage 3 to be designed utilising the new tunnel links being created in Stages 1 and Stage 2, should these stages be or become operational during the Stage 3 construction phase. This would remove considerable heavy vehicular traffic from surface roads and needs to be addressed in the EIS.	· It is planned that trucks would use the M4 East and New M5 entry and exit ramps, once they are operational, to gain access to appropriate project construction ancillary facilities.
· The SEARs should also specify a requirement for the EIS to address cumulative impacts of the proposal across all major issues – traffic, noise, vibration, social, health, visual, heritage, biodiversity, environmental, climate change, flooding and water quality	· The traffic impacts in a cumulative scenario are presented in **Chapter 12**, while broader cumulative impacts are assessed in **Chapter 26** of the EIS.
Leichhardt Council (received prior to the amalgamation of Leichhardt Council into the Inner West Council)	
Comment	**Section where addressed in EIS**
· General Considerations: - The assessment should consider the short-term, medium term and ultimate configuration traffic projects for surface road network (including northern and southern extensions); - There should be full transparency of the impacts on the surface road network (particularly in relation to the feeder roads for the WestConnex portals).	· A traffic impact analysis has been undertaken to assess the impact of a project only scenario on the affected local road network in 2023 and 2033, which is presented in **Chapter 10**, and for an ultimate configuration scenario in the same years, which is presented in **Chapter 12**.
· Traffic impact assessment should not be restricted to major roads – it should also address possible impacts on collector roads and the possibility of the development of new bypass routes/'rat runs' in response to increased congestion, most particularly: - Lilyfield Road - Balmain Road - Tebbutt Street - Flood Street - Darley Road - Catherine Street - Johnston Street - Ramsay/Marion Streets - New north–south connections (through Rozelle Rail Yards) that may be developed as part of The Bays Precinct.	· The scope of the modelling was developed taking into consideration the secretaries requirements, agency letters and forecast project impacts. The resulting scope of assessment can be seen in **Chapter 4** and **Annexure B**. The results of the traffic impact assessment are reported in **Chapter 10**, with mitigation strategies provided in **Chapter 11**.
· Implication of surface road traffic on existing and likely future bus service.	· Future public transport performance was assessed in the traffic impact assessment. The performance impacts on public transport are discussed in **Chapter 10**.
· Implications of the Rozelle Portal Traffic on: - The proposed Lilyfield Road Cycleway; - The built form of The Bays Precinct; - Opportunities for future public transport to The Bays Precinct (see car dependency note below); - The long term possibility of an extended light rail system to service White Bay; - Long term opportunities to re-instate Glebe Island Bridge as a sustainable transport link.	· Operational traffic modelling was undertaken in the Rozelle area and results are presented in **Chapter 10**. Active transport opportunities are dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS. The Victoria Road Bus Improvement Project was taken into account in

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	the project design. There are no publicly available plans indicating light rail to service White Bay or The Bays Precinct, so this has not been assessed. The use of Glebe Island Bridge is not precluded by the project.
· Implications of the Camperdown Portal on: - Booth Street - Pyrmont Bridge Road - Johnston Street - Parramatta Road - The Crescent - Wigram Road.	· The Camperdown interchange is no longer part of the project.
· Implications of the Wattle Street Connection on: - Ramsay/Marion Street - Dobroyd Parade - Hawthorne Parade.	· Operational traffic modelling was undertaken in the Wattle Street interchange area and results are presented in **Chapter 10**.
· Impact analysis should include potential increased parking demand in areas of Leichhardt LGA that are adjacent to high frequency public transport, that may result from increased accessibility for remote commuters (eg western suburbs residents who work in the CBD and prefer not to pay CBD parking costs).	· The traffic and transport assessment is based on traffic modelling using the WRTM, which relies on forecasts of car driver demand sourced from the STM. The STM uses projections of population and employment for the Sydney and forecasts mode choice between car, rail, bus, light rail and ferry modes for future infrastructure scenarios. However, it does not forecast those that would switch at particular stations and so it is not possible to assess potential future increased parking demand in particular areas.
· Council is actively pursuing the development of open space in and around Rozelle Rail Yards and it is essential that the proposal not preclude opportunities to provide such open space including a series of north–south active transport linkages between Lilyfield and Rozelle. Such linkages should be useable areas of open space rather than simply access corridors. The above linkages should also be cognisant of, and not detrimentally impact on, the enhanced residential environment and active transport linkages currently proposed in Council's North Annandale Neighbourhood Movement Plan.	· Active transport opportunities are dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS and urban design opportunities are dealt with in **Appendix L** (Technical working paper: Urban design) of the EIS.
· The project should not increase separation/isolation of any areas, during any phases of its development, and where possible should enhance connectivity between areas.	· Social implications are assessed in **Appendix P** (Technical working paper: Social and economic) of the EIS and **Appendix N** (Technical working paper: Active transport strategy) of the EIS.
· Journey to work times should be assessed for local residents (of Leichhardt LGA) as well as distant commuters, particularly during the construction phase of the project.	· Travel time analysis and potential delays were undertaken and are presented in **Chapter 7** and **Chapter 10**.

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Marrickville Council (received prior to the amalgamation of Marrickville Council into the Inner West Council)	
Comment	**Section where addressed in EIS**
· A significant amount of traffic exiting the motorway at Camperdown is likely to have a detrimental impact on the suburb and surrounding areas, be this via an increase in through-traffic or vehicles searching for parking. Accordingly, induced traffic demand as a result of the new road link needs to be addressed.	· The Camperdown interchange is no longer part of the project.
· Any future proposal to extend (in length or time) clearways, or introduce new clearways, needs to be supported by a local area traffic management analysis.	· No new clearways are proposed as part of the project.
· Widening of streets immediately adjacent to the portal needs to be evaluated in terms of whether this would only act to displace congestion to other squeeze points.	· A traffic impact assessment was undertaken on the road network adjacent to the portals and is presented in **Chapter 10**.
· A thorough analysis and description of project alternatives, including multi-modal solutions that are assessed against relevant state objectives (rather than the objectives of the Project itself) needs to be undertaken.	· This is presented in **Chapter 4** (Project development and alternatives) of the EIS.
· Road narrowing, at-grade pedestrian crossings, traffic light rephrasing changes in favour of pedestrian movement, enhancement of the pedestrian realm, removal of existing clearways, heavy vehicle restrictions on local roads and area-wide speed reductions need to be considered in the context of new portals at Rozelle and Camperdown.	· The road design and the urban design have considered these. Active transport opportunities are dealt with in **Appendix N** (Technical working paper: Active transport strategy) of the EIS and urban design opportunities are dealt with in **Appendix L** (Technical working paper: Urban design) of the EIS.
· Details to be included of how the proposed interchanges and connections to the surrounding road network and associated road infrastructure facilities meet the traffic, pedestrian and overall transport objectives of the proposal. This is to take into account adjacent sensitive land uses, future growth areas, approved and proposed infrastructure proposals and traffic needs of all those using the road, with pedestrian priority at the forefront (reduced road speeds, at-grade crossings, traffic light phasings etc).	· Meeting of the traffic objectives are discussed in this report, while active transport and urban design objectives and opportunities are discussed in **Appendix N** (Technical working paper: Active transport strategy) of the EIS and **Appendix L** (Technical working paper: Urban design) of the EIS.
· Analysis of impacts on adjacent recreation amenities, including the appeal of walking and cycling, in addition to analysis of the impacts on cultural amenity and accessibility (including adjacent local neighbourhoods and their 'look and feel') must be addressed.	· This analysis is presented in **Appendix L** (Technical working paper: Urban design) of the EIS, **Appendix N** (Technical working paper: Active transport strategy) of the EIS and **Appendix P** (Technical working paper: Social and economic) of the EIS.
· Impact on local schools including noise, air pollution, danger from increased traffic volumes including at road crossings as well as reduced likelihood in children travelling actively to school and the associated impact of this on childhood obesity, social awareness and other learning and development factors must also be addressed.	· These impacts are presented in **Appendix I** (Technical working paper: Air quality) of the EIS, **Appendix J** (Technical working paper: Noise and vibration) of the EIS, **Appendix N** (Technical working paper: Active transport

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	strategy) of the EIS and **Appendix P** (Technical working paper: Social and economic) of the EIS.
· The proponent should address how the proposal incorporates good urban design principles such as increased walkability, cycleways and access to public transport. The impact of increased traffic flows, especially during the construction phase, on pedestrian safety should be considered, along with the impact of property acquisition.	· This is discussed in **Appendix N** (Technical working paper: Active transport strategy) of the EIS and in **Chapter 7**.
City of Sydney Council	
Comment	**Section where addressed in EIS**
· The Proponent must fully assess the impacts of the project on the CBD as a result of the Camperdown interchange, including Railway Square and the Central Station precinct, George Street with the operation of light rail services and the urban renewal precinct of Central to Eveleigh at a minimum. The project, in particular the Camperdown portal with associated changes to Parramatta Road, Broadway and the intersection of Broadway, City Road and Parramatta Road would have considerable impacts on the Sydney CBD. Impacts on public transport services and nodes is of considerable concern	· The Camperdown interchange is no longer part of the project.
· The Proponent must fully assess the impacts of the project on the CBD as a result of the Rozelle interchange, in particular the east–west routes through the CBD and in turn, impacts on light rail operation along George Street, and increased traffic on the Harbour Bridge and in turn, impacts on public transport, in particular bus egress during the PM peak period. The Rozelle interchange would have a considerable impact on traffic flowing to and from the city via Anzac Bridge.	· The scope of the modelling was developed taking into consideration the secretaries requirements, agency letters and forecast project impacts. The resulting scope of assessment can be seen in **Chapter 4** and **Annexure B**. The results of the traffic impact assessment are reported in **Chapter 10**, with mitigation strategies provided in **Chapter 11**.
· The Proponent must fully evaluate the inter-relationship of the project with the Sydney City Centre Access Strategy and its long term aims with respect to the Sydney City Centre.	· The inter-relationship of the project with the Sydney City Centre Access Strategy and its long term aims with respect to the Sydney City Centre is discussed in **Chapter 3**.
· In recognition of the proposed WestConnex concession period and considering the profound implications of the project, the future traffic impacts must be assessed at opening, 2031 and 2041 at a minimum. Traffic analysis across an expanded study area must be presented consistently showing the results, without the project, with the project and a cumulative scenario (potentially including Western Harbour Tunnel etc).	· A traffic impact analysis has been undertaken to assess the impact of a project only scenario at opening (2023) and 10 years after opening (2033), as required in the Roads and Maritime assessment guidelines, which is presented in **Chapter 10**, and for a cumulative scenario (including Western Harbour Tunnel, amongst others) for the same years, which is presented in **Chapter 12**.
· Provision of active transport needs to address existing and future land use, as well as be sized for projected land use change and population and employment growth. The	· Active transport provision and urban design opportunities are discussed in **Appendix N**

Agency letters	
Proponent must demonstrate the adequacy of all proposed facilities in terms of current and future desire lines and capacity, recognising the project is being sized for considerable expected growth in traffic demand. The Proponent must consider CPTED principles and demonstrate how CPTED principles have been met through the proposed project.	(Technical working paper: Active transport strategy) of the EIS and **Appendix L** (Technical working paper: Urban design) of the EIS.
· Induced demand and toll avoidance must be comprehensively addressed and the impacts consistently quantified across the expanded study area and all the assessment years (opening, 2031 and 2041).	· The WRTM traffic forecasts for all future year scenarios include induced demand and any potential toll avoidance due to the project.
· Travel time analysis must be conducted across all assessment years (opening, 2031 and 2041) and for public transport (buses) as well as other vehicles on the network. Travel time analysis for public transport must extend into central Sydney, recognising that increased bus numbers and/or traffic in the CBD as a result of the various WestConnex projects would impact travel times across a wide area.	· Travel time analysis for general traffic and for buses in future year scenarios is presented in **Chapter 10**.
· In particular the city is concerned that in providing an alternative access for traffic on Victoria Road from the north of Iron Cove Bridge to the Sydney CBD and eastern CBD (via the Rozelle interchange and Anzac Bridge) there would be a significant increase in traffic accessing the CBD and passing through the centre's already congested streets. Transport and traffic modelling must include the Sydney city centre street network and the land use change envisaged within the draft Central Sydney Planning Strategy, and provide a long term analysis of the impacts. The Sydney city centre is Australia's pre-eminent commercial and financial centre and relies on a high quality public domain, high levels of walking activity, efficient bus service provision and access for delivery and service vehicles.	· The scope of the modelling was developed taking into consideration the Secretaries requirements, agency letters and forecast project impacts. The resulting scope of assessment can be seen in **Chapter 4** and **Annexure B**. The results of the traffic impact assessment are reported in **Chapter 10**, with mitigation strategies provided in **Chapter 11**.
· In addition to the site specific considerations, Council reaffirms its request for the following, more generalised considerations: - Impacts that the increased capacity and freer flow on Victoria Road may have on public transport patronage (ie leaching patrons from public transport); - There should be inclusion of additional objectives that do not relate solely to road traffic improvements; - Consideration of need for the project in the light of future transport/travel technology.	· The traffic and transport assessment is based on traffic modelling using the WRTM, which relies on forecasts of car driver demand sourced from the STM. The STM forecasts mode choice between car, rail, bus, light rail and ferry modes for future infrastructure scenarios. Induced demand is included in the WRTM traffic forecasts and equates to about 0.3 per cent additional daily trips in 2033. While there may be a reduction in future forecast traffic on Victoria Road, south of the Iron Cove Link portals, the number of traffic signals on Victoria Road means that traffic would not be free flow. Project objectives and project need is dealt with in **Chapter 3** (Strategic context and project need) of the EIS.

Agency letters	
Port Authority of NSW	
Comment	**Section where addressed in EIS**
· The Port Authority requests that the Department of Planning and Environment specifically require the applicant to consult with the Port Authority on the following matters: - The final Rozelle interchange design, potential connections to the Bays Precinct and transport linkages - The existing and proposed landownership of the Rozelle Rail Yards, part of which is owned by the Port Authority - Any proposed use of Port Authority lands for staging of construction works.	· Consultation with Port Authority of NSW is occurring.

Annexure B Justification of modelled areas

Introduction

This annexure presents the scope of the road network impacted by the project to provide justification of the nominated boundaries of the operational model areas. Operational modelling was focused around the areas of largest local impact in the AM and PM peak hours, which are generally around the motorway interchanges, namely the Wattle Street interchange, the Rozelle interchange and the St Peters interchange.

In addition to operational modelling, assessment of the wider network impacts outside of the operational model boundaries was also undertaken through screenline analysis, Sydney metropolitan network plots and travel time analysis.

Bandwidth plots illustrating the forecast change in AM and PM peak hour traffic volumes between the 2033 'with project' and the 'without project' scenarios were assessed. Roads expected to carry less traffic in the future 2033 'with project' scenario are shown in green and roads where volumes are predicted to increase in the future are shown in red. The line thickness is indicative of the magnitude of this change – the thicker the line, the more impact there is likely to be. Difference plots with the nominated modelling boundary overlaid for each motorway interchange are presented.

Wattle Street interchange

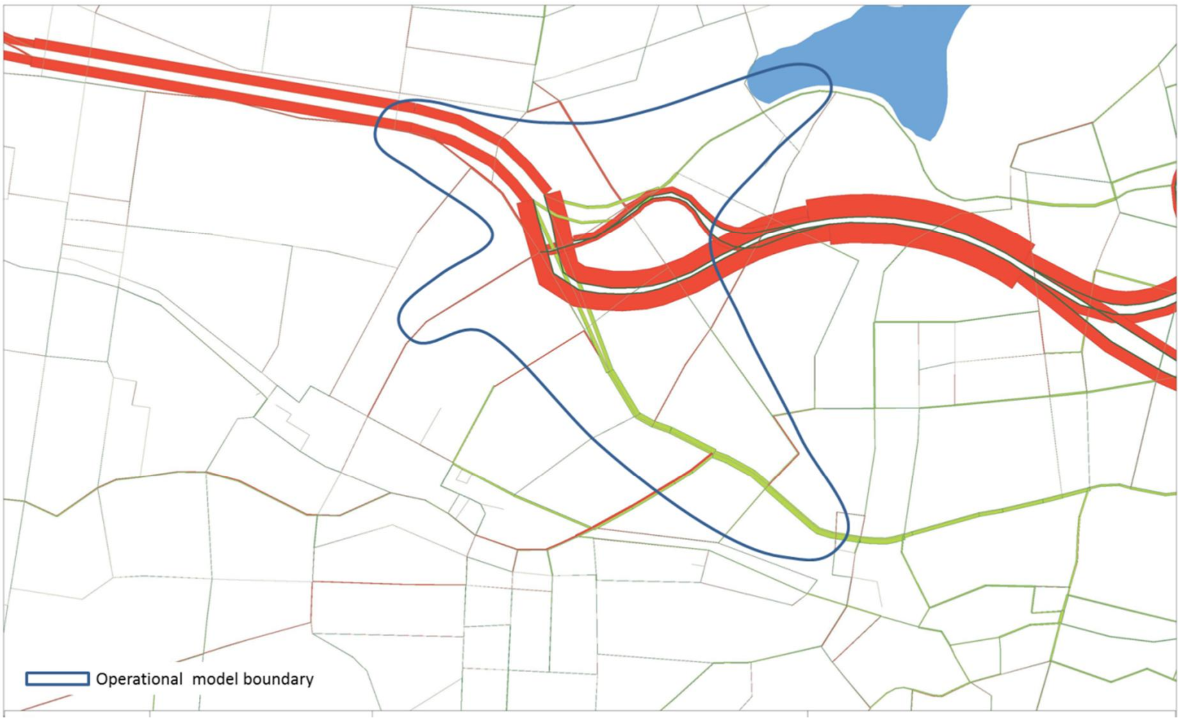
Annexure Figure 1 and **Annexure Figure 2** present the AM and PM peak hour volume difference plots between the 2033 'with project' and the 'without project' modelled scenarios in the vicinity of the Wattle Street interchange, with the operational model boundary overlaid. The impact of the inclusion of the project is mainly focused on Parramatta Road, City West Link and, to a lesser extent, Ramsay Street/Ramsay Road, which are captured within the boundary of the operational model reported on in **section 10.3**. The level of change due to the project along roads like Frederick Street, outside of these boundaries, is small with minimal impact on performance.

Rozelle interchange

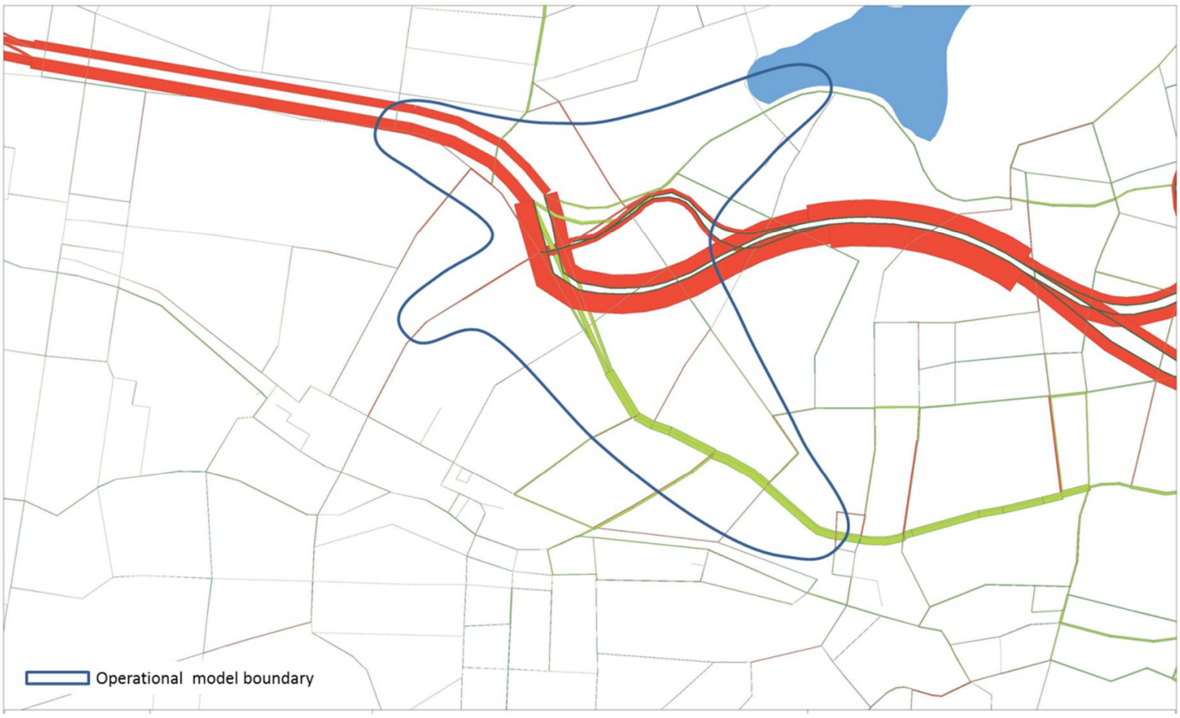
Annexure Figure 3 and **Annexure Figure 4** present the AM and PM peak hour volume difference plots between the 2033 'with project' and the 'without project' modelled scenarios in the vicinity of the Rozelle interchange, with the operational model boundary overlaid. The impact of the inclusion of the project is focused on Victoria Road, City West Link and Anzac Bridge/Western Distributor, which are captured within the boundary of the operational model reported on in **section 10.4**. The impact due to the forecast increase on The Crescent and Johnston Street are captured in the modelling of The Crescent/Johnston Street intersection within the operational model, as well as in the screenline assessment contained in **section 9** of this report.

St Peters interchange

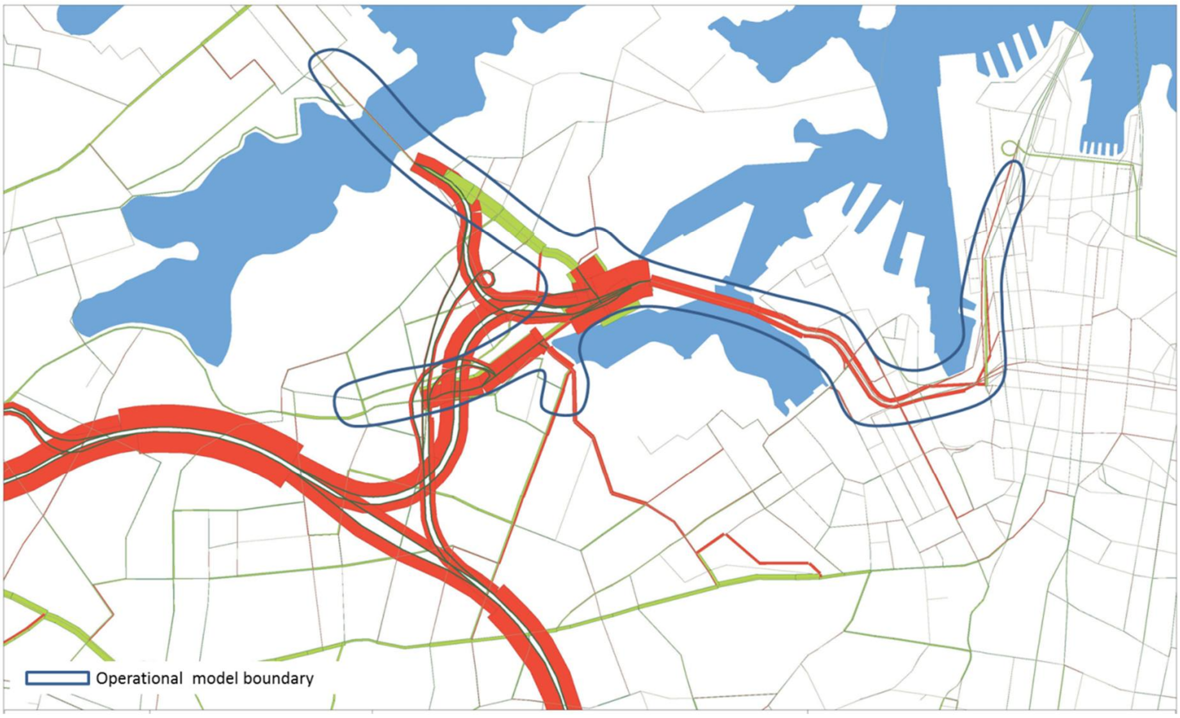
Annexure Figure 5 and **Annexure Figure 6** present the AM and PM peak hour volume difference plots between the 2033 'with project' and the 'without project' modelled scenarios in the vicinity of the St Peters interchange, with the operational model boundary overlaid. The impact of the inclusion of the project is focused on the Princes Highway, Canal Road, Euston Road (south of Sydney Park Road) and the street network north of Sydney Airport, which are captured within the boundary of the operational model reported on in **section 10.5**. The level of change due to the project along roads like Euston Road or Gardeners Road, outside of these boundaries, is small with minimal impact on performance.



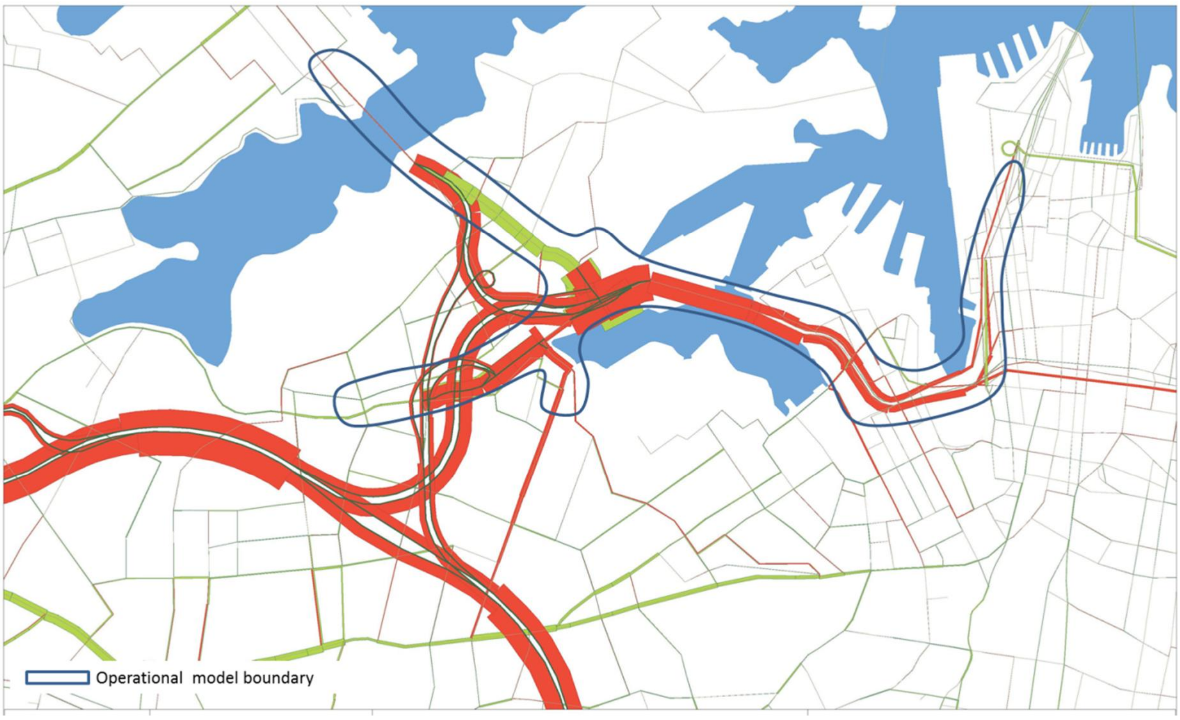
Annexure Figure 1 Wattle Street interchange: comparison of 2033 AM peak hour volumes with and without the project



Annexure Figure 2 Wattle Street interchange: comparison of 2033 PM peak hour volumes with and without the project



Annexure Figure 3 Rozelle interchange: comparison of 2033 AM peak hour volumes with and without the project



Annexure Figure 4 Rozelle interchange: comparison of 2033 PM peak hour volumes with and without the project

Annexure Figure 5 St Peters interchange: comparison of 2033 AM peak hour volumes with and without the project

Annexure Figure 6 St Peters interchange: comparison of 2033 PM peak hour volumes with and without the project

Annexure C Impact of project design changes

Introduction

The M4-M5 Link project was referred to in the EISs for the M4 East and New M5 projects. Both EISs included the M4-M5 Link project in the cumulative impact assessment of the WestConnex program of works. Since the finalisation of these EISs, there have been refinements to the M4-M5 Link project design as previously described and assessed. A description of these design refinements are provided in **Chapter 4** (Project development and alternatives) of the EIS.

The substantive design changes discussed are:

- The removal of the road interchange at Camperdown
- The amendment of the mainline tunnel configuration from three to four lanes (plus merges and tie-ins) in each direction
- The inclusion of a tunnel connection between Victoria Road near the eastern abutment of Iron Cove Bridge and the Rozelle interchange (the Iron Cove Link).

This annexure presents the redistribution of traffic and the impact on traffic volumes using the project design with and without these design changes at the Wattle Street and St Peters interchanges, and indicates if the design developments justify a change in the operational modelling areas at these two locations. A presentation of the redistribution of traffic and the impact on traffic volumes in other parts of the road network is also presented.

Analysis of impacts

To inform the analysis of the traffic impacts of each of the design changes, the WestConnex Road Traffic Model version 2.3 (WRTM v2.3) was used to produce bandwidth plots illustrating the forecast change or difference in the 2033 AM and PM peak hour traffic volumes. Each design change is assessed in isolation to understand the impact to the road network.

Roads that are expected to carry less traffic with the change are shown in green and roads where traffic volumes are predicted to increase are shown in red. The band thickness is indicative of the magnitude of this change – the thicker the band, the more impact there is likely to be.

Removal of the Camperdown interchange

Wattle Street interchange

Annexure Figure 7 and **Annexure Figure 8** present the 2033 AM and PM peak hour volume difference plots showing the impact that the removal of the Camperdown interchange is forecast to have at the Wattle Street Interchange, with the operational model boundary overlaid.

The removal of the Camperdown interchange from the project would cause a forecast reduction of about 300 vehicles (two-way) from the M4-M5 Link between the Wattle Street interchange and the Rozelle interchange in the AM peak hour and 500 vehicles (two-way) in the PM peak hour. An increase in peak hour flows (about 100 vehicles (two-way)) is forecast on parts of the surface road network, such as Dobroyd Parade/City West Link and Parramatta Road, but this would not have a significant impact on the operational performance of these roads and no change in the boundary of the operational model is warranted. The impact of these increases is captured in the Wattle Street interchange modelling carried out as part of this traffic and transport assessment.

St Peters interchange

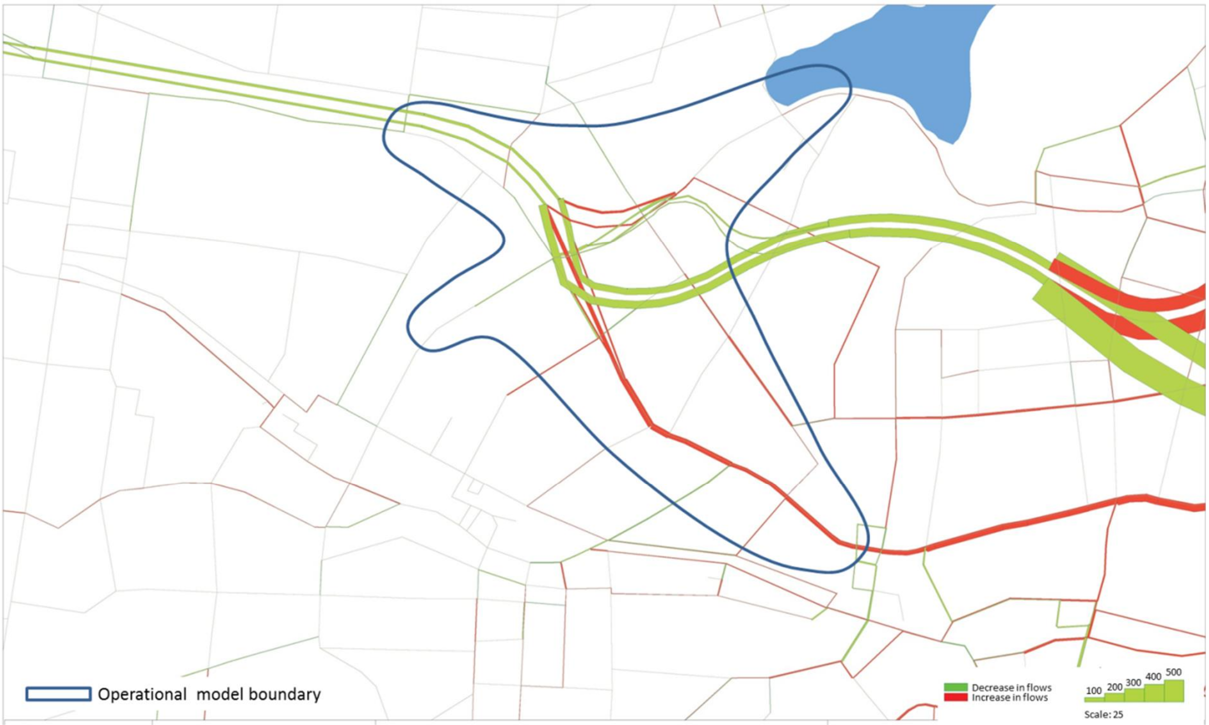
Annexure Figure 9 and **Annexure Figure 10** present the 2033 AM and PM peak hour volume difference plots showing the impact that the removal of the Camperdown interchange would have at the St Peters interchange, with the operational model boundary overlaid.

The removal of the Camperdown interchange from the project would have a forecast reduction on Campbell Road, east of the Princes Highway, of about 200 vehicles (two-way) in the AM peak hour and 50 vehicles (two-way) in the PM peak hour. There is a forecast increase in traffic on Canal Road, east of Princes Highway, of about 150 vehicles (two-way) in the AM peak hour, and on Euston Road, south of Sydney Park Road, of about 100 vehicles (two-way) in each of the AM and PM peak hours. The impact of these increases is captured in the St Peters interchange modelling carried out as part of this traffic and transport assessment.

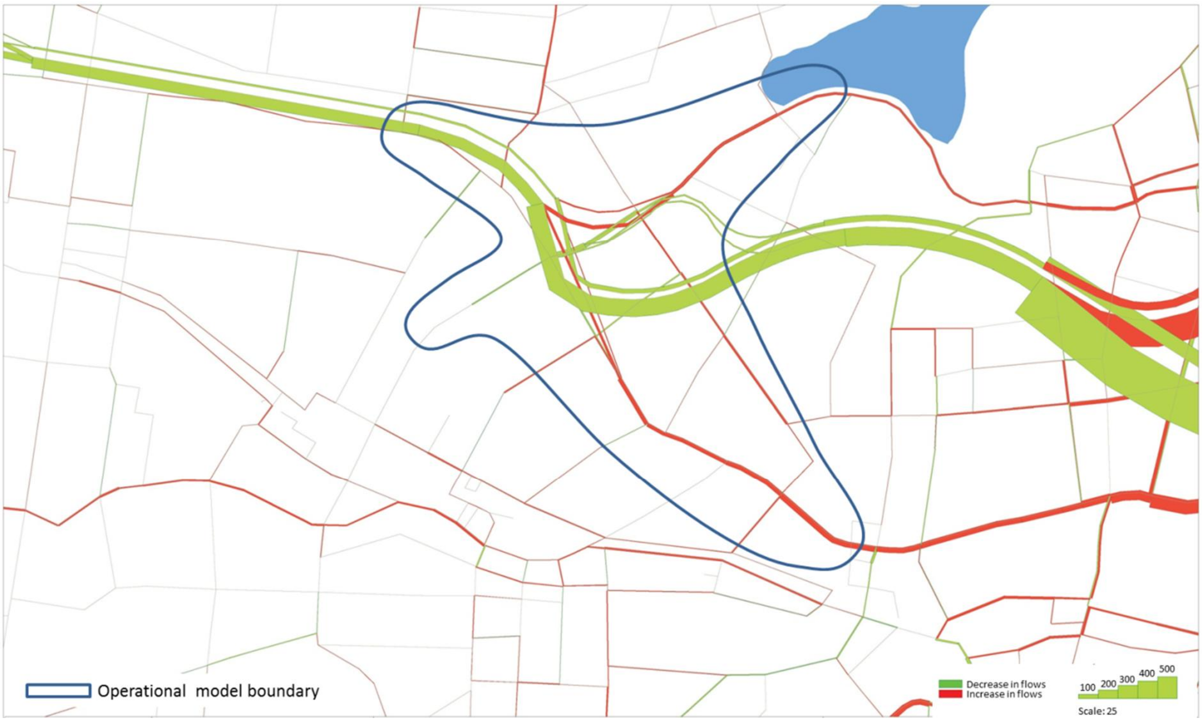
Elsewhere in the operational model area, slight increases and decreases are forecast, however these forecast changes are less than 100 vehicles (two-way) per hour and do not represent a significant change in traffic flows or operational performance. Consequently, no change in the boundary of the operational model is warranted.

Other parts of the network

Annexure Figure 11 presents the 2033 AM peak hour volume difference plot showing the impact the removal of the Camperdown interchange from the project would have on the Sydney metropolitan network. The removal would cause a forecast reduction in traffic to the Camperdown area, along Broadway and along City Road with a forecast increase on the M4 exit ramp to Rozelle and Anzac Bridge/Western Distributor, along The Crescent and along Parramatta Road. The impact of these increases is captured in the Wattle Street and Rozelle interchange modelling undertaken as part of this traffic and transport assessment.



Annexure Figure 7 Wattle Street interchange: changes to the 2033 AM peak hour volumes without the Camperdown interchange



Annexure Figure 8 Wattle Street interchange: changes to the 2033 PM peak hour volumes without the Camperdown interchange

Annexure Figure 9 St Peters interchange: changes to the 2033 AM peak hour volumes without the Camperdown ramps

Annexure Figure 10 St Peters interchange: changes to the 2033 PM peak hour volumes without the Camperdown ramps

Annexure Figure 11 Metropolitan network: changes to the 2033 AM peak hour volumes without the Camperdown ramps

Amendment of the mainline tunnel configuration

Wattle Street interchange

Annexure Figure 12 and **Annexure Figure 13** present the 2033 AM and PM peak hour volume difference plots showing the impact of increasing the number of lanes generally from three to four in each direction in the M4-M5 Link mainline in the vicinity of the Wattle Street interchange, with the operational model boundary overlaid.

The plots show that the additional lanes in the mainline tunnels are forecast to have a negligible impact on the surface roads within the boundaries of the operational model. The changes to the peak hour flows are forecast to be less than 100 vehicles per hour in both AM and PM peak periods, which means that there would effectively be no change to the results from the operational models and consequently no change to the boundary of the operational model is warranted.

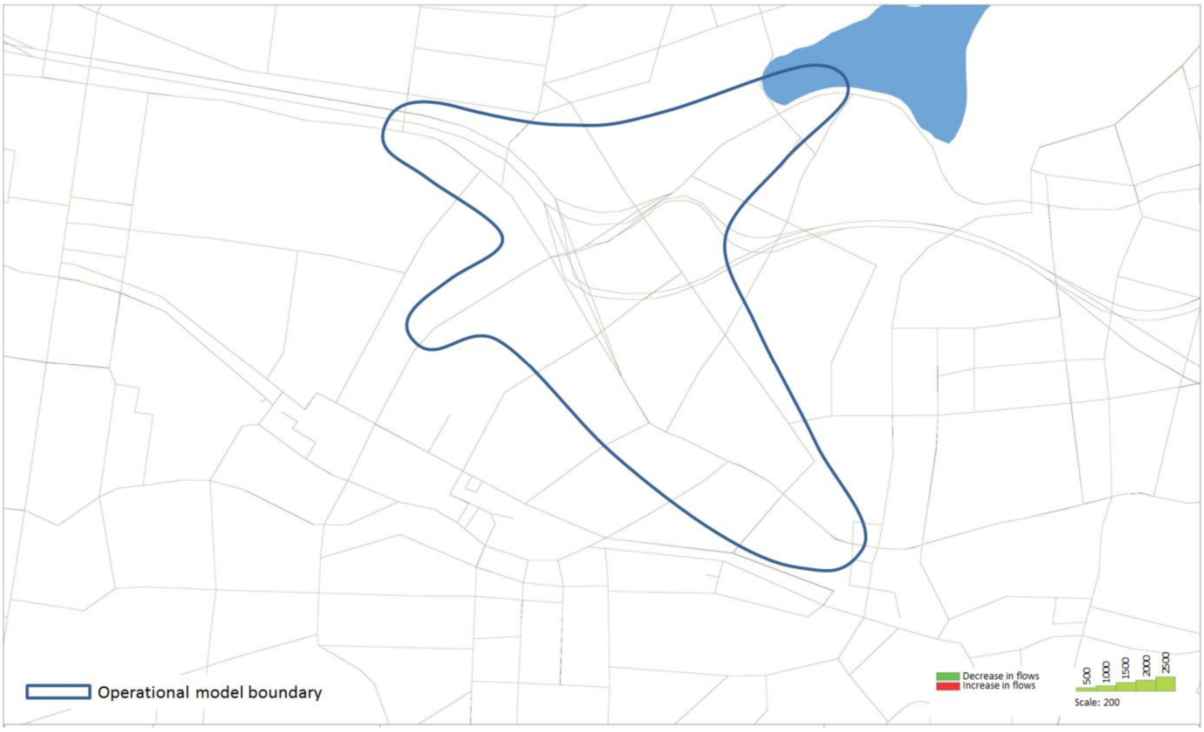
St Peters interchange

Annexure Figure 14 and **Annexure Figure 15** present the 2033 AM and PM peak hour volume difference plots showing the impact of increasing the number of lanes generally from three to four in the M4-M5 Link mainline in the vicinity of the St Peters interchange, with the operational model boundary overlaid.

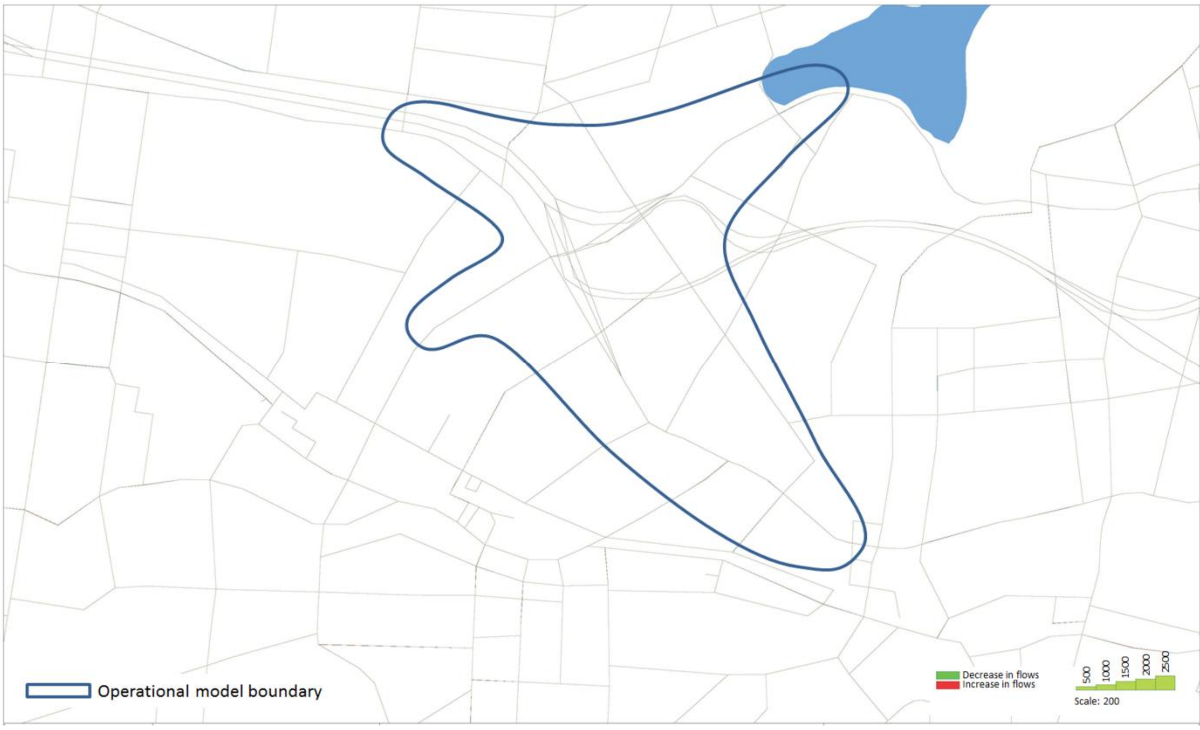
A slight change to flows on the surface road network is forecast. Most changes are forecast to be less than 50 vehicles per hour, including at Euston Road, Campbell Road and Princes Highway. Generally only minimal impacts are forecast on any of the roads in the model area due to the change in the number of mainline lanes and therefore, no change in the boundary of the operational model is warranted.

Other parts of the network

Annexure Figure 16 presents the 2033 AM peak hour volume difference plot showing the impact increasing the number of lanes generally from three to four in the M4-M5 Link mainline would on the rest of the metropolitan road network. The plot shows that the additional lanes in the mainline tunnels are forecast to have a negligible impact on the metropolitan road network.



Annexure Figure 12 Wattle Street interchange: changes to the 2033 AM peak hour volumes with four-lane mainlines



Annexure Figure 13 Wattle Street interchange: changes to the 2033 PM peak hour volumes with four-lane mainlines

Annexure Figure 14 St Peters interchange: changes to the 2033 AM peak hour volumes with four-lane mainlines

Annexure Figure 15 St Peters interchange: changes to the 2033 PM peak hour volumes with four-lane mainlines

Annexure Figure 16 Metropolitan network: changes to the 2033 AM peak hour volumes with four-lane mainlines

Inclusion of the Iron Cove Link

Wattle Street interchange

Annexure Figure 17 and **Annexure Figure 18** present the 2033 AM and PM peak hour volume difference plots in the vicinity of the Wattle Street interchange, showing the impact of the inclusion of the Iron Cove Link, with the operational model boundary overlaid.

The modelling shows that inclusion of the Iron Cove Link into the project design is forecast to increase traffic on the M4-M5 Link mainline tunnels and Wattle Street entry and exit ramps with a corresponding reduction in traffic flows on the surface non-motorway network. The mainline tunnels are forecast to carry an additional 500 vehicles per hour eastbound in the AM peak and a similar volume westbound in the PM peak. These changes would not affect the surface intersections or network.

The biggest impact on the surface network is forecast to City West Link with a drop in traffic volumes of about 200 vehicles per hour forecast in each peak period. This change would improve the surface network operation and consequently no change in the operational model boundary is warranted.

St Peters interchange

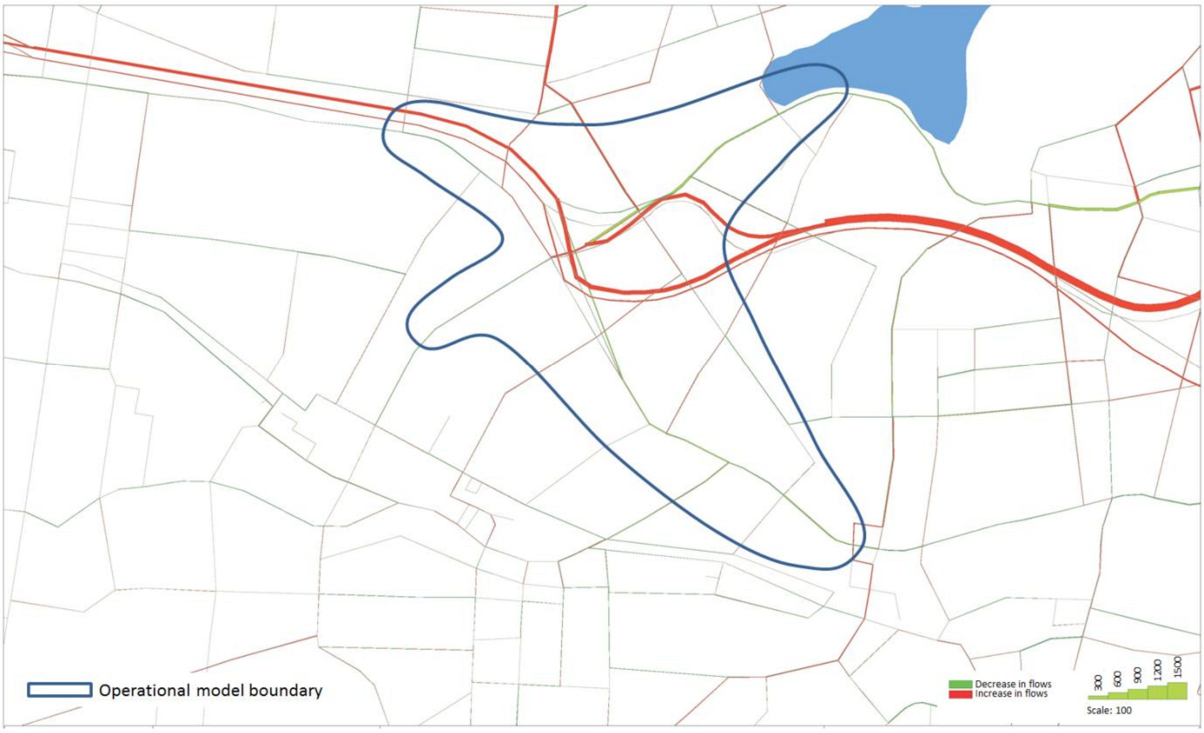
Annexure Figure 19 and **Annexure Figure 20** present the 2033 AM and PM peak hour volume difference plots in the vicinity of the St Peters interchange, showing the impact of the inclusion of the Iron Cove Link, with the operational model boundary overlaid.

The modelling shows that inclusion of the Iron Cove Link into the project design is forecast to generally slightly reduce traffic on the surface roads in the vicinity of St Peters interchange with the exception of Euston Road and Campbell Street. However, the increases on these two roads are forecast to be less than 50 vehicles per hour and not significant in terms of the operational performance of the road network. As the inclusion of the Iron Cove Link generally decreases the volumes in the mainline tunnels and on the surface network, no change in the boundary of the operational model is warranted. The forecast change on Southern Cross Drive in the PM peak hour would be a reduction in volume with the project design and is assessed in the screenline assessment contained in **section 9.5**.

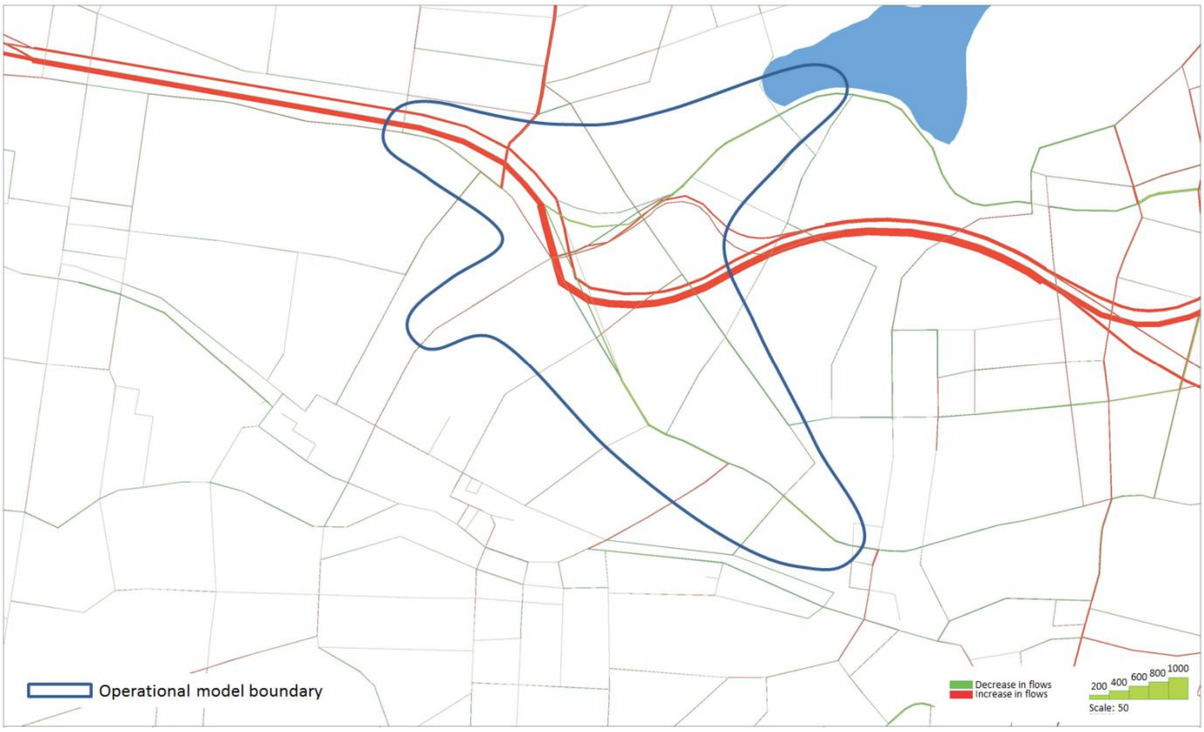
Other parts of the network

Annexure Figure 21 presents the 2033 AM peak hour volume difference plot showing the impact of the inclusion of the Iron Cove Link on the rest of the metropolitan network. The main impact is forecast on Victoria Road, which has a significant forecast reduction in traffic demand south of the Iron Cove Link portals. The inclusion of the Iron Cove Link has therefore reduced traffic demand on this section of Victoria Road. There is also a smaller forecast increase in traffic demand on Victoria Road north of the Iron Cove Link portals, with the inclusion of the Iron Cove Link. The impact of these forecast increases and reductions are captured in the Rozelle interchange operational modelling undertaken as part of this assessment.

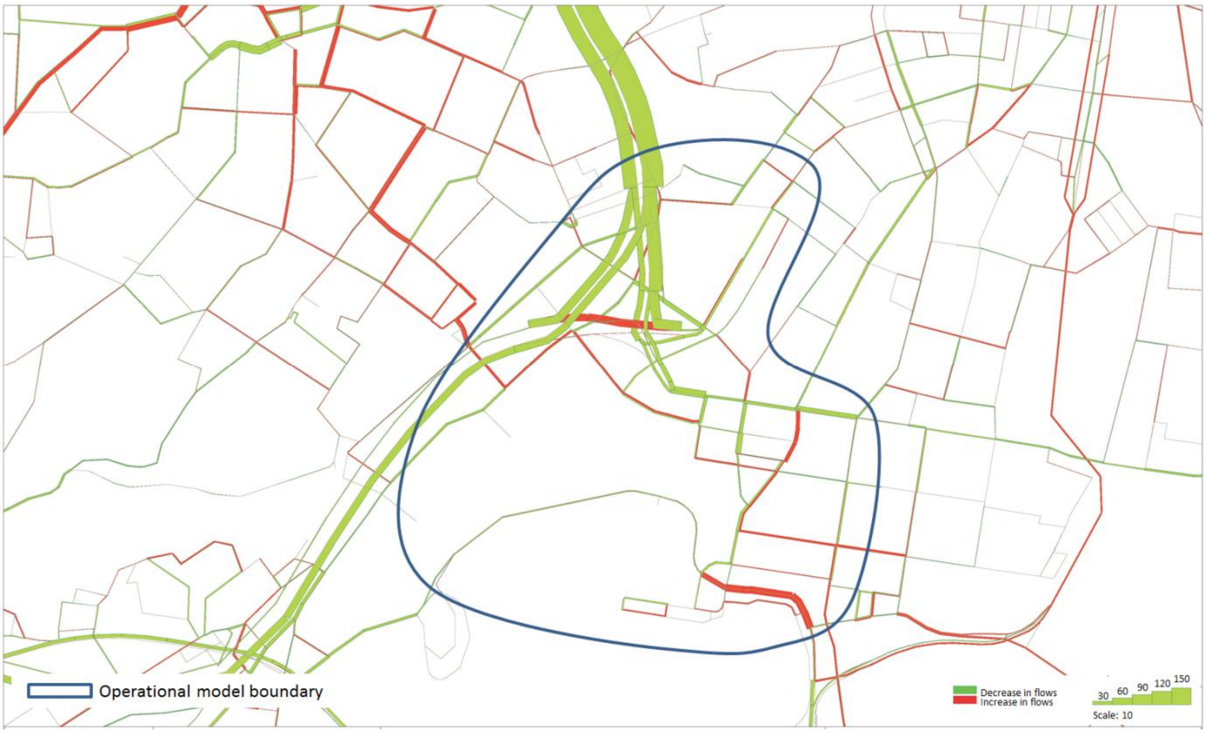
Other changes are forecast on the M4-M5 Link mainline, which are captured in the mainline operational modelling, and on Lyons Road, which has a forecast reduction with the inclusion of the Iron Cove Link in the project design. The changes on Lyons Road are assessed in the screenline assessment contained in **section 9.3.**



Annexure Figure 17 Wattle Street interchange: changes to the 2033 AM peak hour volumes with Iron Cove Link



Annexure Figure 18 Wattle Street interchange: changes to the 2033 PM peak hour volumes with Iron Cove Link



Annexure Figure 19 St Peters interchange: changes to the 2033 AM peak hour volumes with Iron Cove Link

Annexure Figure 20 St Peters interchange: changes to the 2033 PM peak hour volumes with Iron Cove Link

Annexure Figure 21 Metropolitan network: changes to the 2033 daily volumes with Iron Cove Link

Annexure D Heavy vehicle screenline analysis

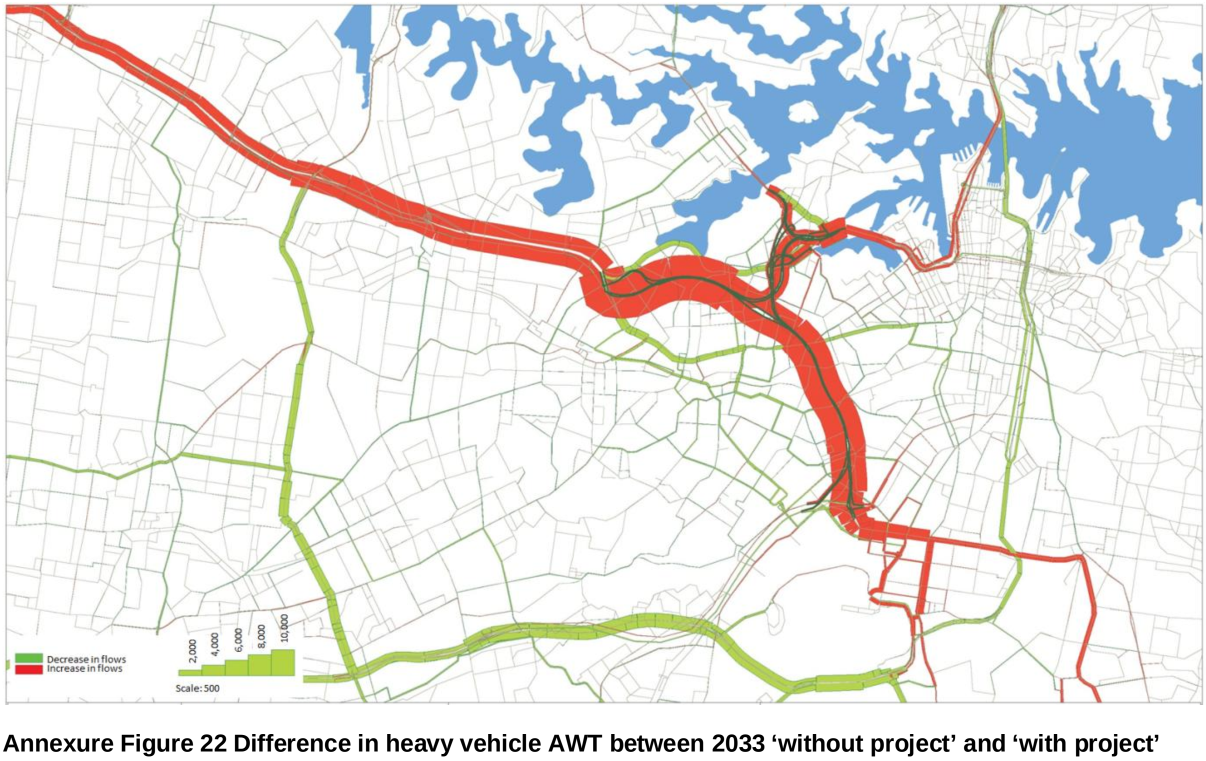
Introduction

This annexure contains screenline analysis carried out using the same methodology as applied in **Chapter 9**. However, this annexure presents heavy vehicle traffic patterns in isolation, and has been carried out for the surface roads within the east–west, the upper north–south and the lower north–south screenlines. These surface roads within the screenlines include non-arterial roads, so as to provide an indication of shifts in heavy vehicle movement.

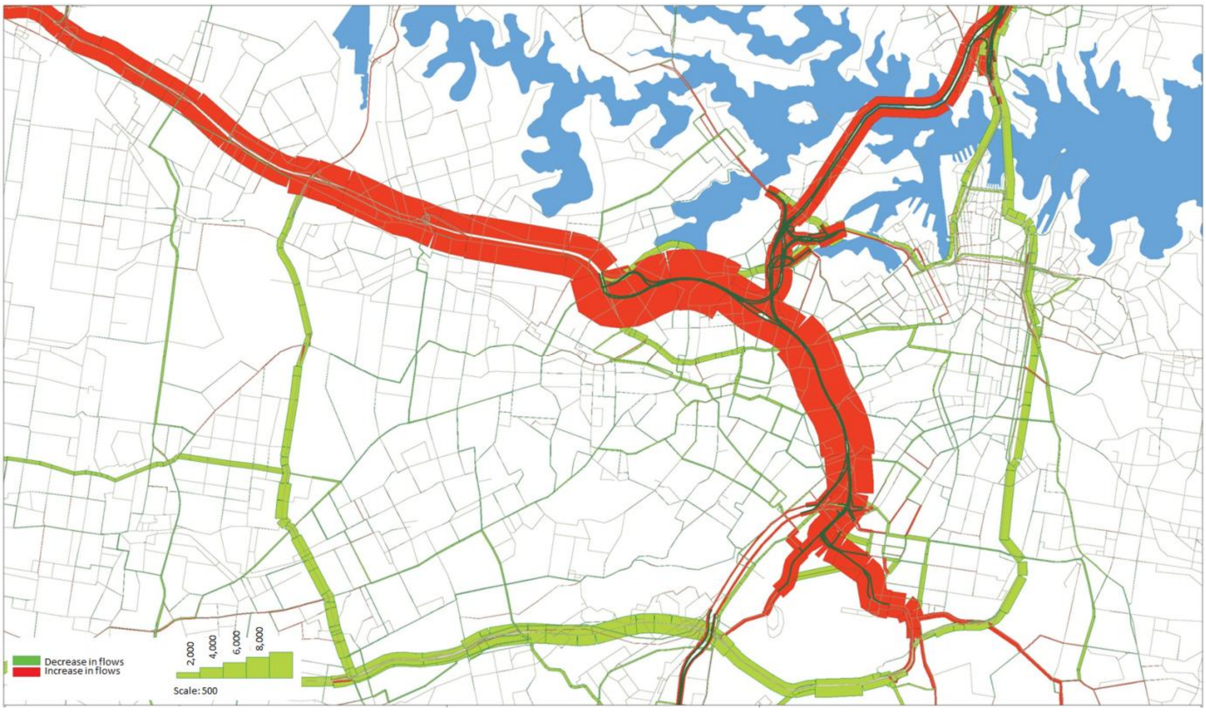
Limitations of heavy vehicle modelling in WRTM are noted: the source of the heavy vehicle origin-destination forecasts from WRTM are from the February 2014 release of demand matrices from the Transport for NSW Freight Movement Model, which were produced using Transport Performance and Analytics September 2012 release of population and employment projections, and induced demand computation are not applied to heavy vehicles.

Sydney metropolitan network

Difference plots showing the impact of the project on average weekday traffic (AWT) heavy vehicle volumes in 2033 can be seen in **Annexure Figure 22**, while **Annexure Figure 23** shows the impact of the 'cumulative' scenario on AWT heavy vehicle volumes in 2033. They show that, the project draws heavy vehicles off existing arterial routes. In particular, there are notable decreases on the existing M5 Motorway, Parramatta Road, City West Link, and the A3. In the 'cumulative' scenario, these impacts are increased, and there is also a greater shift in traffic away from Southern Cross Drive and South Dowling Street as heavy vehicles take up use of the Western Harbour Tunnel.



Annexure Figure 22 Difference in heavy vehicle AWT between 2033 'without project' and 'with project' scenarios



Annexure Figure 23 Difference in heavy vehicle AWT between 2033 'without project' and 'cumulative' scenarios

East–west screenline

Average weekday traffic (AWT) analysis

Annexure Table 2 presents a comparison of the forecast two-way heavy vehicle AWT volumes from WRTM for the surface roads at the east–west screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in heavy vehicle traffic volumes with the project in place and the share of traffic movement on each link.

The key observation comparing 2023 'without project' and 'with project' scenarios is that there is a decrease of about 40 per cent in the volume of heavy vehicles crossing the screenline on surface roads. This decrease is primarily driven by decreases on Parramatta Road and on City West Link. The key observation for the 2033 comparison is the same as for the 2023 comparisons with daily two-way heavy vehicle volumes crossing the screenline on surface roads decreasing by 38 per cent.

Annexure Table 3 presents a comparison of the forecast two-way heavy vehicle AWT volumes from WRTM for the surface roads at the east–west screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 2023 'cumulative' to the 'with project' scenarios are that the patterns of change are similar, with decreases which are slightly larger. In both the 2023 and 2033 scenarios, the daily volume of heavy vehicles crossing the screenline on surface roads in the 'cumulative' scenario compared to the 'without project' scenario decreases by about 45 per cent. These decreases are again primarily driven by decreases on Parramatta Road and on City West Link.

Peak hour analysis

Annexure Figure 24 and **Annexure Figure 25** illustrate the changes in the peak one hour heavy vehicle volumes at the east–west screenline. The forecasts indicate that the impact of the project on peak hour heavy vehicle traffic volumes are similar to the impacts forecast for AWT volumes, with reductions in heavy vehicle traffic on surface roads across the screenline. A difference is that in the peak hours, there are significant reductions in heavy vehicles on Lyons Road as well as City West Link and Parramatta Road. This reflects the greater capacity constraints which exist during peak periods forcing more vehicles to use Lyons Road to move between Haberfield and Rozelle.

Annexure Table 2 East–west screenline: WRTM comparison for with and without project scenarios – heavy vehicle AWT volumes

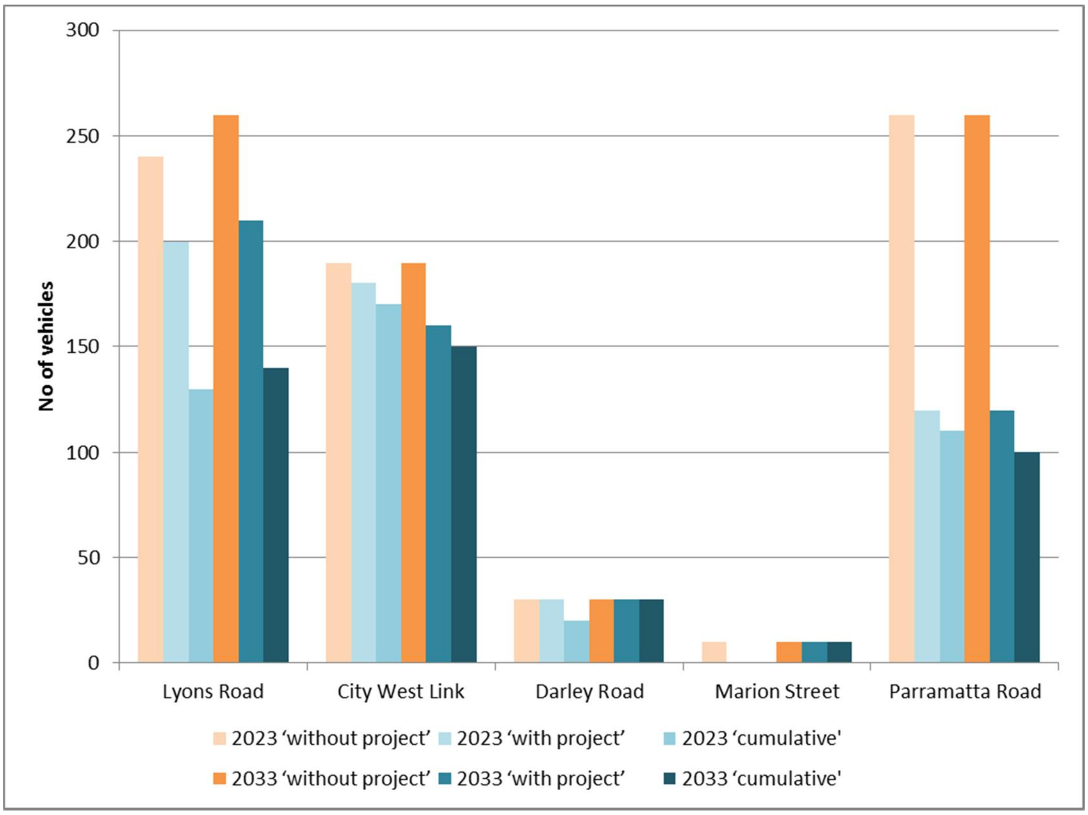
Direction	Location	2023 ‘ without project ’		2023 ‘ with project ’		Change	2033 ‘ without project ’		2033 ‘ with project ’		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Lyons Rd	1,560	14%	1,160	18%	-26%	1,900	16%	1,360	19%	-28%
	City West Link	4,610	42%	2,660	41%	-42%	4,750	41%	2,910	41%	-39%
	Darley Rd	690	6%	700	11%	1%	740	6%	740	10%	0%
	Marion St	80	1%	30	0%	-63%	110	1%	40	1%	-64%
	Parramatta Rd	3,960	36%	2,010	31%	-49%	4,130	36%	2,110	29%	-49%
	Total	**10,900**		**6,560**		**-40%**	**11,630**		**7,160**		**-38%**

Source: WRTM v2.3, 2017

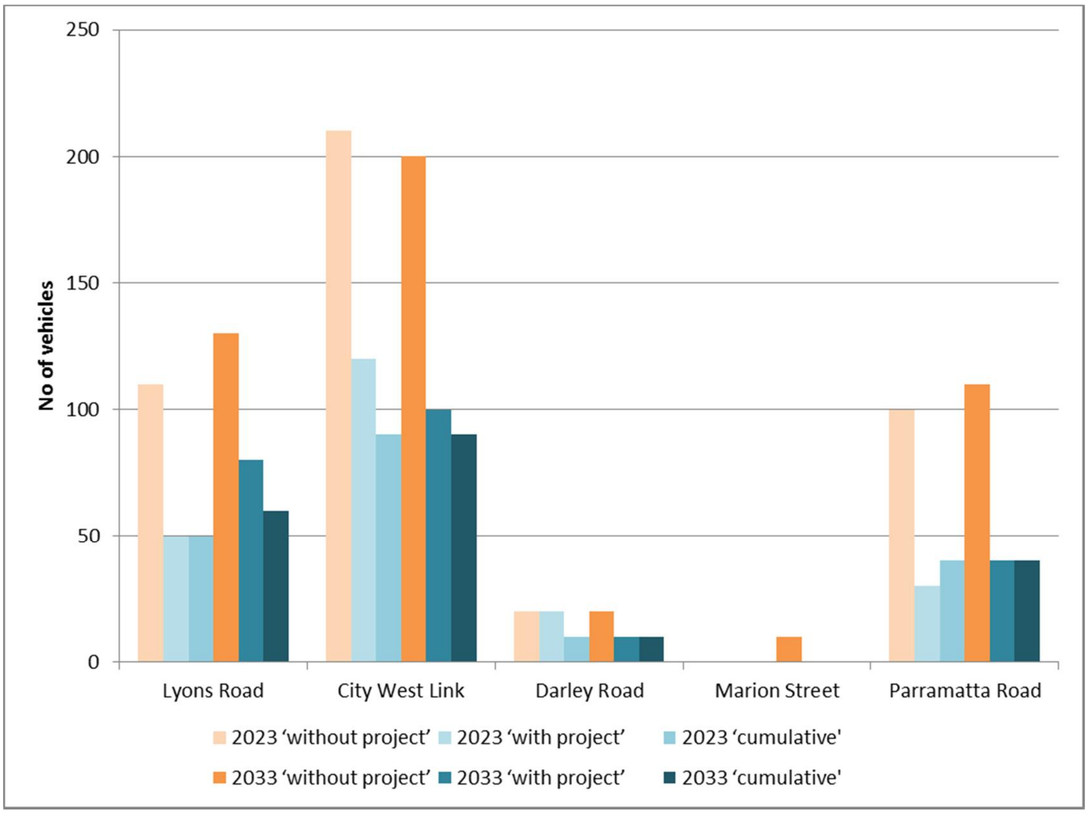
Annexure Table 3 East–west screenline: WRTM comparison for without project and cumulative scenarios – heavy vehicle AWT volumes

Direction	Location	2023 ‘ without project ’		2023 ‘ cumulative ’		Change	2033 ‘ without project ’		2033 ‘ cumulative ’		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Lyons Rd	1,560	14%	1,130	19%	-28%	1,900	16%	1,240	19%	-35%
	City West Link	4,610	42%	2,170	36%	-53%	4,750	41%	2,300	36%	-52%
	Darley Rd	690	6%	630	11%	-9%	740	6%	660	10%	-11%
	Marion St	80	1%	30	1%	-63%	110	1%	40	1%	-64%
	Parramatta Rd	3,960	36%	2,040	34%	-48%	4,130	36%	2,120	33%	-49%
	Total	**10,900**		**6,000**		**-45%**	**11,630**		**6,360**		**-45%**

Source: WRTM v2.3, 2017



Annexure Figure 24 East–west screenline: comparison of two-way AM peak one hour heavy vehicle volumes



Annexure Figure 25 East–west screenline: comparison of two-way PM peak one hour heavy vehicle volumes

Upper north–south screenline

Average weekday traffic (AWT) analysis

Annexure Table 4 presents a comparison of the forecast two-way heavy vehicle AWT volumes from the WRTM on surface roads at the upper north–south screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in heavy vehicle traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing the 2023 'without project' and 'with project' scenarios are:

- A decrease in the volume of daily heavy vehicles crossing the screenline is expected in the 'with project' scenario compared to the 'without project' scenario, with two-way heavy vehicle AWT decreasing by seven per cent
- Significant decreases in heavy vehicle AWT are forecast for Norton Street, Balmain Road, Catherine Street and Booth Street, with two-way AWT on these roads decreasing between about 30 to 70 per cent
- The shift in heavy vehicles away from Parramatta Road also results in an increase in traffic on some roads as traffic moves between the surface road network and the M4-M5 Link. Two-way heavy vehicle AWT is forecast to increase by 25 per cent on Johnston Street, and by almost 20 per cent on Ross Street. This represents an increase of about 100 heavy vehicles on each of these roads over a one day period.

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are the similar to those observed in the 2023 comparisons:

- An overall reduction in heavy vehicle AWT crossing the screenline is forecast in the 'with project' scenario, with two-way AWT decreasing 11 per cent compared to the 'without project' scenario. Again there is an increase in traffic on some links and a decrease on others, as traffic patterns change when vehicles shift away from Parramatta Road and City West Link and onto the M4-M5 Link
- The large forecast decreases in heavy vehicle AWT on Norton Street and Balmain Road are similar to that forecast in 2023
- Several north–south links experience increases in AWT as more vehicles access the M4-M5 Link. Two-way heavy vehicle AWT increases by 28 per cent on Catherine Street, and 15 per cent on Johnston Street. This represents an increase of about 100 heavy vehicles on each of these roads over a one day period.

Annexure Table 5 presents a comparison of the forecast two-way heavy vehicle AWT volumes from the WRTM on surface roads at the upper north–south screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 2023 'without project and 'cumulative' scenarios are:

- A decrease in the volume of heavy vehicle AWT crossing the screenline is expected in the 'with project' scenario compared to the 'without project' scenario. Two-way heavy vehicle AWT decreases by seven per cent
- The greatest decrease in heavy vehicle AWT occurs on Norton Street. Two-way AWT on this key link between City Road and Parramatta Road decreases by about 70 per cent
- An increase in AWT occurs on Ross Street, which connects to the M4-M5 Link and the Iron Cove Link via The Crescent. Two-way AWT increases by 22 per cent, which represents an increase of about 130 heavy vehicles over a one day period.

Key observations comparing the 2033 'without project' and 'cumulative' scenarios are that the patterns of change are similar to those observed for the 2023 comparisons:

- Again a decrease in the volume of heavy vehicle AWT crossing the screenline is expected in the 'with project' scenario compared to the 'without project' scenario, with two-way heavy vehicle AWT decreasing by 15 per cent

- Again the greatest decrease in heavy vehicle AWT occurs on Norton Street with two-way AWT decreasing by about 60 per cent
- A 25 per cent increase in two-way AWT is forecast for Catherine Street, this represents an increase of about 100 heavy vehicles over a one-day period
- A decrease in two-way heavy vehicle AWT of about 10 per cent is forecast on Johnston Street.

Annexure Table 4 Upper north–south screenline: WRTM comparison for with and without project scenarios – heavy vehicle AWT volumes

Direction	Location	2023 ‘ without project ’		2023 ‘ with project ’		Change	2033 ‘ without project ’		2033 ‘ with project ’		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Norton Street	350	15%	110	5%	-69%	500	17%	120	5%	-76%
	Balmain Road	400	17%	340	16%	-15%	490	17%	380	15%	-22%
	Catherine Street	430	19%	350	16%	-19%	400	14%	510	20%	28%
	Johnston Street	480	21%	600	28%	25%	600	21%	690	27%	15%
	Booth Street	70	3%	50	2%	-29%	80	3%	50	2%	-38%
	Ross Street	580	25%	690	32%	19%	800	28%	810	32%	1%
	Total	**2,310**		**2,140**		**-7%**	**2,870**		**2,560**		**-11%**

Source: WRTM v2.3, 2017
Balmain Road is northbound only between Parramatta Road and Leichhardt Street

Annexure Table 5 Upper north–south screenline: WRTM comparison for without project and cumulative scenarios – heavy vehicle AWT volumes

Direction	Location	2023 ‘ without project ’		2023 ‘ cumulative ’		Change	2033 ‘ without project ’		2033 ‘ cumulative ’		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Norton Street	350	15%	110	5%	-69%	500	17%	200	8%	-60%
	Balmain Road	400	17%	380	18%	-5%	490	17%	400	16%	-18%
	Catherine Street	430	19%	420	20%	-2%	400	14%	500	20%	25%
	Johnston Street	480	21%	450	21%	-6%	600	21%	520	21%	-13%
	Booth Street	70	3%	70	3%	0%	80	3%	50	2%	-38%
	Ross Street	580	25%	710	33%	22%	800	28%	770	32%	-4%
	Total	**2,310**		**2,140**		**-7%**	**2,870**		**2,440**		**-15%**

Source: WRTM v2.3, 2017
Balmain Road is northbound only between Parramatta Road and Leichhardt Street

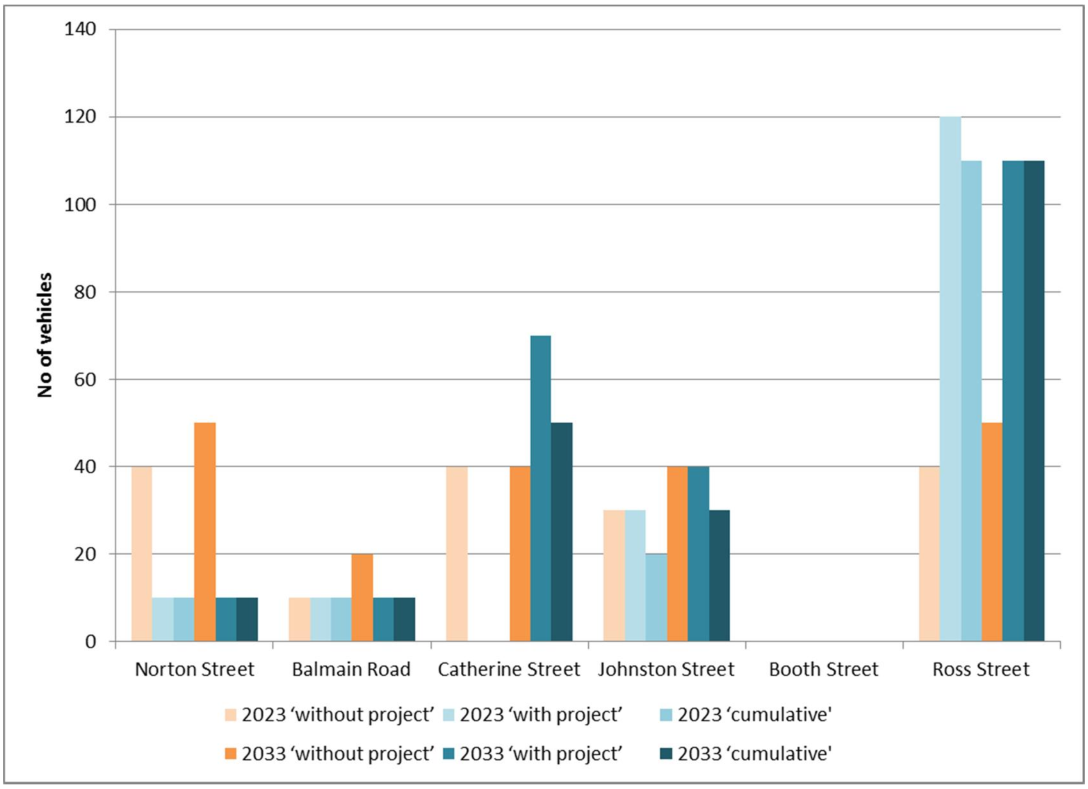
Peak hour analysis

Annexure Figure 26 and **Annexure Figure 27** illustrate the changes in the peak one hour heavy vehicle volumes at the upper north–south screenline. Similar to the AWT forecasts, the AM peak and PM peak forecasts show changes in heavy vehicle traffic volumes on north–south links, with increases on some roads and decreases on others as vehicles move from using Parramatta Road, to using the M4-M5 Link and Iron Cove Link.

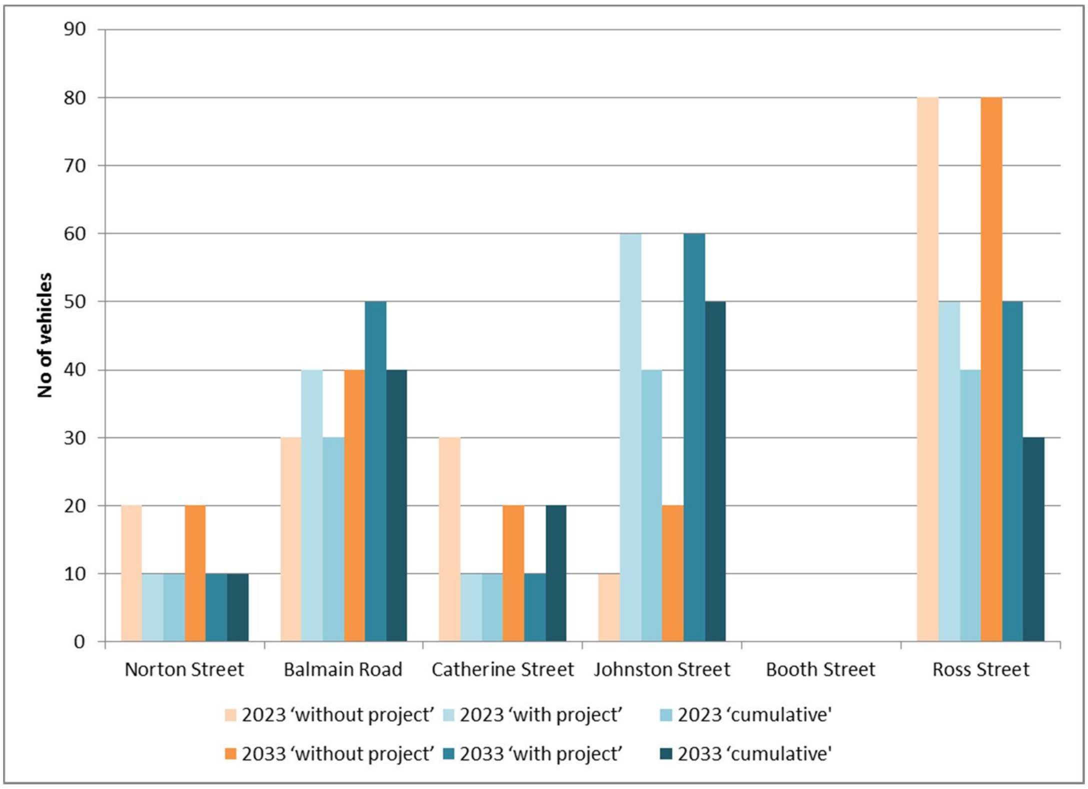
The patterns of change in heavy vehicle volumes differ in the AM peak and the PM peak periods. This is partially due to differences in origins and destinations for vehicle trips in each of the peaks, and also partially resultant from the impact of the turn movements which are allowed at the junction of each of the roads included in the screenline, and their intersection with Parramatta Road and City West Link.

In the AM peak period, decreases in heavy vehicle volumes of between about 30 to 40 vehicles occurs on Norton Street when comparing the ‘with project’ and ‘cumulative’ scenarios to the ‘without project’ scenarios. The largest increases in the AM peak are forecast for Ross Street, where heavy vehicle volumes increase by up to about 80 vehicles over the peak period. There are also smaller increases on Catherine Street of about 30 vehicles or less when comparing the 2033 ‘with project’ and ‘cumulative’ scenarios with the 2033 ‘without project’ scenario.

The impact of the project on heavy vehicle volume on Ross Street is reversed in the PM peak period which sees decreases in heavy vehicle volumes on Ross Street of between about 30 to 50 vehicles. The greatest increase in heavy vehicles in the PM peak period occurs on Johnston Street where volumes increase by about 30 to 50 heavy vehicles when comparing the ‘with project’ and ‘cumulative’ scenarios with the ‘without project’ scenarios. There are also smaller increases of about 20 heavy vehicles or less on Catherine Street when comparing the ‘with project’ scenarios to the ‘without project’ scenarios’.



Annexure Figure 26 Upper north–south screenline: comparison of two-way AM peak one hour heavy vehicle volumes



Annexure Figure 27 Upper north–south screenline: comparison of two-way PM peak one hour heavy vehicle volumes

Lower north–south screenline

Average weekday traffic (AWT) analysis

Annexure Table 6 presents a comparison of the forecast two-way heavy vehicle AWT volumes from the WRTM on surface roads at the lower north–south screenline location under the 2023 and 2033 'without project' and 'with project' scenarios. The table also shows the change in heavy vehicle traffic volumes with the project in place and the share of traffic movement on each link.

Key observations comparing the 2023 'without project' and 'with project' scenarios are:

- There is a decrease in the volume of heavy vehicles crossing the screenline on surface roads in the 'with project' scenario compared with the 'without project' scenario. The total volume of heavy vehicle AWT crossing the screenline on surface roads decreases by 17 per cent
- The largest decrease occurs on South Dowling Drive, as vehicles shift onto the M4-M5 Link to travel north–south between the M5 and Port Botany area and the city or North. There are also significant decreases on Stanmore Road and King Street, which are key north–south arterial roads to the north of the St Peters interchange. Heavy vehicle AWT decreases about 45 per cent on each of these roads in the 'with project' scenario.

Key observations comparing the 2033 'without project' and 'with project' scenarios are that the patterns of change are similar as for the 2023 comparisons. Again, the volume of heavy vehicles crossing the screenline on surface roads decreases in the 'with project' scenario when compared to the 'without project' scenario, with heavy vehicle AWT crossing the screenline on surface roads decreasing by 19 per cent, and this decrease largely driven by decreases on South Dowling Drive and Stanmore Road as vehicles shift onto the M4-M5 Link.

Annexure Table 7 presents a comparison of the forecast two-way heavy vehicle AWT volumes from the WRTM on surface roads at the lower north–south screenline location under the 2023 and 2033 'without project' and 'cumulative' scenarios.

Key observations comparing the 2023 ‘without project’ and ‘cumulative’ scenarios are that patterns of change are similar to the ‘without project’ and ‘with project’ comparisons, with a decrease in two-way heavy vehicle AWT across the screenline. This decrease is larger in the ‘cumulative’ scenarios, driven primarily by a larger decrease on Southern Cross Drive. This is likely due to the increased attractiveness of the M4-M5 Link with the inclusion of the proposed future Western Harbour Tunnel in the ‘cumulative’ 2023 scenario.

Annexure Table 6 Lower north–south screenline: WRTM comparison for without and with project scenarios – heavy vehicle AWT volumes

Direction	Location	2023 'without project'		2023 'with project'		Change	2033 'without project'		2033 'with project'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Stanmore Road	2,160	10%	1,190	6%	-45%	2,320	9%	1,320	6%	-43%
	Addison Road	300	1%	220	1%	-27%	400	2%	230	1%	-43%
	Sydenham Road	2,410	11%	1,970	10%	-18%	2,590	10%	2,010	10%	-22%
	Marrickville Road	820	4%	560	3%	-32%	890	4%	420	2%	-53%
	King Street	920	4%	480	3%	-48%	990	4%	720	4%	-27%
	Wyndham Street	1,390	6%	1,210	6%	-13%	1,310	5%	1,060	5%	-19%
	Botany Road	1,590	7%	1,370	7%	-14%	1,520	6%	1,270	6%	-16%
	Elizabeth Street	700	3%	640	3%	-9%	730	3%	660	3%	-10%
	Southern Cross Drive	12,430	55%	11,160	59%	-10%	14,270	57%	12,630	62%	-11%
	Total	**22,720**		**18,800**		**-17%**	**25,020**		**20,320**		**-19%**

Source: WRTM v2.3, 2017

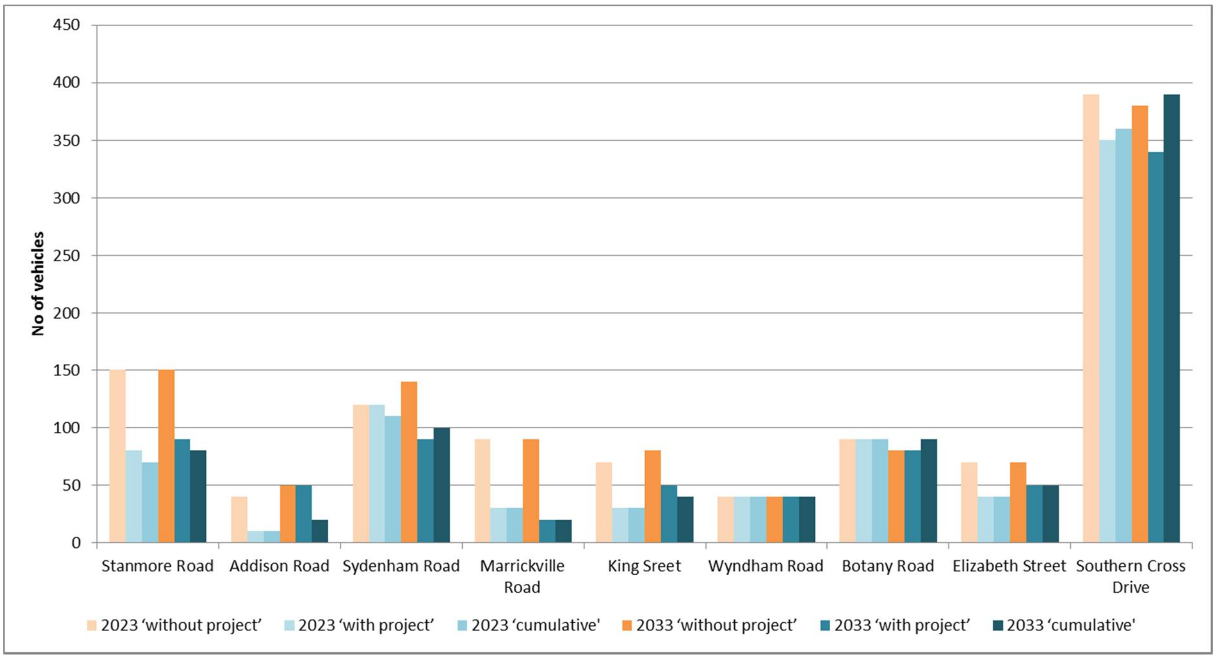
Annexure Table 7 Lower north–south screenline: WRTM comparison for without project and cumulative scenarios – heavy vehicle AWT volumes

Direction	Location	2023 'without project'		2023 'cumulative'		Change	2033 'without project'		2033 'cumulative'		Change
		Volume	Share	Volume	Share		Volume	Share	Volume	Share	
Two-way	Stanmore Road	2,160	10%	1,210	7%	-44%	2,320	9%	1,290	7%	-44%
	Addison Road	300	1%	150	1%	-50%	400	2%	140	1%	-65%
	Sydenham Road	2,410	11%	2,090	12%	-13%	2,590	10%	2,200	12%	-15%
	Marrickville Road	820	4%	570	3%	-30%	890	4%	430	2%	-52%
	King Street	920	4%	500	3%	-46%	990	4%	620	3%	-37%
	Wyndham Street	1,390	6%	1,300	8%	-6%	1,310	5%	1,210	7%	-8%
	Botany Road	1,590	7%	1,240	7%	-22%	1,520	6%	1,230	7%	-19%
	Elizabeth Street	700	3%	670	4%	-4%	730	3%	730	4%	0%
	Southern Cross Drive	12,430	55%	9,560	55%	-23%	14,270	57%	10,470	57%	-27%
	Total	**22,720**		**17,290**		**-24%**	**25,020**		**18,320**		**-27%**

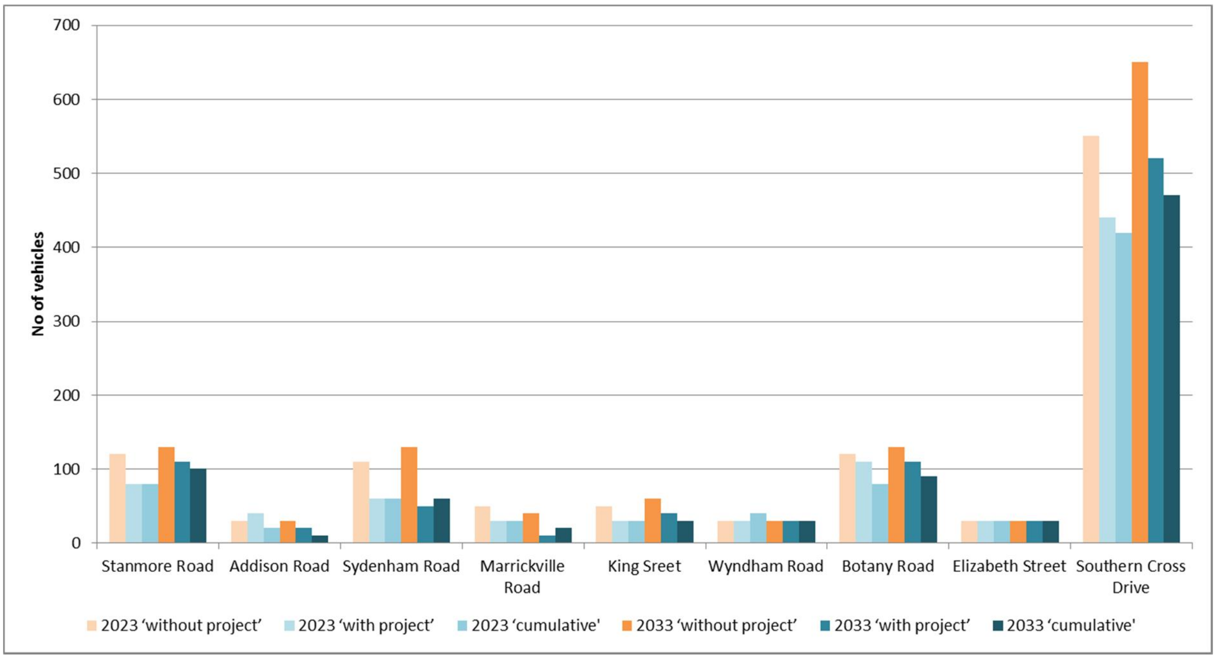
Source: WRTM v2.3, 2017

Peak hour analysis

Annexure Figure 28 and **Annexure Figure 29** illustrate the changes in the peak one hour two-way heavy vehicle volumes at the lower north–south screenline. The peak hour forecasts indicate heavy vehicle traffic volume changes similar to those in the daily forecasts, with traffic decreasing across the screenline. However in the AM peak, the decrease on Southern Cross Drive is much lower. This likely reflects capacity constraints on the network in the AM peak which result in a smaller proportion of total north–south demand being able to shift off of north–south links on surface roads, and onto the M4-M5 Link.



Annexure Figure 28 Lower north–south screenline: comparison of two-way AM peak one hour heavy vehicle volumes



Annexure Figure 29 Lower north–south screenline: comparison of two-way PM peak one hour heavy vehicle volumes